Cultural Psychology of Education 3

Wolff-Michael Roth
Alfredo Jornet

Understanding Educational Psychology

A Late Vygotskian, Spinozist Approach

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Volume 3

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Wolff-Michael Roth • Alfredo Jornet

Understanding Educational Psychology

A Late Vygotskian, Spinozist Approach

Springer

Wolff-Michael Roth
University of Victoria
Victoria, BC, Canada

Alfredo Jornet
University of Oslo
Oslo, Norway

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Preface from the Series Editor

Vygotsky: The Question of Psychological Synthesis

There are three main reasons to be proud of hosting Roth and Jornet's book, *Understanding Educational Psychology: A Late Vygotskian, Spinozist Approach,* in the Cultural Psychology of Education Books Series.

First of all, the intellectual depth of the book surpasses any existing education-oriented "Vygotsky-talking" book, particularly because of its connection with the semiotic approaches in contemporary cultural psychology.

Vygotsky's theory has always been (and still is) a battleground of different interpretations for both theoretical side and practical application: from the sociocultural or cultural-historical activity theories to the Piagetian-social constructivist approaches of genetic social psychology and from the dialogic-symbolic resources approaches to the neo-Meadian approaches. After all, in the history of psychology, Vygotsky represents one among the giants on whose shoulders anybody jumps picking up pieces of his complex theoretical framework and using them as a self-explaining theoretical umbrella for making any sort of scientific claims. Very often one can read in academic papers sentences like "According to Vygotsky's theory…" or "Following Vygotsky's perspective … " as a *façade* of a scientific kind in the polyphony of the research's supermarket (Tateo 2014).

Theories are mainly tools for thinking (Valsiner 2009) that any scholar should use for moving a step further toward a new knowledge construction. The way for reducing the heuristic power of a theoretical model is exactly to replicate or to recall it thousands of times without any additional elaboration. Moreover, Vygotsky was a developmental thinker in his essence (Valsiner and van der Veer 2014). As in the case of Jerome Bruner, to whom the previous book in the series was dedicated on the occasion of his centennial (Marsico 2015a), he would have appreciated to see where the others could further develop his ideas.

In the contemporary academic world, dominated by "ready-made recipes" for explaining psychological processes, Roth and Jornet instead took upon themselves the hard task of revising Vygotsky's legacy on the basis of Spinoza's relevance in

his thinking. The authors focused on the Russian scholar's "later years," still almost unknown worldwide to both the large audience and serious specialists in educational psychology and adjacent areas. By discussing the main theoretical foundations of the Spinozist turn in the late Vygotsky, the authors provide the conceptual and empirical tools to understand the Vygotskian holistic approach to psychology that aimed at overcoming the contradictions (unfortunately still nowadays operating) in developmental and the educational psychology. Vygotsky tried indeed to tackle the dichotomies between body and mind, individual and social, cognitive and affective processes, and biology and culture for the sake of reaching a psychological synthesis, which was his main quest.

The book offers a new look at the whole Vygotskian legacy. In this respect, it greatly contributes to the consolidation of a cultural psychology perspective in education (which is the main goal of the book series) to restore the relevance of a general theoretical elaboration against the flattening of present-day educational psychology, basically conceived as an applied psychology. This is the second reason for being pleased of this volume.

Finally, this book nicely flows into the current attempt to establish the newly developed area of cultural psychology as the general science of specifically human ways of existence (Marsico 2015b; Valsiner et al. 2016). Vygotsky made an effort to develop a holistic approach to the human psyche, which is complex and cannot be explained by mere low-level casual mechanism. The question of the psychological synthesis was Vygotsky's commitment. We should be, at least, equally engaged.

Aalborg, Denmark Giuseppina Marsico
April 2016

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Foreword

> [Vygotsky's] family archive … contains precious documents that reveal to us the internal dynamics of the transition to a new point of view, a transition *that did not manifest itself in the published works.* (Zavershneva 2010a: 41, emphasis added)

> Bring Sp[i]n[o]z[i]sm to life in Marx[ist] psychol[ogy]. (Vygotsky 2010: 93)

Near the end of his life, Lev S. Vygotsky was beginning a radical rethinking of his theory. The new point of view that is apparent in his personal notes and that had made its mark in the literature only in some starting points (e.g., *The Theories of Emotion*) was a turn to Spinoza. Even his famous book on thinking and speech, often referred to as the pinnacle of his work, according to his own notes, was only a beginning that "stopped at the threshold" of the new theory he intended to develop (Vygotsky, in Zavershneva 2010a: 35). The writings of Spinoza were the inspiration for a new direction in psychology that would investigate "the changes in the proportionate role of the soul in the life of the body, and of the intellect in life" (Vygotsky, in Zavershneva 2010a: 39). This turn to Spinoza was to deal with an age-old problem in psychology that has never ceased to exist despite the eight decades that have passed since Vygotsky wrote this note. That is, in much of current educational psychology, there are unresolved contradictions that have their origin in the opposition between body and mind, individual and collective, and structure and process—including the different nature of intellect and affect or the difference between knowledge and its application.

Despite the increasing popularity of Vygotsky's work in the educational and psychological literature, a theory that builds upon Vygotsky's final insights and that overcomes all Cartesian dualisms in our understanding of human learning and thinking has yet to be created (Zavershneva 2010b). Many of the same contradictions that Vygotsky sought to overcome are repeated in contemporary constructivist approaches. These do not overcome dichotomies but rather exacerbate them by individualizing and intellectualizing our knowledgeable participation in the everyday world. Interestingly enough, Vygotsky, whom many use as a referent for making

arguments about inter- and intrasubjective "mental" "constructions," was on the verge of developing a thoroughly monist approach. Grounded in the *Ethics* (Spinoza 2002), central to this approach was Spinoza's dictum that there is only *one substance*. This one substance *manifests* itself in (exists as) two radically different ways: body (material, biology) and mind (society, culture). There are not two substances that are combined (synthesized) somehow into a unit: there is but one substance. Once such an approach is adopted, the classic questions posed by (a) cognitive scientists about how symbols are grounded in the world and (b) constructivist scholars about the relation between knowledge and the world can be recognized to be artifacts of theory. Symbols, just as knowledge, are not merely "about" the world but are *of* this world; they belong and form inherent part of it just as much as our bodies do because they are just one substance.

As a consequence of the Spinozist one-substance approach, human culture itself is taken as the result of natural processes (biology). Culture already existed as a subordinate function of life in the animal (proto-human) world. In and through a process following the *law of the transformation of quantity into quality*—culture became the *dominant* function in/of human life. There is therefore neither dichotomy of nature (biology) versus nurture (culture) nor parallelism of nature and nurture. Instead, there only is the *cultural nature* of human psychological characteristics. Both culture and nature are articulated and emphasized here as irremediably aspects of anything that is *specifically human*.

The central contribution that distinguishes Vygotsky from all other psychologists is his emphasis on *sociogenesis*. Although "social constructivist" and "sociocultural" scholars often refer to Vygotsky, the *social* in their work tends to be treated as constituting merely the external context of thinking and learning, not thinking and learning themselves—which has led Felix T. Mikhailov to assert that most Western scholars have fundamentally misunderstood Vygotsky. Thus, it is common to find in the literature on learning and education claims that groups of learners construct things or ideas *inter*subjectively, which they then *internalize* to become *intra*subjective aspects of their thinking. What such accounts fail to address, however, is the non-dualist character of the late Vygotsky's work, for example, when he notes that all higher functions *are* social relations before they show up as psychological characteristics. That is, whatever higher function we may attribute to a person, at some point in his/her life first *was* a relation with other people. As a consequence, this relation, which itself is thinking, can be studied *anthropologically*. The true sense of the term *sociogenesis* is precisely this: higher psychological functions originate *as* not merely *in* social relations, thereby generating both social facts and social persons. Spinoza's *thought* (i.e., mind), then, exists *in* and *as* the "ensemble of societal relations," which is precisely the phenomenon that distinguishes humans from other animals and constitutes the essence of the species (Marx and Engels 1978). There is only one approach that we are aware of where the primacy of the social exists in this way, and this approach is ethnomethodology (e.g., Livingston 2008). We have taken up the primacy of the social into our own work on *concrete human psychology*, the direction in which Vygotsky was heading but could only sketch in a fragmentary text of the same name.

The central purpose of this book is to work out where we are led when we take Vygotsky's final notes as a starting point for developing theory. That is, this book neither is an attempt at working out what Vygotsky really wanted to say and write, nor is it an attempt at guessing the exact way in which he might have continued his work. Instead, ours is part of an effort to articulate an approach to a cultural psychology of education that has its basis in a Marxist re-reading of Spinoza—in the way Vygotsky envisions it in the second introductory quotation. We do not aim at finding out the/a proper reading of Vygotsky's writing or at establishing what he really meant without saying so. Instead, we pursue a line of theory development that those thoughts that he stated near the end of his life afford and invite following. This educational psychology takes *the primacy of the social* as its fundamental principle and the actual, in vivo material processes of sociogenesis as its object of study. Both aspects are important if the goal of educational psychology is to understand learning and development of the individual.[1]

Many of the problems in the uptake of Vygotsky in the West have been generated in what insiders (e.g., M. Cole, A. Yasnitsky) note to be poor translations of Vygotsky's works into English. For example, even though Vygotsky's collaborator A. R. Luria insisted that the Russian adjective *psixičeskij*[2] [psychical] should be translated as "psychological," it appears, in most translations, as "mental." When Vygotsky entitles one of his last works *Historija razvitija vysšix psixičeskix funkcij,* English translations tend to translate it as "The History of Higher Mental Functions" rather than "The History of Higher Psychological Functions," a version that also would be more consistent with the German (*Geschichte der höheren psychischen Funktionen*), Italian (*Storia dello sviluppo delle funzioni psichiche superiori*), or French translations (*Histoire du développement des fonctions psychiques supérieures*). In such instances, therefore, English translations reflect a mentalism (intellectualism) in the Anglo-Saxon scholarship that is against the explicit warnings of Vygotsky, including the one against doing *interpretive* psychology. From Vygotsky's monist perspective, the psyche is larger than the mental and conscious life—particularly apparent in his emphasis on the unity/identity of intellect and affect or in his insistence on the physical-material aspect of speech. In this book, we offer to overcome these problems by drawing on translations into other languages as well as on the originals and, as we have done over the past several years, by having verified translations with Russian-speaking staff at our university (including V. Atavina) and scholarly colleagues (including M. Cole, D. Bakhurst, J. Valsiner, and A. Yasnitsky). We sometimes quote from the English translation but insert translations of certain terms that are more consistent with translations into other languages together with the original language term. Thus, we might quote a text as "active [psychological (psixičeskie)] states" rather than using what certainly appears inappropriately in an English translation: "active mental states."

[1] These are two radically different processes that are dialectically related and that are also poorly understood in the Western uptake of Vygotsky's work.

[2] We use the scholarly conventions for the Romanization of Russian terms (e.g., "Ч" as "č" rather than as "ch").

We note above that this book does not offer yet another interpretation of Vygotsky's published work. In fact, one Russian, dialectical materialist philosopher who has specialized in the late-Vygotskian works suggests that these "have been substantially distorted by commentators, disciples, and users to meet their own needs" (Mikhailov 2001: 11). Grounded in dialectical materialist thought, we are inclined to follow Mikhailov's path by taking up the agenda of the late Vygotsky, who had turned to the philosopher Spinoza to develop a holistic approach to social psychology by "bringing Spinozism to life in Marxist psychology." In addition to Mikhailov, we are inspired by the philosopher E. V. Il'enkov (1977), who provides a Marxist re-reading of Spinoza that appears to us consistent with the notes of the later Vygotsky. This approach no longer dichotomizes the body and mind, intellect and affect, or the individual and the social. We develop whatever Vygotsky has left, sometimes in fragmentary ways, and, in so doing, articulate an approach to cultural psychology of education that overcomes the dichotomies of other approaches that nevertheless lay claim to be working in the spirit of Vygotsky.

We develop a set of foundational concepts that are often discussed in terms of dichotomies in the constructivist and sociocultural literatures, including the dichotomies between nature and culture (nurture) or the conflation of thinking and speaking. Drawing from materials collected in a variety of concrete settings, we articulate how an approach that takes seriously the primacy of the social overcomes such dichotomies, offering research avenues yet unexplored in educational psychology. Unlike other textbooks where cultural psychology is restricted to (institutional) education, we further include a series of case studies in which core topics of a cultural psychology of education are examined as they play out in actual practices taking place across a diversity of (educational, everyday, work) settings and spanning the life trajectory from childhood to adulthood. The third part of this book offers implications for educational research and practice.

Victoria, BC, Canada — Wolff-Michael Roth
April 2016 — Alfredo Jornet

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Chapter 1
Vygotsky, Spinoza, and Cultural Psychology of Education

> This is the final thing I have done in psychology—and I will die at the summit like Moses, having glimpsed the prom[ised] land but without setting foot on it. Farewell, dear creations. (Vygotsky, in Zavershneva 2010a: 58)

Since the 1960s, when Vygotsky's work first became known to western scholars through the publication of an abridged and problematic translation of *Myšlenie i reč*' [Thinking and Speech] (Vygotskij 1934), there have been tremendous efforts to take up what can be found in the published writings of a person sometimes referred to as "the Mozart of psychology." The uptake and its influence on scholarship are undeniable, which may be gauged from the fact that by the winter of 2016 there are more than 62,000 Google Scholar citations of *Mind in Society* (Vygotsky 1978) alone. This uptake has not only been huge, but has grown exponentially over the years (Fig. 1.1). Some scholars familiar with Vygotsky's texts in their original language, however, suggest that much of what has been written does not reflect the theory that Vygotsky was working towards; instead the literature presents distortions of his ideas for the (ideological) purposes of students and interpreters alike (Mikhailov 2001). Misrepresentations and misunderstanding can be found in textbooks on educational psychology, where Vygotskian concepts are often presented as part of classical psychological frameworks and paradigms that Vygotsky himself strongly rejected and attempted to overcome. The issue becomes further complicated by the fact that Vygotsky never finished many of the plans he had made for his own theory, which was in vibrant and constant development. In support of the latter, there is the relatively recent discovery of Vygotsky's own notes in the family archives, where he is highly critical of his own previous work and speaks of the need to develop a new psychology. This new psychology—as he had described a little earlier drawing on Spinoza—would have so little in common with the old one as the star constellation *Canis* has with a barking dog in the street (Vygotsky 1997).

Unfortunately, Vygotsky was not able to get very far with this revision. We begin this chapter with what are believed to be the last words Vygotsky wrote in his notebooks prior to entering the hospital where he died four weeks later. The quoted text

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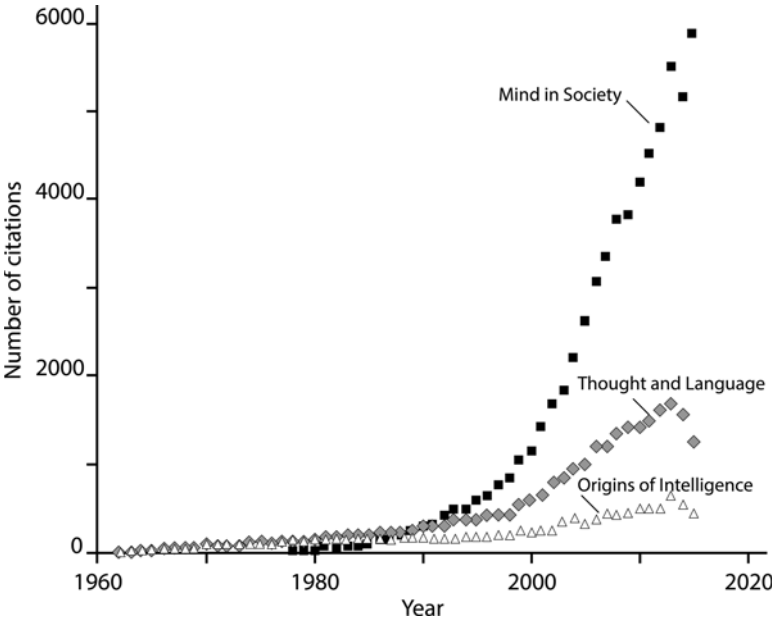

Fig. 1.1 Number of citations for *Mind in Society* (Vygotsky 1978), *Thought and Language* (Vygotsky 1986), and *Origins of Intelligence* (Piaget 1952)

is indicative of how Vygotsky himself situated his life's work—as the journey to a land that he only was able to glimpse without ever being able to set a foot onto it. Even though he had begun a radical revision of his own theories, as can be found in his notes, life did not allow him to actually make much headway in the reformulation of his theory. What might Vygotsky have glimpsed? Where was he headed? What new horizons may such a heading open for us?

What Vygotsky Might Have Glimpsed

> Bring Sp[i]n[o]z[i]sm to life in Marx[ist] psychol[ogy]. (Vygotsky 2010: 93)

In writing the note that opens this chapter, Vygotsky sees himself at the brink of a breakthrough, which he never had the time to actually articulate and communicate to others. If this is the case, then drawing from some of Vygotsky's published works without acknowledging the shift he was making represents an effort of building on what Vygotsky saw as the old psychology that he was on the brink of revolutionizing. A more interesting strategy would be to pursue the journey that would allow psychologists to set their feet on the land that Vygotsky only had seen but could never reach. To our knowledge, psychologists have not attempted to take up that project Vygotsky began to sketch. Throughout this book we point to the many ways

in which current psychological scholarship actually pursues lines of inquiry that already the older Vygotsky had critiqued and rejected; these ways are even less compatible with what was beginning to show itself to the late Vygotsky on the horizon.

In this book, we take on the challenge to work out the field of possible continuations of that journey that Vygotsky was never able to complete. We seek this continuation in a realization of a Spinoza-inspired approach that appears in the quotation that opens this section. This approach does not directly follow what the philosopher actually wrote, but takes it up in the way that a modern materialist dialectical approach could read it: through a Marxist lens. Such a reading of Spinoza was indeed articulated in an analysis of dialectical logic (Il'enkov 1977), where we find a way of theorizing knowing that gives us clues for developing a monist approach to learning and development. Such a monist approach affords resolving many of the quandaries Vygotsky was facing in the psychology of his time and which have made it to our time in the form of apparently unbridgeable dualisms. Throughout this book, we refer to the unity/identity of the *thinking body* to highlight that from this perspective there no longer is a chasm between thinking and living in this world, intellect and affect, doing and thinking, self and other, or any other of the dichotomies that have characterized psychological theorizing throughout its history. Though rarely recognized in any of the current uptakes of the psychologist's writings, the prospects for the work to come—as sketched in the personal notes and in the final paragraphs of his last work *Thinking and Speech* (Vygotsky 1987)—are explicitly grounded in a Marxist conception of *language* and *consciousness*, two most important problems to be solved in the psychology that Vygotsky was working on.

Marxist Foundations of Vygotsky's Work to Come

For Vygotsky, the *psychophysical* problem was the most pressing issue that psychology needed to resolve.[1] However, even though he had been aware of and had analyzed the Cartesian underpinnings in all psychological approaches of his day—both the natural scientific and interpretive versions—he realized during the last year of his life that his own work was shot through with Cartesianism. His turn to Spinoza was to assist him in overcoming whatever was left of dualism in his own descriptions and explanations of human behavior. On the psychophysical problem, he points out that there is a "continuous transition of the external to the internal and the internal to the external, a real rather than imaginary unity and struggle of opposites," and this struggle "m[ay]b[e] the main thing in the development—historical—of consciousness" (Vygotsky 2010: 94). That continuous transition of the external to the internal and of the internal to the external manifests itself in the relation of

[1] The editor of two fragments from the personal archive of the Vygotsky family notes that the psychophysical problem was for Vygotsky what the body–mind problem is for us today (Vygotsky 2010).

thinking and speech. Together, "thinking and speech are the central problem and the *via regia*[2] of all historical psychology" (2010: 94). In this statement, the emphatic content (i.e., "central problem" and "all" historical psychology) is amplified by the use of underline and italics: it truly is the most important issue. In Chap. 13 we articulate how this emphasis on the relation between thinking and speech relates to what Vygotsky considered the essence of human culture: the question of *freedom*. But here Vygotsky is concerned with emphasizing a view of materialism that seldom has made it into western uptakes. Thus, Vygotsky refers to Marx when stating that it is in language that the materiality of consciousness can be observed; and he refers a second time to Marx when stating that the "curse of matter on pure consciousness is moving layers of air, i.e., intercourse with the aid of language" (2010: 95). The project of investigation necessitates a historical approach. But such an approach seems to be seldom conducted from a dialectical perspective, which recognizes this: (a) each new generation exploits what previous generations have produced, but does so (b) "by continuing the passed-on activity under very different conditions" and (c) "by modifying the old conditions by means of a completely changed activity" (Marx and Engels 1978: 45). Even the most cursory analysis of the scholarship in today's psychology would reveal that the transformation of activity and its historical conditions themselves are hardly if ever theorized (see Chap. 13). In this sense, *en*culturation never happens strictly speaking, because the culture of which someone becomes a part—e.g. by means of legitimate peripheral participation—already is changed, as have the conditions in which this culture is observed.

What might Vygotsky possibly have glimpsed that led him to likening himself to Moses? We might find some indications not only in his personal notebooks but also in the last two paragraphs[3] of *Thinking and Speech* (Vygotsky 1987), a book that was only a prolegomenon to a much larger, never-written monograph on consciousness. In those two paragraphs, "Vygotsky explicitly states that the investigation 'stopped at the very threshold' and lays out a plan for the future: an investigation . . . of the entire consciousness in its complex dynamics" (Zavershneva 2010a: 35). Vygotsky begins these last two paragraphs with the stated intention to "say a few words about the prospects that lie beyond the present study" (Vygotsky 1987: 285). The paragraphs therefore can be regarded as a programmatic statement about what would have followed in the larger project. The text of the first paragraph summarizes the intentions and findings of the preceding investigation, which pertains to the relationship between word and object, word and reality, and that reality is reflected differently in the sensing and thinking modes.

In the second part of the first paragraph of the original, Vygotsky then turns to Marx, in part directly quoting from *The German Ideology* (Marx and Engels 1978)

[2] The king's road.

[3] There are two paragraphs in the original Russian text from 1934 (and subsequent versions, Vygotskij 1982 or Vygotskij 2005), as in the German version (Vygotskij 2002), but three paragraphs in two English translations (Vygotsky 1986, 1987), though the paragraph breaks are not in the same place.

and paraphrasing or indirectly rendering other parts.[4] The agenda for the work to come on consciousness, therefore, was to be Marxist through and through. In the pages from which Vygotsky took inspiration for his future work, Marx and Engels are concerned with consciousness, the material nature of human relations, language, and history. The authors note that the material nature of human relations is determined by and the result of needs and means of production that are as old has humankind. Humans *have* a history precisely because they have to produce their lives in and under conditions determined by their physical organization and consciousness. Humans have consciousness because of four requisite moments of their historical conditions: (a) the first historical deed *also* is the production of means for need satisfaction; (b) the first satisfied need, the act of satisfying it and the instrument of satisfaction lead to new needs, which again constitutes the first historical fact; (c) the familial relation, where human beings begin to make other human beings, as the initially sole social relation that enters historical development; and (d) the societal relations and the division of labor that already begins within the familial relation.

The four historical conditions make it that consciousness, "mind [Geist]," is and is "marked" by the curse of being material, a materiality that occurs "in the form of moving layers of air, sounds, in short language" (Marx and Engels 1978: 30). As noted above, Vygotsky writes in his notebook, "Cf. Marx: the curse of matter on pure consciousness is moving layers of air. i.e., intercourse with the aid of language, rather than a connection with the brain! *Sehr wichtig*[5]!" (Vygotsky 2010: 95). The influence of this note on the direction in which Vygotsky was heading is apparent in the fact that much of Marx and Engels' paragraph is taken up in the second to last paragraph of *Thinking and Speech*:

> If "language is as ancient as consciousness itself," if "language is consciousness that exists in practice for other people and therefore for myself," [if "the curse of matter (. . .) weighs on pure consciousness from the beginning,"] then it is not only the development of thought but the development of consciousness as a whole that is connected with the development of the word.[6] (Vygotsky 1987: 285)

In this text, Vygotsky directly quotes parts of the *German Ideology* (Marx and Engels 1978). Of importance to our inquiry, of course, is the fact that he would also take on board the statement concerning the curse of matter on consciousness, and, in this manner, would mark a way out of the psychophysical problem. Consciousness, as language, is a historical product. In fact, "language, as consciousness, is born from the necessity, the need of intercourse with other people" (1978: 30). Testifying to the influence that these insights had on him, a close reader and interpreter of

[4] Two English translations (Vygotsky 1986, 1987) do not reproduce the original quotation marks that separate the phrases directly taken from Marx and Engels (1978) and the remaining text. The German translation (Vygotskij 2002) and a recent Russian version (Vygotskij 2005) do contain the original quotation marks.

[5] Very important.

[6] The text in square brackets appears in the original (Vygotskij 1934: 318), the most recent publication (Vygotskij 2005: 1017), and the German translation (Vygotskij 2002: 467) but was dropped from Vygotskij (1982: 361) on which the English translation (Vygotsky 1987: 285) is based.

Vygotsky's works would later write that the psychologist had abandoned the notion of the sign (language) as a mediator in favor of seeing it as a "prop of the will, i.e., the subjective reality of an *inner voice*, born of its *externalization* for the Other, and thus also for oneself as for the Other within oneself" (Mikhailov 2001: 17).

To understand consciousness, humans have to be understood in the context of the given societal relations and the given life conditions that have brought them about (Marx and Engels 1978).[7] The individual becomes human in and through participation in the practical activities that contribute to the generalized production of needs and need satisfaction in society. In the last texts of Vygotsky—e.g. the introduction to *Thinking and Speech*—that participation in the fullness of life becomes the key to understand thinking, where the *real* inclinations, interests, needs, and desires of the thinking and feeling human being play themselves out. In contrast, traditional psychology had divorced thinking "from the full vitality of life, from the motives, interests, and inclinations of the thinking individual" (Vygotsky 1987: 50).[8] Indeed, traditional psychology had transformed thinking "either into a useless epiphenomenon, a process that can change nothing in the individual's life and behavior, or into an independent and autonomous primeval force that influence the life of consciousness and the life of the personality through its interventions" (1987: 50). But thinking is not like that. Instead, thinking always has a purpose: thinking is *for* acting and speaking and, therefore, marked by needs and affect. Thus, "every idea contains some remnant of the individual's affective relationship to that aspect of reality which it represents" (1987: 50). This then requires researchers to take into account the reality and the affective relationship between person and environment, the unity/identity of which constitutes the real psychological phenomenon. In a lecture given only months prior to his death, Vygotsky elaborated on the category of *perežívanie* [experience], which, as we discuss in several parts of this book, was defined in such a way that it captures all of these dimensions.

Every individual and every generation *finds* as something *given* the sum of the productive forces, capitals, and forms of social intercourse (Marx and Engels 1978). Even the simplest of objects, in their sensual certainty, are *given* to (rather than constructed by) the individual persons, always already found in their constitutive relations with their respective environments. Importantly, these simplest of objects are given to *every* person, even if in different forms. This leads to the fact that there is a social and material world that we have in common: The same world gives itself to everyone. This world is cultural and historical through and through; and so is every individual human being, constitutive part of this world—manifest-

[7] In all of their writing, Marx and Engels never use the German equivalents to *societal* [gesellschaftlich] and *social* [sozial] synonymously. They are not synonymous! Instead, only the former term allows a critique of a class society, whereas the latter refers to anything that we do in common. When taking on an idea from Marx and Engels, Vygotsky, too, makes the distinction (i.e. obščestvenij vs. social'no).

[8] This quotation is indeed a paraphrase from the preface to *The German Ideology* (Marx and Engels 1978), which first was published Institute for Marxism-Leninism of the Central Committee of the Communist Part of the Soviet Union: 1932 in the German and 1933 in the Russian version.

ing itself in the form of body and thought (mind). As a consequence, the "natural world" itself is a cultural-historical phenomenon; and the purest of scientific knowledge is possible only because of inherently societal, culturally and historically conditioned, material, practical-sensual activity. This line of argument makes it "obvious that the real intellectual wealth of the individual depends completely on the wealth of its real relations" (Marx and Engels 1978: 37). This idea is taken up in statements that any higher psychological function was a social relation, and personality is the ensemble of social relations of the individual (Vygotsky 1989). Marx explicitly rejects the constructivist idea of autopoiesis, construction of self, knowledge, and identity, and characterizes as nonsense the notion that individuals *make themselves*, physically or mentally. Instead, humans definitely make each other in and through the transactional relations they live and experience together.

In the same paragraph of *The German Ideology* that describes the cultural-historical origin of language and consciousness, the role of the two in societal relations comes to be articulated. Language allows humans to make present their relations to themselves and to the environment. Thus, for humans, "where a relationship exists, it exists for me, the animal '*relates*' to nothing and not at all. For the animal its relation to others does not exist as relation" (Marx and Engels 1978: 30). This idea also has salience to Vygotsky, who would write, in a text entitled "Consciousness as a Problem for the Psychology of Behavior," that Marx was referring to "the *doubling of experience* that is unavoidable in human labor" (Vygotsky 1997: 68).[9] In contrast to cultural-historical activity theory,[10] where consciousness is a category, Vygotsky rejects the notion to constitute its own category and instead suggests: "it proves to be a very complex structure of behavior, in particular, the doubling of behavior" (Vygotsky 1997: 79).[11] Consciousness is not a different form of being but is conscious being.[12] However, Vygotsky later realizes that the psychophysical problem lurks in this idea of the doubling of reality (Vygotsky 2010). The word and its role in and relation to (verbal) thinking constitute a way out of this dilemma. The word is not something aery-fairy but an integral part of our sonorous and visual reality (e.g. Chap. 9). This is so especially if the word is understood in relational terms, as speaking-*for*-thinking and thinking-*for*-speaking and as something that is a reality for two, because "in consciousness, the word is what—in Feuerbach's words—is impossible for one person but possible for two" (Vygotsky 1987: 285). Consciousness is a historical product, and so is language, which "*is* the real, practical consciousness." Rephrasing Marx, we can say: "the word is the most direct manifestation of the historical nature of human consciousness" (Vygotsky

[9] Marx does so in *Das Kapital* (Marx and Engels 1962).

[10] See Leont'ev (1978).

[11] Vygotsky's notebooks contain many statements about the differences between Leont'ev and himself that were emerging, including the different ways in which they were articulating consciousness.

[12] "Consciousness [Bewußtsein], being conscious, never can be something other than conscious being" (Marx and Engels 1978: 26).

1987: 285). The word is a collective rather than individual product (fact); it is a common feature of human relations and exchanges. It reflects consciousness as a whole (i.e. it reflects Spinoza's *thought*).

Towards a New Psychology

Vygotsky's vision of a new psychology would be achieved in the way that the introductory quotation outlines it: as a Marxist psychology that takes up its spirit from Spinoza. The solution was to come through a dialectical materialist, critical uptake that gets rid of the problems that are present in Spinoza's work as a result of the difference between method[13] and content of writing (Il'enkov 1977). The new psychology would constitute a monist theory that would overcome all remnants of Cartesian dualisms that plagued not only classical psychology but also Vygotsky's earlier work. For example, in his notes he suggests that his discovery of the mastery of the higher functions over lower functions does not work since it retains the two tiers typical of Cartesian division (Vygotsky, in Zavershneva 2010b). The beginnings of this rewriting of psychology partially exist in works such as *Thinking and Speech* and *The Teaching of Emotions*. The former is incomplete in the sense that it was only to be the start of a theory of consciousness, as apparent in the final paragraphs of that text:

> The word's distinguishing feature is a generalized reflection of reality. In the process, however, we have touched on an aspect of the word's nature whose significance exceeds the limits of thinking as such, an aspect of the word that can be studied only within the framework of a more general problem, the problem of *the relationship between the word and consciousness*. (Vygotsky 1987: 285, emphasis added)

The quoted text shows that the significance of the word goes beyond thinking—we might say it goes beyond what generally is referred to by the concept of "meaning"—in that it becomes a key to the study of human *consciousness*, a term that within the dialectical materialist epistemology denotes "*not just a psychological phenomenon* but also, and above all, an *ideological phenomenon*, *a product of social intercourse*" (Vološinov 1976: 114–115). The study of consciousness thus concerns the study of material life to which humans are subjected, where humans not only affect the environment through practical activity, but also change their affective relation with others and with the material world.

An important aspect of Vygotsky's theory is language, in which he sees a manifestation of that part of "consciousness that exists in practice for other people and therefore for myself" (Vygotsky 1987: 285). He thereby articulates the solution to

[13] Spinoza sought philosophical rigor by means of a synthetic geometric method, in which all aspects of the whole system of thought are derived from a primary set of propositions and axioms.

what for many educational psychologists today still is a problem: the relationship between intrasubjectivity and intersubjectivity (see Chap. 4). It is in language that consciousness is individual and collective simultaneously, objectively existing for other people as for myself! Language being a historical phenomenon continuously transformed in every act of speaking, the word also is a realization of historical consciousness in the consciousness of each individual speaker. The issue no longer is the "meaning" of a word but the *sense* towards which the child is oriented from the moment of birth (Zavershneva 2010a). What matters is that thinking "proceeds in a struggle against tendencies within *semantic fields* and in *consci[o]usness of these fields*" (Vygotsky, in Zavershneva 2010a: 44, original underline, emphasis added). That is, the search for the meaning of a word is abandoned in favor of identifying the semantic field and the fundamental issues of sense and its genesis. This orientation towards the semantic field, which always is a reality for two, constitutes one of those advances that have not been taken up in the western literature and that is a mark of the Spinozist turn Vygotsky was taking towards the end of his life. This is also a turn where the sign, the word being the most important instance thereof, loses its role as mediator (Mikhailov 2001). Instead, the *semantic field* constitutes an *accented visible* (El'konin 1994), thereby having precisely the function of logos *as* speech that has been developed on phenomenological grounds. Accordingly, rather than "mediating" a "meaning," speech "lets something be seen (φαίνεσθαι [phainesthai]), namely the *what* that is being talked about, and indeed *for* the speaker (who serves as the medium) or for those who speak with each other" (Heidegger 1977: 32). It is not that the person constructs the seen by speaking but rather, "speech 'lets see' ἀπὸ [apo] . . . from itself what speech is about" (1977: 32). In so doing, speech makes real what it is about for speaker and recipient alike; not what it is *about* in the traditional sense of meaning, but what it is as a real, objective social phenomenon. Judging from the direction Vygotsky was taking, we arrive at some psychological version of this philosophical articulation of our everyday relation to the world in and through language in the study of consciousness. Following this line of thinking, we provide a revised, Spinozist position on the function of the sign in human behavior in Chaps. 4, 9, and 10.

Vygotsky's works have been taken up in different ways by his disciples, disciples of disciples, and interpreters. Not all of these versions appear to be consistent with what the epistemological premises Vygotsky was evolving, as many versions omit some essential characteristics—e.g. the dialectical materialist, Marxist *method* and its *philosophical tenets.* Even fewer scholars, if any, have taken up the works to continue where Vygotsky left off in the final days of his life when he was seeing an absolutely new psychology emerge on the horizon but never actually articulated it. The benefits of continuing Vygotsky's later steps, however, may be huge, as he laid down the beginnings of a path towards the establishment of a non-dualist discipline of psychology that would overcome the dichotomies between mind and body, the individual and the social, and the cultural and the natural that still are present in much of today's educational psychology literature. Throughout this

book, we shall revisit several of those dichotomies and revise them in the light of the emerging view.

Our aim is to take the baton where Vygotsky left it when he was turning towards a new stage in his theoretical development, and to work towards articulating a cultural psychology of education based on this outstanding legacy. Our goal, therefore, is *not* to uncover and elaborate what Vygotsky "really" meant to say and write—which may always remain a contested issue—but rather to contribute to imagining and realizing the sort of educational psychology that would result if Vygotsky's late Spinozist ideas were to be pursued consistently. Thus, we are not concerned with Vygotsky's personal intentions but with the kind of problems and ideas his last works were beginning to elaborate. These problems and ideas we make our own. We begin by examining Vygotsky's legacy in current educational psychology from a critical perspective. We describe how Vygotsky's ideas—never a finished product, but rather living parts of a larger developing form of psychological inquiry—are often taken up as self-standing tools in the service of classical psychology's premises and methods. This has to a large extent prevented our community from developing themes that are central in Vygotsky's notes, which include the importance of the unity of (a) affect and intellect and (b) material life and consciousness. To contribute to re-establishing these ideas into the larger currents of thinking from were they come from, we further describe the fundamental premises that Vygotsky begun outlining through a dialectical materialist reading of Spinoza, which will be foundational to our task of re-imagining a non-dualist cultural psychology of education.

Restoring Life in and to Vygotsky's Legacy

Graduating in law and deeply interested in literature and philosophy, Vygotsky's career as a psychologist began in 1924 and developed until his premature death from tuberculosis only 10 years later. Compared to the work of other influential western scholars—such as John Dewey, who developed his work over the course of a 65-year period, or Jean Piaget, whose work was produced over a 50-year period—Vygotsky's career was remarkably brief. Yet, his work continues to greatly influence current educational theory and practice around the globe (Fig. 1.1). Today, most educational psychology textbooks introduce Vygotsky's theory alongside those of other great twentieth-century psychologists. These texts not only provide a similarly prominent place to Vygotsky but also are quite consistent in the way they present particular notions as the psychologist's main contributions to the field. To the educational psychologist student and practitioner, the Vygotskian cultural-historical theory thus may appear to be a well-established field within psychology in general and within educational psychology in particular. There are clearly defined concepts and methods that are a consistently called upon. Thus, students and practitioners of educational psychology tend to

be familiar with notions such as *zone of proximal development*, *mediation*, and *psychological tools*.

What these characterizations do not make visible is the fact that neither the theoretical and methodological basis of cultural psychology nor the way in which Vygotsky's pioneering work is to inform cultural psychology's future development are a settled matter (Valsiner 2009). In fact, there exists a continuing debate among experts in Vygotsky studies. Some argue that even the most well-recognized American scholars who advanced the cultural-historical approach in the West have developed readings that are inconsistent with the analytical and philosophical premises laid down by the Russian psychologist (e.g., Bakhurst 2007). Thus, despite the propensity of much of current literature in educational research to state an affiliation with Vygotskian theory, making such a claim without considering the historical and conceptual roots and development of Vygotsky's work is problematic for a number of reasons.

One reason for disagreements concerns the fact that Vygotsky's theory never constituted a finalized whole. Rather, it was a theoretical system under constant development that has been described as "a tumultuous process full of contradictions and unfinished ideas" (Rey 2011: 258). Unlike other scholars who generally later in life had the opportunity to reflect upon and elaborate on their own theoretical developments, Vygotsky never got the opportunity of doing so. Rather, his work "remained unfinished, did not loose its heuristic potential, and is open to further elaboration" (Zavershneva 2016: 202).

The difficulties are exacerbated by the fact that existing English translations of Vygotsky's original works often are heavily abridged and edited, which has led some Vygotskian scholars to state (a) that "existing translations are marred by mistakes and outright falsifications" (van der Veer and Yasnitsky 2011: 475), (b) that the 1962 and 1986 translations of *Thought and Language* are unacceptable, and (c) that the most cited work, *Mind in Society*, is indeed not Vygotsky's own text but a compilation that is unsatisfactory from a historical point of view. In addition to the problematic translations of the work, there is also the issue that different works produced during different stages in Vygotsky's life have been published and translated at different dates, which makes it more challenging to get an idea of how Vygotsky pushed the thinking about psychological theory.

Undeniably, the ideas Vygotsky articulated have contributed to important shifts in the way today's psychology of education is investigated and practiced. A number of reviews concerning the impact and developments of ideas in current educational research make an important turn away from a sole interest in the private mind and towards acknowledging the importance of social practice in learning and development (e.g. van der Veer 2007). Yet, the widespread adoption of Vygotsky's writings, which sometimes goes without clear reference or only through isolated citations to his original work, has not gone without criticism by researchers interested in building a cultural-historical theory consistent with its foundational problems and principles.

One such a principle concerns the importance of taking a genetic, historical approach not only to the development of the psyche and of consciousness but also to the sciences. As Vygotsky writes in the foundational text "The Historical Meaning of the Crisis in Psychology,"

> [w]hen one is somewhat acquainted with the methodology (and history) of the sciences, science loses its image of a dead, finished, immobile whole consisting of ready-made statements and becomes a living system which constantly develops and moves forward, and which consists of proven facts, laws, suppositions, structures, and conclusions which are continually being supplemented, criticized, verified, partially rejected, interpreted and organized anew, etc. Science commences to be understood *dialectically* in its movement, i.e., from the perspective of its dynamics, growth, development, evolution. (Vygotsky 1997: 292)

Despite Vygotsky's warnings not to build on "dead, finished … ready-made statements" and to understand instead any scientific movement as "a living system," the ideas he articulated continue to be taken up and presented in ways that completely detach them from the historical currents of development that brought them forth in the first place. Disconnected from a historical and developmental understanding of Vygotsky's own intellectual growth, important aspects of his legacy are lost or appropriated in ways that critically depart from the larger constructive project that the original works had set forth.

Two interrelated problems emerge from a lack of engagement with Vygotsky's larger history of theoretical development. First, and perhaps more important, is the gross overlooking of Vygotsky's main project of founding a "new psychology" that should overcome the problems plaguing behaviorism ("scientific psychology"), on the one hand, and subjective empirical ("interpretive") psychology, on the other. The former had avoided consciousness as a subject of psychology and, in so doing, remained purely materialist. The latter had focused only on the ideal and subjective (e.g. "meaning"), making it impossible to treat psychological phenomena as material and natural. Sixty years after these "two psychologies" had been marked as problematic (Vygotsky 1997), the same problems affecting the psychology of his time were again articulated with regard to the cognitive revolution, which had been an attempt "to bring 'mind' back into the human sciences after a long cold winter of objectivism" did not succeed (Bruner 1990: 1).

Bruner, as others after him (e.g. Cole 1996), saw the need to overcome cognitivism and argued for the need to develop a *cultural psychology*, one that would largely be based on Vygotsky's intellectual legacy. Such a psychology, as Vygotsky made clear throughout *all* of his works, was to be based on a *dialectical materialist* approach.[14] The latter, however, is often ignored or neglected. Thus, concepts that were developed to overcome the dualisms between body and mind (culture and nature) are appropriated in the service of the very practices that Vygotsky fought

[14] In conversations with colleagues, we sometimes hear the suggestion that Vygotsky, in referencing Marx and Engels, was simply doing lip service to the regime of his days. This may or may not have been the case. More important to us is the fact that his *method* of inquiry fundamentally is materialist dialectical, as is his reading of Spinoza independent of whether or not he names it a Marxist re-reading.

against. As a result, much of the research utilizing one of Vygotsky's most often cited concepts—i.e. the *zone of proximal development*—does so within "a cognitive developmental research paradigm" (Newman and Holzman 1993: 67) that is incompatible with Vygotsky's non-dualist project. Instead of "Vygotsky's radically monistic methodology being employed to call into question the fundamental mentalism and dualism of cognitive psychology, the ZPD … is made into a 'more social' tool for result, thus reinforcing the mentalism and dualism" (1993: 67). Taken within classical schemes of cause–effect inquiry, Vygotsky's notions loose their explanatory power precisely because they are turned into ready-made conceptual molds rather than as real, self-developing theoretical problems. If a truly Vygotskian framework is to inform educational research, then a *genetic* approach must complement if not substitute the dominating cause–effect paradigm.

A second problem derives from the widespread tendency to ignore Vygotsky's own developmental trajectory. Rather than facing a single, unitary, and complete theory, scholars studying Vygotsky's texts and history are identifying at least three different stages or moments in Vygotsky's developing thinking (Zavershneva 2010a). During the first and the third moments, roughly fitting into the 1915–1927 and 1931–1934 periods, respectively, Vygotsky gave particular importance to themes such as *imagination*, *fantasy*, *emotions*, and *personality*, and emphasized "the generative character of the psyche" (Rey 2011: 257). The second period, in contrast, involved a more objectivist and instrumental turn towards *reflection* as an organizing theme, and the idea of *sign mediation* and its role in the development of higher psychological functions became central. It is this period that seems to have had the strongest impact on current uptakes both in the USSR (Russia) and in the West; and it is the one that most often is identified as constituting Vygotsky's cultural-historical theory. However, this has come at a price: Vygotsky's instrumentalist and intellectualist ideas are overemphasized to the detriment of other equally important themes such as the role of the emotions, fantasy, and imagination.

Rey's assessment is in agreement with that of Zavershneva, who had the opportunity to study documents from the family archive of Vygotsky—which include the notes that the psychologist wrote during the last years of his life. These documents make apparent a major shift towards the end of Vygotsky's career where the "semantic structure of consciousness" became the organizing principle in his theory. Consciousness, a theme that transpires from all of Vygotsky's work, is in this later phase recovered as the most central subject of study. These analyses align well with those by yet another Vygotskian scholar, who notes that in Vygotsky's last Spinozist works, "the idea of semiotic mediation is supplanted by the concept of the intersubjective speech field" (Mikhailov 2006: 35). The findings are not trivial, for if the core principles and analytical concepts that Vygotsky was developing towards the end of his life have largely been ignored or only partially addressed, what other ideas and developments could there be for educational psychology that have not yet been developed?

The fundamental tenor of our message is that by following up and building on Vygotsky's *later* developments—where the problem of consciousness and the idea of intersubjective speech field are central—we can evolve a suitable and

fertile path to build a truly non-dualist discipline of psychology. This will be a discipline that restates psychological problems not as mental but as problems of *life*. Il'enkov and Vygotsky virtually express the same phenomenon that is at the heart of Spinoza's non-dualist thinking, which conceived of Nature as a unitary, self-moving force.

> Consciousness determines life (the image), but it derives itself from life, and forms its component: ergo *life determines life [itself]* through consciousness. (Vygotsky, in Zavershneva 2010a: 48, emphasis added)
>
> In man, therefore, Nature thinks of *itself*, becomes aware of *itself*, senses *itself*, acts on *itself*. And the "reasoning," "consciousness," "idea," "sensation," "will," and all the other special actions … are simply different modes of revealing a property inalienable from Nature as a whole, on of its own attributes. (Il'enkov 1977: 34, original emphasis, underline added)

The proposition that "consciousness" both "determines life" and "derives itself from life" indeed marks an important departure from most present-day uptakes of Vygotsky's texts, where the notion of *mediation* is presented as a central tenet. For if we agree with Spinoza—as did Vygotsky and the German philosopher L. Feuerbach before him—that there is only *one* substance—which "is in itself and conceived through itself" (Spinoza 2002: 217)—then there is no need for mediators that connect consciousness to life. Instead, there is one life that moves towards itself: "life determines life." There is but one world the evolution of which manifests itself in and by means of a myriad of histories, which at once constitute human history and the history of individual persons. This non-dualist view affords for a radical reconsideration of what it means to consider *the social* as primary. For, if "it is clear to all but the most extreme Neo-Platonists that learning occurs in 'a social context'" (Newman and Holzman 1993: 63), what else is there to learn by following Vygotsky's last Spinozist steps?

Steps Towards a Non-dualist Discipline

There is a history of thought attempting to overcome all forms of dualism that reaches from Spinoza to the materialists including Feuerbach, whose work is critically examined by Marx and Engels (i.e. in "Theses on Feuerbach"). This history would influence the attempts of founding a universal psychology that would be able to explain concrete human behavior and the role various psychological functions (thinking, dreaming) play in the conduct of concrete life. Among the psychologists with a decidedly practical (Marxist) bent, we find Vygotsky but also G. Politzer, from whom the former took much inspiration (e.g. "psychology = drama" [Vygotsky 1989: 67]).[15] In this section, and as a pre-requisite for continuing our quest towards a non-dualist cultural psychology of education, we elaborate on the fundamental

[15] The two psychologists are contemporaries, having lived during approximately the same time: 1896–1934 (Vygotsky) and 1903–1942 (Politzer).

features of this history of dialectical materialist (Marxist) thinking, which itself underlies Vygotsky's Marxist re-reading of Spinoza and his attempts to constitute a new psychology.

Transcending Dichotomies

> Dialectical psychology proceeds first of all from the unity/identity [edinstva] of psychological and physiological processes. For dialectical psychology, *mind* is not, in the words of Spinoza, something lying outside of nature or a kingdom within a kingdom, *it is part of nature* itself, directly linked to the functions of the higher organized matter in our brain. (Vygotskij 1982: 137, emphasis added)

In the quotation, Vygotsky takes up a fundamental Spinozist insight: the *unity/identity* of the psychological and physiological dimensions of human life, that is, the unity/identity of body and mind (thought). In this conception, *mind is part of nature*. As shown above, Vygotsky has his sight set on producing a dialectical materialist psychology, a psychology that takes a Marxist lens to reading Spinoza. In this, he certainly did not mean a psychology subject to the political ideologies that link themselves to Marx, especially those that undergirded the Soviet state. Instead, it was to be a psychology that no longer operated with the dichotomy of body and mind (i.e. the psychophysical problem), no longer reduced mind to the body or the body to the mind. It was to be a psychology that instead understood both body and mind as attributes of one and the same substance. In his own words, Vygotsky never got to that point of developing this dialectical materialist perspective on the thinking body. But a fellow countryman did. It was left to the philosopher E. V. Il'enkov—whose work on dialectical materialism features Spinoza throughout—to develop a monist position on the *thinking body*. The real keystone of the approach is that

> there are not two different and originally contrary objects of investigation—body and thought—but only *one single* object which is the *thinking body* of living, real man (or other analogous being, if such exists anywhere in the Universe), only considered from two different and even opposing aspects or points of view. (Il'enkov 1977: 31)

A materialist conception of the thinking body takes as fact that thinking "is a mode of the real existence of the material body, the activity of the thinking body in real space and time" (Il'enkov 1977: 223). Late in his life, Vygotsky presented the category of *perežívanie* [experience], the identity/unity of person and environment. According to the latter, there is a *trans*actional relation such that a person and her lifeworld cannot be understood independently because each part is involved in defining the other. We may therefore write this unit in the form of *{person | environment}*. This unit has intellectual, practical, and affective characteristics, which exist simultaneously as aspects of the larger whole.[16] The adjective *transactional* means that in any performance situation, understanding the role of the

[16] In American pragmatist philosophy, *experience* is used in that way (e.g. Dewey 1934/2008).

person characteristics requires specification of the environment and understanding the role of the environment characteristics requires specification of the person.

In dialectical terms, we may alternatively speak of person and environment as two different, always one-sided manifestations of the same phenomenon, which is that of a transactional relation; this phenomenon is known only through its manifestations. This is a Spinozist framework in that the event referred to as thinking cannot be located exclusively in the body generally or in the brain specifically. Here, the event of thinking is a necessary rather than fortuitous part of a chain of events the beginning and end of which lie outside the thinking body. The necessity of it is not brought by external analysis, but exists a priori in the event's history. Thus, to understand a simple fact, such as our perception of the full moon in the sky, which we have come to see as a circle, requires a description of the physical organization of the human body that produces this perceptual experience by necessity, which the light does not produce in an inanimate object. As noted in the context of "the lightning bolts of Spinoza's thought" (Vygotsky 2010: 92), perception already is suffused with affect. The thinking body refracts the influences in a way that these are felt as coming *from external things* rather than being the result of some internal construction in the way that the (radical) constructivist discourse has it. In the latter discourse, everything is the result of our mental constructions. For the thinking body, the shape of the moon in the night sky is experienced as the shape of the moon itself, not as the result of the caprices of a mind that makes whatever it wants of the light that strikes the retina.

In the Spinozist approach, two substances (things) external to each other have nothing in common and therefore cannot affect each other. However, when two things are but manifestations or attributes of one and the same substance, they already and inherently—and thus necessarily—are related and do not need to be brought together. For Spinoza, as for Vygotsky, both the living body—in contrast to the dead body—and the thinking body are manifestations of Life.[17] The same issue appears in different form for Vygotsky when he articulates the relation between thinking and speaking and the role of the word in interpersonal communication. Attributing his idea to the German philosopher Feuerbach, Vygotsky (1987) notes in the final paragraphs of *Thinking and Speech* that the word in consciousness is reality for two but impossible for one person. The materialist philosopher does not limit himself to the word but comments on reality writ large: "Only that exists, which is simultaneously for myself and the other, wherein I and the other agree, which is not only mine" (Feuerbach 1846: 308). If something is not only mine, it is inherently social: mine and not mine simultaneously.

As soon as we think in terms of *transactional* phenomena, it is impossible to attribute cause and effect to entities that are external to each other, such as when culture and people are said to *inter*act. In accordance with Spinoza's approach, if there were two entities external to each other they could not stand in a cause–effect relation, one cannot affect the other (Spinoza 1883, proposition 6). Within a transactional relation, and contrary to much current research in education, the parts of a

[17] That idea also is central to a materialist phenomenology (Henry 2000).

system are part of each other and therefore there cannot be a cause separate from effect. This interrelation is expressed in materialist dialectical philosophy, in reference to Spinoza, by stating that "*substance is causa sui*"[18] (Marx and Engels 1975: 499). The implication is that the body "cannot cause changes in thought, cannot act *on* thought, because its existence as 'thinking' *is* thought" (Il'enkov 1977: 34). Accordingly, thought and (bodily) extension cannot be two substances, because they could not be in any kind of relation let alone in the relation of thinking and movement that characterize the thinking body. Another consequence is that thought cannot be the cause of physical expressions, verbal or gestural, as explicitly formulated in *Thinking and Speech* (Vygotsky 1987). This is so because "all talk of thought first arising and then 'being embodied in words' … and later in actions … from Spinoza's point of view, is simply senseless" (Il'enkov 1977: 44). We develop this point in Chap. 3, where we discuss the unity {communicating | thinking} and show how that unit includes (psycho-, socio-) genesis.

An important Spinozist influence can also be detected in Vygotsky's insistence on unit analysis that is to replace the traditional scientific approach of analysis in terms of elements. A Marxist psychology no longer takes conscious processes as subjects of investigation in their own right. Instead, "conscious processes … are understood as parts of larger psychophysiological integral processes" (Vygotsky 1997: 83). Already Spinoza was going "beyond this method because it is his philosophical aim to understand the place and role of every part, 'mode,' in the general plan of the whole, to understand the part as a separate manifestation of universal, integral Nature" (Mikhailov 1980: 67). Fundamental to such a part–whole approach is that the whole, being present wholly in each one of its parts, is more than the sum of its parts or, more correctly, is *not* a sum at all, but rather a movement. That movement cannot be reduced to parts without losing its most fundamental feature as *living* movement, namely *animation.*[19]

The thinking body is not something opposed to life, but is a manifestation of the {person | environment} unit, also termed *perežívanie* [experience] in Vygotsky's theory. It does not reflect upon but follows in its movements the shape of other bodies in the environing world. This shaping, as our own research has shown, begins with the movement of hands in the manipulation of materials, movements that subsequently function as symbolic gestures with or without the original materials present, and then are reflected in speaking (see Chap. 12). In a dialectical materialist approach, this finds its expression in statements about the power of thought, which reveals itself as *objective truth* in praxis and, therefore, as the second thesis on Feuerbach states, always is a practical question: "in praxis man has to prove the truth, i.e., reality and power, the this-sidedness of his thinking" (Marx and Engels 1978: 5). Thinking never exists in itself; it never is for itself. Thinking always is *for* something else. It always is thinking-*for*-doing (speaking, manipulating, escaping).

[18] "Substance is its own cause."

[19] *Animation* is the "fundamental, essential, and properly descriptive concept" of life (Sheets-Johnstone 2011: 453).

The expression thinking-*for*-doing transcends a dualist approach because it reducibly involves mind, body, and world (i.e. inside and outside).

The role of thinking can be understood by considering it in the evolution of the human species: as a function that became dominant because of the advantage it provided to survival as a biological species. The critique of vulgar materialism takes into account that the "nature preceding human history is not the nature in which Feuerbach lives, not the nature that today . . . no longer exists anywhere" (Marx and Engels 1978: 44). Because consciousness presupposes the four moments of historical conditions referred to above, a Marxist science has to show the articulation (i.e. joint) of nature and culture, that is, has to exhibit the emergence of consciousness (and language) as a process of transition and anthropogenesis. If thinking had not constituted an advantage, it would not have been selected in the evolutionary process. But thought (reasoning) exists *as* societal relation. A Marxist anthropology, therefore, has the goal to explain the turnover from soci(et)al relations when they emerged as a minor function in the life of human ancestors to the point when they became the dominant function. Society and its culture then constitute the *nature* of the human species. The dichotomy of nature and nurture thereby is overcome because each is but a manifestation (attribute) of one substance. In Chap. 2, we articulate this development in a description of anthropogenesis, which lays the foundation for a social psychology à la Vygotsky where there is a primacy of societal relations that constitute the concrete manifestation of all forms of thought. In Chap. 5, we show in which way thinking and reasoning are *social*—not because people do them together in groups, but because they exist *as* relations that constitute society.

Knowing-How and Life's Power to Act

Cause and effect relations are still the dominating explanatory paradigm within which much of Vygotsky's legacy is assimilated in current educational psychology—both in quantitative and qualitative studies. Individual ideas cause people to act in particular ways, just as educational interventions are seen as having individual pieces of learning as their effect (Maxwell 2004). This scheme of thought corresponds to and derives from a classical epistemology that splits ideas from their objects. In Spinoza's *Ethics*, however, as expressed in the sixth axiom of Part I, a true idea corresponds to its object, a notion that is central to the dialectical materialist conception of the unity/identity of categories and the corresponding aspects of the world. The thinking body thus moves in accordance with the things of the world, making unnecessary the existence of a priori (mental) *schemas* of actions.[20] In fact, the very idea of there being schemas that underlie and cause bodily movement—as

[20] This fundamental insight also arises within phenomenological philosophy, where there is a primacy accorded to movement over schemas (e.g. Sheets-Johnstone 2011).

suggested in current enactivist theories—takes us back to the body–mind dichotomy that Vygotsky attempts to escape by turning to Spinoza.

In the Spinozist view, ideas are the result of two very different phenomena: the form of worldly object and the form of the body. These two cannot be taken apart to get to the essence of the two forms, since their essence consists in their unity and mutual development. As soon as we take whatever we have received from the objects in the world through acting and sensing in isolation from the object, or from the acting and sensing, we are left with "nothing, no idea of any kind" (Il'enkov 1977: 68). In Vygotsky's work, this aspect is reflected in *the primacy of the social*, whereby any higher psychological function *was* at some time a real relation with another person. That is, the individual participates in the production of soci(et)al relations, and these real relations become forms of individual behavior, which individuals eventually comes to produce on their own. This immediately makes *unnecessary* the notion of *internalization* so prevalent in current scholarship and textbooks of educational psychology, a notion that Vygotsky himself was in the process of abandoning in and with his turn to Spinoza. Thus, "in the relation between thinking and speech," rather than internalization, "[there is] a continuous transition of the external to the internal and the internal to the external" (Vygotsky 2010: 94). As a result, movement creates the distinction between the internal and external rather than being caused by it. If the thinking body follows the external form, it already is taking the form and does not have to internalize it: the body and its thinking are one, the body being the organ of thinking. If that form is repeated, a form of resonance is created that constitutes remembering and the memory of the form. This is so whether the stimulation comes from the outside or from the thinking body's movement.[21]

An idea is adequate, according to Spinoza, when it is a refraction of the coincidence of the form of the body and the form of the external thing. The idea of a circle, for example, is adequate when the thinking body produces a circle outside of itself, on a piece of paper or in some other medium. The idea of a circle is adequate when it is defined by means of an instruction for how to construct a circle in the real world, for example, by means of a line fixed at one end while the other moves in a way that holds the line taut. In this instance, "the *nomical definition* [arises] *together* with the *real action of the thinking body along the spatial contour of the object of the idea*" (Il'enkov 1977: 264). When, on the other hand, "a man says that the lines drawn from the centre of a circle to its circumference are not equal," he not only "attaches a meaning to the word circle different from that assigned by mathematicians," but also is proven incorrect by concrete actions in the world (Spinoza 1883). Adequacy, here, is tied to the activity of the thinking body in its world—the point expressed above that is so important in the Marxist diction that the power of thinking is expressed in practical action.

The point in the eleventh thesis on Feuerbach that philosophers only attempted to understand the world without transforming it (Marx and Engels 1978) has its

[21] That precise insight also was the result of an inquiry from a very different perspective, an inquiry that established the foundations of the person in its habitudes (Maine de Biran 1841).

equivalent statement in Spinoza: "the mind, inasmuch as it has inadequate ideas, is in certain cases necessarily passive" (1883: Part III, Postulate II, proof).[22] Thus, an idea is adequate when "my body (my hand) really describes a circle, and the awareness of this state (i.e. of the form of my own action in the form of the thing) is also the idea" (Il'enkov 1977: 69). The more varied the ways in which a thinking body acts on and perceives external things, the more in common it has with other bodies, and the greater is its power to act. This is the guiding idea in a Marxist critical psychology, where learning is defined as *expansive* when it is directed to the expansion of the power to act (Holzkamp 1993). If we can increase our power to act, in other words, if we can increase our control over the conditions, then it is rational that we do so. Indeed, it is in our interest to do so. The rational becomes then not only an analytical but also an *ethical* question.

A weakness in the work of Spinoza, however, is the fact that his thinking body, "moving along the given contours of natural bodies, took their shapes" (Il'enkov 1977: 224) without transforming them. In this way, Spinoza did not account for the *creative* activity of humans, which produces new shapes, needs, and desires, thereby changing the natural world. But in changing the world, in productive activity, the thinking body changes, and it further changes in becoming conscious of its new activity. Creativity is a central theme in Vygotsky's thinking, and such emergence of qualitatively new forms of consciousness should become an important aspect of the psychologist's distinction between quantitative changes (learning) and qualitative changes (development) in human behavior and consciousness (see Chaps. 2 and 6). That idea of humans changing the world, and, therefore, the idea concerning who and what they are (an idea elaborated in Chap. 13), is new to the Marxist reading of Spinoza and the pre-Marxist materialist philosophies (e.g. that of Feuerbach against which the "Theses" are directed).

Another important idea is that of investigating thinking through the determination of its *function* in a world of objects rather than focusing on its structural determination independent of that world—as it tends to be done in cognitivist theories. This idea moves the focus away from mental structures or functions in themselves, and brings thinking back into the real world of activity in which humans think and move in their everyday pursuits. Thus, "the real being of the living brain was also thought, and the real thought was the being of the living brain" (Il'enkov 1977: 216). In philosophical terms, this means that

> the immediate unity of soul and body, which admits nothing in the middle, and leaves no room for a distinction or even contrast between material and immaterial being, thus is the point where matter thinks, body is mind, and conversely, mind is body, thought is matter. (Feuerbach 1866: 163)[23]

[22] Vygotsky makes reference to Spinoza's definition suggesting that it can be justifiably applied to child development, where the "initial consciousness of the infant still completely lacks active [psychological (psixičeskie)] states, that is, [psychological (psixičeskix)] states internally determined by the personality" (Vygotsky 1998: 233).

[23] Marx and Engels (1978) rightly point out that Feuerbach's position, in identifying mind with body, fails to recognize the inner contradiction in the worldly foundation of life, which detaches itself from itself to form an apparently self-sufficient kingdom (i.e. consciousness). In other words,

This has the consequence that a functional determination of thinking can be found "only if you do not probe into the thinking body (the brain), but carefully examine the real composition of its objective activities among the other bodies of the infinitely varied universum" (Il'enkov 1977: 73). The study of what is in the skull, Spinoza attributes to doctors and anatomists. There is nothing of relevance to thought that can be found in the structure of the brain because the *functional* determination arises in *external and objective* activity. Vygotsky later would conclude that "it is ridiculous to look for specific centers of higher psychological functions or supreme functions in the cortex" and that functions "must be explained . . . in external terms, on the basis of the fact that man controls the activity of his brain from without through stimuli" (Vygotsky 1989: 59). He argues for a *concrete* human psychology where anything specifically *human* about our behavior—including thought—exists in and, more importantly, *as* societal relation. This is not to say that there is nothing relevant going on in our brains, but that what is to be found there is significant always in relation to a functional whole that includes individuals and their societal environments. Thus, Vygotsky's ideas were indeed decisive in the foundation of neuropsychology, most saliently through the works of his colleague and disciple A. R. Luria.

To understand thinking qua mode of action requires us to investigate it in the course of the engagement of the thinking body in the system within which it functions. That is, we have to investigate the "systems of relation 'thinking body and its object'," that is, "in the system thinking body–nature as a whole (with Spinoza it is 'substance,' 'God')" (Il'enkov 1977: 52). Any investigation of an individual body, however, only gives us a partial and one-sided aspect of thinking. For this reason, Vygotsky is careful to identify the general in any specific case he investigates, because the general is true for all cases. Thus, in *Psychology of Art* (Vygotsky 1971), he requires only one example from one art form, the fable, to derive a psychology of *all* forms of art, not just a psychology of the fable. Not surprisingly, an epigraph with a quotation from Spinoza opens that book. Vygotsky's is a specific attempt to arrive at a description of art as a manifestation of one substance, which, therefore, is common to all art forms.

Thought, taken as a mode of action of the thinking body, has to be investigated in comparison with the mode of action of a non-thinking body. Such a comparative method is crucial to a truly genetic approach. This also means taking a temporal perspective, for an inactive thinking body no longer is thinking but only a (material) body. The immediate consequence of this is that we cannot investigate structures (of thought)—as this occurs in investigations of mental structure—but only thinking-*for*-acting, which inherently is in movement. Vygotsky therefore points to the necessity to investigate thinking and speaking—more accurately, perhaps thinking-*for*-speaking and speaking-*for*-thinking—as intermeshing processes, two very dif-

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Feuerbach's materialism is of the kind that can be found to the present day in the natural sciences and positivist psychology, and which cannot account for the emergence and concrete existence of consciousness.

ferent manifestations of the same {person | environment} unit. That unit includes the sense of the situation as a whole.

Concrete Human Psychology

A most important idea Vygotsky took on from the materialist take of Spinoza's work concerns a focus on the whole person in the fullness of life. In various places of his writing, Vygotsky makes reference to Feuerbach, who developed a materialist approach to Spinoza. One of the philosopher's texts argues against dualisms emphasizes that thinking cannot be understood when it is separated from the human being in its flesh and blood (Feuerbach 1846). In a passage Vygotsky refers to and quotes repeatedly, Feuerbach suggests that psychology has not abandoned the distinction between thinking and being, but considers the two as different manifestations of a unit. It is not individual "mental" thinking that can be the real object and organizing principle. Instead, the lead is to be taken from Feuerbach, whose "whole materialism is expressed in the distinction of phenomenon and being within psychology and in the acceptance of being as the real object of study" (Vygotsky 1997: 322). Thus, thinking is not a mere subjective activity, as seen in the experience that thoughts come to us ("it thinks") and that thoughts are subject to an *organic* development.[24] *The whole being is becoming in the course of its life*. This is the organizing principle, for example, when Vygotsky writes that the understanding of thinking requires us to view the person in its full life, where the motives and interests of the person come into play, and where intellect and affect are but two manifestations of the unit of person acting in the environment. If thinking is considered outside of the fullness of real life, then it becomes an epiphenomenon. Thus, we insist on the unity/identity of thinking-*for*-doing and doing-*for*-thinking. By disconnecting thinking from everyday life, "we cut ourselves off from any potential for a causal explanation of thinking" (Vygotsky 1987: 50). This again is a fundamentally Spinozist take, whereby the phenomenon can be understood only in its functional relation to the situation as part of ongoing life. Vygotsky thereby was working towards a concrete human psychology that emphasizes both the *concrete*—as opposed to ideal—and the *human*—as opposed to scientific psychology of animals, a human psychology that would be essentially a "*psychology in terms of drama"* (Vygotsky 1989: 58). He attributes these ideas to a contemporary materialist psychologist, Politzer, who was striving to work out a psychology based on the works of Marx and Engels.

The idea of psychology as drama, though deriving from the concrete (Marxist) psychology of Politzer, fits well into Vygotsky's approach. This becomes clear in his principle that any higher psychological function *was* a social relation first, and, therefore, a real relation between people: "Hence the principal method of *personifi-*

[24] In different places, Vygotsky (e.g. 1989, 1997) quotes the German physicist and founder of German aphorisms G. C. Lichtenberg, which are in fact quotations that appear in the same passage from the works of Feuerbach, from which he also quotes in other places.

cation in the study of cultural functions" (Vygotsky 1989: 58). This is why all the analyses in this book focus on the real relations between people, where, what for some or all participants has been fused into one comes to be divided anew.[25] As Vygotsky suggests, higher processes may be experimentally unfolded into drama—which is the same kind of conceptual underpinning as we find in the breeching experiment characteristic of ethnomethodological studies (Garfinkel 1967). In breeching experiments, participants find themselves in situations where their normal ways of functioning no longer work, for example, because they wear inverting lenses or because they are blind (–folded). It is in such situations that the work going into making the everyday world structured and navigable, which tends to be invisible because it already forms part of our repertoires of moving and being, is made visible again. In {teaching | learning} situations,[26] we observe the very same phenomenon, because some practice that a person normally achieves on her own exists *as* the social relation between people, and, thereby, is visible again in its original (genetically prior) form (Chap. 5).

The concrete human psychology that Vygotsky aims at developing seeks its foundation in a practical understanding of human behavior, in how people actually do what they do. But it does not remain materialist in any simplistic way: It is in and through real praxis that subjectivities are produced. In a concrete human psychology, the questions of subjectification and of objectification are one and the same question because, "as individuals express their life, so they are. What they are, therefore, coincides with their production" (Marx and Engels 1978: 21). Concrete human psychology, a positive psychology by nature, takes up such an agenda and describes how we experience thinking and explains this thinking in terms of its function in real, concrete life of society. An aspect of behavior is psychological because it is part of the drama of life (Politzer 1928). A movement towards this view can be seen in the work on the psychology of the actor, which Vygotsky describes from a concrete human psychological approach as "a historical and class category" (Vygotsky 1999: 240). However, in his available writings Vygotsky still fell short of the goal of developing a *concrete human* psychology, because he investigated, for example, child development in a psychological laboratory and thereby was not taking into account that the thinking of a child in the drama of a scientific laboratory is different from the thinking of the child participating in life's dramas in all the other (more familiar) locations where these unfold.

[25] Historically, our own sensitivity and attention to the social relations as educational researchers have a different intellectual origin, namely in ethnomethodology and conversation analysis.

[26] Throghout the book, we use the term {teaching | learning} as a means to emphasize the social irreducibility of instructional situations, in which not the individuals alone, but the soci(et)al relation is the unit that learns and develops.

Conceptual Sketch of the Remainder of This Book

The remainder of this book is divided into three parts, each coming with its own introduction. Over the course of the five chapters that appear in part I, we articulate some of the foundational issues for a cultural psychology of education grounded in a Marxist re-reading of Spinoza by re-visiting existing Cartesian dichotomies that plague past and current educational psychology. Most important is a consideration of the historical constitution of the unity/identity of biology and culture, which lies at the heart of Vygotsky's project that was designed to address the psychophysical (i.e. body–mind) problem. His own work started with the assumption of the primacy of the social, which is associated with the necessity of a sociogenetic method (Chap. 4). That assumption, in turn, needs to be grounded in a *Marxist anthropology*, which has to show that the societal really provided a new function to the human species and constituted an evolutionary advantage that was selected in the course of its natural history (Chap. 2). Other topics from the group of psychophysical problems include the unity/identity of {communicating | thinking} (Chap. 3), {intersubjectivity | intrasubjectivity} (Chap. 4), and {learning | development} (Chap. 6).

In part II, we present five case studies that focus on fundamental phenomena that historically have been of interest to educational psychologists. One such phenomenon concerns the emergence of reading as a *social* practice. In our analysis, we exhibit how and why we have to think of reading as something social rather than individual; and we show how this social nature—simultaneously grounded in biology and culture—has its genetic origin in and *as* societal relation (Chap. 7). The other four topics also have been among those of interest to Vygotsky, including: (a) the genesis of intention (Chap. 8); (b) the nature and origin of scientific conceptions (Chap. 9); (c) the nature and functioning of the sign from a Spinozist perspective, which radically revises Vygotsky's own (subsequently rejected) theories that still dominate scholarly discussions (Chap. 10); and (d) a more symmetric approach to the genesis of the zone of proximal development anchored in the notion of {teaching | learning} that allows for teaching and learning on the part of all participants in social relations (Chap. 11). In each chapter of parts I and II, and by means of a coda, we revisit core notions present in current educational psychology research and respecify them in light of the emerging theory.

In the third and final part of this book, we present some implications and conclusions. In chapter 12, as a means of summarizing the range of issues raised throughout the previous two parts, we present an extensive investigation that focuses on and exhibits the *thinking body*. This thinking body is not materialist in the vulgar interpretation,[27] does not harbor the specters of Cartesianism that are present in enactivist and embodiment theories, and does not harbor the contradiction between the individual and society. Instead, we offer up an investigation that exemplifies what a take on learning might look like when it is inspired by a Marxist re-reading of Spinoza and designed to build on and further elaborate Vygotsky's legacy. We

[27] The *vulgar* interpretation merely identifies consciousness with matter.

then develop some implications for research, measurement, and educational practice that arise from the perspective developed in the earlier parts of the book. Ethics and freedom, two aspects central to Spinoza and which were present throughout Vygotsky's entire career, become aspects in our consideration of educational practice and of our place as educators and researchers in society.

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Part I
Foundations

> There are not two different and originally contrary objects of investigation—body and thought—but only *one single* object, which is the *thinking body* of living, real man … only considered from two different and even opposing aspects or points of view. Living, real thinking man, the sole thinking body with which we are acquainted, does not consist of two Cartesian halves—"thought lacking a body" and a "body lacking thought." In relation to real man both the one and the other are equally fallacious abstractions, and one cannot in the end model a real thinking man from two equally fallacious abstractions. (Il'enkov 1977: 31)

Throughout his career, Vygotsky was thinking about the historical crisis that defined the psychology of his days, which expressed itself in two, method-related ways in which psychological research was conducted. One part of the field, *scientific psychology*, was focusing on the body and its physiology, whereas the other part, *interpretive psychology*, was concerned with intellect and its interpretations. In various parts of his work, Vygotsky denotes the issue to be the psychophysical (i.e. body–mind) problem of classical psychology. In response to the situation, Vygotsky strives towards a unitary approach that constituted more than a simple addition, interaction, or synthesis of the two psychologies. In the text on the historical sense of the crisis of psychology (Vygotsky 1997), he envisions a Marxist psychology. He has his mind set on a psychology that would write its own *Das Kapital* (Marx and Engels 1962), that is, a book that provides a historical account of the development of economic exchanges from early barter exchanges to the complex capitalist economy of the 19th century. This account was to be a materialist dialectical one, in which a cell form—*value* in the case of Marx—evolves into increasingly complex manifestations. Vygotsky turned to the writings of the Dutch philosopher B. Spinoza, who had attempted to overcome the dichotomy of body and mind by suggesting that there was only one substance (Nature), which manifested itself in material form and as thought. Spinoza's work had laid the ground for a monist approach but had remained in a philosophical plane, whereas Vygotsky was working towards a *concrete psychology.* Vygotsky therefore felt that he needed

to go beyond Spinoza and read his work through the lens of Marx. He never lived long enough to make much headway in such a project. In fact, in his last note prior to entering the hospital where he then died Vygotsky compared himself to Moses who had seen the Promised Land but was not allowed to actually set foot in it (see Chap. 1). But other dialectically operating scholars did in fact later articulate such an approach, an example of which is found in the quotation that opens this first part of the book.

The psychophysical problem, the separation of body and mind, manifests itself in different ways.[1] Among those ways Vygotsky noted was the separation of the physical and semantic aspects of speaking, the separation of intellect and affect, thinking and speech, and the relationship between the individual and the social. To resolve the problems, Vygotsky turned away from his earlier work and toward a Spinozist monism, which breaks with the parallelism of body and mind. Vygotsky attributes to the philosopher the idea of a relative, changing *inner* relation of body and mind. This opens up the opportunity to investigate "the changes in the proportionate role of the soul in the life of the body, and of the intellect in life" (Vygotsky, in Zavershneva 2010a: 39). Part 1 is concerned with articulating the foundations of a psychology that emerges when we take a monist perspective as the starting point for theorizing in the way that Vygotsky did during the last years of his life.

The most important aspect in the project of establishing a Marxist psychology lies in the recognition that what makes humans specifically *human* is society, which is distinct from the societies of other animals. Thus, "the human nature is not an abstractum inherent in the single individual. In its reality it is the ensemble of societal relations" (Marx and Engels 1978: 6). This dictum finds its expression in a psychology that stipulates the societal relation as a concrete, witnessable, and lived manifestation of all higher psychological functions and that conceptualizes personality in the form of this ensemble (Vygotsky 1989). Mind no longer is relegated to the individual and her brain but is part of what we *do* by participating in the life of society. In this case, then, thought exists *as* the ensemble of soci(et)al relations rather than in individual minds the contents of which are inaccessible to any anyone else. Instead of being confined to the skull of individuals, as radical constructivists hold it, thought and consciousness—in the form of the word—exist as a witnessable reality to any member of society. But human societies are the result of natural evolution; culture, referring to anything animals do, is

[1] Examples in contemporary literature where body–mind dualism persist are enactivist and embodiment approaches because these continue to postulate such things as schemas that are supposed to underlie the bodily movements that enact them. One trenchant critique of the latent Cartesianism in enactivist and embodiment approaches is based on the phenomenological analysis of dance (Sheets-Johnstone 2009). Indeed, a critique of the fundamentals of the enactivist and embodiment approaches already exists since the late 18th century (e.g. Maine de Biran 1841), a line of thought taken up in recent materialist treatments of the role of the body in knowing (e.g. Henry 2000).

not inherited and biologically determined but is the result of evolution. The underpinnings of a Marxist social psychology, therefore, are given by the results of Marxist anthropology. This means that the foundations for the new psychology cannot be the study of the psyche as such. Instead, it has to include the investigation of its formation as part of human history at large. Whereas Vygotsky takes the primacy of the social as a given, a Marxist approach needs to show how the societal nature of thought arises in natural evolution. It is precisely this point that we elaborate in Chap. 2.

In Chap. 2, we provide a glimpse from the origin of the psyche, articulating how thinking, acting, and emoting are not three different factors of animal life but are different modes of being of an irreducible system. The description constitutes a point of departure to provide a model of the *genesis* of qualitatively new forms in the {organism | environment} development. This model of morphogenesis—which is also a genesis of functions—can be used to describe the emergence of culture as the dominant function in the lives of our species during anthropogenesis. Culture (mind), therefore, is not different from nature but in fact constitutes a mode of being in and of the natural world. Biology and culture are two manifestations of the same Nature. We provide case studies that exemplify how the same biologically determined body movements first are part of physical work and later take on symbolic function.

His life being too short, Vygotsky was unable to do much of the developmental work required to formulate a Spinoza-inspired Marxist psychology. He had been working on two books, which were to be preparatory works: *Thinking and Speech* (Vygotsky 1987) and *The Teaching of Emotion* (Vygotsky 1999). It was in the former that he began articulating the relation between thinking and speech, one of the psychophysical problems he had listed to be addressed. The traditional view, which is present in much of current scholarship even when it avows to be Vygotskian, holds that thinking precedes speaking so that thinking reveals (externalizes) itself in speech and action. In an entry appearing in his personal notes, Vygotsky remarks that this view of action and speech as revelation "is deeply wrong," and he suggests "this is what distinguishes us from all the old psychology" (in Zavershneva 2010a: 43). The question for him then is this: How does the internal psyche relate to external behavior? In *Thinking and Speech* (Vygotsky 1987) he focuses on speech alone, not on other modes of communication or action. In Chap. 3, we expand Vygotsky's focus from speaking to communicating and develop a monist perspective on its relationship with thinking. One issue we note above is Vygotsky's concern for the changing relation of mind and body, which, in the case of thinking and speech, concerns two forms of development. In the mature individual, verbal thinking develops in a "complex movement from the first vague emergence of a thought to its completion in a verbal formulation" (Vygotsky 1987: 249). It develops in response to and together with the changing situation. On the other hand, in children and adolescents, verbal thinking develops on two planes: a situational and an ontogenetic one. Here, the two forms of devel-

opment are difficult to tease apart. In Chap. 3, we therefore provide two types of case studies: the development of thinking and speech in the case of (a) university professors in the course of lecturing and (b) high school students in a physics lesson.

The psychophysical problem also manifests itself in the traditionally postulated relationship between intrasubjectivity and intersubjectivity (Mikhailov 2001). In the constructivist approach, the single, *individual* subject constructs knowledge and "meaning" in her mind. Frequently, this is also the case in self-avowed social constructivist, socio-historical, and sociocultural theories. In such theories, the sole difference to radical constructivism is that a social construction precedes the individual construction (internalization). The problem is fundamentally Cartesian, because it is based on the extension of space where each part is external to any other part.[2] In the Spinozist agenda that Vygotsky only began, consciousness begins with intersubjectivity, "the real–ideal intersubjective field of their common '*co-spirituality,*' the universal forms of their culture" (Mikhailov 2001: 20). We can witness the first step Vygotsky makes in this direction at the very end of *Thinking and Speech*. Here he notes that the word is impossible for one person but a reality for two. That is, to understand real human praxis—e.g. communicative praxis—we have to begin with the word or statement as a reality for interlocutors instead of beginning with the assumption that there are different meanings and subjectivities. The word is consciousness in material form. We develop this aspect of subjectivity in Chap. 4. The approach facilitates making the radical shift required when we consider the world, including language, as given to us—every human being first and foremost *finds* itself in a world *given to it* from the beginning. It could not construct the world upon birth because the very tools of construction would have to be constructed first—which leads us to an infinite regress. But if the world is given to one person, it also is given to everyone else. This world that gives itself, including language and others, is common to all of us and, therefore, is an intersubjective world. This intersubjective world—so Vygotsky began to realize in his references to the real relations of people as the genetic origin of higher functions—is the foundation of intrasubjectivity, which manifests itself in personal thinking and personality.

Once we recognize in society the essence of what is human, there is then a primacy of the social.[3] In Chap. 4, this primacy is expressed as the condition of intersubjectivity for intrasubjectivity. In Chap. 5, we show how cultural practices such as reasoning first appear in the life of a person *as* social relations with others before

[2] In philosophy, this idea is referred to as *partes extra partes*.

[3] From a phenomenological perspective, the origin of intersubjectivity arises from a singular plural: being-with. Thus, "prior to 'me' and 'you,' the 'self' is like a 'we' that is neither a collective subject nor 'intersubjectivity,' but rather the immediate mediation of Being in '(it)self,' the plural fold of the origin" (Nancy 2000: 94).

they become part of the personal repertoire of behaviors. That is, reasoning first *is* a form of collective behavior in which the child already takes part and only later is observable as individual behavior. Important to this formulation is that there is no "social construction" of something that the child subsequently constructs on its own and, in so doing, internalizes. Instead, when evidence for some higher function or behavior is observed, it can be traced back to a soci(et)al relation. That relation *was* the higher function or behavior (Vygotsky 1989). Indeed, the very possibility of recognizing an instance of behavior as an instance of a higher psychological function already presupposes the social nature of the latter, which would be unrecognizable if it were fundamentally internal and individual. Thus, the trivial notion of the social holds that something occurred *in* or *is the result of* a social relation when there is a group. This trivial notion leaves open the possibility for a process of internal construction. Vygotsky formulates the social in a strong version by saying that any higher psychological function *was* a social relation so that all higher functions are social through and through. We use case materials from a second-grade mathematics class for the purpose of grounding and exemplifying the proposed approach.

A final manifestation of the psychophysical problem to be discussed here manifests itself in the often non-thematized relation between learning—a continuous, quantitative change—and development. The latter constitutes a radical because revolutionary change when a new qualitatively new function emerges in the life of the subject. Initially, Vygotsky considered the emergence of higher functions as qualitatively new forms (neoformations) from lower functions, which, therefore, constituted two tiers. In a notebook entry from December 1932, he writes that his own earlier work was inappropriate because it postulated the mastering of a lower by a higher function (e.g. voluntary over involuntary attention) (Zavershneva 2010b). He thereby realized that what had been one of his main discovery found in educational psychology textbooks to the present day in fact harbored Cartesian dualism. In Chap. 6, we articulate a way out of the old dilemma where change of thinking is modeled either in terms of discontinuities (à la Piaget) or in terms of continuity (maturation). Using a classical problem in educational and developmental psychology, reasoning on the balance beam, we show with empirical materials how learning and development can be articulated (connected) in a dialectical approach characterized by the law of the transformation of quantity into quality and quality into quantity.

As a whole, the entire part 1 of this book provides entry points into the kind of Marxist-Spinozist reworking of educational psychology that Vygotsky might have envisioned but could never realize. The fundamental tenor of this part is that there are not two functions, body and mind, but only a single substance that manifests itself in different ways. The approach leads us to the conception of the living, *thinking body*. Here, the relationship between the body and thinking is that between an organ and its function (Il'enkov 1977). That is, the body is related to thinking as the legs are related to walking or as the eyes are related to seeing. The living body and

the living thought are but attributes of one substance. In the thinking body, the two attributes cannot be separated because

> [t]he first (*physical being*) is here in the second and for the second. The second (i.e., *the purposeful, voluntary self-development of its physical being, its self-awareness*) is in the first and for the first. Together, as hypostases of one and the same essence, as attributes of Spinoza's one and only substance that are impossible for one *outside* of the other, they are thought and extension, extensive corporeality. (Mikhailov 2001: 20, original emphases, underline added)

In this quotation, we highlight the preposition *for* because it manifests a relation that cannot be reduced to one or the other of its parts. Physical being is *for* self-awareness and self-development, and self-awareness and self-development are *for* the physical being. Such use of conjunctions and prepositions expresses a *relational* ontology that transcends any separation of body and mind, for "if there be such things as feelings at all, *then so surely as relations between objects exist in rerum natura, so surely, and more surely, do feelings exist to which these relations are known*" (James 1890: 245). It is such a relational ontology that we establish as the basis for a cultural psychology of education.

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Chapter 2
Biology | Culture

> Dialectics covers nature, thinking, history—it is the most general, maximally universal science. The theory of the psychological materialism or dialectics of psychology is what I call general psychology. (Vygotsky 1997a: 330)

There is a debate that has existed in developmental psychology for more than 100 years, a discussion that continues in present-day foundational texts to the field of educational psychology. The debate is that of *nature versus nurture,* where the roles of biology (nature) and culture (nurture) on human behaviors come to be juxtaposed. That the debate is alive can be seen in the fact that books on this topic continue to be published.[1] This is astonishing because over 80 years ago there have already been strong arguments on the dialectical materialist grounds of cultural-historical psychology that higher psychological functions cannot be reduced to biology or to culture (Vygotsky 1997a).[2] For example, with respect to the acquisition of language, there are those emphasizing the role of nature, highlighting the apparently innate, genetically determined ability to acquire language; and there are those emphasizing the role of nurture (culture), suggesting that we acquire language by means of imitation. Vygotsky suggests that both approaches, the biologizing of psychology and the psychologizing of biology, are equally false. And yet, the general solution to overcome the dichotomy has been a "consensus view [that] states that both nature and nurture play interactive roles in stages of language development" (Sternberg and Williams 2010: 64). Nature and nurture here are seen as two parallel planes that *inter*act, as apparent in the following statement:

> With age, children acquire many different forms of cognitive expertise. Such acquisition is not a necessary result of age. Rather, innate processes interact with the opportunities afforded by the environment for them to acquire the mastery that will enable them to deal effectively and even expertly with the world around them. (Sternberg and Williams 2010: 70)

[1] Examples include Keller (2010) and Goldhaber (2012).

[2] Others have made the argument before, including the French philosopher P. Maine de Biran (1766–1824) based on his phenomenological studies or the German philosopher L. Feuerbach (1804–1872) based on materialist grounds.

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But in the *parallel* approach, new problems arise since the two aspects now need to be brought into relation by means of some third element—i.e. mediational means. This would not satisfy a dialectical materialist, who sees the solution in an approach that allows a dialectical leap from biology to (cultural) history and, thereby, viewed both as manifestations of one and the same substance.[3] At the end of his life, while working on a theory of emotion, Vygotsky "planned to build the positive part of his theory upon Spinoza's ideas, where he hoped to find the monistic point of view so much needed by psychology. The second part of *A theory of the emotions*, however, remained unwritten" (Zavershneva 2016: 130). Research building on Vygotsky's legacy, however, has identified an important point in the natural history of humankind, where a radical change occurs that legitimates the search for a monist approach: the dialectical step during which culture becomes the dominant function in the essence of our kind.

In a cultural-historical historical approach to (educational) psychology, analyses must reveal the genetic origin of the higher psychological functions. For psychology this means two things. First, the *phylogenetic* origin of the higher psychological functions, which are cultural features rather than features of genes or of cells, needs to be identified in the natural history of the human species. Second, the *ontogenetic* origin of higher functions also has to be identified in the soci(et)al relations of the developing person. Third, a cultural psychology of education needs to come to terms with a Marxist anthropology, which seeks to establish how nature and culture are irreducibly connected (Jantzen 1991): culture as an expression of nature, selected as a life-determining function in the course of human evolution. To be able to understand the particularities of the human psyche, this science has to show when and how the specifically human society and its culture emerged and how characteristically societal phenomena have become specifically human psychological phenomena. The two, materialist psychology and Marxist anthropology are part of the larger project that Vygotsky anticipates in stating that psychology needs its own *Das Kapital*. In such an endeavor, psychology obtains "its own concepts of class, basis, value etc.—in which it might express, describe and study its object" (Vygotsky 1997a: 330).

A materialist psychology has to operate historically, in the way Marx had done in *Das Kapital* (Marx and Engels 1962), where economy is derived from a cell form. The implication is that all its theoretical categories have to be reconstructed historically, beginning with the evolution and the dialectics of nature. Such a historical reconstruction has to establish (a) when in the evolution of the species, what eventually will have become the characteristic feature of humans has emerged—namely, the fact that humans do "not simply live under conditions, but produce the conditions under which they live" (Holzkamp 2013: 19); and (b) how this feature has developed up to the point that it became the dominant function determining the being of humans. This agenda was first realized in the reconstruction of the human psyche from the beginning of life (Leontyev 1981), and was sketched for the event

[3] That one substance is not to be confused with pure material, as this occurs in vulgar materialism.

of anthropogenesis, the historical period when there was a dialectical overturn and culture, one of many functions in the life of hominids, became the dominant function determining the life of the members of the human species (Holzkamp 1983).

As the introductory quotation shows, Vygotsky accepts dialectics as the "maximally universal science." But he does not ask us to blindly apply dialectics. Instead, he asks us to heed the advice to find dialectics in, and derive it from, the phenomena under investigation, and not to impose dialectics on nature and history (Marx and Engels 1975). If we were to act otherwise, we would end up with a science full of contradictions because of our desire for making the world look like and follow our ideas—contradictions expressed in mundane phrases such as something working in theory but not in practice. Even today, a lot of psychology is done imposing unrealistic models on the world—such as when the human mind is modeled on the digital computer.[4] Most psychological categories—those not based on a (phylogenetic and ontogenetic) historical reconstruction—are unrealistic because it has never been shown how and when they could have emerged in the evolutionary course of the human species or in the course of cultural history.

How might such reconstructions work? For cultural-historical psychology, this means that some basic unit, a "cell" form, needs to be identified within which the whole of the phenomenon shows itself in the most abstract and rudimentary forms. In a dialectical materialist approach to political economy, commodity *value* is identified as the "economic cell form" of bourgeois society (Marx and Engels 1962). Beginning with commodity value, Marx shows a possible historical trajectory from the simplest of barter exchanges to the capitalist markets in the nineteenth century. An equivalent identification of a cell of psychology would be the key to all psychology (Vygotsky 1997a). It was a student and collaborator of Vygotsky, A. N. Leont'ev, who would engage in such an endeavor with his reconstruction of the human psyche from the origin of life, when single cellular organism swam in the life-sustaining aqueous solution.

From the Origin of the Psyche

> We shall thus take sensation, which reflects objective external reality, as the elementary form of the psyche, and treat the problem of the origin of the psyche in this concrete form as the problem of the genesis of a "capacity for sensation" or (what is the same thing) *sensitivity proper*. (Leontyev 1981: 10)

Systems biologists begin their theorizing with the assumption of the organism-in-its-environment as the relevant unit to be studied.[5] In natural history, however, such a relation cannot be the starting point since it itself is the consequence of the

[4] To our knowledge, no psychologist has shown how such a brain functioning like a digital computer could have emerged in evolution and what the historical conditions were of such an emergence.

[5] See, e.g., Uexküll (1973).

historically evolved conditions. Prior to the appearance of organisms, materials exerted upon each other immediate effects, such that the external forces of one material (cause) were directly *reflected* in the other (effect). With the appearance of living organisms, there are not only external effects that bring about changes directly, but also the organisms themselves change their structure through evolutionary processes.[6] As a result, the organism population as a whole becomes particularly suited to every *particular* environment. This no longer is the form of reflection characteristic of inner bodies but constitutes the new form of *functional reflection*. Fins and flippers are reflections of the properties of water; but water did not directly *cause* the presence of fins and flippers. Instead, there was an evolutionary course whereby fins and flippers increase the possibilities of water-based organisms and, therefore, have become *functional* for the survival of the population systems. The phylogenetic evolution of organisms, therefore, cannot be found in the organism alone. Instead, appropriate units of evolutionary developmental interests are {organism | environment} functions specific to the population or species. "Such connections are of a *primary functional* type; and they evolve *secondary structural* characteristics of the organism, which are the evolutionary sediment of the optimization of functions and the foundation of ever-expanded functionality of life activity" (Holzkamp 1983: 66). In cultural-historical psychology, we cannot study the human individual in and of itself. Instead, the relevant unit for studying the psychology of human beings is the {person | environment}, which Vygotsky denoted by means of the category *pereživanie* [experience] (Vygotskij 2001). More generally, the person is an organism. In the {organism | environment}, processes may then be located more towards the environment or more towards the organism pole. This then allows us to take a look at a possible, intelligible and plausible, evolutionary trajectory of a key feature of animal forms, *sensibility*, in the first cellular organism with which life started on earth.

For sensibility to emerge and become (be selected as) a dominant function in animal life, some form of inner contradiction has to exist that constitutes a selective pressure. For an organism swimming in a homogeneous aqueous medium supplying it with food, there is no selection pressure.[7] Everything it requires is present. Food and wastes can be freely exchanged with the environment. However, as soon as this

[6] Bateson (1987), an anthropologist and cyberneticist who developed a monist view on the psyche distinguishes between Creatura and Pleroma—two notions he draws from the psychiatrist Jung. Pleroma denotes the world of nonliving matter, and can be described by the laws of physics and chemistry. Here, inertia or cause and effect are defining criteria. Creatura, in contrast, denotes the world "of explanation in which the very phenomena to be described are among themselves governed and determined by difference, distinction, and information" (1987: 18). Interestingly, and very much in line with a Spinozist approach, Bateson included *evolution*, *embryology,* and *life* in general within the category of the "mental" (meaning "mind" in the broadest sense).

[7] At the time of this writing, new scientific evidence is published concerning the possible mechanisms of the "Cambrian explosion," that is, the explosion of the numbers of species populating the earth (Fox 2016). Thus, once a threshold of oxygen levels was crossed, enough energy was available to support the life of predators that had not existed prior to the Cambrian. The evolution of predators, in turn, constituted environmental contradiction for other species.

original medium no longer is homogeneous in terms of food availability, there is a lack that leads to selective advantages for those organism types in a population that are able to ("intentionally") move into regions with higher food concentrations. For intentional orientation to evolve, the food must not exist merely in dissolved form but also in a location-specific form so that ability to move towards the location provides an advantage. Both types of food materials exist initially, those dissolved in the medium and those that exist in "an environment of discrete objects" (Leontyev 1981: 45). Moreover, there needs to be the ability to make perceptual distinction such that those potential food materials in the environment providing appropriate signals can be identified.

At that pre-psychic stage, the organism has some capacities that exist side by side: the capacity to change location and irritability. Irritability here means that there exists a sensitivity to certain external conditions that does not express itself in the form of a sensation. Irritability itself is not sensation, which means that there is no yet *consciousness*.[8] The organism moves in the aqueous medium affected by the chemical substances around the organism because of the capacity of irritability. If, for example, there were changes in light intensity when the organism approaches a location-specific food source, that is, if in the environment there existed a constant co-occurrence of food density and light intensity, then conditions would be such that moving and increasing irritation could be associated. At that point, irritability would exist both for necessary life-sustaining processes and arbitrary properties of the environment. But there would not yet be a *function* that emerged from the differentiation of the two. The function would emerge precisely as *sensitivity*, that is, "the function of the processes that mediate the organism's activity directed to maintaining its life is nothing other than the function of *sensitivity*, i.e., the capacity for sensation" (Leontyev 1981: 41). Organs of sensitivity are those that include the {organism | environment} transaction necessary for survival but that cannot fulfill the function themselves. There are structural conditions for the emergence of organs such that the afferent processes related to irritability can be translated into efferent processes of motion.[9] Thus, for example, if the natural factor is light, then the organism may have the capacity to be irritable by that form of light (visible or infrared). As a result of the processes described here, some new perceptual organ develops (e.g., specific heat or light sensitive cells, the latter of which may develop into a proto-eye).

Sensibility constitutes a new capacity that transforms the functions of mobility and irritability. Mobility was an epiphenomenon that stood in an unspecific functional relation to other capacities. With the emergence of the association with changes in the intensities of irritations, mobility enters into a new functional relation and becomes something like an elementary orienting activity. This allows a new definition of sensitivity: "Sensitivity (capacity for sensation) is genetically nothing other than irritability in relation to that kind of environmental influence that brings

[8] Here, we use the term consciousness generally, not in the sense of intellectual awareness.

[9] The adjective *afferent* refers to inward-oriented processes, whereas the adjective *efferent* refers to outward-oriented processes.

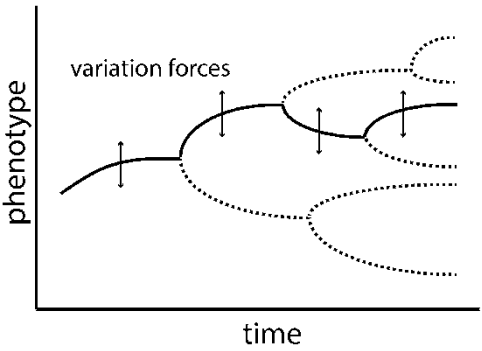

Fig. 2.1 Example of two continuously changing functions, the relation of which, *f*, changes qualitatively along the trajectory from left to right

the organism into correlation with other influences, i.e., that *orients it in the environment* by performing a signal function" (Leontyev 1981: 42). As a result of this *new form* of irritability, the organism has available a novel way of completing its main vital processes (i.e. feeding). That is, if the organism encounters a lack of food, it also can make movements that bring it closer to the food sources associated with the stimulation. The new functional form that has emerged is *qualitatively* different from the old form. The qualitatively new has emerged from quantitative changes in the system, for example, from the changes in registering irritations and the strengths of associations made.

The qualitatively new function is a necessary condition for the functional reflection in the {organism | environment}, but its emergence by no means immediately makes it the dominant function in the organism's life-sustaining activities. It is one among many functions. A step is required whereby this one among many functions becomes the *life-determining* function. Such a changeover might occur, for example, if the external conditions were such that the organism would no longer be able to survive without the capacity to actively seek and access food resources based on the capacity to detect them. That qualitative change from subordinate to dominant function is the beginning of a new and different evolutionary path based on and determined by the new functional relation.

It is important to note that the overturn in the dominance is not the result of something happening in a single dimension, as this seems to be depicted at times in accounts of evolutionary phenomena. Instead, it is the result of the inversion of dominance of two continuously changing functions. It is the qualitative change in the kind of relation between two functions that new functions become dominant. To exemplify the situation, take two continuously changing functions (1, 2, in Fig. 2.1). The figure shows that the relation between the two, the arrow, flips over, that is changes qualitatively. Thus, even though both functions change continuously in the

evolutionary history of the organism, the (dialectical) inversion of the two is discontinuous—from "+" for any interval to the left of the intersection to "–" for any interval at the right of the intersection—rather than continuous. Importantly, even though the original function has been negated, it does not (need to) disappear but instead continues to exist in the background. It also continues to exist as the very condition that allowed the emergence of the new function and, as such, remains in the system as a sort of sediment.[10] Vygotsky observes the same type of relation in the ontogenesis of the person. Thus, Vygotsky comments with regard to development in the child, the "mechanisms of behavior formed earlier *continue to exist*, *new* mechanisms arise on their base, and interests, that is, needs that set these mechanisms in motion, *change in a most radical way*" (Vygotsky 1998: 13, emphasis added).

Once the new function has become dominant, the previous one loses its importance as the organismic system is restructured according to the newly emerged and more effective function. For example, with the emergence of a specific organ to sense light, the surface of the organism that previously may have served a dual function of irritability and external metabolism now becomes specialist, some cells serving the new function and becoming part of an organ, the others retaining the single joint function or obtaining new functions altogether. The origin of sensitivity also constitutes a bifurcation in the life of the organism. There are, on the one hand, primary and original processes that are linked directly to the maintenance of life. On the other hand, a new form of activity evolves that changes the {organism | environment} by allowing the organism to change its relation to the properties of the environment. These two types of processes exist in a complex and dynamic relation.

The original framing of such a developmental process was grounded in experiments with skin cells exposed to radiation in the form of infrared and visible light, which led to the hypotheses about the emergence of sensibility (Leontyev 1981). These ideas are consistent with more recent advances of evolutionary-developmental biology, such as the evolutionary concept of the *chreod* that the biologist C. H. Waddington proposed (Gilbert 2000). A chreod is a stable developmental pathway for a specific type of cellular specialization and its associated stable metabolism. How a genotype is expressed phenotypically depends on the environment, which means that a cell may have available different developmental pathways (chreods) (Fig. 2.2). These different pathways constitute channels that are relatively stable with respect to variations in the environment. Any genotype therefore includes multiple parallel pathways; and this totality of possible channels (chreods) constitutes a morphological field (Thom 1981). This field allows genetic variation to occur without changing the developmental trajectory. However, when there are sudden and sufficiently large changes in the environment that make the current phenotypic expression no longer viable, the developmental trajectory may jump into another stable pathway that now constitutes its new developmental trajectory. In the devel-

[10] This is one of the reasons why "misconceptions" do not disappear. Being the result of fundamental experiences in the world, the "misconceptions" remain as the ground that enables the very scientific conceptions that eventually overturn them (e.g. Roth 2015).

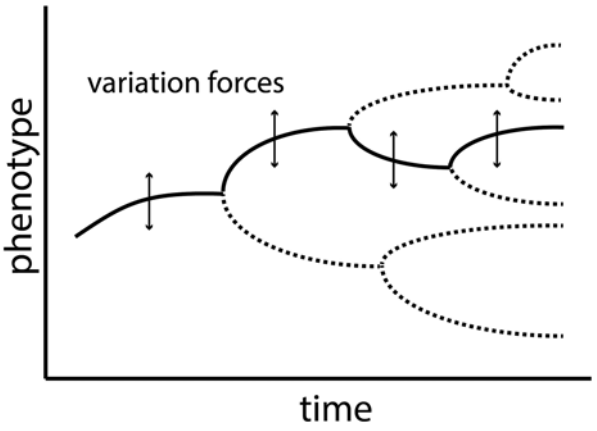

Fig. 2.2 Evolution creates an epigenetic landscape, where, next to the path taken by the phenotype, there are other paths. Variations of genotype or of epigenetic environment push development to a different path

opment of an organism, which begins with a single fertilized cell, cell specialization occurs. An embryonic cell may become a nerve cell (e.g. sensitive to light or heat) or a skin cell—but may not become some other form of cell, which arises at a different part in the overall genetic landscape. We see here that the account of cell development from modern evolutionary developmental biology precisely takes the form that Leont'ev hypothesized based on his research on the sensitivity of skin cells to light and heat.

Modeling Morphogenesis

From the study of the emergence of a new function generally, we draw insights as to the *historical method* for studying the morphogenesis of new psychological functions (neoformations). Drawing those insights is crucial for developing a concrete human psychology. Unlike classical psychology, which makes an ontological distinction between its methods and its phenomena of interest, thereby constituting an insurmountable divide between the two, concrete human psychology derives its methods from a critical analysis of the real dynamics that constitute its subject of study. Our account of the emergence of new functions exhibits five general characteristic aspects:

1. There is a period during which we observe quantitative changes in the {organism | environment}, such as when an initial homogeneous aqueous medium begins to show intensity gradients and the emergence of location specific objects.
2. There is a first *qualitative* change when the new function of sensibility becomes available to the system (i.e., {organism | environment}).

3. There is a period when the old function (undirected, random movement) and the new function (directed movement) co-exist.
4. At some point, as the result of pressures associated with contradictions, there is a turnover in the dominance of function so that it now is the main function determining the life conditions of the organism; this is a *second qualitative* change in the life history of the organism.
5. The organism–environment unit is on a new evolutionary path because the new function provides new possibilities, including a reorganization of previously available possibilities.

During the first, third, and fifth periods, we observe *quantitative-continuous* changes, which may include (a) an increase in the general, undirected mobility, (b) an increase in the association between the intensities of irritation and movement, or (c) a steady increase of the new function (sensibility and directed mobility). Out of these changes suddenly arise qualitative changes in steps 2 and 4. That is, we observe how coordinated quantitative changes lead to qualitative change, and qualitative changes lead to new trajectories of quantitative change.

When we now ask for the manner in which morphogenesis—a true developmental phenomenon in the way Vygotsky conceives it—may be modeled, we may begin with the similarities of the structure exhibited in our description and the ways in which the emergence of new forms is described in two existing fields: a branch of mathematics denoted as *catastrophe theory* (Thom 1981) and *dialectics* (Marx and Engels 1975). We begin with the latter formulation, which was very much at the heart of Vygotsky's concerns in his text on the historical sense of the crisis in psychology, where he articulates problems that continue plaguing the field to the present day. As shown in the introductory quotation to this chapter, the text acknowledges in dialectics the "maximally universal science."

Our account of dialectic phenomena has three important features. First, there is a transition from quantity into quality (steps 2 and 4), and from quality into quantity (steps 3 and 5). Second, there is a co-presence of two interpenetrating functions that reverse in dominance, an analogy of which we present above (Fig. 2.1). Finally, morphogenesis is the result of opposing contradictions at the two poles of the {organism | environment}. These three features embody the three main laws of dialectics, which have been abstracted from natural history and the history of human society: "the law of the transition of quantity into quality and the reverse; the law of the interpenetration of opposites; the law of the negation of negation" (Marx and Engels 1975: 348). The third law also is called the law of development through contradictions. The text points out that these laws are not to be imposed on phenomena but instead should be derived from the observations. Thus, we find many examples of natural phenomena exhibiting the dialectical laws mobilized in the works of philosophers of dialectics. We find them also in the works of Vygotsky, who does not merely pledge allegiance to Marx because of the repressive political climate in the Soviet Union in his days, but whose methodical procedure *is* dialectical through and through. Vygotsky makes direct reference to that page in Engels' *Dialectics of Nature* (Marx and Engels 1975) where we find the statements of the three laws and

the warning about identifying versus imposing them. His warning was directed at those psychologists, who aimed at developing a Marxist psychology by imposing dialectics on phenomena. Using a dialectical method, Vygotsky was very much interested in phenomena of development, which correspond to the formation of qualitatively new psychological functions, as distinct from learning, a term we use to refer to the more-or-less (quantitative) type changes that can be observed in human behavior. He points out that these two types of changes, quantitative and qualitative, *must not be conflated* (Vygotsky 1998). Our description of the becoming of sensibility therefore takes on exemplary character for the type of description that is required for describing phenomena at the heart of educational psychology: learning and development. We turn to such phenomena in Chap. 6.

The second approach to modeling the emergence of neoformations in living systems exists in *catastrophe theory*, particularly that part concerned with the characterization of morphogenetic phenomena. These phenomena exhibit the transition of quantitative changes into qualitative changes, which then lead to new forms of quantitative change. To allow making a connection between the catastrophe theoretic description and dialectics, we follow G.W.F. Hegel, Engels, and Vygotsky in using an example from the natural world that readers are familiar with. When water (liquid) is heated for a while, it eventually boils. After some boiling, no water is left in the pan and all our material has turned into steam (gas). While it is boiling, both liquid and gaseous forms co-exist. The phenomenon can be depicted in two ways. When we plot what we have done, we observe an initial increase in temperature to the boiling point (T_b), then a constant temperature while the water is evaporating (i.e., a vertical jump), and finally an increase in the temperature of the steam (Fig. 2.3, insert). The second way of plotting the phenomenon produces a *phase diagram* (Fig. 2.3, main). It shows how at a constant pressure (i.e. the arrow featuring the trajectory is horizontal) a *continuous* temperature increase from A to B leads to a *qualitative* change of the substance from liquid to gas. For certain pressures, a substance may not at all be converted into liquid form and only the gaseous form exists. At what is called the *critical point*, the second form becomes possible.

This same example also has been modeled using catastrophe theory (Komorowski 1981). In a catastrophe theoretic description of morphogenetic processes, we do observe a sudden transition between two forms (Fig. 2.4, 4). That step corresponds to the step visible in the insert (Fig. 2.3). But we see more. On the left side of the diagram, we note a function that changes continuously with the variation of the horizontal parameter (Fig. 2.4, 1). At one point, however, there is a bifurcation where a second function appears (Fig. 2.4, 2). This point directly corresponds to the critical point. However, the system follows for a while a trajectory where the original function dominates (Fig. 2.4, 3) until—generally as the result of infinitesimal and unpredictable changes—the system jumps into the state where the other function is dominant (Fig. 2.4, 4). In that new state, the system then develops along a new trajectory based on the possibilities that come with the new function (Fig. 2.4, 5). In catastrophe theory, points [2] and [4] are known as *elementary catastrophes*.

In the preceding section, we refer to developmental pathways (chreods) in developmental biology. These chreods and the changes in phenotype have been

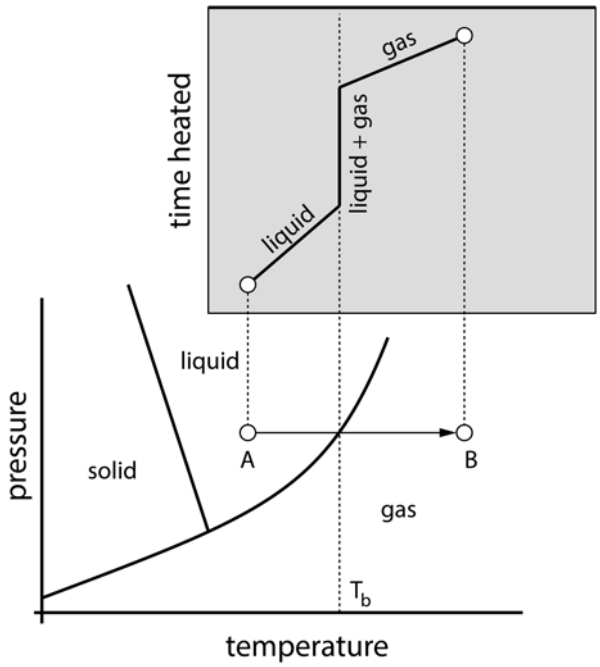

Fig. 2.3 A phase diagram of the transition of a liquid into a sold when the temperature is increased while going from A to B. The transition occurs at the boiling point T_b. The insert features a traditional heating curve turned on the side to map onto the main figure

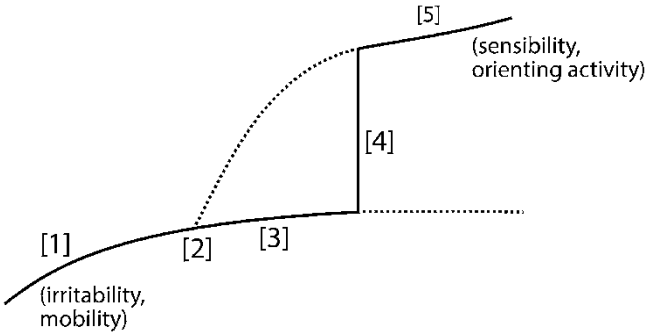

Fig. 2.4 A morphogenetic view of the emergence of a new function

modeled using catastrophe theory by the biologist who introduced them (Waddington 1974). The model from catastrophe theory expresses not only two of such parallel pathways but also how at some point in the development of the genotype, genetic variations introduce a new function that is not expressed phenotypically (dotted lines in Fig. 2.2). When we follow a cell or organism in its development, then there are repeated branching points generating an epigenetic field of pathways

along which development occurs (Fig. 2.2). These pathways can be visualized as valleys along which a ball rolls. There are forces that push the phenotype uphill, and, therefore away from the valley floor representing the current phenotype (Fig. 2.2, arrows); such forces include variations of genotype (organism) or epigenetic environment. When such a force is large enough, that ball might actually be rolling down into another valley, which is the analogy to a different, newly dominant phenotype. Adaptation occurs not by the sudden emergence of new genes and traits in response to environmental change. Instead, the genetic potential for the new trait already exists (Fig. 2.4) but comes to be fully expressed when environmental pressures (contradictions) are sufficiently large to make survival on the developmental trajectory impossible in its current form, and turning the once peripheral form into the necessary and dominant one. This also gives signification to the expression that a function precedes the organ; organ development already is possible but does not occur prior to the changes in the environment. It is not the change in the environment itself that pushes the development of an organ. Instead, the function exists and, when the forces in the epigenetic landscape are such that a different phenotype is favored, the existing function leads to the conversion into a task-specific organ.

From Biology to Culture

> A relation generative of man is nothing other than the affective, sense-giving relation of our animal forebears, in the first instance, toward one another. (Mikhailov 2001: 26)

A key question for Vygotsky was that of the relationship between biology and culture, which simultaneously is the question of the relationship between body and mind (respectively). We note above that there are two reductive tendencies, which already existed in Vygotsky's days and which were the object of his critique. One tendency reduces the higher psychological functions (i.e., cultural characteristics) to biology, one example being Piaget's theory of cognitive development that is modeled on biology and biological processes, including adaptation and assimilation. The other tendency is to reduce biological aspects to culture, which can be found in all of those theories that attempt to explain the entirety of psychological functions by means of cultural processes. Vygotsky, however, critiques not only these two forms of reductionism but also any other attempt in which biology and culture are seen to exist in parallel. In his later texts, he is working instead towards a developmental theory where there is only one evolving phenomenon, which, at a point in its history, transitions from having biology to having culture as the dominant and determining aspect of the {organism | environment} system. Biology and culture are then but two manifestations (expressions) of the same phenomenon, whether we investigate the development of our human

species during anthropogenesis (phylogenesis) or the development of the individual during ontogenesis.[11]

Vygotsky, as a cultural-historical psychologist, accepts and takes as the starting point the existence and dominance of culture in the determination of human life processes, thereby leaving it to Marxist anthropology to answer the question when and how culture became dominant in the concomitant process of anthropogenesis. Other Marxist psychologists, in the wake of Leont'ev, provided an early sketch of how such a transition might have occurred (e.g. Holzkamp 1983). In that sketch, the evolutionary trajectory exhibits the same pattern that we describe above, where culture becomes a new function in the determination of the life history of the human species. Culture initially is a subordinate function and, at some point and due to a rather rapid change in the environment, leads to the selection of culture as the characteristic of a new developmental trajectory. To better understand that crucial shift that marks the beginning of human history, we sketch in this section some of the findings from present-day research among the species closest to humans in the classification of life: the great apes.

Among the key characteristics of human behavior is the use of tools. However, tool use in itself cannot be the key to distinguish humans from other animals. Tool use has been reported also among the great apes, where chimpanzees and orangutans fashion branches to "fish" for ants and termites or to extract seeds from hard-to-open seed cases. Even among the crows one can find tool use; and the New Caledonian crow is particularly apt in chaining the use of multiple tools to reach a food item. In most of the reported cases, the animals pick up the material, fashion a tool, use it, and finally drop it when it is no longer needed. However, in one chimpanzee culture, where stones are used to crack a particular kind of nut, these are carried around from one site with a suitable anvil rock to another where it will be finally used for the purpose of cracking nuts (Mercader et al. 2002). That is, there is a form of intentionality, whereby the *future* use of the tool in a different site is anticipated.

Another feature that characterizes human behavior is the division of labor, such as when human hunting groups divide up into those with guns and those with dogs or sticks chasing the prey out of hiding ("beaters"). However, such division of labor with strict role specialization also has been reported among other species, including chimpanzees hunting colobus monkeys or bottlenose dolphins hunting their prey (Gilby and Connor 2010). The beaters push the prey towards the hunters, and, when the prey has been killed, both killers and chasers share in the meal. This is a form of exchange behavior—exchange, together with production, consumption, and distribution, being one of the fundamental activities of humans (Marx and Engels 1983)—where a favor or form of labor is exchanged for access to food. Other forms of exchanges exist, for example, in the exchange of food for sex with unrelated females, a behavior that also has been shown to exist among human hunter-gather societies (Gomez and Boesch 2009).

[11] We do not at all imply reference to the "ontogenesis repeats phylogenesis" hypothesis.

The identification of culture requires indices for the presence of behaviors in one or more populations and the concurrent absence of these behaviors in other populations within the species. Indices for the presence of culture that have been used in the literature include: (a) *labels*, for example, ways of marking the presence of certain food items or predators; (b) *signals*, for example, using leaves in front of the mouth to amplify sounds and specific song dialects; (c) *skills*, including those for using natural objects as tools for specific purposes, such as fishing for ants, termites, or seeds; and (d) *symbols*, such as arbitrary sounds that appear in specific situations, including the consistent vocalization that can be found in certain orangutan populations but are absent in others (van Schaik et al. 2003). The use of such labels, signals, skills, and symbols is perpetuated within groups, as a result of living in the society. New members to the society, while inheriting certain biological capacities, come to use these features only as part of their participation in the group. Rudiments of culture that satisfy all these requirements have been identified among the orangutan and the chimpanzees (e.g. Whiten et al. 1999).

The natural scientific studies concerned with culture among the orangutan and chimpanzees tend to theorize the situation in this way: If there is an individual who uses a particular label, signal, tool, skill, or symbol, then the offspring can copy it. What makes special those populations where cultural behaviors are observed is the fact that they live in groups, which increases the density of individuals. This allows offspring of less capable individuals to imitate the behaviors of more competent others that are not their mothers. The result is the view of a collection of individuals, where some learn by imitating others, which then becomes an instance of something referred to as "*socially* learned." This account, however, portrays a model of cultural transfer from individual to individual, where all the uses and related skills are individual. There is nothing specifically and irreducible *social* about these animal populations as described in the natural sciences. Culture, for Vygotsky, as for sociologists such as É. Durkheim, cannot be reduced to the sum of its individual parts. Such studies of culture among primates, therefore, are not actually cultural in the sense that Vygotsky takes this to be. We observe this difference especially when he writes that "any higher psychological function … was the social relation between two people" (Vygotsky 1989: 56), that the "*relation between higher psychological functions was at one time a physical relation between people*" (1989: 56), and that "development proceeds … toward *individualization* of social functions" (1989: 61). In these descriptions, there is a social relation; and it is a social relation that eventually shows up as a higher psychological function. The process is not one of individuals copying individuals, but one of individuals exhibiting behavior that exists in the group as a form of relation between people. In this way, the behavior is truly social (and cultural).

The description closest to Vygotsky's position comes from a study of mother–infant relations among bonobo (chimpanzees), the genetically closest relative of our species (Hutchins and Johnson 2009). That study documents that the bonobo exhibit forms of stabilized ("frozen") movements that have some but not all the characteristics of language. The particular movement studied is—consistent with the quotation that opens this section—the carrying activity in which mothers and infants engage in a

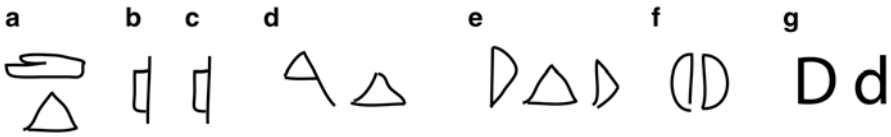

Fig. 2.5 Evolution of the letter D from symbols standing for the sound /d/. (**a**) Egyptian (3000 BC). (**b**) Kemetic (3200 BC). (**c**) Semetic (1500 BC). Sinai hieroglyphic. (**d**) Phoenician (1100 BC) and early Hebrew (~1000 BC). (**e**) Greek (800–600 BC). (**f**) Latin (0 AD). (**g**) Modern

coordinated way. That is, mothers do not just pick up the infant but the infant itself moves in the direction of meeting the requirements for being carried. Some of these movements come to be frozen into gestures, such as when the infant leans back and reaches with its arm in a particular way that tends to lead to a ventral carry. That is, what had started out as part of a pickup movement, when frozen, becomes a signal for the mother.[12] Importantly, the lean back never is observed in, and therefore copied from, the mother. A movement segment that has been part of the mother–infant relation, when frozen and displayed by the infant standing alone, has become a sign that the infant uses to get picked up by the mother. Here, it is an aspect of the affective relation, a movement segment in the pick-up and carrying behavior, that is the origin of the subsequently observed higher function of signaling the desire to be picked up and carried.

We observe such a progression in the development of written language, too, where iconic representations of things that populate the material world become first associated with a sound. Later, after some modifications, these representations turn into abstracted and abstract signs that no longer resemble the things that they originally stood for. Consider, for example, the Kemetic, Semetic, Phoenician, and Hebrew sign standing for *daleth*, door. It eventually, through progressive changes, turned into our letter "D" (Fig. 2.5). That is, the letter arose from the symbol for door, the word of which starts with a sound /d/.[13] In a similar way, the letter A arose from the symbol for an ox head (ox = *aleph*), which, after begin rotated so that the horns pointed downward, turned into the letter *alpha* and our modern *A*.

In the world of our nearest relatives, we find cultural features and tool use similar to early humans, the remains of which were found in Oldowan sites (Mercader et al. 2002). Most hypotheses about anthropogenesis agree that changes in climate pushed the proto-humans from the forest habitat out into the savannah. This change in environment constituted sufficient pressure that provided those groups with advantages that were drawing from and extending existing capacities, such as tool use and innovation or other, survival enhancing, culturally perpetuated ways of being. There is then a similar changeover in dominance of the existing {individual | environment} to new functional relations in which cultural aspects become dominant that heretofore were only minor functions. Here, then, cultural features provided an advantage

[12] In Chap. 12 we provide evidence of such a "freezing" of activity-related movements into symbolic gestures during school science activities.

[13] The sound notation /d/ is that used by the International Phonetics Association.

in biological evolution. The functional turnover brought about a new context for development, both cultural and biological, such as when extended tool use constitutes a favorable context for the development of dexterity; or when increased use of symbols that have arisen from frozen movements constitute a context for the development of the brain.

With the emergence of culture as the main determinant of human life, biology is not abandoned; it just takes a lesser role. In early human development, cultural and biological processes mutually affect each other precisely because the former emerged and unfolded as a form of the latter. Biology never disappears, as can be seen from its deep integration in some cultural phenomena such as sports, where winning and losing depend on biological and cultural characteristics of the athlete simultaneously, and both shape the expression of each other (e.g. the role of motivation and affect in changes of the physical body through training, the role of the body in affect and the production of motivation).

The Thinking Body and the Body–Mind Problem

> In comparing the data of onto- and phylogenesis, we did not for a moment take the point of view of biogenetic parallelism, intending to find in the history of the development of the child a repetition and recapitulation of those forms of thinking that prevailed at previous stages of human history. (Vygotsky 1998: 41)

In the preceding description of the formation of rudimentary signals among the bonobo, there is no disjunction between body and mind. The movement required to signal wanting to be carried *was* part of the mother–infant relation before it became a frozen aspect of the joint pickup movement. It is the same movement that produces the sign and contributes to being picked up. Here, we follow Vygotsky's suggestion not to fall into biogenetic parallelism and into the recapitulation hypotheses, whereby ontogeny repeats phylogeny. Concrete forms of reasoning during anthropogenesis and concrete thinking today are not the same processes, though comparative, historical studies may assist us in understanding what aspect of the ancient form constituted possibilities that manifest themselves today. There are good reasons for such an approach, because humans have changed biologically since the time that they had more in common with the great apes than they have today. Moreover, the environment in which children are born and the features they encounter, and the phenomena that they participate in, all are very different from the ones that reigned millions of years ago when Lucy (*Australopithecus afarensis*) and her tribe wandered about in what today is East Africa. Nevertheless, we must take into account the fact that humans are biological and cultural beings simultaneously. The two aspects interpenetrate one another, they *trans*act, rather than being parallel entities that only *inter*act. Thus, there are bilateral influences, whereby, for example, higher psychological functions afford directed neuronal growth, and directed neuronal growth affords higher psychological functions. Importantly, no mediators are required to connect ontologically distinct things, because there already is only

one substance. Vygotsky therefore writes of the merging of two lines of development in ontogenesis, the biological and the social-cultural. Making reference to the transition between childhood and adolescence, a time where both biological (e.g. sexual maturation) and cultural developments (abstract forms of reasoning) move at a rapid pace, he suggests that

> we cannot find the key to a true understanding of the changes taking place if we do not take into account that not only the content of human thought, not only the higher forms and mechanisms of human behavior, but the driving forces of behavior themselves, the very motors that set these mechanisms into action, and the direction of human behavior undergo complex social-cultural development. (Vygotsky 1998: 12)

An instructive example that exhibits not only the integration of body and culture during ontogenesis but also appears to play an important role in speech development exists in the emergence of the pointing gesture (Vygotsky 1997b). In Vygotsky's account, the development begins with a failed grasping movement when some object is too far away for the baby to actually reach it. This is the first time that a movement has occurred, which later comes to be frozen into a pointing gesture. The movement has been towards an object, and, for this reason, *objectively* indicates it. There is an inherent relation, since gesture and object are but two ends of the same unitary event, here the event of *approaching,* which does not require a higher psychological function. When the mother becomes aware of the movement, she may see this as a pointing gesture. In *treating* the spontaneous approaching as a pointing gesture, the situation becomes a caring social relation in which mother takes the object and places it into the baby's hands. The baby's movement thereby has brought about an action on another person. The baby, connecting this single event or its repeated occurrence to the whole situation/s, eventually begins to point as a means to obtain objects. The crucial point here is that the function of the movement has changed. In fact, a new function has emerged in that rather than being oriented to an object, the movement is oriented to another person. Although the movement looks the same, when it is intended for the other, its effects are also monitored. The development is of the type depicted in Fig. 2.2. The movements of the baby are enabled by its biological development but its function, in the gesture, is social through and through. It is so because the *pointing* was a relation first, whereby the child's movement leads the mother to take the object and to give it to the child. There is a coordinated movement between baby and mother—much as there was the above-reported relation between baboon infant and mother in the coordinated movements leading to a pickup and carry. In its petrified form, the movement has transformed into a pointing gesture with symbolic function that encapsulates the type of situation generally and the social relation specifically. This qualitatively new function then becomes context as part of which the child further develops, thereby entering cultural ontogeny.

We may find Vygotsky's historical account insufficiently fine-grained. He begins with the suggestion that the baby is trying to grasp the object. He presupposes an already existing intention underlying the movement. However, where does this intention come from? Do we not need to provide an account of the emergence of

intention? Materialist phenomenological studies suggest that an intentional movement actually is an endpoint of a development that begins with unintended and initially random movements (Henry 2000).[14] When we observe a newborn baby until a particular age, many of its arm movements appear to be random, uncontrolled. It is only when particular movement trajectories establish themselves that a capacity emerges for repeating them. It is only when there is a capacity for a movement to repeat itself and to recognize itself in the repetition that something such as an "I can" is established, and which is at the origin of intention. There is a *power-to-move-itself* immanent to an intentional movement—whether it pertains to pointing, touching objects to find how they feel, or to reach for an object. But that intentional power itself cannot be the result of (personal, individual) will. Instead, it is the result of a "deeply affective [*pathétique*] auto-donation of Life" (2000: 202). It is only when movement takes possession of itself, so to speak, thereby becoming a living capacity, that it also obtains the capacity of deploying itself to reach for any object that it has never before attempted to reach. But that initial taking possession of itself *cannot be* the result of intention (will), for intention and will presuppose the capacity to move in the desired (required) way. The latter have therefore been denoted by *passive habitude*. We elaborate on the emergence of intention in Chap. 8.

We may also take a neuroscientific perspective on the emergence of intentional movement.[15] In neuroscientific terms, there emerge neurons that mirror those other neurons that actually bring about a movement (Rizzolatti et al. 2006). Those mirror neurons are templates for future actions, and their firing does not require the firing of those that they mirror. These mirror neurons are at the heart of our understanding the "why" of the actions of others (Gallese et al. 2007). Eventually, when a person hears action sentences, those mirror neurons also are firing. Experiments show that if the content of a verbal phrase is inconsistent with the body movements that are required of the research participants, then the responses are much slower than when the two are consistent. These mirror neurons are the basis for coordinated, social processes between mother and infant and the increasing synchronization of their movements, facial expressions, and voices.

Both the materialist phenomenological and neuroscientific analyses mentioned above imply that the historical account of the pointing gesture that Vygotsky discusses requires further elaboration and precision. In an initial step, therefore, it may be that the first soci(ie)al relations where particular movements are involved may not be intentional at all. A baby in a stroller may not actually *intend* to reach for a rattle. But as soon as a parent pushes the rattle closer or into the hand of the child, a particular form of their relation plays itself out. After repeated occurrences, the capacity of repeating the movement establishes itself, and with the capacity comes intentional movement. It is only because there exists a capacity of a movement to be repeated that there can be the intention to repeat it: intention is the result of habit. In

[14] Much of this work is grounded in the initial studies of movements, habits, and thought by Maine de Biran (e.g. 1841).

[15] Neuroscientists themselves have recognized that phenomenological studies anticipated what their own studies only recently show (Rizzolatti et al. 1997).

that case, then, both the capacity to repeat a movement and a social function may emerge together. As a consequence, the pointing gesture is the result of a "petrification," so to speak, of a movement directly arising from a social relation. Many movements never ever reach this stage. Even adults exhibit a large number of movements that have no role in relations with others, such as is the case of grooming gestures (though in some situations these may be perceived and treated as "fidgeting").[16]

The history of communicative gestures among adults, too, involves bodily and cultural developments. Thus, one study describes the emergence of an abstract gesture that two researchers use to state what might be glossed as "students have difficulties understanding physics lectures" (Roth 2016). On the side of the hand/arm movement, the two initially repeated the movements of a physics professor they had observed and analyzed. In the first instance, the physics professor drew a curve on the chalkboard that looked like a half-parabola on its side. In subsequent lectures the professor used the same movement to refer to the graph he had made previously. The two researchers, who initially only repeated the movement, shortened it over time until they ended up with just a mere flick of the wrist-hand configuration—transformations similar to the ones observed in the historical evolution of writing (Fig. 2.5). The function of their gesture also changed over time. Whereas it initially referred directly to the situation of the professor drawing or making the related gesture, it subsequently was used in place of saying "the students in this class do not understand what the professor is saying." Still later, when the two researchers were using only the hand-wrist movement, it was in the place of a gloss that pertained to students and physics lectures in general. In this case, therefore, we observe a history of the bodily movement and a second history of its function in the conversations. That is, this study shows how an aspect of communication, inherently social because of its use to affect another, has a history of a changing hand-arm movement and its function in social exchange. As we elaborate further in Chap. 3, similar developments can be observed with regard to speech and the associated development of thinking, where forms of speaking develop from having nominative function to achieving symbolic functions independent from the immediate environment.

Coda: Intermeshing of Body and Culture

Vygotsky insists on the inseparability of biology and culture in the study of human behavior. We sketch in this chapter how culture is an aspect of human nature, which became a dominant function in the human–environment relation through processes of natural selection. On evolutionary grounds, therefore, culture is one manifestation of human life, the other manifestation being its biological nature. In human development today (ontogenesis), we need to heed the fact that human

[16] Although there is insufficient scientific evidence to support a correlation between lying and such grooming movements, they may in some situations be taken as indicators (e.g. Vrij 2008).

growth manifests itself in two forms, which are bodily and cultural. We exemplify this phenomenon in the dual nature of *pointing*, which is based on the emergence of specific movement trajectories in social relations with others. *Pointing* is *social* from its beginning, not because individuals construct it by themselves or in concert with others, but because the pointing gesture is simply a petrified concerted movement in and of a mother–infant relation. The iconic gesture mimicking a physics professor used by the researchers is social (cultural) because of its function in the researchers' relation, and it is biological because without the physical body and its development it would not exist at all. We therefore strictly differentiate the two lines of development but do not separate them. Both are attributes of one substance. This two-sided nature of human development, as he states, is a methodical problem because the two lines never are found in pure form. It is a challenge because "the requirement of differentiating both processes contradict[s] recognizing their merging as a basic form of [psychological (psixičeskogo)] development of the child" (Vygotsky 1997b: 22). Moreover, is not the intermeshing of the biological and cultural lines of development, which itself is subject to development, an obstacle to the recognition of the unique contribution of culture in the development of a child? In his last works, Vygotsky emphasizes the irreducible relation of body and culture (mind), for example, when he points out that it is impossible to understand a sound-word unless its (bodily) prosodic and its semantic aspect are taken into account together. This is so because the semantic aspect of a word may be completely irrelevant in some situation—a phenomenon that we observe when someone utters the "f-word" while working, where it serves as a form of affective evaluation of work progress rather than as a reference to copulation. Changes in the intonational contour correspond to changes in the affective tone perfusing the situation.

Vygotsky tends to focus on culture, and insists on articulating his interest in the role of culture on development. Throughout this book, we insist on maintaining the focus on a unitary developing whole, which, for us, is the *thinking-body-in-situation*. When we study this unit, then biological physical aspects may be more or less visible; but they are never absent. Moreover, because we focus on sign-*use* rather than on metaphysical verbal concepts or "meanings" that the words are said to express, our focus retains the unity of the two enmeshed and inter-communicating lines of human development. That is, we are working towards a *concrete human psychology*, which is both biological and cultural, deeply grounded in the sense-giving, affective relations that any individual entertains with others. There is neither (a) nature *or* nurture (biology *or* culture) nor (b) nature *and* nurture (biology *and* culture) in parallel. Instead, consistent with Spinoza's *one substance*, there is only one developing phenomenon expressed as the unity/identity of biology and culture, which, in the study of individuals inherently pertains to the social nature of the thinking body. This unity/identity cannot ever be reduced without losing some aspect of the whole. We take it that the "effective identity between the two lines of evolution of the living, the biological and the strictly human, i.e., the cultural, is established in the course of ontogeny" (Mikhailov 2001: 11). Vygotsky, as it often

is presented in current takes up, does appear to give primacy to the cultural. In our own work, we instead pursue a line of work that follows Mikhailov's reading of Vygotsky and Il'enkov's Marxist uptake of Spinoza in the idea of the thinking body. We thereby are at crosscurrents with some other scholarly development that represent today's mainstream sociocultural theory (e.g., Cole, Wertsch). This other type of work, Mikhailov suggests, often misrepresents Vygotsky's later orientation with the use of notions such as *internalization* and the distinction between the *social plane* and some *inner plane*.[17] More consistent with Mikhailov's take are the elaborations of a modern take of Spinoza developed by Il'enkov, who had specialized in the elaboration of materialist dialectics.

Mikhailov emphasizes the notion of the *intermeshing* [spletenie] of two lines that Vygotsky writes about, which has different implications than the *merging* of two lines that appears in the English translation. The concept of merging allows a reading according to which two "*completely different* foundations" (Mikhailov 2001: 14) come together (fuse). But this is not what we get from reading Spinoza, whose work Vygotsky takes as an inspiration in his own writings on the teaching of emotions. In this last work, there is one and the same principle at the origin of human life. As a result, there is a unity/identity of biological and cultural lines of development. The unity/identity therefore manifests itself in two forms that appear to contradict each other. But this unity/identity is not *constituted by* opposites that somehow have been merged and fused. This is the crucial difference between the two very different conceptions; and Mikhailov attributes the latter conception (i.e. fusion of two lines) to Western scholars.

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[17] The equivalent notion for an approach attempting to reduce development to biology would be *socialization* and *adaptation,* processes whereby biological capacities come to be subordinated to socio-cultural constraints (Mikhailov 2001).

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Chapter 3
Communicating | Thinking

> The movement of the thinking process itself from thought to word is development. Thought *is not expressed in* the word *but is completed in* the word. One might therefore speak of the becoming (as *unity/identity* [edinstve] of being and nonbeing) of thought in the word. (Vygotskij 1934: 269, emphasis added)

In this chapter, we develop a cultural-historical perspective on the relationship between communication and thinking, thereby not only building from but also expanding Vygotsky's original work in the field, which focused on the relationship between speaking and thinking as indicated in the introductory quotation. In a note from December 1932, Vygotsky articulates the relationship "language/thought as a psycho/phys[ical] problem" (Zavershneva 2010: 73). The investigation of the thinking and communicating relationship generally and speaking particularly is key to overcoming the traditional psychological problem of the rift that separates body and mind, thinking and physical action, and real words used versus "meanings" that presumably transcend the physical world we inhabit. Accordingly, thinking serves a function in the unfolding event of life; it always is thinking-*for*-doing in a world that is never the same, always changing so that no person or thought steps into the same river twice.[1] And words are deeply integrated in the physical reality of life as we experience it. The relation between the thinking body and thinking is that of an organ to its function—like legs are *for* walking, eyes are *for* seeing, or lungs are *for* breathing.

In the relation of communicating and thinking, there are both ontogenetic and functional aspects. Ontogenetic aspects concern the ways communicating and thinking unfold as part of a person's development from child to adult, whereas functional aspects concern the ways in which thinking and communicating relate to each other within particular stages of development such as within a particular event (e.g. a conversation). In the child, the two aspects are conflated so that it is not (always)

[1] Plato, in *Cratylus*, attributes to Heraclitus the idea that everything is in motion, flux, and therefore that there is nothing that ever stands still. To be useful, thinking itself has to follow this never self-identical world (see also Bakhtin 1993).

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clear what develops: as the relations between speech and thinking develop, so do new functions. In the mature mind, by contrast, the ontogenetic development generally is much slower, so that changes in the functional aspects of the relation become more visible. In this chapter we address both ontogenetic and functional aspects in the relation between thinking and communication. We exemplify these with different cases: (a) two experienced lecturers, where ontogenetic development is less salient and (b) a group of upper secondary students in a science class. In the latter case, we examine functional relations between thinking and communicating and how those changes in the functional relation lead to new cognitive formations. Before doing so, however, we present a way of theorizing thinking and speaking that underlies most if not all of today's mainstream approaches to educational psychology, and which may be detected even in studies that claim allegiance to cultural-historical psychology or versions thereof (sociocultural, cultural-historical).

Relation of Thinking and Speaking

In classical cognitive psychology, thought and meaning are theorized to exist in the form of cognitive (conceptual) *structures*. Many approaches represent such structures by means of *semantic networks* and ideas in the form of the activation of propositional networks (Anderson 1985). Take the phrase

(1) Jean will give her son Johnny a red truck.

This phrase might get further specification by such additions as "for birthday" or "for Christmas." It is composed of three simpler phrases:

(2) Jean will give a truck to Johnny.
(3) The truck is red.
(4) Johnny is her (Jean's) son.

The propositional content of such phrases may be represented as a *tuple*, a finite ordered list of elements that constitute the units involved in the making up of propositions such as those presented through (2) to (4) (Devlin 1991). In the present case, these lists include, respectively:

(5) {*Give*, Jean, truck, Johnny, future}
(6) {*is-red*, truck}
(7) {*is-son*, Johnny, Jean}

The phrase presented in (1) may also be represented in a graphic way using a propositional network (Anderson 1985). Each proposition is represented by an ellipse, around which the various elements of the relation are organized (Fig. 3.1). Each node may be considered an idea, and the links between nodes are associations. Thinking then can be theorized in terms of the spread of activation in memory from node to node.[2] Speaking is premised by the activations that spread among and

[2] In some research on gesturing, the functions of (certain) gestures may be precisely to increase the activation and, thereby, to facilitate the thinking and its external expression.

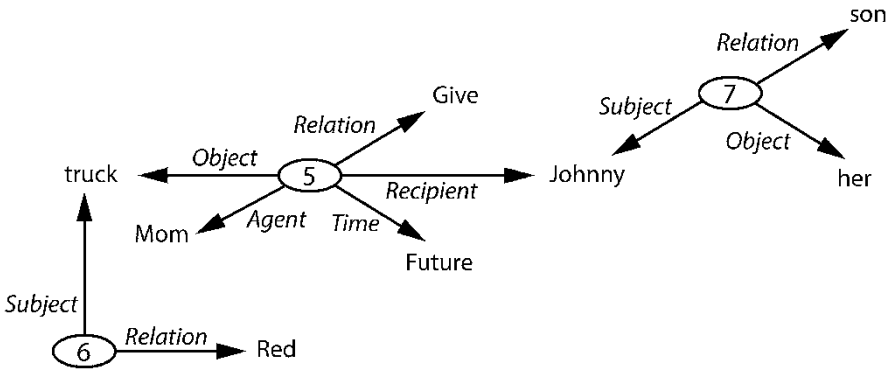


Fig. 3.1 A propositional network for the phrase "Jean will give her son Johnny a red truck"

thereby link the simple propositions (2) to (4). Everything that comes to be said already has its equivalent in the activations of the mental representations. When composed, the representations come to be made available in public a little like the contents of computer memory come to be available in a memory dump, where there is a one-to-one correspondence between the content of the memory and what appears on the printout. Within such a framework, we can then think of the development of concepts in terms of the relations that those concepts may entertain with other words and in the changes of the predicates that it may participate in. Indeed, according to this perspective, each word already is a concept. In both the child and the mature adult, speaking is thought to externalize whatever is activated in memory. The Said therefore represents not merely thinking but also the structure of the mind. A strict equivalence is maintained between words (propositions) and mind.

It should be immediately apparent that the cognitive psychological theory differs substantially from the description provided in the introductory quotation from Vygotsky's writings. According to the latter, the thinking process is not constant but moves. This movement is from thought to word. Most importantly, this movement itself is development—not an externalization of something that already exists in the mind. It is not the speech-initiating thought that we obtain by listening to the word, because thought is *restructured* in the movement to the word, "it is not expressed but completed in the word" (Vygotskij 1934: 269). The quoted textual passage is quite explicit about the relationship between thought and word, the former *not* being something expressed in the word, as if its contents were emptied into the available words that then are serving as containers. Instead, in the movement from thinking to speaking, thought *becomes*. Thought develops in speaking.

In Vygotsky's quotation we also find a perhaps cryptic parenthetic clause added to *becoming*, which is to be understood as "the unity/identity of being and nonbeing." That is, the phrase asks us to consider thought in its *passing from nonbeing to being*, an event commonly denoted by the noun *becoming*. If thought is becoming in the word, then the thought first exists when expressed in words and subsequently is apparent in and to the mind; it comes into being rather than being activated memory dumped in the outside world, as postulated in classical cognitive psychology. In

other words, the network, if it were to be something that could be pinned down at some point in development, is the end result of speaking rather than its causal precedent. That the latter might be a more accurate account of the phenomenon can be taken from the observation that even speakers very familiar with their topics may, after apparently having articulated what they have been working on, write down what they have been saying in an apparent recognition that it was something new to them. In one reported case, an experienced researcher, after having gotten up from his seat to tell his audience what some common conceptions in the field were, produces a number of graphs together with his talk only to sit down to copy everything he has done and said into his research notebook (Roth 2016). In such situations, people are seen to communicate and, in their own communication, are finding a new form of thought in what they have said: they can actually learn from their own doings and words.

One important aspect of speaking that the semantic network approach does not address is the fact that in the situated use of phrases the grammatical subject and the psychological subject of talk often diverge. That is, the *what* of communication, the signification of a phrase,[3] the difference that makes a difference and therefore delivers news, changes from situation to situation and may do so even within a situation. We find an example of the separation of the grammatical and the psychological subject in the sentence "The clock fell" (Vygotskij 1934). In a situation where the clock does not work, being told that it fell constitutes for the hearer a new piece of information. The other person might have said, "The clock *fell*," where the italicized verb is stressed by means of intonation and perhaps speech intensity. In its propositional form, the fact of having fallen is the predicate, the clock being the subject. Psychologically, the clock appears first in consciousness as the psychological subject. In this case, thus, the grammatical and the psychological subject fall together. But now suppose we heard the noise of something falling to the ground in the direction of the kitchen while having a conversation in the living room. In that moment, the subject in our consciousness, that is, the psychological subject, is the fact that something fell. Upon entering the kitchen our spouse says, "The *clock* fell," where what is informationally new is that it was the clock that had fallen. In such a situation, the grammatical subject (the clock) is not the same as the psychological subject (that it fell). Falling is the psychological subject that now is elaborated by the psychological predicate "clock." To make grammatical and psychological subject coincide in this second function of the phrase, we would have to change the phrase into something like this: "The fallen is the clock." Using the tuple notation described above, therefore, the first situation would be captured by the set {*fell*, clock}, whereas the second situation is represented by duplet {*is-clock*, fallen}. As shown by means of italics, the informational difference between what are indeed two phrases—"The *clock* fell" and "The clock *fell*"—comes from their intonation, that is, a physical aspect of the word; it also comes from the *concrete* organization of the

[3] It would not be unusual to find the word "meaning" in the place of signification. We avoid its use because, pragmatically speaking, "the philosophical concept of meaning has its place in a primitive idea of the way language functions"(Wittgenstein 1953/1997: 3).

actual (lived) event, which has a sequence of its own. From a purely linguistic point of view (written without the intonation and without including its place in a sequence of actual events), however, the phrases semantically are exactly the same.

A second case where the significance (function) of a phrase changes despite it having the same form from a purely semantic network analysis is apparent when the some word is repeatedly used in close succession. A classic example exists in a story told in the *Diary of a Writer* (Dostoevsky 1994). In that story, the author overheard the conversation of six drunken workmen, which consisted of six repetitions of the same word that was too obscene to be rendered here. Each time the word was pronounced, its function was different, initially manifesting a comment on an earlier remark and then turning into commentaries on commentaries. The changes in function were brought about, among other things, by the change in intonation, a fact that points us to the need to consider the sound-word as object of inquiry, where "sound" refers to the phonetic and "word" to the semantic (dictionary) aspect. Two existing discussions of Dostoevsky's story offer accounts of the variations in possible uses of a sound-word, where the lower limit of such use coincides with the dictionary sense, and the upper limit is given by the concrete contextual conditions of the utterance (Vološinov 1930; Vygotskij 1934). More recent advances in communication studies and conversation analysis have made it clear that the sense of an utterance always is given by its context within an unfolding conversation, its sense changing depending on its position in a sequence of conversational turns. In a similar way, in our database, we observe a case of ten repetitions of the word "penis" in a high school physics class, but in none of these cases was the male reproductive organ at issue. In such situations, therefore, the search for the "meaning" of the word is fruitless, for it is the variation of the physical sound that matters and the evaluative function it symbolizes, that is, the prosodic aspects of the speech.

Unity/Identity of Opposites

The two preceding examples make clear that modeling thinking in terms of semantic or propositional networks does not adequately describe how people actually think and communicate.[4] Vygotsky's approach is substantially different from that offered by the classical view of cognitive science, which still dominates current research in (educational) psychology. The key to Vygotsky's take consists of the psychologist's insistence on focusing on thinking and speech as involving a unity/identity. But to understand this requires considering two radically different

[4] This point, which Vygotsky was making over eighty years ago, has been taken up in contemporary research within the emerging field of *situated cognition* (Roth and Jornet 2013). Holding it as one of its essential tenets, "situated cognition research rejects the hypothesis that neurological structures and processes are similar in kind to the symbols we create and use in our everyday lives" (Clancey 1993: 87). Accordingly, conflating psychological structures and processes with linguistic and formal descriptions (such as propositions, maps, or graphs) constitutes a category error on the part of researchers.

ways in which the notion of *identity* functions within each of the approaches. In traditional formal logic, the epistemological basis of classical psychology is represented by three laws: (a) the law of identity $(\forall p)\ (p = p)$; (b) the law of non-contradiction $\neg(p \cap \neg p)$; and (c) the law of the excluded middle $(p \cup \neg p)$.[5]

Pertaining to identity, and from this formal view, two things are identical to each other when they are one and the same thing. In treating talk and behavior as external outcomes of an internal (mental) process, in tacitly postulating that speech is indeed *expression* of thinking and that the structure of the latter can be modeled on the basis of the structure of the former, classical psychology is effectively implementing a formal and abstract scheme of identity. That scheme "opposes the 'similar' and the 'different,' the 'general' and the 'particular,' and does not indicate a method of interconnecting them within an integral, single object or within a coherent integral group of objects" (Davydov 1990: 37). For this later reason, analyses taking the classical perspective either conflate the two, or make their difference an insolvable problem. Not providing a method for their unity, analysts can only impose artificial (abstract) methods from the outside in the attempt to account for their unity.

Dialectical materialists (including Vygotsky) use the term *identity* differently. In the dialectical tradition that underlies his thinking, identity denotes *unity of opposites*. In their identity, hence, two opposites are not the same thing but are inherently related to each other. In fact, "opposites" are only contradictory manifestations (i.e. *external* expressions) of one and the same thing that has an inner unity. But this one thing is accessible only through its manifestations. Thus, whereas in formal logic—and consequently also in classical psychology—thinking and speech need to be either conceived as being one and the same thing or as opposites and therefore external to each other. In the dialectical approach, thinking and speech are conceived as internally connected to each other without being the same thing (Il'enkov 1977). Thinking and speaking, though different and contradictory, are indeed manifestations of the same: the living, thinking body that is itself an expression of life. It is this sense of the term identity that features in the chapter-opening quotation and in many other parts of this book.

In a dialectical materialist approach to the relation between thinking and communicating, therefore, words, concepts, actions, or any other aspect of intelligent behavior, *have a unity of their own.* Rather than the analyst having to impose, by means of formal analyses, a unity that is external to them, the dialectical approach Vygotsky employs—which we further advance in this book—*follows* thinking and speech in their internal logic of development. Both are functions of the thinking body in the course of its participation in societal activity: thinking-*for*-speaking/doing and speaking/doing-*for*-thinking. When seen from this perspective, thinking is not only generative of speech, but speaking, while it is unfolding, generates thinking. It is for this reason that the dialectic approach is *genetic*, and the very phenomenon provides for its own method of study because it is itself a method of generation. In analyzing the relation between thinking and speech, we are interested in understanding how the two develop in a mutually transforming relationship while coming to exist in actual, concrete *acts* of speaking.

[5] Also expressed as: either p or not-p and *tertium non datur* [a third is not given].

In developing his framework on the internal relationship between thought and word, Vygotsky focuses on speaking and the use of language without including other aspects of communication that have more recently become of interest to educational psychologists, such as the hand/arm movements that accompany speech and are considered important for understanding thought in both research and educational practice. In this chapter, we thus go beyond Vygotsky, taking his ideas further by focusing on communication more generally rather than investigating only word-use. Our analyses exemplify how thinking *becomes* in and as actual (communicating) situations, rather than the latter being an external context within which thinking is expressed. Here, we understand that "what is designated by the word 'situation' is not a single object or event or set of objects and events. For we never experience nor form judgments about objects and events in isolation, but only in connection with a contextual whole" (Dewey 1934/2008: 66). Accordingly, studying the relationship between communication and thinking requires considering the person together with her environment—i.e., {person | environment}.

Finding Thinking in Communicating

Opposing the classical psychological approach that treats (external) talk as the expression of (internal) thinking, some researchers have recently noted that "thinking is an individualized version of (interpersonal) communicating" (Sfard 2008: 81). But in these positions also exists the risk to reduce thinking to speaking, especially if communicating is treated to be "mainly linguistic." In line with the Spinozist tack taken in this book, we show in this section how thinking develops in communicating as part of the larger developmental and material situations that include them both. Vygotskij (1934) considers thinking and speaking to be two lines of development. He takes a look at mature thought to tease apart effects that are due to ontogenetic development and those that mirror the developing sense of the situation. We take here the same approach and examine the latter aspects as they unfold in a lecture by experienced adults (professors).

Researchers sometimes use deficit perspectives to account for certain performances, such as when students are said to have cognitive deficits or to hold misconceptions. To anticipate the possibility of claiming that the people in our examples have deficits in one or another way, we draw on fragments from the lectures of highly competent university professors with 20–40 years of experience. In each example, we observe the professors marking something on the board only to erase it and put something else in place. We have previously reported the same kind of repeated writing and erasing in the case of a professor talking about a "preconceived notion," sometimes requiring two or three iterations prior to finalizing an idea (Roth 2016). Why, one has to ask, would a professor with 30 years of experience in his field of research write and draw only to erase what has been written and drawn—especially given that he was only presenting an already existing, preconceived notion?

Our first example derives from a third-year university physics course in optics. In the context of a student question about radiation of a heated black body, the instructor with over 20 years of experience teaching physics talks about the relation between an object's temperature and color in the context of the production of steel. After having talked about the problem of hardening steel by bringing it to a high temperature, the professor also notes that it becomes very brittle in the process. This requires the machinist to temper the steel. The professor walks to the chalkboard, sketches Cartesian coordinates, and says, "What you have done in terms of temperature is." He then draws a line while saying, "you bring the steel up to the temperature here," stops, marks off the abscissa, writes an "R," moves the hand to the end of the previously drawn line, stops, moves back down to the abscissa, marks off another point, and writes "Y," while saying "in the red to yellow range." He then moves the hand back to the upper end of the line and, apparently connects the beginning of what comes to be a vertical line, while saying "and then you quench it, you cool it off really quickly." It is at that point that Fragment 3.1 picks up.[6] The professor continues saying, "You re-heat the steel, you bring it up to what is called the straw color," and marks of a third point to the left of the "R."

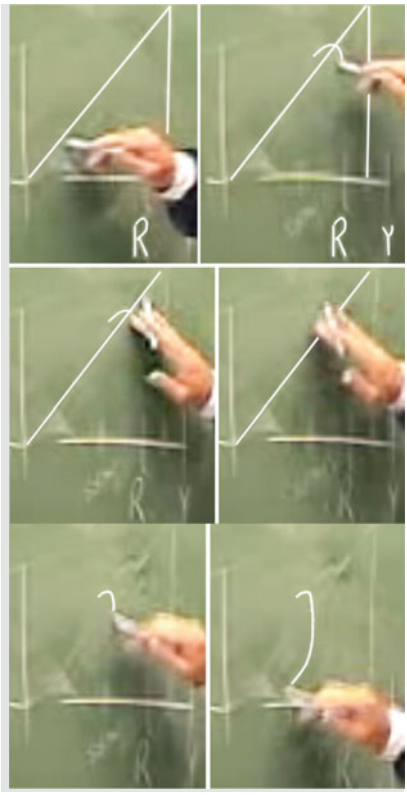
Fragment 3.1

01 and then >what you do is you< re::e (0.5) you reheat the steel you bring it upto >whats=usua'y called=the str*AW* color which is a cooler temperature and >its abit=o=a=mix< and its so that there ((*circular gesture*)) and it there would be lots of infrared in it (0.6)

02 and you bring it up there but then you

03 reduce its temperature

04 slowly in some curve (0.5) back down and that tempers the steel



[6] The transcription conventions used throughout this book are available in the Appendix.

He begins drawing another curve, which initially moves parallel to the original one but then turns downward (line 02). He stops and wipes off part of the curve in moving his hand over the chalk line backward (line 03). He then draws a new turn and returns the curve to the abscissa to the left of what he has marked as "the straw color" (line 04).[7]

In this instance, we observe what we might call a self-correction. The professor is drawing something, sees what he has drawn, and then wipes it off only to draw something looking like it in a new place (further left and down along the line running at about 45° with respect to the horizontal). If thought was there first, and the communicative act (drawing) came second, why would the professor have to self-correct? Why would thought not have corrected itself prior to letting him do the drawing only to make him wipe out his earlier work forcing to draw it again differently? Why, if he had an established cognitive framework concerning the issue he is addressing (the relation between temperature and color in alloy materials), would he draw something apparently incorrect only to replace it by something else that apparently is correct? A common way used in classical cognitive psychology to get out of the quandary is to introduce "misfirings," or some other process that interferes between whatever is encoded in the cognitive framework and its actual production in the world. But this explanation sounds like a Ptolemaic correction to a false model of the universe, where epicycle over epicycle is introduced into the model to make it account for actual observations.

An alternative explanation for this kind of events, where experts exhibit uncertainty and the need to self-correct even when communicating about things they already know very well, concerns a shift in notions of expertise and knowing. In the episode analyzed here, it is quite apparent that the self-correction comes at a point when the drawing has already been produced and has become part of the perceptual environment. Rather than the dumping of a piece (or pieces) of (already known) knowledge, we observe a thinking body dealing with a material situation—a drawing on a chalkboard—that, far from an already settled and finalized thing, is in its making and unfolds in real-time. On this account, the professor's knowing and his performing in the world are not detached moments, but exist together as a single {person | environment} reality. This is consistent with the observation that we all can make every day: we communicate without having everything worked out in our minds only to read from an internal display—as if we were TV anchorpersons reading from the teleprompter a text that we previously composed. Rather, in communicating, our thinking develops; and as thinking develops, so does communicating. There are two distinguishable but enmeshed movements; there are two enmeshed lines of becoming. Thought never exists already formed but always becomes, as part of a changing environment that includes our speaking. That changing environment is refracted in the development of thinking. As a result, the individual never can fully predict her own speaking or say what she is thinking.

[7] It turns out that in this diagram, because of the physical laws of blackbody radiation that relate color and temperature, the return curves should be the same as the heating curves, and the relationship between temperature and color is not linear.

The argument that thinking unfolds with or, rather, *becomes* in communicating, may be countered by the allegation that the professor may have simply taken a wrong route first to address a problem, having later realized a better solution after having evaluated his own drawing. The latter allegation, however, assumes that the situation can be divided into task environment—the objective problem of answering a question—and problem space—the mental representation of the problem that the professor has and which he may be seen in the process of correcting. On this account, the professor may have "intended" to act according to what he was verbally producing, correcting what he had graphed after comparing it with the formerly intended. Yet, we also find instances where experts self-correct their communication even when what has been done (written, graphed) and what has been said (the verbal description of what one is doing) coincide.

A second example derives from a second-year university course on thermodynamics. After having explained how an air conditioner works, the 33-year veteran professor (some 40 years after completing a PhD) moves to explain the working of a refrigerator in terms of a Carnot cycle graph, a graph that has been repeatedly used in this course, and which relates pressure, volume, and temperature (as in Fig. 3.2). After having produced the graph—including signs for the inside (food) and environment, and the energies Q_1 and Q_2 transferred from the food into the environment—the professor moves to writing two equations "$Q_{in} = Q_1$" and $Q_{out} = Q_2$. He then writes "$Q_{in} > Q$" while saying "Q-in is greater than Q-out." He stops, gazes at his writing, and produces the interjection "um." Three seconds later, he erases the "in" from the left "Q" and writes "out" in its place. He then writes "in" next to the Q on the right

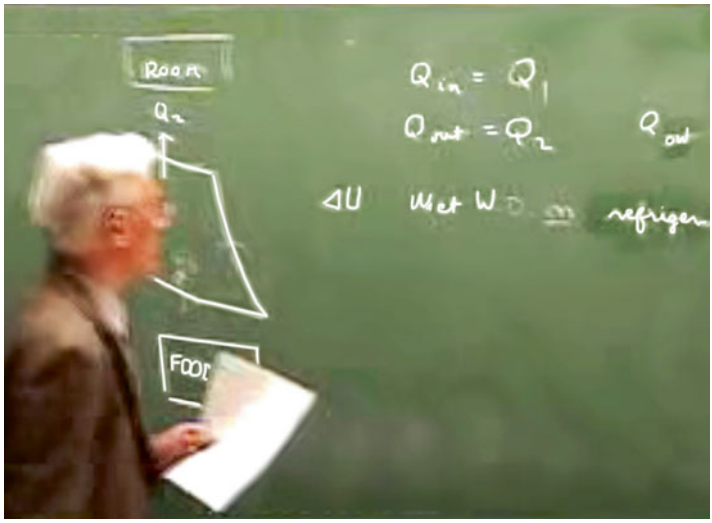


Fig. 3.2 The professor has stepped back to look at what he has done, including the Q_{out} and refrigerator that he has changed after having written something else before (Writing was enhanced to improve readability)

side of the inequality. He steps back about 2 m, and, like a painter with respect to her latest brush stroke, gazes at the equation as if taking in what he has just produced before moving on to talk about the internal energy to the system. Only seconds later, he writes below the inequality the letters "frid" while saying "oh that's fine, fridge is," stops, erases what he has written, then writes "refrigerator" in its place while saying "no that is the refrigerator." He then steps back again to look at what he has done (Fig. 3.2).

In this example, reading and writing work in concert, as the professor verbally articulates what the hand is writing on the board. Whereas in the preceding case the self-corrections concern a graphical feature, here the ideas are expressed verbally, including expressive forms that are typical within the discipline of physics—e.g., the "Q," which generally refers to heat and the mathematical symbolisms of equal and greater signs. Notably, the professor produces what he says and steps back, as if to get a better look at, or perspective on, what he has done. He acts as if he were stepping back to situate the work results in a larger context and to allow him to take an outside perspective, not only on the specific product but also on the producing situation in which he has been immediately before.

In the two cases presented here, thinking is not something that the participants first had done and *then* expressed, or even "enacted." Rather, it is more parsimonious to suggest that the thoughts were "found" in the communication, recognizable as such only after actions had already come to an end.

Moving to Know

In the preceding section, we observe highly competent individuals produce something on the chalkboard only to erase it again and to replace it with something else. We suggest that this phenomenon results from the fact that thinking is not directly accessible but only its results are, so that people find their more elaborated thought in the contents of their communication. Consistent with the view that thinking does not precede but exists in thinking-*for*-communicating, we observe other situations where people act-*for*-thinking rather than the other way around. Thus, for example, good Tetris players are so fast that cognitive models—whereby the player perceives an object (zoid), formulates a plan for the next action, and then implements this plan—fail to account for the speed by a factor of two (Kirsh and Maglio 1994). Instead, Tetris players rotate to see the results of their actions, which they then use in further actions. Another account of the relationship between thinking and action comes from the discoverer of the DNA structure, who describes the decisive instant in this way, which occurred when J. D. Watson came to his office one morning:

> Though I initially went back to my like-with-like prejudices, I saw all too well that they led nowhere … [I] began shifting the bases in and out of various other pairing possibilities. *Suddenly I became aware* that an adenine-thymine pair held together by two hydrogen bonds was identical in shape to a guanine-cytosine pair held together by at least two hydrogen bonds. All the hydrogen bonds seemed to form naturally; no fudging was required to make the two types of base pairs identical in shape. (Watson 2012: 207, emphasis added)

In this situation, Watson moved the shapes around and *then* became aware that certain pairs were identical in shape. That is, there was not *first* an idea about the identical shape that was *then* produced by implementing some forms of action. Instead, the identical shapes and the actions required to produce them are known only after he has perceived the shapes to be identical. Moreover, to recognize the identity, the shapes have to have given themselves in the first place, that is, they have to have appeared in consciousness as identical. Watson would not have had to move the shapes about had he already known what the results of his doing would be. Even if someone were rotating images in their mind, they still would be doing a rotation prior to anticipating its results. In this instance, therefore, we observe an instance of the process acting-*for*-thinking.

The examples just provided are taken from the literature and, therefore, we do not have the data to exhibit what we actually observe *in real time*, when people articulate thinking and, as shown here, where they move about as a way of finding their thinking prior to inscribing it in material form. To exhibit this in actual empirical materials, we return to one of the thermodynamic lectures where the professor is in the process of talking about the magnetocaloric effect. This effect involves the heating or cooling of a magnetic material due to the application of a magnetic field that is turned on and off. In his lecture, the professor announces that this phenomenon is easily seen and understood using a graph in which the entropy (*S,* a parameter of order) is plotted against the temperature (*T*) of the magnetic material.

When we turn to the episode, the professor has already drawn the coordinate axes with their labels. Between the axes he has drawn two curves, one representing the *S*–*T* relation for the magnetic field turned off ($B=0$) and the other one for the magnetic field turn on and therefore unequal to zero ($B\neq 0$) (Fig. 3.3). Between the curves, he has also drawn two lines (Fig. 3.3a), the vertical representing the turning on of the magnetic field with temperature remaining constant, and the other one horizontal, corresponding to the turning off of the magnetic field, which entails a lowering of the temperature at constant entropy. Fragment 3.2 begins after the pro-

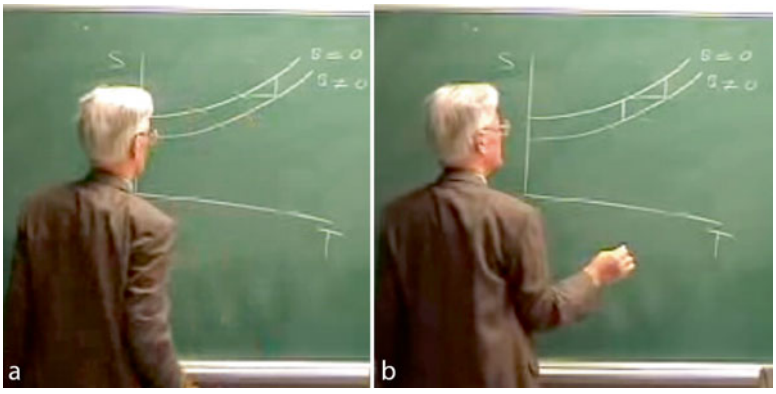


Fig. 3.3 (**a**) The professor has stepped back to look at what he has done prior to producing the next part of the graph. (**b**) A little while later, the professor has stepped back again after having added a vertical line

fessor has stepped back after having drawn the vertical and a horizontal lines connecting the $B=0$ and $B\neq 0$ curves (Fig. 3.3a); and it ends when the professor has stepped back again after made another line in the diagram (turn 07, Fig. 3.3b). Between these two instants in time, almost 15 s have gone by. The professor has been articulating what we describe in the preceding paragraph, and he has moved a lot (Fig. 3.4).[8]

Fragment 3.2

01 (1.00) (0.32) a:nd uh:: (0.44) kh:m (0.25)
| [a] [b----------b] [c] [d]

02 (1.00) (1.00) and then i i said it
[e] [f] [g] [h]

03 by the tIMe you get to HE:a (0.65)
[i] [j]

04 (1.48) when you put

05 it ina magnetic fIE:ld and that we=re kinda putn
[k] [l] [m----------

06 by the time you get to hERe when you put it in
---------- m]

07 the magnetic fIELd it goes to> thE:a
[n] |

We observe that before the professor really produces some intelligible words, almost 5 s pass. However, although there is a lot of pausing with respect to speech, interrupted by interjections, when he refers to what he has said in the previous lecture (line 02), he has already stepped forward, moved his hand to the left (Fig. 3.4a), right and up (Fig. 3.4b), further right and up (Fig. 3.4c), to the left (Fig. 3.4d), to the right again near the end of the earlier drawn horizontal line (Fig. 3.4e), back to the left (Fig. 3.4f), and, while leaving a very faint trace on the board, moved horizontally to the right again (Fig. 3.4 g). He then states the same idea twice: by the time you get to where the previous horizontal line had ended—i.e., when the magnetic field is turned of and $B=0$—and you turn the magnetic field on (lines 03–05, lines 06–07). His hands move about some more, as if he was uncertain where to start the line that he would be drawing next (Fig. 3.4 h–m). It is only then that he actually draws a vertical line that goes from a point on $B=0$ (magnetic field turned off) to the point below on $B\neq 0$ (magnetic field turned on). Readers may note that the professor has not actually attached the line to the end of the horizontal line even though he is talking about a continuous process or without having described something to occur that would take the material along the $B=0$ line to the point where he draws the vertical line.

[8] Those readers a little familiar with physics will quickly note that the two curves do not intersect each other nor do they intersect the ordinate axis at $S=0$, as per the standard of physics.

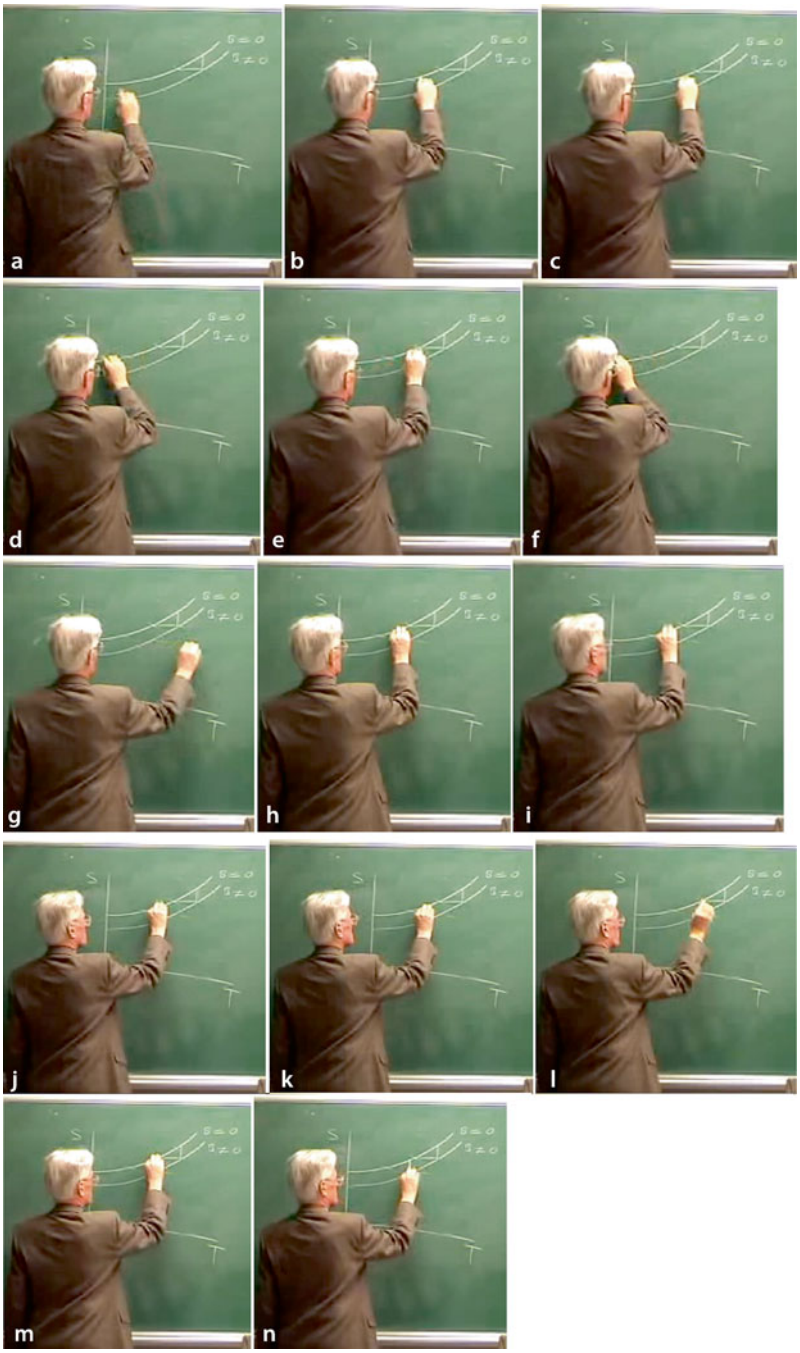


Fig. 3.4 Movements of a professor while in the production of another line

The first question we have to ask is this: Why does a physics professor with over 40 years since being granted a PhD take such a long time to produce this single line from a curve that undergraduate students are supposed to know? It does take time, he moves the hand about, and he repeats what he is saying—*as if his thought was forming in the course of acting*. This cannot be accounted for on the basis of aging, for (a) these phenomena are observed across the whole life span (as shown in the studies reviewed above) and (b) attached to aging also is a gain in expertise, which would predict improved performance. Whatever the case, the empirical materials are consistent with the view that the professor's hand movements are giving structure to the perceptual field rather than there being perception first and action second. On this account, the moving hand can be seen as an articulation in which thought may be found; it is thinking being articulated. Or we might say, it is moving-*for*-thinking. At the end, not all of the professor's movements will have an equivalent in the diagram. Only some of them come to be fixed ("frozen"), such as the faint line produced while holding the chalk to the board while the right hand and arm move from left to right (Fig. 3.4f–g). The eventually drawn vertical line (Fig. 3.4n) does indeed intersect with the $B \neq 0$ curve at precisely the point that the faint line does, so that the latter comes to form part of the procedure that allows the professor producing the vertical one in that given location. However, there is a lot of hand movement between the drawing of the faint horizontal line and that of the vertical line—as if there were some doubt. At one point, the hand is where the line *should have been according to the theory*, but it returns to the left where the downward movement then produces a line that intersects with the tentative horizontal one.

When all is said and done with the graph, the professor turns around to look at his lecture notes on the desk and, intonating as if he were distraught, says that he had suggested already during the preceding lecture that there was something wrong with the graph that he had produced.[9]

This brief fragment supports the hypothesis that, rather than the implementation of a plan, moving the hand about makes visible where the next line in the graph is to be placed. As it turns out, after he draws the vertical line, the professor produces a horizontal one that intercepts the S axis at the point where it is intercepted by the $B = 0$ curve. That is, the hand has been moving about, making an idea materially visible, which then could be taken to produce another, equally visible idea, prior to making it definitive in the drawing. The actions are not the result of already developed thoughts but are a constitutive part of thinking's developmental movement. It is from the hand movements that the ideas take shape and unfold. Even articulating a phrase and then repeating it to continue into the next idea creates the opportunity to observe one's thought, which provides the possibility for a self-correction similar to those that we observe in the hand/arm movements. That is, self-correction is enabled by articulation, which then can be perceived as an idea that is kept or replaced in the correction that follows.

[9] It is only some time later, while elaborating the consequences of some formula under discussion, that he finds what is wrong with the graph. He then produces in less than 10 s and without hesitation the equivalent to Fragment 3.2 in the correct graph.

In this case, we see how body movements are integral to thinking. We observe a thinking body rather than a mind that somehow exports its products (ideas) into bodily form across the body–mind gap. It is precisely because they begin with a gap that theorists need to introduce the notion of mediators, which are things that are material and ideal simultaneously (e.g. signs). More so, even the stepping back is part of the movement of thinking (thus, thinking and communicating cannot be conflated). Such stepping back does not require reflective thought but may be the result of the experience that such movements lead to a better appreciation of what has been done.

From the First Dim Stirring of a Thought to Its Formulation

> Let us try now to imagine the complex structure of any actual process of thinking and the associated complex movement from the first vague emergence of a thought to its completion in verbal formulation. To do so we must move from a genetic to a functional plane of analysis. (Vygotskij 1934: 268)

In the quote that opens this section, Vygotsky refers to thinking as an *actual process,* a *movement* that begins with a vague thought and completes itself in a verbal formulation. In the preceding section we show how, even in the case of experienced and competent lecturers, communicating and doing never mirror prior thinking. Rather, thinking and acting (i.e. communicating or doing) unfold together as manifestations of a larger whole. Communicating, doing, and thinking all have their function in the larger project of human activity in a continuously unfolding world that is never the same: All three modes are characterized by their relation to the activity as a whole, which is indicated by such expressions as *in-order-to, for-the-purpose-of, where-in, with-which, for-the-sake-of-which,* or *towards-this*. More so than in the case of experts, the *developmental* nature of the relation between thinking and (doing) speaking becomes visible in cases involving less experienced individuals, including students, where new forms of thinking and talking are still emerging.

One of Vygotsky's key findings was the observation that the relative function of thinking and speech was not established once and for all, but rather *changes* throughout the person's development. This finding was so important to Vygotsky that he wrote: "the discovery that word meaning [i.e. the unity/identity of thinking and speech] changes and develops is our new and fundamental contribution to the theory of thinking and speech" (Vygotsky 1987: 245). Notably, not only the relation changes, but also the two aspects, thinking and speaking, follow different paths of development in ontogenesis. In the young child communication "begins with the initial single word utterance" (1987: 250) and then moves to the coupling of words into phrases, then the coupling of phrases, and eventually to the coupling of series of complex sentences. Speech thus follows a process of development from part to whole. Thinking, in contrast follows an opposite path of development. Thus, with regard to the semantic aspect of speech, "the child begins with the whole and only

later partitions its fused thought" (1987: 250). That the two aspects follow opposite directions, however, does not imply that they are separate processes. On the contrary, "precisely because of their contrasting directions of movement, the development of the internal and external aspects of speech form a true unity/identity [edinstvo]" (1987: 251). This unity/identity exists in and through actual social relations, which lead both to the mastering of language and to the increasingly differentiation in conscious awareness of what initially is an undifferentiated whole.

To illustrate how the functional interplay between thinking and speech develops and gives rise to new ways of thinking and speaking that first emerge as social relations, we draw in this section from a study where upper-secondary students participated in an inquiry-based science curriculum. In contrast to the cases presented above, we discuss a situation in which the objects of thinking and communicating are not familiar but are the object of learning. In the episode, one of the participants (Andreas) spontaneously identifies (a) a digital animation depicting the inner workings of a heat pump to be connected to (b) a scientific principle about the pressure, temperature, and boiling point of a liquid (saturation temperature) and to (c) a previous task where the students had experimented with a syringe filled with lukewarm water and had been asked to explain their observations as they manipulated the level of pressure inside the syringe. Andreas clearly remembered this event, when, during a post-test interview, he referred to conceptual connections across different tasks. In that episode, he "saw like all the relationships, in a way." The fragment from that episode begins at that point in time when the students had moved the cursor over an interactive animation that depicts the inner workings of a heat pump, as illustrated in Fig. 3.5.

As the cursor moves, a window provides information about pressure and temperature at different locations. A few seconds into the sequence, the student holding the cursor (Andreas) emphatically invites the others to "look here," and verbally offers an identification of what is there to be seen: "the boiling point thing."

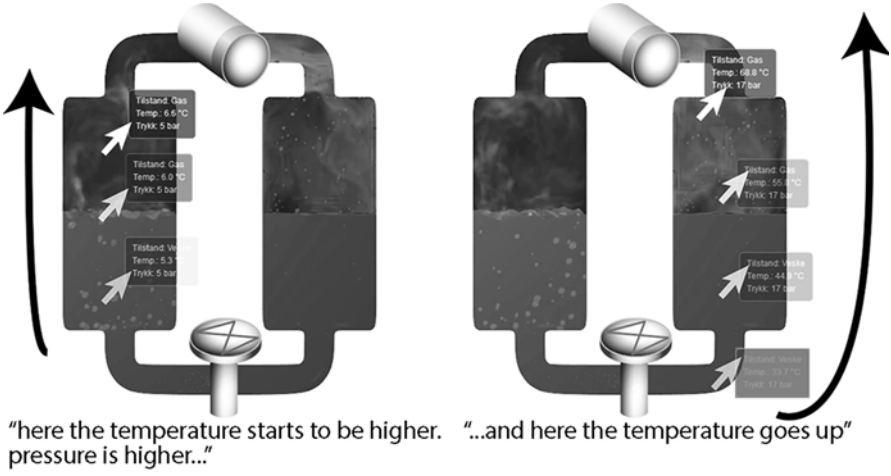


Fig. 3.5 Initial path traced by the students moving the cursor over the image

Fragment 3.3

01 Andreas: look here. >look.< it's the boiling point law thing.
02 Isaac: [oh ye::a:::h
03 Andreas: [here the temperature starts to be higher. *((moves cursor over left-side chamber))* pressure is higher. (1.5) and here, (1.7) *((shifts cursor over to right-side chamber))* the temperature::::goes (.) higher up (3.4) *((moves the cursor upwards over right-side, Fig. 3.5))*
04 Rachel: okay. can someone explain that figure to me?
05 Isaac: Andreas. you explain it. (2.4) *((the group is attending to and operating over the computer))* [I didn't get it.
06 Andreas: [just look at it. I think it was easy *((orients laptop towards his peers))*
07 Rachel: okay. >can someone explain it to me?<
08 Andreas: what is the law again?

At first there is an acknowledgement token in the form of an interjection, "oh yea"; and then there is an account describing changes in temperature and pressure as the cursor moves over the screen. After the account finishes, there first is silence and then a query for an explanation (turn 04). The request for an explanation is reified in the next turn, which also makes it apparent that the other students "didn't get it." That is, where there was an acknowledgement first, there now is a request to repair the account given—even though the account has included performative aspects that are visible (the moving of the cursor disclosing different values for temperature and pressure in different locations). In addressing this request, Andreas invites the others to "just look at it." He slightly moves the laptop towards his peers adding, "it was easy." The latter turn, however, is taken up with yet another request for an explanation, as if nothing that had been said or done so far had *explained* anything. In response, the next turn offers a question: "what is the law again?" That is, instead of an explanation, there is a query that concerns the very law that initially was claimed to be the thing seen in the animation.

As it will turn out, between the instant in which Andreas first identifies the animation as an instance of "the boiling point law" and the instant when the students achieve a complete formulation of the law and how it can be found as a visible aspect of the animation, 50 conversational turns will have passed. If thinking was to coincide with communicating, we may ask, how could the students recognize an instance of a scientific law without apparently being able to formulate either the law or how it is instantiated in the animation? The latter had indeed been designed to illustrate, among other things, the relation between pressure and saturation temperature in the heat pumps that the students now are talking about. The scientific law was formulated in a previous lecture during the curricular trajectory, and it was previously illustrated through a series of hands-on experiments. Yet precisely because the law and its connections with different observable phenomena constitute the objects that the students are to learn during the curriculum, and in contrast to the case of the professors discussed above, the students cannot yet *know* them in any well-articulated way. There is not a thought, but at best its dim stirring.

Episodes where students identify two different situations as involving a common notion or conceptual structure are commonly referred to in educational psychology literature as *transfer* of learning (see Chap. 13). In transfer, learners apply knowledge previously learned in one situation in new situations that are structurally similar or analogue. The transfer account, however, rests upon the same "postulate of constancy and unchangeableness" (Vygotsky 1987: 245) that the psychologist had problematized eight decades ago. In the lesson fragment, there is little evidence of a constant and unchangeable understanding of the things being done and talked about. Rather than the result of a completely formed thought, the connection between simulation and scientific law seems to be in a dim nuclear state that still requires development, articulation, and completion in verbal formulation. Andreas' first account already exhibits some hesitancy, with long pauses and the lengthening of phrases—so as to give time to actions (moving the cursor over the animation) to unfold. The accounts are acknowledged by means of requests for explanations; and, in place of verbal explanations, there is the presentation of the animation itself. There also are requests for more explanation.

Throughout the episode it is possible to discern how the participants' ways of perceiving and verbally describing the animation not only change but also follow different but intermeshed paths of development. Consistent with the observation that "the child's thought emerges first in a fused, unpartitioned whole" (Vygotsky 1987: 250) we initially notice here a spontaneous perception of the animation *as* an instance of the boiling point law. That is, the animation and the description emerge together as an undifferentiated whole from the outset, without the participants' discerning of which features and nuances of the animation do indeed correspond with the law and how they do so. We already note above the hesitant nature of the account while the student moves the cursor slowly over the animation, as if he did not know what was going to be found, despite already having given it a name. Rather than the result of some form of articulated thinking, the connection between animation and law is first perceived *immediately*. It is *given* in the situation rather than being constructed. As such, it stands for itself and the participants are not yet able to represent it in communication. Thus, Andreas instructs "look[ing] here," but what is there to be looked at is not verbally specified.[10] Instead, it is given in terms of its situational aspects (e.g. the students' orientation towards the laptop display screen, the movement of the pointer over the figure). Similarly, when requested to provide an account of what can be seen, Andreas does not articulate either the law or the connection with the animation, but asks to attend to the situation itself ("just look at it").

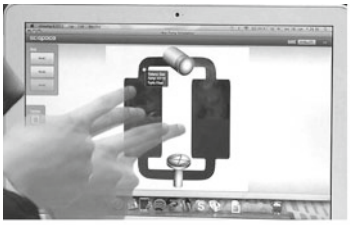
By contrast, and consistent with Vygotsky's observations, the role of speech emerges first in its indicative and nominal function. There is a clear and discrete statement, "it's the boiling point." At first, however, the latter is not further elaborated or connected to other verbal forms. Rather, the name (word) forms part of the whole it names: it is undifferentiated from it. It is only as the joint inquiry unfolds that the perceptual field becomes more articulated, and the ways of talking about it

[10] The very same phenomenon has been reported from other physics classes in other countries (e.g. Roth 2006).

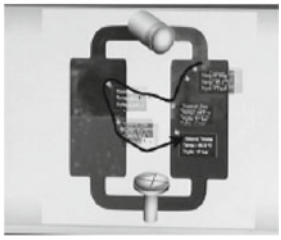
become more complete and independent. We observe aspects of such development in the following fragment, where new perceptual differentiations emerge along with new possibilities for verbally describing the connection. Prior to the fragment, addressing Rachel's last request for an explanation, Isaac has provided a gestural and verbal articulation that describes the animation in terms very similar to those in the previous fragment. Complementing Isaac's description, Andreas' response makes salient another similarity: "it's exactly like the syringe" (turn 14). This phrase makes reference to a previously performed hands-on investigation in which lukewarm water inside a syringe was observed to boil because the pressure dropped when the plunger was drawn back. Importantly, this new realization brings about a new take on the animation, where novel differentiations emerge.

Fragment 3.4

14 Andreas: =it's exactly like the:: syringe.
15 Isaac: the same as the syringe.
16 Andreas: but pressure increases, right?
[in this animation.
17 Isaac: [pressure increases, (.) yes, it must be something
[like that.
18 Andreas: [>wait<. look at the pressure
here.
19 Isaac: *((moving cursor over simulation))* as you see–
>yes because< there–



20 Andreas *((takes over cursor))* here the pressure is much greater then? (2.0) *((moves cursor from right to left and then back to right-side chamber))* find that about the laws, Andy.



After the analogy between animation and hands-on experiment (syringe) is offered, two expansions follow: one introducing a nuance about how the model is not "exactly like the syringe" and another one laying down the prospects for "look[ing] at the pressure" (turn 18). The students verbally articulate the possibility that pressure is "much greater" in the form of a query. We then see the cursor moving over the animation, which discloses information regarding pressure and temperature; and there is a new request to "find that about the laws."

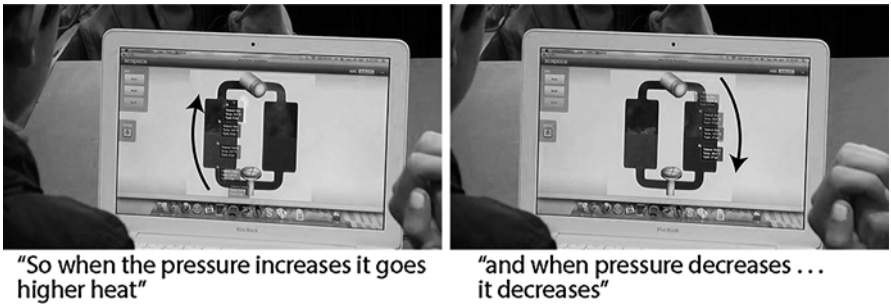


Fig. 3.6 A new exploratory path discloses the figure in a new light

In this fragment, the students treat the animation as a perceivable and accountable feature of the setting. At first the students move the cursor upwards in the two chambers and describe it as both involving increment in temperature. Now a contrast between the two chambers becomes apparent. Thus, although the animation comes to be identified as related to yet another situation (the syringe experiment), it is not known in advance which new features and knowledge this realization will bring about. Thus, the students do not yet know the pressure and temperature that will be in each chamber. The new insights come about only after the students change the material situation, which affords attending to it in new ways. A few speaking turns later, they will have established a new way of perceiving and accounting for the visible structure: in one chamber pressure increases and in the other pressure decreases (Fig. 3.6). This result contrasts the earlier and less nuanced observation that both pressure and temperature increase in both chambers (Fig. 3.5).

As the inquiry progresses, new perceptual differentiations reveal themselves; and new materials are added (including the reading of part of three thermodynamic laws that the students had in their notes). New opportunities in the speech field also emerge. There is a movement from the original nominative function, very much restricted to the immediate perceptual field, towards more elaborated accounts that no longer depend on the presence of the materials being talked about. Towards the end of the episode, we hear a complete account of the connection between figure and law that had been first recognized. A marker of a sudden realization ("wait") also precedes this account. But this time, there is neither a mere nominative function nor the need to further transform the material situation (animation) so as to reveal new features.

50 Andreas: >WAit.<(1.2) the lower the pressure, the lower the boiling point, right?

The account is now first elaborated in propositional form, "the lower the pressure, the lower the boiling point," where the different terms in the proposition stand in relation to the other terms rather than to a given situation. The proposition is offered as a premise, while the students are accounting for the observation that the blue color in one of the chambers (the other one is red) stands for its colder temperature. A {query ("Is it cold water?") | reply} comes to articulate an account that

(while being about the simulation) does not simply rely on what is immediately made visible in the situation. Now the fact that the students observe water boiling and that there is at the same time low temperature is presented as necessarily implying that "it must be low pressure" (turn 58).

58 Andreas: as you can see, ((*points over left-side chamber*)) it boils with low temperature. then it must be low pressure.

Here, not just the way in which students think and talk about the simulation has changed; the whole functional organization of the connection between thinking and speaking has changed. Having started out with a dim awareness of a relation, we now have arrived at a point where a verbal elaboration has taken the place that earlier was taken by the actual inquiry. Having become part of the students' developmental history, they no longer need to act upon the simulation and find out the pressure in the blue chamber. Thinking has become more abstract (less dependent on the actual situation); and speech has become more elaborate and denotes more than just one specific situational aspect.

Coda: Thinking and Communicating as Intransitive Verbs

Classical psychology and all of its current variants begin with the premise that the individual mind—which processes, constructs, and transfers information—has primacy over doing and speaking. These approaches cannot account for instances such as those presented in this chapter because they always take the individual mind as the source (causal origin) of what is said and done. In the cases examined here, both experts and novices are found to be surprised and surpassed by what they have already done; and learners find themselves doing and recognizing things they have never done or recognized before. Most importantly, thinking changes even when participants are not intending change. This requires us to think about development in an additional way, that is, intransitively.

In the constructivist metaphor that underlies many present-day theories of development, the individual is intentionally oriented towards the object learning, which she constructs. There is therefore a transitive orientation between the learner and the learning object. This transitive orientation is quite apparent in the notion of *self-directed learning*, which implies the directedness towards the object. Unlike classical approaches to educational psychology, which posit a *transitive* model in which prior events in the mind produce latter actions and words, the Vygotskian approach outlined here allows approaching the relation between thinking and doing/talking *intransitively*. This relation involves considering thinking and doing/speaking along with other intransitive verbs, including "hoping, growing, and dwelling" (Ingold 2011: 6). Instead of having to set either thinking or doing/speaking as primary, the one being the outcome of the other, there is a primacy of *movement* in the Vygotskian perspective. Growth is the phenomenon of interest, that is, the fact that the relation

between thinking and speech changes and develops as a function of the project under way. Such an approach, for example, makes it problematic to begin with the idea of individual *intention* and turns the latter an object of empirical analysis. We provide such an analysis in Chap. 8.

The intransitive perspective takes into account that life goes on, whatever we do, say, and think. We may consider this in terms of a river, where the subject and its object are like bridgeheads, and the bridge is the action that connects the two. This is the transitive view; and it is a metaphor for the way in which the psychological mainstream considers thought (subject) and communication/acts. But life itself continues to flow whatever we do and, therefore, in a direction perpendicular to the bridge. To create an analogy for the Vygotskian approach, we need to consider the relation as one of swimming across the river. Whatever the initial impulse for speaking might have been—i.e. the dim thought initiating speaking—is changed in the stream of life while communicating or doing so that the end result, what ultimately will have been said or done, no longer stands in an iconic relation with the original thought. But the situation is more complex, because transitive movement (i.e. speaking and doing) is changed while the thinking changes even before the other side is reached. Vygotsky asks us to consider thinking and speaking as two lines of development, a request that can be taken up in a more contemporary manner as two *lines of flight* without beginning or end (Deleuze and Guattari 1980). These two lines are corresponding, that is, they are communicating and therefore taking corresponding forms. We may use the vines of a kiwi plant as an analogy (Fig. 3.7). As these vines grow, some of them grow together and shape each other as they do so, only to separate again to apparently independent developmental lines. We can no longer say that the shape of one is the cause of the shape of the other. Instead, there is a mutually constitutive relation where both vines shape and are shaped in the process of growing and growing together. It is in terms of this analogy that we consider thinking and speaking, thinking and communicating.



Fig. 3.7 The interlacing vines of a kiwi plant shape and are shaped by one another as they grow (together) (© Wolff-Michael Roth, used with permission)

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Chapter 4
Intrasubjectivity | Intersubjectivity

> The ability to create intersubjectivity is increasingly considered a fundamental aspect in learning processes, especially when a socio-cultural vision of learning is embraced … only by joint participation in collective practices and activities we can make sense of experiences and share meanings within our community. … Being able to go beyond one's own perception and include another's way of thinking is the basis for the construction of intersubjectivity. (Ligorio et al. 2005: 358)

In the introductory quotation, we observe a theoretical position on learning that is characteristic of much of the current research literature taking a sociocultural approach: intersubjectivity is a problem, which arises because the individual has to be able to go beyond it's own perceptions and ways of thinking to include (those of) the other. Intersubjectivity then is the result of an individual's construction, which may in fact be the internalization (interiorization) of something that has been constructed before within a dyad or group. That is, this theoretical position, though most often implicit and against the stated intentions of the researchers taking it, begins with the individual as a unit of analysis and then poses as a problem how dyads and groups can in fact go about life in a concerted way. Throughout his work, Vygotsky was highly critical of and rejected this position. Thus, he noted that psychologists

> assume that there is a special individual psyche and that from the interaction of individual psyches or psychologies there arises a collective psyche or psychology common to all individuals. Thus, social psychology is regarded as the psychology of a collective individual in the same way that a crowd is made up of single individuals. … These psychologists do not admit that somewhere, in a remote and intimate corner of his thought, his feelings, etc., the psyche of an individual is social and socially conditioned. (Vygotsky 1971: 14)

Vygotsky takes his own position drawing on a quote from the works of K. Marx, for whom "man is a ζῶου πολιτικόυ [zoon politikon] in the true sense of the word, not merely a social animal but an animal that can individualize itself only in society" (Marx and Engels 1983: 20). Saying that everything we humans are is inherently social does not mean that a particular individual characteristic is present in all other members of a society, social class, or group. Vygotsky continues to be right

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with his critique of individualistic approaches to the human psyche, which is quite evident when we consider models proposed by scholars affiliating themselves with sociocultural or sociohistorical approaches, or who modify an individualistic Piagetian construction of the world so that it takes into account the teachings of Vygotsky, leading to so-called social constructivism. For the purpose of clarification, we discuss the traditional position in two different and influential theoretical approaches: A socio-constructivist (psychosocial) approach and an approach based on cultural-historical theory. In both, *mediation* features as a central concept designed to intercede between persons and their contexts of action.

Common Approaches to Intersubjectivity

Realizing that the administration of traditional Piagetian tasks involves the experimenter, some scholars in the tradition have expanded their focus to investigate the testing situation, including the child, experimenter, and task. Confronted with the task, the child engages in cognitive activity. This activity then is said to be "mediated" by a "*tripolar subject-task-experimenter interaction*" (Grossen and Perret-Clermont 1994: 254, original emphasis). There are two aspects to this mediation. First, the child orients to and engages with the task; but because it also talks to the experimenter, this person mediates the child–task relation. In this approach, the experimenter constructs the task conditions and therefore "gives it certain meanings" (1994: 254).[1] We are also encouraged to regard a second form of mediation: the task, which is the object of the interaction, mediates between the child and the adult. That task carries with itself social, cultural, and historical dimensions ("meanings") so that any intersubjectivity that the experimenter and the child construct in their dyad is interindividual, social, and cultural. The object of their interaction, therefore, is "to a certain extent, *preconstructed* … and *intersubjectively created*" (1994: 254). We may depict this approach in the superposition of two triangles, where a solid line marks the original relation and two dotted lines signify the mediation (Fig. 4.1).

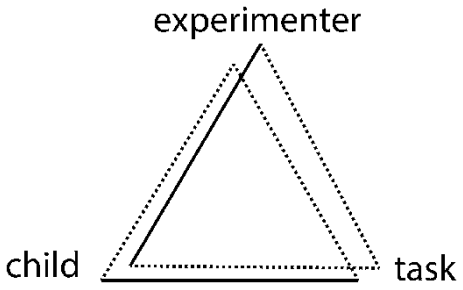


Fig. 4.1 In the post-Piagetian constructivist position, the experimenter mediates the child–task relation, and the task mediates the experimenter–child relation

[1] The authors do not specify, however, how the child could discover such "meanings," which, inherently, are in the mind of the individual. What would be the child's model for constructing meaning if it were forever confined to its own constructions?

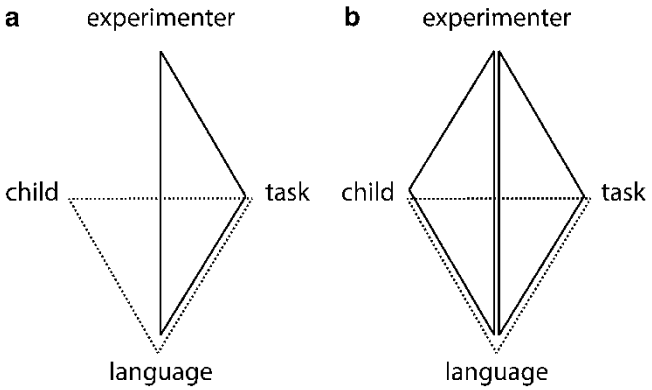


Fig. 4.2 (**a**) In the cultural-historical approach, there is the primary experimenter–task–language relation, and a child–task–language relation that is to be achieved. (**b**) The child–experimenter–language relation materializes the bridge between the existing and the intended relations

The representation also makes apparent that there is something missing in the mediations, which the authors have to introduce as an afterthought: the cultural and historical dimension.

The most influential uptake of a cultural-historical approach in Western literature, explicitly grounding itself in a reading of Vygotsky and his students and coworkers A. N. Leont'ev and A. R. Luria, would present this situation by introducing a fourth element and a third mediational triangle (Cole and Engeström 1993). This fourth element is language (text); it is the element that also introduces cultural history specifically. The primary mediated relation is that between experimenter, task (an aspect of the world), and language; the intended and to-be-achieved relation is that between child, task, and language (Fig. 4.2a). A third mediational triangle constitutes the bridge between the existing mediated relation and the intended one: the experimenter–child–language relation (Fig. 4.2b).

Both approaches, though arising out of different historical traditions, share the use of the construct *mediation*. This construct is necessary as soon as there are two separate theoretical entities that somehow need to be brought together. Thus, for example, Descartes had started with extension suggesting that each extended part is outside of another extended part (i.e. *partes extra partes*). Because two human beings take up different parts of space they therefore are completely separated cognitively. They must be brought together by an intermediary. Similarly, materials (bodies) were different from the soul (mind), which required a mediator to bring them together. In Descartes' case, that mediator was the pineal gland, which, extended and part of the mind/brain, produced the link between body and soul (mind). The early Vygotsky, even though he was striving to overcome the body–mind and individual-collective dichotomies, presented the relation between people in the same way. Thus, he used triangles in which tools and signs take the role of the mediator between the child and the world or between the child and other people

(Vygotsky 1989). It is that representation that the editors of *Mind in Society* (Vygotsky 1978) have taken up, where they also use parts of the psychologist's later work that has made it into *The History of the Development of Higher Mental Functions* (Vygotsky 1997). But the same language intervening between the child and experimenter also mediates between the child and the child himself, so that "an operation always has two objects: *the brain* and *the object of the psychological task*" (Vygotsky 1989: 62). That is, in his earlier work, Vygotsky was confronted with the same problems that psychology generally and most of his followers specifically have been perpetuating to the present day. Thus, he also had the problem of identifying

> the function, role, and origin of mediators—those translators from a "completely *alien, other*" language—the language of the objective world, into a language of the affects and senses of an individual's innermost subjectivity, a language that is "totally one's own" … namely, the problem of the *inception and development* of the human mind in the strict sense. (Mikhailov 2001: 15)

According to Mikhailov, Vygotsky, in his final works, was on the brink of overturning what he had done so far, moving completely away from the need to use mediators that a Cartesian dualism or even a body (material)–mind (culture) parallelism requires. Vygotsky, in his personal notes, conceptualizes his own earlier approaches as laden with "deficiencies" (Zavershneva 2010: 54). As can be seen in the beginning of his preparatory studies on emotion, Vygotsky was taking up a Spinozist agenda in which there was only *one* "thinking substance" (Vygotsky 1999: 163). In psychology, this substance would manifest itself in the thinking body. We can see already in an earlier work that Vygotsky began using mediation in a different way. Thus, in a triangle that relates the sign, the tool, and mediating activity, that activity is not a mediator standing between tools and signs at all. At best, it is the locus where these things appear together. Moreover, he writes that the triangle "is intended to present the *logical* relation of the concepts, but not the *genetic* or *functional* (on the whole, real) relations of the phenomena (Vygotsky 1997: 62, emphasis added). Here, the psychologist points us to the difference between the logical relations expressed and the *real relations* that exists between the concepts—which, in the dialectical materialist tradition to which he belongs, are concrete, actual (not abstract) relations. In real relations, signs generally and language specifically do not *mediate* and stand *between* the individual and her world, *between* the individual and others. Instead, language is an integral part of this world; and knowing a language, as we show here, is indistinguishable from knowing one's way around the world more generally. As much as we do not say that the world mediates our access to the world, we propose abandoning the notion that language mediates our relation to the world generally and to aspects of the world (language, text, the Other) specifically, because saying so does not add anything to our understanding of how we learn and grow. The water does not mediate the swimming of the fish; swimming is a possible behavior (a function) because there is water. In the same way, speaking is possible because it is material in a material-sonorous world and because there is the capacity of hearing.

As soon as we accept the notion that language is not a mediator but an integral part of the world that humans inhabit—that it does not mediate but contributes to

constituting a semantic or sense-giving field—we have overcome any need to introduce the concept of mediation. But, with it, we have also overcome the problem of intersubjectivity, because we are beginning with the world and language as that which is given to all humans. Thus, when we emerge into consciousness, we already have a world together with language, and both are given to us in the same way that they are given to everyone else.[2] Human beings did not start constructing themselves and, then, sought intersubjectivity; instead, when they became conscious they already found themselves relating to others and with communicative competence that constituted the basis for their conception of themselves and their individual subjectivities. There is an originary being-with, a *we* that exists "[p]rior to 'me' and 'you,'" and "the 'self' is like a 'we' that is neither a collective subject nor 'intersubjectivity,' but rather the immediate mediation of Being in '(it)self,' the plural fold of the origin" (Nancy 2000: 94). As a result, "*individual subjectivity* emerges simultaneously with *intersubjectivity*—a human being becomes an individual when she experiences herself as another to another human being" (Roth et al. 2005: 13).

Critical readers might point out that there are instances in our lives when we do not understand others and we try to come to understand by engaging with them. In this case, the critics address a real phenomenon that requires explanation. What they have not considered, though, is the fact that the very experience of failing to understand requires common understanding as its condition, including the competence to sense those occasions where common understanding does not appear to exist. That is, as a condition for establishing a lack of intersubjectivity there already has to exist intersubjectivity that now is seen as broken and in need of repair. Hence, that very phenomenon our critics may want to use to undermine the present argument does indeed confirm it. This is so because the problem presupposes the intersubjectivity that the critics are forced to establish when they begin with the individual as the element from which to construct the social. In the way a non-moving ground (earth) is the condition for any experience of movement, intersubjectivity is the common ground against which not only intrasubjectivity comes to exist but also the absence of intersubjectivity.

Givenness of the World

An often-cited text on intersubjectivity suggests that "communication aims at transcendence of the 'private' world of the participants" (Rommetveit 1976: 94). Quotations and references to this work are not surprising in a world that emphasizes individualism and the private mind, which somehow needs to be transcended for human beings to produce the social in and through their action. It fits well into social psychologies that emphasize interpretation (e.g. Wertsch 1985) over the very

[2] It is precisely that givenness of our everyday world that phenomenological philosophers have analyzed as the constitution of mundane cognition that provides us with the key to intersubjectivity, which is the source of any intrasubjectivity (Marion 1997).

conditions that make any interpretation possible. In this section we exhibit some of the fundamental aspects of the social and material world that—although often problematized in those approaches emphasizing interpretation—never come to be questioned in actual practice, even when there is a conversation about different ways of experiencing some object.

The fragment presented here derives from a task that asked second-grade children in a mathematics class to make plasticine models of a mystery object hidden in a shoebox. There was a hole in the box covered by a screen so that the children could reach into the box to feel the object but they could not see it. The video features three girls, Melissa (right), Jane (center), and Sylvia (left). At the time of the fragment, the three already have shaped their plasticine, two taking the shape of slabs (Sylvie, Jane) and one being in the form of a cube (Melissa). The fragment opens with the offer of an observation sentence, which attributes a cubical form to the mystery object; but a conversationally long pause begins to unfold. There is no reply, or, rather, the response is silence on the part of the other two (turns 01–02). The next statement is about the need to measure "it." There is then an uptake of the earlier articulated "cube," which thereby makes this turn a reply to turn 01.[3]

Fragment 4.1

01 M: i think its a cube. ((*S still with lH in box*))
02 (3.3)
03 need t'be able to measure it ((*tosses cube in hands, gazes at it*))
04 (0.6)
05 S: why's *that* a cube. touch: (0.2) ((*turns shoebox to M*)) touch it (1.0) feel the flat part
06 (0.7)



07 >ifyetouchit< like (0.2) <thi>s (0.8) youll see.=
08 M: =<bt i still (0.6) think its> ((*reaches rH into the box, feels about*))



[3] The transcription conventions are made available in the appendix.

In this reply, we observe not merely a claim, as in turn 01, but a question of the claim ("Why's that a cube?") connected to a procedure supporting that question: the mystery object can be touched, as if lying between the two hands arranged in a catholic prayer formation (offprint, turn 05); and it can be felt as being narrow when held between thumb and index finger (offprint, turn 07). We may gloss this presentation, therefore, in this way: "Why is this a cube given that it feels flat, as a slab between two palms, and fitting into the narrow thumb-finger configuration?" As the uptake shows, the statement was taken as a challenge to the claim, without, however, being sufficient; this allowed the original claim to survive ("I still think it's a cube").

In the research literature, there are many studies in which the social aspects of such situations are reduced to the three-ness of the girls, the fact that there are three persons. They are doing something together. This fact tends to be used to warrant that whatever is happening deserves the adjectival characterization of "social." Within that social, there is individual cognition and what we observe is somehow the result of their exchanges. Researchers might point out that at the time when Melissa will change her own plasticine model to make it consistent with those that Jane and Sylvia already produced, the three have (re-) established intersubjectivity with respect to the nature of the mystery object in the shoebox (e.g. as a result of negotiations). We suggest, however, that whatever they are doing is premised on an intersubjectivity that is much more fundamental and foundational.

In the episode, two girls disagree as to the question of the nature of the mystery object in the shoebox. Although they have had taken turns reaching into the box, feeling the object, they disagree, as seen in the different gestures Sylvia makes that describe, and thereby instruct, how the object has to be held. As noted, Melissa eventually changes her cubical model to make it into a slab. Historically, such situations often are characterized as the outcome of a "negotiation." But we may ask, "is it useful to think about this episode in terms of negotiation that leads to intersubjectivity?" We propose that any suggested achievement of intrasubjectivity already presupposes intersubjectivity. For example, the girls do not disagree about the presence of an object. Each girl feels something when reaching into the box. But they do not construct what they feel. Instead, *it feels like* a slab or a cube. The girls do not make the object feel like something but instead, for each the object *gives itself* in some rather than another way. Not only the object is given but so is the mode of experiencing. The girls can contest that the object feels this rather than that way because they presuppose that the object indeed gives itself in the form of something felt. What they contest is *the way* it felt rather than the fact of feeling. They can talk about the content (i.e. *what*) of the feeling because the *how* of the feeling, that is, the mode of perception, is already accepted as a given. Also given are the modes of expression, including the ways in which Sylvia holds her two hands in the catholic prayer-like or caliper configurations. Furthermore given is the very possibility to communicate something, including what an object feels like when taken in the hand or felt with the fingers. None of these given things and phenomena are at issue. Their commonness, which arises from the common physical access to one and the same environment, literally is common to their senses (i.e. common sense), thus is

the common ground for anything else to happen. This goes as far as including the intersubjectively existing possibility of differing with respect to how the mystery object may be felt or otherwise experienced. That is, when Sylvie exhibits particular hand or finger configurations, the very intelligibility of these expressions is presupposed and not at question. This intelligibility itself points us to intersubjectivity rather than differing subjectivities. *The identification of different subjectivities is premised on intersubjectivity.*

In a radically constructivist world where separate individuals with their own subjectivities construct knowledge and meanings of what is said and done, intersubjectivity as such is impossible. This is so because "*two substances having different attributes have nothing in common*" and "*when things have nothing in common, one cannot be the cause of the other*" (Spinoza 2002: 218). Intersubjectivity in such a situation is impossible because the individual could at best ascertain the viability of its own knowing (as in Descartes).[4] Awareness always being the outcome of a rational construction, the individual constructivist mind cannot be in direct touch with its social and material world, so that a subjectivity that includes the subjectivity of the other is impossible. This individual mind therefore cannot have anything in common with another mind. But how, in the first place, would any individual even be able to come to the conclusion that something is or is not shared? On what grounds would the constructivist mind arrive at the conclusion that there is something individual as distinct from something social and shared? The answer lies in the fact that we do not construct a world but instead we always already find ourselves in a world that predates our consciousness and which includes the other, who is with and within us. Thus,

> a child does not invent his own language, but he finds the words in a ready-made state, fixed to ready-made things … [which] means that a child attributes [confers] these words to the same objects to which we attribute them. (Vygotsky 1994: 345)

This familiar mundane world of everyday experience—always already given so that we find ourselves in the mode of being-there—constitutes our common ground. That givenness of the world is the condition of intersubjectivity, which, in turn, is the condition for intrasubjectivity. Everything else presupposes the common ground. The girls inhabit a common world, in which they know their way around; and this common world includes the words they hear and use to get certain things done.

The problem of intersubjectivity was at the heart of inquiries in a research tradition other than psychology, a field in philosophy researching the phenomenalization of the world (e.g. Husserl 1940). In this field, it was recognized that we would not be able to identify anger in the external behavior of the irate or happiness in the external behavior of the merry—unless we first adopted an outside perspective on our own behavior and correlate it with the affects we experience. The outside perspective on our own behavior is the condition for seeing in the behavior of others a

[4] Thus, an analyst of the problem of intersubjectivity in Descartes writes: "Under this dualism the body came to be thought of as a mere capsule, with windows called sense organs, in which human consciousness, cut off from the immediacy of the world around it and forever secure from the possibility of intersubjectivity, lived" (Fullbrook 2004: 406).

manifestation of their inner experience. This shows that a perception of the self, my subjectivity, always is intermeshed with a re-presentation of the view of myself seen from the perspective of the other than self (*alter ego*). A pure presentation of self and subjectivity, an auto-presentation, is inherently impossible. This interlacement of self (*ego*) and other-than-self (*alter ego*) testifies to "the presence of the *alter ego* at the heart of the ego" (Franck 1981: 157). That recognition of the other *as* other is itself an achievement that requires something like language, which is not the product of one person but always a reality for two. As a result, there could not be (intra-) subjectivity if there was not already intersubjectivity, especially with respect to those aspects of our experience that pertain to the higher psychological notions related to affects.

The Word as Reality for Two Persons

> In consciousness, the word is what … is absolutely impossible for one person but possible for two. The word is the most direct manifestation of the historical nature of human consciousness. (Vygotsky 1987: 285)

The individual word specifically and the word as a singular standing for the whole of language generally tends to be attributed to the individual speaker and is taken to stand for his/her "meaning." Educational psychologists, for example, use interview talk as a way to get into the individual mind of their research participants. To be able to attribute the word to an individual, however, requires breaking the word out of the exchange relation in which it occurs, out from the living, fleeting discourse realized temporally and in the present where it is used to get something done (Ricœur 1986). The price we pay for doing so is that we end up with linguistic signs that only refer to other linguistic signs, which allows us to fix the "signification [semantic content] of the speech event, not the event as event" (Ricœur 1986: 185). We do not get at the *Saying* as saying but only at the *Said* independent of the context of the Saying. In other words, we lose that all saying is saying-*for*-doing-something-in-the-world. It is precisely that independence from the context that allows researchers to attribute the *Said* to the person generally and to the (structure of the) mind more specifically. Unsurprisingly, from a monist position we are advised to return the Saying to the real and concrete relation in which it is produced by investigating thinking and speaking only in "the full vitality of life" (Vygotsky 1987: 50). In this section, we elaborate a way of understanding the word as something belonging to both speaker and recipient, where the word—like the streets we walk, the houses we enter, or the theaters an stadiums that we populate together—becomes a manifestation of a common consciousness, which manifests and refracts itself differently in different persons, and which can also be denoted as common sense.

The introductory quotation points our inquiry into a different direction in stating that the word is impossible for one person but is possible for two. How might we elaborate this statement that is rarely if ever taken up in the scholarly literature in a

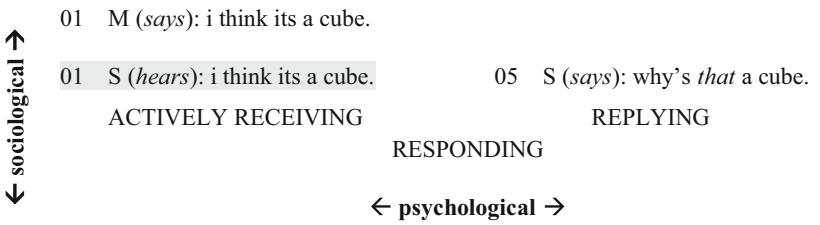
further development of the Spinozist approach Vygotsky began to articulate? What he writes makes sense within the distinction that Ricœur makes between living speech, where (a) *discourse* is but a fleeting moment of the event as a whole and (b) *language* is realized in the self-sufficient and self-referential world of the text. In living speech (discourse), the interlocutors are co-present to each other and to the situational surroundings, which are treated as the common ground. The Saying has its place and makes sense in the situation as a whole, and the connection is realized by all the indexical references that make the surroundings part of the communication. This is no longer the case when we consider the word as text—e.g. the transcriptions of interviews or videotapes of children in activity—because the referential function of speech to the current activity and setting "finds itself intercepted" (Ricœur 1986: 141). What remains is but the (abstract) semantic function of the word. One important aspect of the referential function is the addressee of discourse, the Other of speech, *to* whom discourse is directed, *for* whom speech is designed, and, in the most general way, *from* whom discourse has come and to whom discourse returns. All these relational terms—*to, for*, and *from*—point us to the inherent connectedness of speaker and recipient rather than to their difference. In *returning to* the other, discourse also affects the other, and it is precisely this impact on the other that we lose when we investigate words as text rather than as discourse. As the following analysis shows, we lose much more than that: we lose all real comprehension of what our research participants specifically and humans participating in everyday situations generally are doing or have done unless we consider speech in a relational way. We lose sight of not only the sociological dimensions of discourse but also the psychological dimensions. We completely miss comprehending *why* people talk in the first place. To rectify the situation, consider the following case coming from the same learning unit presented above, which will allow us elaborating an analysis in which the Vygotsky quotation that the word is a reality for two makes sense and is taken into account.

We return to the beginning of Fragment 4.1 where Melissa, in the middle of the task, says, "I think it's a cube," which is in reference to the mystery object in the shoebox for which the group has been asked to produce a model. Melissa is not just somehow transferring the contents of her mind, using language as some neutral medium (tool) to the outside where it then stands on her own. Rather than making available the contents of her mind—as if she were emptying a container—she first and foremost is addressing the others. She is speaking *to* them *for the purpose of* moving the task ahead. What she says is shaped by the fact that the discourse is *for* her peers rather than her parents, school principal, or journalist producing a news feature on innovative approaches to mathematics teaching. These peers are there, in the same room and at the same time. The words, which are the result of the resonances in Melissa's mouth, also resonate in the ears of Jane and Sylvia. As a first step of improving our analysis, we create a transcription that also includes the act of listening, of *actively receiving*[5] the words to which, as we can see above, Sylvia will

[5] This notion of *active reception* is dialectical in that it makes apparent both agential and passive aspects of human experience.

be replying. She would not be able to reply *to these* words unless they had been ringing in her hears and unless she had attended *to* this ringing, and unless she had opened up to receive the words in real time and without knowing what the content of speech will have been when everything is said and done. Leaving out the pause and the second part of Melissa's phrase, we obtain Fragment 4.2, which includes the speaking and the hearing (grey highlight), who, in turn, replies in speaking. We hear the return as a reply because it picks up the same words, reconfiguring what grammatically was a constative into a question: "Why's that a cube?"

Fragment 4.2 (excerpt)



We immediately observe that the phrase, unfurling from Melissa's lips, *simultaneously* is a reality for Sylvia. We do not know whether Jane has been attending to what Melissa says. But we will know that Sylvia has been actively attending after she will have picked up turn 01 in turn 05. We therefore observe an intersubjective dimension of the word, which exists in the simultaneous reality of the phrase for two or more participants in the situation.[6] Simultaneously with the intersubjective dimension, there also is an *intrasubjective* dimension. Sylvia is not inactive or passive while Melissa is speaking, which the normal ways in which transcriptions are produced may lead us to suppose. Without actively attending to the words, recipients would not be able to reply to them. Instead, they might be saying something unrelated. Witnesses of such situations may speak, in French, of a *dialogue de sourds* [dialogue of the deaf], that is, witnesses may speak of participants as speaking past each other. But here, Sylvia's reply in turn 05 presupposes her active reception in turn 01. It is apparent that Sylvia's *response* exists not just in the actual reply, but instead also includes the active reception and comprehension.[7] The intrasubjective dimension, therefore, moves from actively attending, during which comprehension evolves and the reply comes to be formed to actually articulating the reply. This reply has to be analyzed and considered in the same way, which we have not represented in the diagram for reasons of space, and which we forgo because it unfolds in the same manner. Let us emphasize, though, that this reply also has an intersubjective dimension.

[6] The cameraperson filming this situation, and, vicariously, the researchers later watching and analyzing the scene also are witnesses of the reality of he words.

[7] *Responding* theorized in this way goes together with the notion of *perežívanie* [experience], for it includes the environment as the subject experiences (hears) it and her reply.

This brief analysis shows that each act of speaking irreducibly is inter- and intrasubjective; it also has synchronous and diachronous dimensions. Each turn—including both active reception and replying—constitutes a response.[8] Thus, when the first girl begins to speak after the three have arrived at the table where they work, speaking is in response to the situation as a whole and to the task they just received specifically. Every act of speech, as every act taken more generally, is part of a response to a response. In fact, to know just how what they said comes to be taken up by others, speakers themselves monitor the response—which includes the recipients' body movements, body positions, facial expressions, smiles and laughter, and the likes. Whatever the (verbal) reply, it is a form of communication to the original speaker, which indicates not only something new but also how discourse was received and what it has done so that it can be addressed in the next turn, for example, by restating a message in different words for the purpose of achieving a preferred reply. There is therefore "a vast difference between the mechanical description 'A gave B such and such information' and the description of the interchange 'A answered B's question immediately'" (Bateson 1996: 68). We can see the need for taking such a more holistic perspective on speech situations in Fragment 4.3.

Fragment 4.3

→	01	W:	em an what did we say that group was about.
	02		(1.00)
	03	C:	°what do you mean li [ke?°
→	04	W:	[WHAt] was the
→			(0.15) WHAt did we put for the name of that group.
	05		(1.51)
→	06		whats written on the card.
	07		(0.26)
	08	W:	°°s:::::°° °quares°-



The fragment issues from the same second-grade mathematics curriculum where, during the first lesson, each child was asked to classify a mystery object being pulled from a black plastic bag. There were two choices. Either a mystery object was to be placed with an existing collection of the emerging classification system or on a new mat that therefore started a new category. The fragment takes us into Connor's turn. He initially has placed on an empty mat what educators know to be a cube.

[8] Even a first phrase that begins a verbal exchange is a form of responding in that it addresses the situation as a whole (Waldenfels 2006).

When Mrs. Winter, one of the two teachers conducting the lesson, asks him for his reason, Connor states that the object is bigger than others. Mrs. Winter reminds him that size is not a feature that can be used to distinguish the objects in the current situation. She then asks Connor to reconsider his categorization by holding the object next to all existing groups of objects. Connor eventually places his cube on the mat where there already are two objects and next to which there is a card with the inscription "cubes, squares." The fragment begins with the offering of a question, the reply to which takes the form of a question, "What do you mean?" (turn 03). We then observe an aborted phrase that begins with an interrogative, followed by the offer of a query concerning the name of the group (on which Connor has placed his object). A pause develops (turn 05) and, without Connor having spoken, Mrs. Winter offers what we can hear to be a rephrasing of the preceding two versions of her query. It is in and as a reply to "What's written on the card?" that Connor articulates one of the two words inscribed on the card next to the collection of cubes. All the while she is speaking, Mrs. Winter gesticulates in the direction of the collection of cubes (see grey highlight in the transcription and the depiction of the situation on its right).

Some educational researchers might suggest at this point that there was an issue with intersubjectivity, which we might gloss in this way: Connor does not know what Mrs. Winter is saying (her "meaning") and that they then engage in reestablishing this lost intersubjectivity. There is, however, no indication that the two participants are not aligned; and there is all indication that intersubjectivity is precisely what makes this event possible. Both exhibit awareness of being part of a mathematics lesson, of the task they are working on, and of their respective institutional roles. Even though there is an apparent query concerning the semantic content of a preceding turn, turn 03 treats turn 01 as an address, an offer of something to which a reply turn is appropriate. Even if turn 03 had taken the form "I don't want to (respond)," it would still express the understanding that there was an address of some sort, though it might have led to a very different kind of resulting situation.

The return query (turn 03) also implies the possibility that there is some form of return that will be such that it satisfies the request expressed in turn 01. It presupposes that there is something that has been said, but which is still hidden. It is on this assumption that a reply makes sense and is rational; and it is on this assumption that some future evaluation can be anticipated as an intelligible action to follow the production of the searched-for reply. This will have been witnessed when Mrs. Winter, following Connor's phrase "squares," replies by saying, "squares *and*"; this is followed by a pause that gives Connor an opportunity to provide an additional word. The very joint production of a pause and its being taken up as an invitation to offer a missing word already presupposes the competence required for participating in classroom talk. That is, if intersubjectivity did not exist, it would be all but impossible for Mrs. Winter and Connor to work together so that "squares" and "cubes" could be produced in the way that these eventually came forth. Indeed, the very act of speaking (conversing) on the part of Mrs. Winter and Connor presupposes the existence of intersubjectivity.

The blame for such situations where an apparently called-for reply is not forthcoming frequently is attributed to the student, who may be denoted as not under-

standing or to be of feeble mind. Sometimes blame is attributed to instructional strategy or teacher. This is not unlike the instruction in a baking recipe, "Knead until smooth and elastic," where the person may wonder, while kneading the dough, whether what she feels in her hand is what the recipe describes: a smooth and elastic dough. Here, too, we might find attributions of blame to the recipe or to the user. Much more interesting than making an issue of "the meaning" within the frame of a mechanical description of message is the pursuit of the *transactional* (mutually changing) relations that we exhibit in our analyses below.

We note that the first rephrasing occurs in the response to a query—the reply in fact constituting the previous turn as a query—about what she is meaning to say completed by the adverbial "like," which can be heard as an invitation to say in other words the same (i.e. something like that). Mrs. Winter replies in just this manner by producing a new version of a query that changes from "what . . . that group was about" (turn 01) to "what we put for the name of the group" (turn 04). In turn 06, then, we observe another rephrasing to "what's written on the card." It appears as if Mrs. Winter has just rephrased the earlier query.[9] However, the situation is more complex, as can be seen from the transformed transcription in Fragment 4.4. We assume for an instant that Connor does in fact hear Mrs. Winter saying, "What did we put for the group?" (turn 04). There is a pause. From Mrs. Winter's perspective, there is an intended question that does not obtain its reply equivalent. Turn 06 takes the same form as turn 04, which has treated turn 03 as a request to restate the original query in turn 01. That is, turn 06 treats the pause as a failure to understand what the phrase says and as a request to restate in other words what has been said.

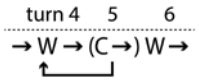
Fragment 4.4 (excerpt)

04 W (*says*): WHAt did we put for the name of that group.		
04 C (*hears*): WHAt did we put for the name of that group.	05 C (*says*): ((*nothing*))	
	05 W (*hears*): ((*nothing*)).	06 W (*says*): whats written on the card

We see here that turn 04 is the reply part of the response to turn 03, which, therefore, will have had the effect of getting Mrs. Winter to restate what she said before. That turn 04, when actively received, is affecting the recipient (Mrs. Winter). But turn 06 provides evidence for Mrs. Winter's own monitoring, for, when there is no indication that a verbal reply seems to be forthcoming, she produces another restatement.

[9] There is also another aborted attempt at doing so.

These considerations therefore lead us to a much more complex situation than that some person *W* (Mrs. Winter) tells another person *C* (Connor) what is in her mind.[10] Each act of speaking and the effect it has on the speaker needs to be understood in the conjunction of four actions:



(4.1)

First, *W actively receives* and *is affected by* the foregoing situation or speech by another (first arrow). In the second part of the response, *W* then replies; and, as a result of acting to influence someone else (second arrow), she is changed. As part of the effort to find out what she has done, *W* actively monitors the response of *C* (recursive arrow); and this monitoring therefore affects *W*. As a result, the *W* is not the same across the turns. Instead, she is a person affected and changed by three forms of action. An active reception in turn 04, the production in turn 04, and the active monitoring of turn 05. This triplicate affection enters another cycle with that same reply of *C*, to which *W* will reply in due course.

As can be seen in our analyses, the kind of phenomenon that the diagram above depicts is not one of *inter*-action. In inter-action, "thing is balanced against thing in causal interconnection" (Dewey and Bentley 1949/1999: 132). In the situation examined, we do not see two persons—two subjectivities—simply causing the response of the other without being affected in turn. Rather, each turn at talk is the result of the unfolding conversation as a whole; each turn changes the conversation and is changed by it. And so are those participating in the event. Paraphrasing a text from Marx and Engels (1978) that had influenced Vygotsky's vision for the future development of his theory (see Chap. 1), we might say this: The first historical deed is the production of the means to the satisfaction of a communicative need; and the production of new communicative needs is the first historical deed. Communication therefore is not an *inter*actional but a *trans*actional phenomenon. Unlike interaction, transaction denotes the movement of a system that cannot be reduced to its parts or to relations taking place between the parts. As the system moves and changes, so do its parts. That is, seen as a transaction, the emerging social relation cannot be understood without including in the analysis its own temporal unfolding and self-affection. A transactional unit of analysis includes change and time, rather than having the latter as an outcome of the interaction between unchanging elements. Intersubjectivity cannot be the end result of an interaction but needs to be understood as the primary phenomenon. Just as affect vanquishes affect in the Spinozist perspective (Vygotsky 2010), intersubjectivity vanquishes any intersubjectively available lack of intersubjectivity. Without this primary phenomenon, we cannot come to terms with any intra-subjectivity or with the work that people actually perform to get on the same page when engaging in joint practices and tasks.

[10] The equivalent would be the situation in which a research participant giving the researcher some information, which the latter attributes to the former's state of mind, his mental structure.

Coda: Revisiting Intersubjectivity and Mediation

We begin this chapter with a sketch of some common approaches to intersubjectivity, which become problematic in their positing the individual as the unit of analysis. We note that any theory that begins with the individual as an element of society will have intersubjectivity as a problem.[11] This problem cannot be solved by means of the concept of mediation or negotiation. This is so because intersubjectivity is required for the individual to know of or "construct" intrasubjectivity and lack thereof. An undifferentiated *being-with* is the condition for the intersubjective social relation within which any possible individualization can emerge. We refer to the phenomenological analyses that have examined the requirement for seeing in the behavior of others anything that reflects inner thoughts or emotions: that which is alien to the self, the Other, already has to be part of the self. A great deal tends to be made of the process of *internalization* that appears in the earlier works of Vygotsky. That idea, which takes the human being as a capsule into which something enters and out of which other things spill has a deeply Cartesian split at its heart. Not surprisingly, towards the end of his life, Vygotsky developed a different approach that had partly made it into the last chapter of his work on thinking and speaking: the word is reality for two. In his notes, we furthermore find something opposite to what frequently is said, that is, that inner speech follows external speech. Instead, in his notes he writes, "Inner speech does not come after external. Inner medi[a]t[io]n exists from the very outside in speech, wh[ich] is the undifferentiated unity of extern./inner speech" (Vygotsky, in Zavershneva 2010: 55).

In the preceding sections we show how intrasubjectivity is the correlative of a world given to us in perception rather than being the result of a construction. This world is given in perception not merely as a percept or as representation, which then needs to be further interpreted and made sense of. Instead, sense always already is there, even if participants may perform work to contest what a situation stands for or how it can be talked about. The construction metaphor only gets us so far, and it falls apart as soon as we begin to investigate the origin of human consciousness. That is, if the mind is the result of a construction, its very tools of construction also need to be constructed, just as any other human tool needs to be made before it can be used. How, in the absence of mental tools and the image of a mental framework could the mind have produced both—given that an understanding of a mental framework is the condition for the intentional construction thereof? That is, human beings become conscious of a world that can be and is common to them precisely because it is (a) given. Language, a sonorous part of the world, is but one of the aspects that newborns encounter upon birth—and, as some studies suggest, they do so already during gestation if only because of the resonances of language in the bodies of the mother. If language already exists, in fact, if we are speaking at the moment of becoming conscious of language, then again it is, qua given, a gift to every other person as well. Neither world nor language is *between* the Other and me. Instead, I

[11] For a brief history of intrasubjective philosophy see Fullbrook (2004).

inhabit a world of which I am an integral part and that is common to all of us. We all constitute contexts for each other and for our own behaviors. This is seen in the two empirically derived representations in Fragment 4.2 and the relation (4.1). In both instances, speaking, as a special form of action, is intermeshed with other actions.

From our analyses emerges a position that is incompatible with the classical characterizations of intersubjectivity, which requires various forms of mediations. Thus, if there were not already a common world that the experimenter and the child inhabit together and share, and if the task was not already implied as a possibility in this world, nothing would be able to produce intersubjectivity (Fig. 4.1). It is precisely on the basis of a common world and common sense—whether we are familiar with that particular part (i.e. the experimental task situation) or not—that a task can be intelligible and responded to in equally intelligible ways. We are referring here not to a world that is common in the fact that all the participants have the same world *in their mind*, but the *one world* that all the participants can sense and become aware of—in whichever form each individual comes to sense or becomes aware. If the task and its conditions really were alien, no mediator (experimenter, sign, language, activity) would bring the two together. The alien never is encountered, and in those instances where we come ever so close, our familiar world comes to be enriched and the alien has already withdrawn (Waldenfels 2006). It is only because of its promise to be intelligible that some psychological task can become part of the child's world. When investigating real experimenter–child exchanges, we are never confronted with the situation that the child and the task are completely alien—though the latter, clearly of an unfamiliar kind, readily will become part of the world that the child learns to navigate, including the forms of language that can be found within.

An important aspect of the approaches that make intersubjectivity a problem is the process of mediation, which has to be invoked whenever there is an encounter of two things external to each other (*partes extra partes*) that somehow need to be brought into relation. The position that emerges from our empirical analyses is incompatible with a view that posits cultural-historical forms of mediation as conditions to establish intersubjectivity (Fig. 4.2). Instead, our analyses are consistent with a pragmatic approach, which recognizes language as an integral part of the world in which it is used. This integral and irreducible relation is expressed, with respect to the relation between people, in the Vygotsky quotation according to which the word is a reality for two persons. These persons, though Vygotsky does not state explicitly so, are part of the same situations in the common pursuit of some activity (e.g. lesson, psychological experiment).

The material world and the language that is used within it are connected so tightly that there is no distinction possible between knowing our ways around the world generally and knowing the language specifically (Davidson 1986). This is particularly evident in situations when the literal (dictionary) sense of a word is not at stake, such as in analogies, metaphors, jokes, games, and the like. As noted in Chap. 3, when "penis" resounds ten times in sequence in a physics classroom, an analysis shows there to be a game of repeating the initiating word with the

appropriate intensity and intonation. In such a case, linguistic competence consists in recognizing that *this* word in itself—its dictionary sense of the male reproductive organ—is not at stake and that what really is happening is the invitation to a game. But the root and basis of this competence cannot be found in the dictionary. This is why learning a language exceeds learning a code and is more like becoming familiar—practically, intellectually and affectively—with a particular part of the world. The first time that the word penis resounds in the physics class is not just the beginning of a game that fell from the sky. Instead, as an invitation it has to be a reality for at least two persons, the one who is offering up the invitation and the one accepting it; and all the others participating in the game recognize in the accepted opening move that a game is in play until it is closed by an equally accepted move of closure. Intersubjectivity exists and is the condition for the use of the word "penis" and is independent of the dictionary senses ("meanings") that the participants have to share. For this game to unfold in *this* way, the very intelligibility of the offer of a beginning, here realized in the sound /ˈpiːnɪs/, is integral to the world. That (inherently intersubjective) game already is in play the very first time it occurs and in the absence of any (stated) rule whatsoever.

Throughout this chapter we show that speakers do not have to intrasubjectively construct or interpret the world before they can have a conversation. Intersubjectivity is not something that the participants work out, but instead is already given to and presupposed by them. Yet, we recurrently see people having to manage whether and how others (correctly or incorrectly) hear what they say or do. This is so because of two different aspects: (a) the fact of being always already aware "that" we are talking together and are competent to do so and (b) the fact of having to deal with the inescapable and never fully finalizable question of "what" we are talking about. In our analyses, we exemplify how speakers monitor the effects of their speech, and how this effect is taken up in their future actions. If speakers design their speech for the specific recipients—a designing that for the most part of life speakers are not conscious of—and if they use a language that in any event has come to them (rather than being the expression of utter solipsism) then this exhibits the primacy of the *inter*subjective over the intrasubjective. In fact, in actively attending to the speech of another and in attending to the *Said* by taking it up and replying to it, the *intra*subjective is *inter*subjective through and through. There is therefore a dynamic unity/identity, which we express as {intrasubjective | intersubjective}. Its nature is such that "we have nothing within us, all that is within is on the outside. We have 'on the outside' the subjectivity the world of speech, of the world of thought" (Mikhailov 2006: 36). We may therefore also speak of *intra-intersubjectivity*.

At the end of this investigation, we have come full circle from the statement of intersubjectivity as a problem through a series of investigations to the recognition of a dialectical (transactional) unity/identity that manifests itself as intersubjectivity or intrasubjectivity. We come to recognize "the problem" of intersubjectivity as the result of an individualistic take on cultural-historical phenomena. The Vygotsky quotation used above—the word as impossible for one person but as constituting a reality for two—is a manifestation of the approach that we evolve in the course of our empirical analyses. In Chap. 10, we return to and elaborate on the consequences

for understanding such psychologically important phenomena as conceptions and conceptual change. If there is a dynamic unity/identity of intrasubjectivity and intersubjectivity, then it is useless to seek the source of the social in the structures of the individual mind.

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Chapter 5
Primacy of the Social and Sociogenetic Method

> Formerly, psychologists attempted to derive social behavior from individual behavior. They studied individual reactions observed in a laboratory, and then, in a group, they studied how the reaction of the individual changes in a group situation. (Vygotsky 1997: 106)

Following the cognitive revolution, many scholars adopted information-processing approaches to study knowing and learning. In the 1980s, at the height of the information-processing paradigm, a shift was observable in theories of knowing and learning that moved to individual (Piagetian, radical) constructivism and then to social constructivism. In the latter version, however, the social tends to be taken in a trivial way, the social merely constituting external *context*.[1] Thus, the development of an individual is described in terms of "the maturation of the nervous system," which "determines the totality of possibilities and impossibilities at a certain stage" (Inhelder and Piaget 1958: 337). The social environment constitutes a context "indispensible for the realization of these possibilities," which, therefore, "can be accelerated or retarded as a function of cultural and educational conditions (1958: 337). When someone writes something into a personal diary, the result is taken to be an individual construction; when two students do some writing together, then the result is socially constructed and subsequently internalized by means of another individual construction.

There is in fact a problem with the very concept of construction (Roth 2011). The verb *to construct* is derived from classical Latin, and literally has the sense to pile (*struere*) together (*con-*). It was used to denote what craftsmen were doing, such as to construct a house. Is a house the result of an individual construction if I do it on my own? Conversely, in which sense is the house I am building on my own social? Consider the following example from our own experience of building an entire floor of a house, sometimes working alone and sometimes with a helper. In framing the walls, holes are left into which slabs that we know to be doors are later installed.

[1] In Chap. 13 we provide a critical historical analysis of the notion of context as it is currently used in different theoretical approaches.

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These slabs, as everything else, are not individual because one person has installed them alone. Instead, these slabs are social through and through. Evidence of this is given by the fact that when this part of the house is finished, visitors will not try to go through "windows" or "walls" but they push these slabs to get into the room behind. These slabs covering the holes in the wall—though an individual installed all of these—are social because they were produced *by* and *for* people to go through and enter the room (e.g. office). The builder also steps through the door on a daily basis to enter his office. But this, too, does not make the door individual. The individual relates to this part of the house in the way he has learned it in relations with others. In his building of the door, the builder has returned to the Other—i.e. the idea of stepping through a hole in the wall and closing it with a wooden slab to prevent temperature variations, and to have privacy—what has come to him from this Other.

Overzealously critical readers might immediately hold against us that all of this may be true for building a house, but it surely would not be true for something like writing into one's diary, thinking in private, or talking to oneself. But here the critic is on a path in the direction opposite to the one that a concrete human psychology is taking, for "to write for oneself, means to relate to oneself as to another" (Vygotsky 1989: 58). That is, writing for oneself comes after relating to an Other; and it is modeled on the relation with others. More importantly, Vygotsky does not just state that writing for the self is modeled on writing for others. Instead, he considers this relation itself to be a general law. Thus, immediately following the quoted phrase, he writes: "*This is a general law for all higher psychological functions*" (Vygotsky 1989: 58).

So what is the essence of this law? We can find it in Vygotsky's statement: there is a relation with an Other, and this relation with an Other subsequently becomes a relation with oneself. The relation with others is the social, and it is maintained by social behavior. My behavior is not social *in itself*; it is social because it originates in and is oriented *towards* a relation with others in ways that let the social be seen and known. My behavior is such that other people can recognize in it their own behavior. This can be observed, for example, in the following situation. In front of the office, the above builder takes off his sandals. When visitors come, they too take off any slippers. Visitors do so without having been or having to be asked. They do so without having been taught the rule, "Take the shoes off prior to entering the office," and in the same way they would be doing if they were to enter a mosque or Japanese tearoom. Readers all too quickly might say that the visitors take their shoes off because their host has taken his (house) sandals off. We counter that the host is not just taking his shoes off, as if it were an individual action. This action is social because of its intelligibility to others, who, in the taking off of sandals see an invitation—or, perhaps stronger, see a rule—that in this office no shoes are to be worn.

In this chapter, we develop the idea of the *primacy of the social*. We do not mean to replace the primacy of the individual by its opposite. Instead, we show that the individual and the social always implicate each other, having been born from a singular plural being-with that predates human forms of consciousness. The indi-

vidual and the social are not the two sides of the same coin but, in relation, always appear together. What individuals do—when drivers cross a four-way intersection with nobody else around, or when someone writes into a diary—always is premised on the social relations that they have participated in, lived through, and undergone. To set up the contrast with the social understood and treated in the trivial way (i.e., as co-presence of individuals), we take a brief look at some published work that deals with the ways in which norms come about in school classrooms. We then provide an example from our own research and articulate the various ways in which the primacy of the social—that is, the social in the strong sense—manifests itself. We finally move to discuss the *sociogenetic method*, which is a way of seeking out and investigating phenomena often ascribed to individuals but that in fact have their origin in social relations involving these same individuals at an earlier point in time.

Ways of Theorizing the Social

The social is theorized in different ways. Here we consider two such ways, which radically differ from each other: the social as context, typified in the social constructivist approach, and the social as a phenomenon *sui generis*,[2] typified in the ethnomethodological and in Vygotsky's take.

The Social Constructivist Way

After a prominence of Piagetian constructivism, and in the wake of a social constructivist advances in the sociology of science, researchers in psychology and education—becoming aware of the recently translated works of L. S. Vygotsky—also made a social turn. Social constructivism was hailed as an advance over Piagetian constructivism because it made salient that what counts as being-in-the-know does not depend on the individual, who (only) "constructs" "private" "meanings." Instead, what counts as being-in-the-know is a function of a collective. That collective is thought to be the result of individuals getting together; and, if their "individual" "meanings" differ, these individuals "negotiate" until they come to some form of agreement. That agreed-upon version, which first is the result of social interaction, can then be "internalized" (interiorized) and thereby made individual. Students' activities in domains such as mathematics and science were understood to be cognitive *and* social phenomena (e.g. Cobb et al. 1992), a view that brought together but kept separate what happens inside the individual

[2] *Sui generis* is another way of saying that the phenomenon exists its own right. This implies that it cannot be reduced to the individual. A social phenomenon, thereby, is not the sum, product, or synthesis of individual phenomena.

(cognitive) and what happens between individuals (social). That type of social happens when individuals get together; getting together therefore constitutes the context for individual cognition to occur. As a result, any common practices that emerge are understood to be the result of settled disagreements. Likewise, any rules that come to be established as a result of the interactions and negotiations are understood as having been socially constructed before they are internalized to then determine the behavior of the individual. In a very strong sense, therefore, the social is incidental to the practices and to cognition because the underlying premise is the same: "meanings do not travel through space and must under all circumstances be constructed in the heads of language users" (Glasersfeld 1989: 444). Social interactions only have the function of leading to the modification, honing, and adaptation of private meanings. Take the following case from the work of a leading research group within the social constructivist paradigm, which has had tremendous influence on research in the learning sciences and (mathematics) education.

The fragment we consider derives from a seventh-grade classroom where the teacher and researchers provided a curriculum designed to allow students to make better connections between worldly phenomena and associated mathematical descriptions (e.g. histograms). The researchers were also interested in developing a culture characterized by specific "socio-mathematical norms." In the fragment, Kevin and Melissa take turns at talk; and the relation of the turns is subsequently evaluated. The teacher further invites Melissa to listen to what Kevin will be saying next and assess it in terms of its relation with what she has said before. The text does not tell readers what Melissa has said before, but she is to monitor the content of Kevin's subsequent turn with respect to what she has said before. Whether Melissa acts in the way that the teacher projects cannot be known; she will have to find out after Kevin has had another turn.

Kevin:	Ok, I'm just going to restate what Melissa said.
Melissa:	Thank you, I'm having problems
Teacher:	Ok, this will be helpful.
Kevin:	I know …
Teacher:	Wait, wait. Can I clarify? Melissa, your job is to make sure that you agree with what he's saying that you're saying. Ok, that's your job. And everybody else is to listen and see if you understand. (Cobb and Tzou 2009: 152)

Using such episodes, the study suggests that the teacher was encouraging students to help each other by restating explanations and by checking their own interpretations. The teacher is said to have emphasized obligations—e.g. to listen actively or to strive to understand explanations. Using the same type of transcription, the study notes that the teacher was successful in getting the students to "renegotiate" the social norms in the classroom. The study also suggests that the emerging norms (a) did not orient students to the specific task-related aspects of the lessons and (b) that "they provided the students with little guidance as to how they might do so in ways that related to the teacher's agenda" (2009: 152).

The Ethnomethodological Take

The constructivist (constructionist) version of social reality has come to be questioned in studies concerned with the ways (methods) in which everyday folk generally and those in the scientific disciplines particularly not only produce the mundaneity of the social order but also make this order and the order-producing work visible to each other for the purpose of its continued production (e.g. Livingston 2008). The problem of the constructivist account is that the *social* character of scientific and mathematical reasoning is only an incidental rather than a constitutive feature. Thus, for example, a demonstration in physics is not social when it is done in front of a class but individual when someone does it on her own (e.g. while prepping for a lecture). Instead, the social character of an experimental demonstration of physics "is neither incidental to the demonstration nor a matter of argument and empirical evidence, but present to practitioners as the witnessed physics of a demonstration and required by practitioners to be present for the demonstration to be witnessed" (2008: 212). What we are required to find and describe instead is "the social as the irremediable physics of physics" (2008: 212).

In social constructivist analyses, following rules is understood in a mechanical way—even if and precisely because the rule followers may construct their "private" (subjective) "meanings" of the stated rules. However, people do not act mechanically, following rules as if they were sociological or psychological dopes (Garfinkel 1972). Instead, people act in ways such that their ways of acting can indeed be recognized; and they monitor the recognizability of their actions in the actions of those they are affecting. People drive cars, play chess, or do mathematics by orienting to the present conditions; and in their driving, playing chess, or doing mathematics, members reproduce these conditions. The violation of the unstated rules of forming a queue is notable and noted by those acting in accordance with them and by those acting in violation; and the very act of violating the unstated rules presupposes the existence of the unstated rules as they compare with which they constitute as a (sanctionable) violation. Moreover, members to a setting produce and exhibit sequentially ordered turn taking for others to see and orient to and to exhibit the domain-specificity of their turns. People do not just produce actions. Instead, there is reflexivity at work that is part of the social underpinning that makes such things as mathematics lesson possible in the first place. This reflexivity not only makes these lessons possible, but also their recognizable mathematical nature even and precisely when there are individuals involved that are just beginning their membership (taking up staff positions, membership roles).

The Social for a Cultural Psychology of Education

In the Spinoza-inspired Marxist psychology that we develop here building on Vygotsky's foundations, the social is not just context but indeed immanent to human action. Such a position of the social is the immediate consequence of the

type of phenomena that the category *perežívanie* [experience], which names the {person | environment} dialectic, captures. In this chapter, we articulate a different way of reading episodes such as the one Cobb and Tzou provide, where the social is not the result of negotiation of individual meanings. In so doing, we develop an approach to educational psychology that recognizes the primacy of the social. This primacy can also be expressed in this way: Independently of whether an action is produced when a person is alone or in a group, the action is social as soon as it is produced (others being or not present) in ways such that others can recognize it as something they could have done themselves. Mathematicians act in ways such that other mathematicians can see that what they do is legitimate mathematics rather than something else; mathematicians act in these ways independent of whether other mathematicians are actually present. Students, in the process of learning, normally do not know beforehand whether their actions reflect legitimate mathematics. But they can find out after the fact that some action was not consistent with the rule/norm that a teacher previously articulated.[3] Precisely because they do not know in advance what some "social" "norm" looks and feels like, they have to act to be able to find out whether what they have done is what they ought to have done (according to a rule). If the finding is positive, there is at least one case of an observable action that was marked as a member of a class of acceptable actions; if the finding is negative, then there is a non-member in the class of actions. In either case, the premise of the students' findings is the social relation between each other and with the teacher, and the very social nature of talk. There is no negotiation going on here. And whatever is social in the "social norm" when Kevin, Melissa, and their classmates orient towards contributing to and monitoring classroom talk for the presence of certain patterns is the result of a much deeper sociality: the relation that *was* the rule/norm first.

We begin this section by articulating the general way in which social constructivist theories are made to operate. It is not cognition itself that is social; in that take, individuals still internalize whatever is made within some collective. But when individuals do something on their own, it is the result of an individual construction. Vygotsky suggested something very different. In his approach, there is a primacy of the social. Whatever higher psychological function can be identified first *was* a social relation with another person. Vygotsky did not suggest that something (e.g. meaning, rule) initially existed *in* a social relation, something that the participants may have constructed together to be internalized by individuals. Instead, the higher psychological function is identical to that earlier social relation. First, there is a social relation, "development in itself" (Vygotsky 1989: 56). The relation then becomes a reality for others, and ultimately becomes a feature of the individual "through what it previously showed

[3] This is the same that we experience with any form of instruction. When we try following it, for example, in trying out a new recipe, we tend to find out after the fact that we have done something wrong even though we believed to have done everything as specified in the recipe. We find out when something has gone wrong that we must not have followed the instruction while assembling a piece of ready-to-assemble furniture.

is itself for others" (1989: 56). In his theory, the primacy of the social exists in the fact that every form of content, every process of thinking, first *was* a social relation and only subsequently is exhibited by individuals. In other words, behavior first visible in a collective subsequently becomes visible in individual behavior. But there is no "construction"; especially, there is no intellectualist mental construction. Instead, there is participation in transactions involving others and material things.

In the following sections, we elaborate this alternative way of theorizing the social in educationally relevant settings. We use fragments from the same mathematics curriculum in a second-grade classroom that also features in Chap. 4. There were two teachers present: the regular teacher, Mrs. Winter, and a mathematics education professor, who designed the curriculum based on enactivist principles. We begin with a lesson fragment later in the curricular unit, where we observe a form of mathematical reasoning, and subsequently trace this form of reasoning to its genetic origin recorded earlier on in the same curriculum.

The Social in Mathematical Reasoning

In this chapter we are concerned with describing the genetic origin of mathematical reasoning, which, we suggest following Vygotsky, first *was* a social relation that the children were part of. Higher psychological functions are the result of connections and re-organizations involving more basic functions, such as perceiving and associated forms of describing (Vygotsky 1997). The social of mathematical reasoning consists in that people not only act but also provide a reason, state their thinking, and do so with aspects that are mathematical rather than artistic, scientific, or philosophical. We return to the lesson fragment already presented in Chap. 4, where three girls debate the nature of a mystery object that they have been touching but that has been inaccessible to their sense of vision. In that chapter, we provide a possible gloss for what Sylvia articulates in the event: "Why is this a cube given that it feels flat, as a slab between two palms, and fitting into the narrow thumb-finger configuration?" We therefore observe two actions, one in which an object is classified and the other in which an object is classified connected to a procedure that accounts for the classification.[4]

In this fragment, we observe a form of mathematical reasoning that might be attributed to the individual (Sylvia). The question is, however, whether it is an individual action or a social action. Notice that across the three turns at talk and in the associated hand gestures, a constative appears together with evidential support. It takes the form "claim + account" for how to produce supporting evidence.

[4] Transcription conventions are available in the Appendix.

Fragment 5.1

01 M: i think its a cube. ((*S still with lH in box*))
02 (3.3)
03 need t'be able to measure it ((*tosses cubical model in hands, gazes at it*))
04 (0.6)
05 S: why's *that* a cube. touch: (0.2) ((*turns shoebox to M*)) touch it (1.0) feel the flat part
06 (0.7)



07 >ifyetouchit< like (0.2) <thi>s (0.8) youll see.=
08 M: =<bt i still (0.6) think its> ((*reaches rH into the box, feels about*)) a cube.



We therefore observe some action, here the naming and categorization of an object *together with* a description of the thinking, that is, the basis for the classification that here appears in the form of a description of a method ("touch it, fill the flat part"). If it were possible to have completely individual constructions, Sylvia would not need to connect a form of reason to a claim. Indeed, she would not even need to articulate a claim but treat the object in whatever way it appeared to the hand. The very form of mathematical thinking, claim plus account, already implies the social nature of the thinking. It exists for herself in the same way it exists for Melissa and Jane; indeed, it exists for herself *as* it exists for Melissa and Jane. Some 10 min later, after reaching into the box eight times, and following the procedure that Jane described involving each hand touching and turning an object, Melissa expresses surprise and then reshapes her plasticine into a slab. Such results often are described to be the outcome of negotiations and, therefore, designate whatever Melissa knows as the result of a social construction that she then interiorized. However, there is much more essentially social to this episode than negotiation of individual meanings or understandings.

Here we observe a student act—making a statement that questions another's statement—and then provide a reason, that is, the grounds upon which the statements of the other can be questioned. She thereby makes visible the rational basis

of the claim. Even though one might be tempted to state that Sylvia *believes* that the object is not a cube, that belief cannot be *just* subjective. In being articulated for the other, the intelligibility of that supposed belief is presupposed.[5] A belief can be analyzed, shown to have structure, and so on. But there is more to it. The questioning of the cubical nature of the mystery object is the result of an exploration through touch. What Sylvie provides as reason is an *account of the work* one has to do to have sensual experiences that are inconsistent with a cube. We may gloss her communicative act in this way: If the object is held between the palms of the two hands, then one can feel the larger rectangles as opposed to the smaller extension of the dimension from hand to hand shown in the caliper configuration. She provides an account of the work inside the shoebox; and this account, provided *for* another, is presupposed to be intelligible on the part of this other.

An interesting historical parallel has been provided in the description of "poets," that is, those scientists, philosophers, and writers who create new vocabularies. Such a poet, in the course of his early work, "is typically unable to make clear exactly what it is that he wants to do before developing the language in which he succeeds in doing it" (Rorty 1989: 13). As long as something is incommunicable, if purpose and reason for actions cannot be made public in some way, it inherently is not social; but it neither exists psychologically (i.e. in consciousness). Thus, the pre-conscious experience of a body—the body that gives rise to a feeling that is the condition for naming—is incommunicable and, therefore, radically subjective. But we do not have access to this subjectivity because it is invisible (Henry 2000). That invisible subjectivity is transcended, however, when an experience—such as those that led to the first formulation of present-day geometry—can be repeated, the recognition of which requires re-presentation (Husserl 1939). But anything that can be made present again, inherently, is namable, that is, can be indicated by another form of presentation, including bodily signs (gestures, perceptions) and linguistic signs (language). The common sign forms then afford others to find in their own utterly subjective experiences those that are subject to the same descriptions. The objectivity of the natural and social world in the face of the utter subjectivity that characterizes my experience arises not merely from the fact that its structures may be reproduced. Instead, it arises from the fact that I orient to and make publicly available to others the production of the facts. I do not just act but, in providing accounts (reasons), make the production visible and, therefore, inherently part of the world always already given to me. To think here is a method to explore the world; as a method, as something that can be repeated, it is *primary* social and sharable, and not social as a result of it being an individual's construction that then can be shared.

We may formalize these relations in the following way. There is work that an individual does and that thereby is utterly individual. No other individual has done precisely the same work, which, because of the once-occurrent nature of life, even

[5] Even those *mis*conceptions that researchers and educators deplore are *intelligible*, and, therefore, shared (Roth 2008). In Chap. 10, we pursue this line of work in the investigation of conceptions and conceptual change.

the same person cannot repeat identically. We also have an account of that work; and this account, articulated in words and gesture, has a particular form that can indeed be reproduced. The two, work and account, obtain a relation that is typical for the structure of *social* action (Garfinkel and Sacks 1986). We may express the relation in this way: "doing [account]." Thus, as per Sylvie's account, Melissa will be finding out that the object is not a cube if she *does* the work described by "feel the flat part (prayer configuration) if you touch it like this (caliper configuration)." When the account is missing, an action (statement) becomes challengeable. We see this in the abridged excerpt from Fragment 5.1:

Fragment 5.2 (abridged excerpt)

01 M: i think its a cube.
03 need t'be able to measure it.
05 S: why's *that* a cube?

Melissa states that the mystery object is a cube but also provides a modifier that "softens" the factual nature of the statement ("I think"). She does articulate the need to make measurements, but, here, she does not provide an account (reason). The challenge then targets the absence of the account: *Why* is the object a cube? For the time being, there is no counter-statement but instead a request for the reasons that would make it possible to reproduce the claimed nature. A little later in the task, Melissa provides such an account by showing a caliper configuration using her thumb and index finger along three orthogonal edges of her cubical plasticine model and, simultaneously, by saying "they are all the same." Their approach changes because the method of inquiry and the resulting tactile sensations become the object of their talk. At that point, Jane proposes, by means of example, putting one hand into the shoebox to feel the mystery object and, holding a model in the other hand, to do with it what the other hand in the shoebox does. When Melissa does what she has seen Jane doing and heard her describe, she suddenly expresses surprise and then immediately begins to reshape her plasticine into what will eventually be a flat rectangular solid similar to those that Jane and Sylvia shaped before. That experience of a tactile sense, though utterly subjective, has as its intersubjective pendant in the account of the work required so that the mystery object feels in ways that are manifestly of the same form (as expressed in the models).

The above-formulated structure of social action takes the form "doing [reasoning about (geometrical) shape]." The "doing" refers to the actual work, and the parenthesized statement "reasoning about (geometrical) shape" is a gloss that (might) be used (by teachers or students) to characterize this work. As shown in the fragment, Sylvia provides precisely such a gloss; and the actual work was accomplished during the lesson. She questions why the mystery object in the shoebox should be a cube and then provides an instruction to touch and a description of what can be felt: the flat part. It was completed in and as *joint* work.

Within a cultural-historical tradition, we are aware of only one program of research that takes an approach consistent with the type of analyses described here,

an approach that was concerned with developing a science of the subject (Holzkamp 1983). In this program, the subjective *reasons for action* are understood to obtain *necessarily* a social reference to the generalized other in that they are stated in language and therefore are intelligible. Actions in and of themselves are not inherently social. But *my subjective* reasons (i.e. verbal articulations that are always done in some language of a culture) are, in their very communicability, also are *inter*subjective reasons for actions. Thus, if I were unable to make available intelligible reasons for my actions to others, then I would not even have such reasons for myself. Conversely, when an action *appears* to be irrational, then this often is so because the observer is unaware of the context within which the action has developed. Even the actions and reasons of residents of psychiatric institutions are rational once we look at the referential whole within which they are located.[6]

The Social Nature of *Joint (Social)* Work

In the preceding section, we exhibit and exemplify the primacy of the social in mathematical reason, and then move to the structure of practical action that constitutes its social (objective) as opposed to individual (subjective) nature. In classical approaches, however, actions are attributed to individuals.[7] If our claim is that there is a primacy of the social, then we have to provide an account of the (social) ways in which action becomes attributable to the individual. In this section, we are concerned with understanding how and under what conditions joint (social) work comes to be thought of, and experienced, as if it were the result of a collation of individual actions. That is, whereas *individualistic* psychologies need to be able to show how something like collective action can come about—which, as suggested in Chap. 4, they do by taking recourse to the concept of mediation—a cultural psychology that begins with the primacy of the social has to provide an account of how something that is fundamentally social can be seen as if it were the result of individual action.

Watching any form of social event, we always witness some whole, a whole characterized by transactional relations. Entering the classroom in which Fragment 5.1 was recorded, we did not perceive some elements from which we then built the whole. Instead, we entered a *classroom* and, in the context of the classroom, came to know Jane, Melissa, and Sylvia *as* students and Mrs. Winter *as* their teacher. The desks were desks rather than something else (e.g. dining tables, picnic tables)

[6] See, e.g., Bateson (1987) and Rommetveit (1976).

[7] F. Nietzsche has been an ardent critic of the attribution of actions to individuals, who, thereby, are depicted as the causes of actions. Thus, he writes:

> *There are neither causes nor effects*. Linguistically we cannot get away from this. But this does not change matters. When I think the *muscle* separately from its "effects," then I have negated it … *In summa*: *an event is neither caused* nor *causing. Causa* is a potential to bring something about, invented and added to events. (Nietzsche 1954: 768)

because we found ourselves in a classroom. In mundane cognition, some identifiable (useful) thing never is a thing in itself. Instead, a thing exists in its particular way, *in relation to* and *for the purpose of* a totality that determines it as *that* thing rather than as another. Sometimes, when a thing is moved from one setting to another, it is used differently; it has different function. Such objects have come to be known as *boundary objects* (Star and Griesemer 1989). This notion indexes the relation between thing and thing-totality because it makes thematic the different function of some artifact in different social contexts.

When we observe and analyze the social world, we cannot really say what a person is doing *in and to that situation* unless we look at the effect. Thus, merely by looking at the words "it's a cube" (Fragment 5.1, turn 01), we do not know what the phrase does in and to this situation. We may analyze the phrase and note that there is an index to some entity ("it"), the subject of the sentence, which is characterized as a cube in the predicate ("is a cube"). We can look up the words in a dictionary; and we may do nothing but speculate about the "meaning" in the mind of the person who said it. Was it an assertion, a question, a reply, or an offer of a reply that the person is uncertain about? Scholars often introduce into transcriptions signs extraneous to the situation, such as question marks, exclamation marks, and other signs to mark some things that were actually not available in this way. The following are five possible ways in which the phrase might have been intonated, heard, and transcribed:

1. *It* is a cube?
2. It is a *cube*?
3. It *is* a cube?
4. It *is* a cube.
5. It is a *cube*!

We do not know how the phrase is taken up and, therefore, how it has changed the social situation in which it appears. Different things *can be done* with the same phrase. In fact, the take-up will depend on the situation, which, as shown in Chap. 4, may lead to a divergence of the grammatical and psychological subject. In the five cases, the grammatical subject always is the same "it." But it differs from the psychological subject, which consists in the subject to which whatever is informationally new (psychological predicate) concerns or falls upon.[8] The intonation changes the phrase psychologically even though it has the same grammatical form (word order)—were it not for the punctuation marks that are added when the phrase is transcribed. In the first instance, the "it" is emphasized, which, when there are several objects available, might have a next turn of the type, "No the other one." In this event, the question concerns the subject, that is, it concerns which of two or more objects was namable as cube; but the predicate was not questioned. In the second instance, "cube" is emphasized, whereas "it" is not. The question now concerns the predicate, whereas the subject itself is definite. In the third instance, the verb part of

[8] See Chap. 3 where we discuss the changes in psychological subject and psychological predicate when the intonation is changed.

the subject is at stake, which can be seen if the next turn was "no, it was a cube" or "no, not yet, but it will be a cube." Case 4 differs from the preceding only by a change in the punctuation. Now it has become an assertion, whereas in the fifth case, there is a command with respect to the predicate while the subject is unquestioned. We might find the last case in a situation where a student asserts some entity to be a rectangular solid and the teacher, perhaps thereby also cutting off any further debate, commands that the entity be characterized as cube.

In the joint (social) action {turn 01 | turn 05} of Fragment 5.1, the first part takes the role of an assertion that the second part renders problematic (i.e. questions).[9] That is, what turn 01 is, its function in *this* talk, and, therefore, what it has done in and to *this* situation is that of an assertion (i.e. in and through its having been taken up as such in the relation). In this assertion, a particular object is characterized by means of the predicate "is a cube." This is only part of the determination of turn 05, the second part coming from its relation to the turn that takes it up (i.e. turn 08). That turn reasserts ("still") the predicate, despite the provision of a procedural description. In each case, the function of the turn is given not by the turn itself but by virtue of its place in the sequentially unfolding whole of the talk. How do we get from these relations structured in the way shown in relation (4.1), to the action as something individual?

In a first step, to reduce to individuals what actually are irreducibly social relations we have to show that actions can indeed be interpreted like a text, where each statement is independent of contextual particulars and only a function of other statements or propositions. To be able to consider an action in itself, to attribute it solely to an individual and to consider it independent of the unfolding social relation, it has to be objectified through a process of fixation similar to that by means of which spoken words come to be fixed in a (written) text (Ricœur 1986). In the process, the action no longer is the *trans*action that we actually witness. The "I think it's a cube" and "Why's that a cube" come to be taken independently and are attributed to the individual speakers. But as soon as we begin looking for, wondering about, and asserting individual "meanings," we get ourselves into hot and turbulent waters. This is so because we then place ourselves into a practice of speculative epistemology rather than into science. We are no longer concerned with the event that the girls produce as a witnessable *objective* (because recognizable type of) event, an event the production of which they actively make visible (e.g. by means of providing reason). That irreducibly relational aspect of language, turn 05 as questioning the assertion in turn 01, disappears from our analyses when we consider individual turns as productions of individual minds. Yet, in the setting of this mathematics classroom, turn 01 visibly is treated as an assertion; and it can be paired with a statement that questions the validity thereof because it is recognizably an assertion. If Sylvia could not hear turn 01 in one rather than any other of the many possible ways (#1 to #5 or more), it would be impossible for her to produce a reply to the

[9] The notation {query | reply} denotes a social action that cannot be further reduced because a specific phrase functions as a query because there is a reply, and a phrase functions as a reply because there is a query.

question. This is so because the relation of turn 05 to turn 01 would no longer be apparent and repair actions would have been needed if the conversation were to proceed further. But in its specific, recognizable appearance, turn 01 exhibits its irreducibly social nature. It is therefore necessary to begin with *trans*actions, inherently social-relational in nature, rather than attempting to build the social from individual actions that somehow float *between* solipsistic minds.

Speaking of transaction allows us to understand that every action, including every instance of speaking, really is a *re*action to another *re*action to which it is a response (Bateson 1987). As we describe in Chap. 4, *trans*action is different from *inter*action. In interaction, two or more agents exchange actions, which go from one, the subject of the action, to another, the object or recipient (Dewey and Bentley 1949/1999). Here, subject, object, and their relation can be abstracted from one another. By contrast, the term transaction denotes social relations that cannot be reduced to any of their parts—or to *inter*actions of parts—because the parts are intermeshed and, as and together with the whole, are changing. Transactions are precisely the origin of all higher psychological functions. Tracing what appear to be individual higher psychological functions to their social origin is the heart of the *sociogenetic method*.

Sociogenetic Method

In Piagetian theory, the individual is the result of biologically driven development. Thus, for example, this theory describes the appearance of formal operational schemas among children aged 11–12 in precisely those terms (Piaget and Inhelder 1966). In relation to proportions, and using the example of the balance beam (see Chap. 6), the child is said to discover the equivalence ratios when she adds to the weights at constant distance on one side of the beam while changing the distance on the other side and holding constant the weight. The child discovers *for herself* certain logical structures, here those related to the Klein four-group.[10] It is apparent, however, that it would be quite a feat for any human being to rediscover on her own everything that cultural tradition makes available to daily production of social phenomena; children do not invent language and other signs (e.g. Vygotsky 1994). It does not surprise, then, that Piaget would be criticized from the perspective of social psychology that pays due attention to the cultural and historical origins of the thinking of individuals (e.g. Vygotsky 1987). Particularly problematic is Piaget's idea that the child's egocentric thought should stand midway between her earlier autism and the sociality of the adult. We note above the suggestion that any higher psychological function first *was* a social relation with another person (Vygotsky 1989). It

[10] It has been pointed out that Piaget had collapsed two distinct phenomena, the mathematical Klein four-groups, which are transformations of transformations, and the logical and physical INRC (identity, negation, reciprocal, correlative) groups. Whereas this makes sense in the case of the balance beams, it does not generalize to other situations (Seltman and Seltman 1985/2006).

is not that the function was *in* the relation, where the child could pick it up and then internalize it; nor does he write that some other unspecified thing is socially constructed and then internalized. For Vygotsky, then, the behavior of an individual observed at some time can (and must) be genetically traced back to situations with others where that same behavior was *jointly* achieved. Thus, for example, in Chap. 4 we show how conversational features such as {query | reply} are *social* facts because of the interdependence of the turns that constitute them. A child first contributes one or the other part. Eventually, the child, in conversations with herself, produces both turns in sequence. The genetic origin of this self-talk lies in conversations with others. The child plays an integral part in bringing about the joint achievement of a {query | reply} and, thereby, produces the context that determines its actions. That is, the child does not bring about the behavior on her own. Instead, the child already produces one part of the behavioral whole of which she now forms irreducible part. Accordingly, it is not as if the behavior or situation—or its mental equivalent—had to be internalized. Instead, the child may already have done the work of (a) bringing about any one part of the behavior whole and (b) seeing the other. When the child does all the work to bring about this whole, then the behavior and psychological function become attributable to her. To provide a concrete example, we return to the second-grade mathematics classroom. We do so precisely at a point in time where the kind of reasoning seen in the preceding section was not yet observable and observed as an attribute of the individual.

Ontogenetic Origin of Mathematical Reasoning

In the preceding section we show how the children in the class were beginning to reason mathematically (Sylvia did, Melissa did not in the episode). At the beginning of this curriculum on geometry, the children did not tie their actions to reasons. In this example, we enter the video recording in the middle of the task that had taken up almost the entire first lesson by means of which the teachers had introduced the three-week geometry unit. The task began like this. The teacher pulled an object from a black plastic bag and explained that the task consisted in either putting the object to a group of like objects or to start a new group. Because hers was the first object, the teacher put a colored mat on the floor and placed the object on it. Then she added another, empty mat to the floor. The teacher called a child by name, who then had a turn at pulling an object (without feeling around) and at placing it with other objects or on a mat of its own. The children were asked to state their thinking, but neither color nor size was to be used as reason for classifying an object. During that entire lesson, only one child in that class of 24 placed an object *and* provided an account (reason) to explain why s/he had categorized his/her object in that way.

We enter the lesson during Connor's turn, who already had placed his object (a cube) on a mat of its own—even though the geometrically savvy could see that there already existed a group of that *type* of objects. Prior to turn 01 in Fragment 5.2, the teacher has asked Connor to take a look at his "block," take it to each of the existing

groups, and decide whether it belongs to any one of these. The offprint in turn 01 features Connor holding his object next to a cone, which occurs after he has held it next to a group of objects on a mat labeled "cubes, squares," and following which he will be holding it to a pyramid. He then completes a {question | reply} in turn 02. The fragment exemplifies how the children, in their first geometry lesson, initially do not tie classificatory actions to accounts, exemplified here in Connor's placement of his mystery object on a mat and then remaining silent without having provided a reason. Indeed, most children immediately began to retreat to their seat so that the teacher, in each case, said something of the kind that she does in turn 04 in the fragment above. In Connor's case, there was little time between his action and the reply, which came as a request to state a reason for thinking in this way.

Fragment 5.2





01		(5.68) ((*Connor holds his object next to the cubes, quickly next to the cone, then the pyramid*))
→ 02	C:	°um uh um° i thinki::t probably: go (0.98) THIS one. ((*Places object with the two cubes*))
03		(0.46)
04	W:	and can you tell us why °you think that.°
05		(1.29)
→ 06	C:	coz:: these are more squares. ((*Waves hand above cubes*))
07		(0.40)
08	W:	°uh hm° ((*Connor shifts gaze to the teacher, picks up his cube*))
09		(1.06)
10	C:	they are all squares i think

Failing to provide a reason is not inherently a fault; and there is nothing unusual about not providing reasons for classifications. Thus, for example, in a fish sorting facility that we observed in the course of five-year ethnographic study, the workers were not asked to provide verbal accounts (Roth et al. 2008). Instead, the *placement* of the fish was taken as an account of the workers' thinking; and when the placement of a specimen was "erroneous," then another worker engaged in corrective action by placing the specimen on the appropriate conveyor belt (Roth 2005). Similarly, as observed in a scientific laboratory, when the actions of a scientist were questioned, it was always because other members were seeing something relevant that the actions had not acknowledged (e.g. moving the slide under a microscope

when others said they had seen a research relevant object). The results of the action are treated as accounts of the work.

In this classroom, however, reasoning is counted only when it is tied to a specific verbal account that makes it mathematical rather than something else. In the fine arts, students might indeed *legitimately* classify by color (but not by size), whereas in the science class, they may *legitimately* classify by size (but not by color and shape). That *tying of action and justificatory account* so that it is recognizably *mathematical* is one of the "socio-mathematical norms," one of the higher functions observed later in the lessons (as described in the preceding section). It did not exist early on in the unit. How then do such social norms emerge? They do so in and as of the transactional order (social relation). In the present situation, the norm *is* the social relation anchored on two turn pairs, one that Mrs. Winter completes and the other one that she initiates; and she does so with the same turn.

I ⎧ C: ((*Places object with the two cubes*))
⎩ W: and can you tell us why you think that ⎫ II
C: coz these are more squares. ⎭

The second turn begins with a conjunctive "and" rather than with some other way of continuing, which could be a "but" or "are you sure?" Instead, the "and" accepts what has been done (i.e. positively evaluates it, at least for the moment) and simultaneously asks for something additional (provides an opportunity for adding something) that apparently is missing from what has preceded. The turn also provides a description, an *instruction* for what is missing to come both as process ("can you tell us") and content ("why you think that"). As such, it also is the first turn of a {query | reply}, which is constituted as such by the second turn, "coz there are more squares." Importantly, then, Connor has produced a classification *and* he has provided an account. That is, he has completed the two parts that we characterize above as the structure of practical (social) action: He has done the work of a classification by placing his object with others on a mat labeled "cubes, squares" *and* he has provided an account (reason) for doing so: doing + "coz theses are more squares." That "and" in the middle turn invites both the next part and its connection to the first. Importantly, that invitation cannot be simply attributed to Mrs. Winter. As we see in Chap. 4 and as we repeat above, an invitation is an invitation only because there is an acceptance. Whatever Mrs. Winter says also rings in Connor's ears. What Connor first produces as a reason *for* Mrs. Winter eventually becomes a reason for himself. His action, in taking up the invitation and by providing a reason accepting it, is an integral part of the joint (social) action. There already exists a communicational competence that is generative of the higher order function that we observe.

Connor may not have produced the two parts on his own, doing so only after having been invited to add the second part. But he is already doing the two parts and, therefore, does not have to somehow internalize them, as is so frequently suggested in the literature. There is nothing "socially constructed" visible in their circle or between Connor and Mrs. Winter that the former can now "construct in his mind." Moreover, if Mrs. Winter were said to be scaffolding, she would not be constructing

but only providing a context for it.[11] Instead, for the traditional educational psychologist to state that Connor reasons mathematically, the boy only has to make the second part follow the first without Mrs. Winter having a turn in between.

We note above that the turn "and can you tell us why you think that" is understood as part of a joint (social) action. In this sequence, there are two turn pairs (I, II) hinging on one turn that "glues" the other two turns together. It is a contextual modification that allows the joining of the two turns. That middle turn completes Pair I by evaluating what has preceded, both in affirming it and constituting its shortcoming, which precisely is a statement of the reasoning that *accounts* for the classificatory act. This middle turn also initiates another pair (II) that invites the recipient to state his thinking. The next turn—following, as we see in Fragment 5.2, a considerable pause—accepts the invitation by stating that there are more squares. The middle turn thereby offers up an invitation not only to add something but in fact to connect the second, discursive action to the first. It is as the sequence of classification, solicitation of thinking, providing reason—a sequential order of distributed work in which the student takes the first and third, and the teacher takes the middle slot—that we first observe the *social* praxis of classifying (sorting) three-dimensional objects. There is an order at work that is witnessable by those present: classificatory action followed by provision of reason. It first exists in the sequential turn-taking order of student (S) and teacher (T) in the form S-T-S and later is observed in a single turn S (e.g., Melissa, Sylvia). That is, there is a reduction of a transactional order S-T-S → S that parallels the process of pairing from {classifying | requesting accounting | accounting} → {classifying | accounting}.

So far we have achieved only the first part of showing that a higher psychological function, here tying action and reason, first *is* a social relation. The second part has not yet been shown: the sociality of *mathematics* (geometry). Any suggestion that *mathematics* is a *social* practice has to show the essentially *mathematical* dimension in an observed action. We see part of this additional work in Fragment 5.3, which derives from the earlier part of Connor's turn when, after having placed his object on a mat of his own, Mrs. Winter asks him to state his thinking, especially inviting him to address "why does it get its own group?" The reply (turn 01) states that the object is bigger than the other objects (already on the floor). The reply to the reply (turn 03) requests to stop and to remember what previously has been stated as a rule (norm): size and colors do not count in this (language-) game.

Fragment 5.3

01 C: cause this one is *sort* of (0.32) bigger than the other ones?
02 J: °thats=s[ize.
03 W: [*co*nnor ((*Connor picks up his object*)) (.) jst a minute st*op* for a sec. ((*Hand held out in "stop" position*)) (0.53) remember we:'re not telli c*oun*ting s*i::z*e (0.62) >so thats b*ig*ger or smaller and we are not< cou:nting c*o*:lor.

[11] When a house is painted, scaffolds are used. But the scaffold has nothing to do with painting. It supports the painter in doing what she has to do.

Here, then, we have an evaluation of the turn that provides a reason. The evaluation exists in the statement that size is not counted, and, as if attempting to make sure that the recipient produces a statement that does not include size. Color, too, is discounted ("we are not counting"). In that game that they are playing, which earlier has been named geometry, some accounts (reasons) are counted in, and others are counted out. The tie of action and account, as we show above, is social. A distinction is made between (a) those inherently (social) accounts that are in and applicable to the game in play and (b) those that are out. Those in play, therefore, are typical in the game of mathematics (geometry), whereas others, though these are indeed possible accounts and therefore social, lie outside the domain of mathematics.

When the account is provided, the classificatory work is completed. The children have the opportunity to learn, by actively attending to the evaluations of what they have said, which accounts are valid and included and which are not and therefore excluded from the game in play. We may also say that the children learn a rule. They do so not by listening to it being stated in words—in the course of this lesson, Mrs. Winter finds herself in the position of having to restate the rule eight times in the course of the lesson—but by constituting a living part of the transactional order that requests them to select an alternative reason whenever their first option had been color or size. It is by (affectively as much as intellectually) attending to the pairing in {turn 01 | turn 03}—which here discounts the contents of turn 01—and by acting in appropriate ways that the children come to know the rules for participating in the game of mathematics rather than some other game.[12] Accounts that address shape are in, but accounts in terms of size or color are out. As a consequence, those accounts that remain in the game, the (social) rules that describe what is happening in this classroom, are social and mathematical through and through. They are so not because some negotiation has led to them but because they are both a transactional order (event) and the content thereof (product).

Identity Is at Stake

The primacy of the individual in classical psychological theories is apparent whenever an institutional role is used to explain the nature of an unfolding relation without first examining the concrete social work by means of which the functions of different individuals become established (e.g. Roth et al. 2005). In such approaches, the identity of participants not only tends to be presupposed but also is used as part of theoretical schemas explaining actions and social events. This is particularly salient in the literature on teaching, where whatever happens in the classroom tends to be explained in reference to the teacher's actions (most often limited to talk) that is said to bring about, mediate, or scaffold children into doing something that they previously have not done. The "T" or "teacher" in the transcription then is a sign of

[12] It should be apparent that children's turns are "appropriate" as long as the equivalent to turn 03 does not discount what they have said or done.

the attribution of particular knowledge or power that the person is said to have; and the equivalent "S" or "student" stands for someone who is to learn. But, from our extensive experience of teaching and doing research on knowing and learning in schools we know that this order of affairs changes when those taking the institutional position of the student are in the know and those in institutional positions of the teacher are less so. We observed this also in interviews that a not-particularly-outstanding undergraduate student did with physics professors, when the latter, invited to participate in an expert think aloud protocol, started asking the former whether they are right and ended being tutored in producing the correct answers (Roth and Middleton 2006). On the other hand, the identity as it relates to its social and material context often is omitted, such as when traditional psychological research—e.g. children's conception of the universe—leaves out the institutional context and the person that the children confront in their clinical interviews. Yet, again, attention to the transactional unfolding of social events makes it visible how identity and context mutually constitute each other and are one.[13] That the identity and the context of speaking are indeed at stake can be seen in the following mundane situations initiated by a ringing telephone.

Fragment 5.4

01 ((*telephone rings, Erika, the person called, picks up*))
02 Erika: Yea?
03 Caller: You want to go for dinner?
04 Erika: Barb?
05 Caller: Yea.
06 Erika: Would love to.

In {turn 03 | turn 04}, at stake is not the question but the identity of the caller. Here, the reply part shows that the "message" of the initiating turn is the voice itself, which provides a hint as to the speaker. This hint allows the person-called to hypothesize that the caller is her friend Barb. In that reply, the content of the phrase does not matter. But, as seen in the offered query seeking to establish the identity of the caller, it is also the context within which any reply finalizing the {query | reply} is taken and to which it responds. In the present case, the finalizing reply part comes in turn 06; and it takes a positive form. If turn 05 had been something like, "No, its Lisa," a reply might instead have been in the negative: "I would have loved to, but ever since I got up I've had this terrible migraine." If we are on Erika's end of the line, we could assign "B" to the turns only after turn 05. If we were producing a transcription that had "B" or "Barb" instead of "Caller," we would misrepresent the event, for Erika does not know who the caller is until the confirmatory turn, which follows the hypothesizing query that offers up a possible identity (turn 04). As long as the identity of the person is not satisfactorily resolved, we may witness events

[13] In such singular plural entities, different dimensions may be analytically identified and discussed. But these dimensions never exist independently because they always are manifestations of a single whole manifesting itself in plural ways.

like those in Fragment 5.5. Here, the caller cannot get to the issue that has motivated the call, because the inviting requests for identification are not satisfactory provided.

Fragment 5.5

01 ((*telephone rings, called picks up*))
02 Erika: Whose this?
03 Caller: I am calling on behalf of
04 Erika: who's this?
05 Caller: well, I am calling
06 Erika: but who are you?

We learn from these fragments that there is relational work involved in constituting the participants, a work that is unfolding and therefore cannot be known until events come to an end. It is non-sense, therefore, to begin our analysis by inferring the reasons for why people do and say what they do and say based on *who* we think they are due to some institutional or otherwise informal role that is externally assigned to them. As soon as we focus on the relational work, we are able to see phenomena to which we are not attuned when taking a social constructivist approach. We observe the *internal* constitutive work, where identities are results of that work and not of analysts' will or wisdom. Thus, rather than assuming that an individual is *teaching* just because she is in the institutional position of the teacher may blind us to the fact that she learns or has opportunity to learn. Our sociogenetic method may then begin by investigating the relation, which allows noticing all sorts of phenomena, such as a teacher learning in the very situations that she is apparently attempting to assist a student in learning to do mathematics. That is, our sociogenetic method may then turn up teacher learning as much as student learning, and student teaching as much as teacher teaching. Who someone is and can be is a function of the social relation, and, conversely, some aspect of the social relations we entertain may become an attribute that others ascribe to us (our identities) and to our (ways of) thinking.[14] It is not something that can be given prior to the analysis. Identity is itself the product of the actual unfolding of the social relation.

The result of the preceding is that the social relation is thus both object and method. We do not need to impose a method that is external to the social situation in order to understand the social situation; the social situation itself is a method of organization that makes it possible for analysts and participants alike to recognize identities in persons. Consider the following fragment from the mathematics lessons in the second-grade classroom. We may gloss what is happening as "Mrs. Winter restating her question," and Connor as "answering" only after the third statement has been produced. It would not be unusual to find in the literature char-

[14] In Chap. 13 we examine and discuss how schooling contexts lead to processes of both subjectification and objectification, which means that as product of social realtions, there are both social objects and social subjects (persons).

acterizations of such fragments in terms of the concept of *scaffolding*. In the sociocultural literature, authors might use the term synonymously with the *zone of proximal development*, whereas in other literatures it has arisen from the observations of tutoring, where the term has arisen independently from Vygotsky's work (e.g. Wood et al. 1976).

Fragment 5.6

→ 01 W: em an what did we say
that group was about.
02 (1.00)
03 C: °what do you mean
li [ke?°]
→ 04 W: [WHAt] was the
→ (0.15) WHAt did we
put for the name of that
group.
05 (1.51)
→ 06 whats written on the
card.
07 (0.26)
08 C: °°s:::::°° °quares°-



Researchers commonly mark the speaking of an institutionally designated teacher by means of a "T." Whereas such a characterization is indeed useful to some extent, it veils another issue that the relational approach of the sociogenetic method allows us to see. This becomes apparent as soon as the question is asked, "Why is Mrs. Winter asking Connor three times the same question?" More pointedly, the question may be, "Why does Mrs. Winter *need* to rephrase her question?," which may be followed by, "Should she not have stated an *answerable* question the first time she asked?" These questions now orient us to Mrs. Winter, who, in such situations, is getting better at asking questions such that students *can* indeed answer. Is not Mrs. Winter also learning and being taught—in and *by* the unfolding situation—on how to do better?

Readers with school teaching experience may have been in situations that resemble the one in Fragment 5.6. They may then have used those questions that students actually did reply to as the first question in a similar situation with other students. When the teacher is successful and uses a form of question again and again, she has changed; and she has done so in a situation such as the one depicted above. We have documented such changes in teacher questioning in a study where two teachers, a regular classroom teacher (who knew the students very well) and a science specialist (who had designed the curriculum) worked together in the same classroom and as a result did indeed develop their questioning practices (Roth 1998). Over a 12-week period, the observable {question | reply} occurrences changed tremendously, where the first part of the turn pairs were increasingly

appropriate for soliciting *immediate* and *complex* student replies. In the preceding fragment, Mrs. Winter, as the teachers in the cited study, is a learner, a student, as much as being the institutionally designated teacher. The institutionally designated students involved in such episodes do not function as students. Instead, they have functions similar to what we call scaffolding above. If Mrs. Winter is also a learner, why then should we characterize her by means of a "T?" That social relation, the transactional order observed in Fragment 5.6, is the origin of *becoming* for both participants. Each participant is an integral part in and of the becoming of the other. Each participant is part of the environment of the other and, because of the irreducible {person | environment} unit, each person is constitutive of the Other and, thereby, constitutive of herself. The becoming of the Other is at the heart of the becoming of the Self.

Coda: Demystifying Internalization

If something ought to unite all the different attempts to advance and apply a Vygotskian approach to the study of learning and development it should be the acceptance of the general genetic law of development: "every higher [psychological (psixičeskaja)] function was external because it was social before it became internal" (Vygotsky 1997: 105). Yet, as others have argued before, far from all current uptakes of Vygotsky's work have paid adequate attention to this fundamental formulation.[15] There are countless instances in the educational psychology literature where this principle is taken in the trivial sense: whatever people learn was available first *in* a social relation to be somehow, magically, internalized by the individual. Throughout this chapter we show that such a reading, which firmly retains the individual as the primary subject, is contrary to Vygotsky's formulation and constitutes a mere recast of the psychologist's basic insight into a (social) constructivist agenda that is indeed incommensurable with the former.

Associated with the mainstream uses of Vygotsky's work is the notion of *internalization,*[16] which in educational psychology handbooks is portrayed as involving "the cognitive internalization of what is being shared" (Murphy et al. 2011: 402). It is the shared object that students "internalize, encode, and process … to construct an elaborated mental representation" (2011: 402). Through this chapter we show how those characterizations neither adequately describe the learning events that we observe nor are in line with what Vygotsky was writing. In our analyses, we do not observe "internalization" or mental "construction" but rather

[15] N. Veresov (e.g. 2004) is one of those scholars who contributes enormously to revising the incorrect uptake of Vygotsky's work that has occurred in the past.

[16] Knowing that the translators often chose the adjective "mental" rather than "psychological" makes it comprehensible why that myth of internalization could have had such a grip even on scholarship in the sociocultural and cultural-historical traditions. The psychological, in contrast to the mental when thought of as "internal," also covers the practical and affective side of actions.

see how participants *become* in and through their speaking. They are participating in doing something—*and so they become*. This is different from what social constructivist and other Western versions of sociocultural and sociohistorical brands have made learning and identity to be: the intellectual construction of knowledge and identity by verbal means. Nothing is further from what Vygotsky was working towards—although he did write the word "constructivism" in the same text in which he articulated his call for sociogenesis. Thus, "man not only develops: *he also constructs himself*. Constructivism. But contra intellectualism (i.e. artistic construction) and mechanism (i.e. semantic construction)" (Vygotsky 1989: 65, original emphasis, underline added). His take on the question of the subject is more consistent with a Marxist perspective: "what [individuals] are thus coincides with their production, as much with *what* they produce as with *how* they produce" (Marx and Engels 1978: 21).

Published studies tend to mobilize the notion of internalization as a means to account for what we observe participants make visible to each other and to themselves. In so doing, they effectively put into a black box and turn into magic what actually has been a concrete and empirically available event. Towards the end of his life, Vygotsky was very critical of such methods (Zavershneva 2010). What researchers miss is the actual phenomenon they aim at investigating and, with it, they miss all possibilities of establishing psychology as a scientific discipline. Instead, the sociogenetic method proposes to follow developmental events in their concrete realization, without putting ahead constructs and ways of theorizing that may be completely extraneous to the settings and lives of the research participants. In our sociogenetic analyses of mathematical reasoning and identity we show that researchers miss something when they posit internalization as a category. What they miss is precisely a description of those competences that are already in place for the social relation to exhibit a higher psychological function even though not all participants already exhibit it when acting alone. Unlike the constructivist approach, which presupposes a constructive function in the individual without demonstrating it in its analyses, the sociogenetic method allows demystifying internalization and makes learning a natural, empirically available phenomenon. The method also allows researchers to be surprised, a key aspect of science, because those otherwise already established and taken-for-granted categories—including learners' identities, who teaches and who learns, or what type of psychological organizations are required for a learner to become competent in a particular knowledge domain—are known only after and not in advance of the analyses.

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Chapter 6
Learning | Development

> The connection between natural development, the behavior of the child based on *maturing* of his organic apparatus, and the kinds of development we are considering is a connection that is *not evolutionary*, *but revolutionary*: development does not occur by *gradual, slow changes and accumulation of small changes* that, as a totality, finally cause a substantial change. Here, in the beginning, we observe development of a *revolutionary* type, in other words, *sharp and basic changes* in the type of development itself. (Vygotsky 1997b: 110, emphasis added)

In most manuals on educational psychology, Vygotsky's theory is presented as a theory of cognitive development. In the scholarly literature, however, the term *development* is used rather loosely in the place where one might also use the word "change." This can be seen in the literature on teaching, where terms such as *professional development* are employed without implying the *revolutionary* changes in consciousness articulated in the introductory quotation. Instead, professional development might simply mean that teachers add this or that strategy, this or that technique to their *continuously* growing repertoire. In the introductory quotation, however, we note a distinction between (a) evolutionary processes, which are gradual, slow, cumulative, and compatible with the maturing of an organism and (b) revolutionary processes where change is sharp and fundamental. The revolutionary processes are not the result of the totality of small changes that arise from accumulation. Instead, the changes are so radical that a new "stage in the development of behavior, on the one hand, negates the preceding stage, negates it in the sense that properties present in the first stage of behavior are removed, eliminated, and sometimes converted into an opposite, higher stage" (Vygotsky 1997b: 111). At the same time, that older, "preceding stage exists within the subsequent … manifested and existing only in a different form and different expression" (1997b: 111).

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In Chap. 2, we present a model of dialectical processes. It distinguishes between two very different forms of change, one gradual and cumulative, the other revolutionary and sudden, arising from the former unpredictably in response to variations on the environmental pole of the {organism | environment} unit. This model also is useful to describe changes that human beings undergo during their lifetime, some of which are cumulative and continuous whereas others involve revolutionary and take the individual from one to another, qualitatively different form of thought and consciousness (Roth 2016). The two are connected by means of a dialectical law of the transition of quantity into quality.

In the current educational and developmental psychology literature, the distinction between two different kinds of change processes is not always clear. There are theories that distinguish qualitatively different stages, such as the developmental theory of J. Piaget, whereas other theories describe changes in terms of accumulations, for example, in terms of continuous logistic curves (see below). Clarifying such a distinction is important for educational psychology if we take seriously the insight that "the problems encountered in the psychological analysis of teaching cannot be correctly resolved or even formulated without addressing the relation between learning and development in school-age children" (Vygotsky 1978: 79).

In this chapter, we work out a way of approaching changes in behavior by means of the dialectical framework outlined in Chap. 2. We review and consider the problematic in the context of a classic problem in cognitive development research: reasoning on the balance beam. We denote gradual, slow, cumulative, and evolutionary changes by the term *learning*, and the radical, revolutionary, qualitative changes by the term *development*. We thereby avoid the kinds of problem Vygotsky finds himself in, when he uses the same term "development" to refer to "abrupt crises" and to "slow evolutionary, and lytic flow" (Vygotsky 1998: 190). To avoid confusion, he hastens to add, following the reference to the revolutionary changes that opens this chapter: "it is the kind of characteristic that would exclude the possibility of applying the concept of development to this process" (Vygotsky 1997b: 110). We thereby arrive at a way of theorizing change in the behavior or reasoning of an individual by means of a dialectic process, denoted as {learning | development}, based on "the dialectical principle of the transition of quality into quantity" (Vygotsky 1997a: 83). This change process manifests itself as learning in some instances and as development in other instances. More importantly, consistent with the model in Chap. 2, development, a qualitative change, arises out of learning, a cumulative quantitative change; and new forms of learning, quantitative changes, arise out of the qualitatively different forms available after a revolutionary change. This allows us to show how an essential feature of the way development arises from {teaching | learning} [obučenie], a phenomenon associated with the *zone of proximal development*. The latter concept makes sense only when the dialectical transformation of quantity into quality is actively addressed. Unfortunately, there are studies where the concept is used without nevertheless making the case that indeed *development* rather than *learning* has been observed.

Classical Studies of Reasoning on the Balance Beam

One of the classical topics in developmental psychology—which has had impact in the way cognitive development is portrayed in educational psychology in general, and in *conceptual change* literature in particular—exists in reasoning on the balance beam (Inhelder and Piaget 1958).[1] Figure 6.1 shows a classification of different levels of cognitive complexity required to solve the balance beam task. The balance beam tasks were used to investigate the emergence of a particular scheme, proportional reasoning, which Piaget subsumed to the operations of the Klein-four group, which he conflated with the I N R C group of logical operations (i.e. *I*dentity, *N*egation or i*N*verse, *R*eciprocity, and *C*orrelation). Thus, for example, to reestablish balance of the beam after placing a weight, this weight might be taken off on the side that goes down (N) or a corresponding weight may be placed on the other side that goes up (R). Whereas the operation N cancels an earlier operation, R compensates for it. The I N R C group, for Inhelder and Piaget, produces the proportionality schema required to solve balance beam problems by means of a comparison of the relations between the two weights (w_1, w_2) on different sides of the fulcrum and the respective distances from the fulcrum (d_1, d_2) according to

$$\frac{w_1}{w_2} = \frac{d_2}{d_1} \tag{6.1}$$

This schema corresponds to Level 8 performances in the present classification (Fig. 6.1) and solves all tasks on the balance beam in that configuration. Other tasks require more aspects than this schema. Tasks where one weight is submerged into water, for example, require taking into account additional variables such as those seen for Level 9 and 10 performances. Our categorization system also includes operations that Piaget did not consider on the other end, such as isolating the device from the perceptual ground or beginning to discriminate the different parts of the device. Although Piaget did not include them, such operations are the precondition for children to engage in the ways that he described: if you do not perceive something, if something is not part of your lifeworld [Lebenswelt], you cannot act upon it. Our own studies show that without attending to what students actually attend to and perceive, it is impossible to appropriately characterize what they do and why (e.g. Roth 2006).

Spending an entire chapter on the balance beam task, Inhelder and Piaget (1958) manifest interest in how children, in the course of their development, eventually solve the task correctly by using the I N R C group, that is, how they get to Level 8 (Fig. 6.1). Characteristically stating their results in deficit terms, Inhelder and Piaget

[1] One of the authors (WMR) has done his PhD work on the development of reasoning on the balance beam from a neo-Piagetian paradigm. He later developed classical cognitive psychological theories to account for such reasoning, thereafter modeled this development using artificial neural network, before finally providing a situated cognition account thereof. The Spinoza-inspired approach provided an occasion for considering this past work in an entirely different way.

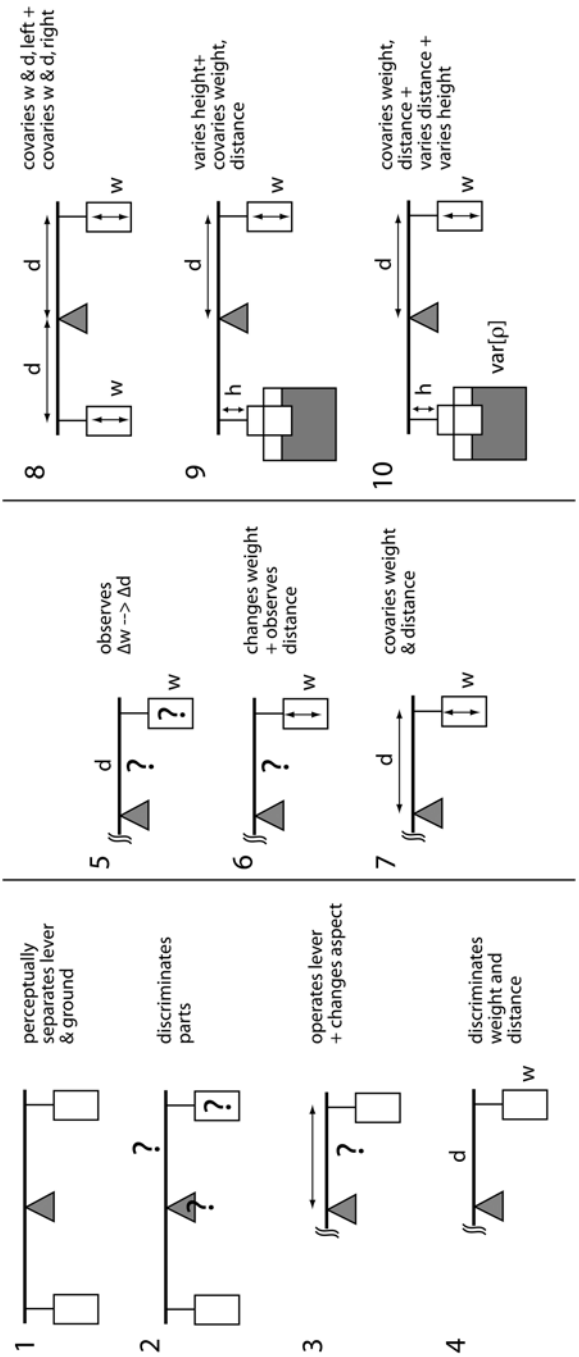


Fig. 6.1 Levels of cognitive complexity of reasoning on the balance beam

find that in a first stage, children are failing to distinguish between their own actions and the external processes (i.e. the actions of the objects). Thus, rather than merely distributing weights on the two sides of the beam, children between 3 and 5 years interfere with the beam to make it level and do not let it go, as if expecting that the balance will conserve the results of their manipulations. The researchers note that such children do not differentiate between their own actions and those of the instrument, and so are not concerned with the distances nor do they try to coordinate distances and weights on the two sides. Children from about 5 to 7–8 years of age, in turn, begin to integrate intuitions about compensating weights and suggest that there need to be weights on both sides. They add and take off weights without however achieving accurate equalization of the two sides to make the beam level.

Between the ages of 7 and 10, children use *concrete operations* performed on weight and distance but do not coordinate the two. At this stage—which Inhelder and Piaget refer to as IIA—children begin to coordinate weight and distance (e.g. Fig. 6.1, Level 7) after having noted that a smaller weight compensates for a larger distance. They predict that equal weights have to be at equal distances to balance the beam and that if the weights are equal, the side will go down where the weight is farther away from the fulcrum. In the second part of this stage (IIB), children reason in terms of an inverse correspondence of weights and distances. Inhelder and Piaget observe a new operation in this stage, which consists of a double serial ordering of weights ($w_1 > w_2 > w_3 > \ldots$) and distances ($d_1 < d_2 < d_3 < \ldots$).

In the third stage, then, arriving between the ages of 12 and 15, individuals tend to "discover" and explain the law of proportionality (Eq. 6.1). They are said to exhibit *formal reasoning*. Even though participants do not explicitly refer to it, they employ the operations of the I N R C group—much like children and even adults correctly speak a language without having to have an explicit knowledge of grammar.

In Piagetian theory, the social constitutes but a milieu within which development occurs. Thus, for example, he states that "generalization of the same mental operation … is made so naturally in the course of stage III that it is hard not to allow for the role of spontaneity in the progressive structuring of the data, even if it is hastened by the surrounding social environment" (Inhelder and Piaget 1958: 37). That is, although the social environment may be hastening the process, it is not directly and especially not *generatively* involved in the structure of the phenomenon. Development, thereby, comes to be reduced to biological maturation.[2] The coordination with cultural patterns is due to a process of *socialization*, where the wild mind of the child increasingly comes to be domesticated, so to speak.

Vygotsky strongly argued against theories that viewed development in terms of continuous changes of a single dimension that at some point overcome some threshold. A single variable can neither describe nor appropriately model development

[2] The authors also write, however, that "the organization of formal structures must depend on the social milieu as well" (Inhelder and Piaget 1958: 337). But, as pointed out in Chap. 5, they also state that all the developmental possibilities arise from the maturation of the nervous system and that the cultural and educational conditions accelerate or slow this realization.

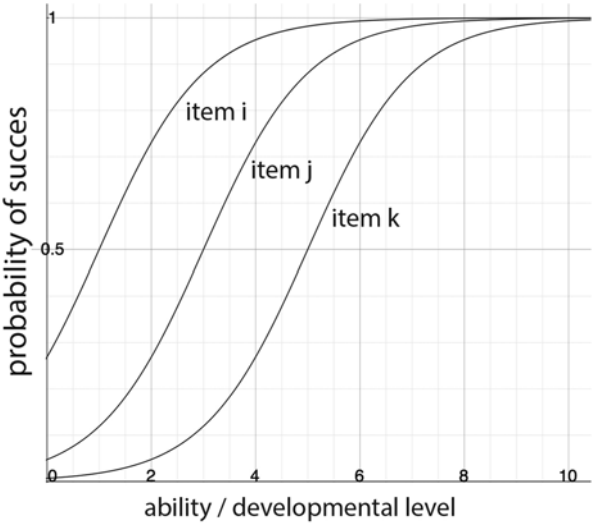


Fig. 6.2 Result of a linear logistic modeling of changes in task performance

because, in development, there is a changeover from one quality (factor) to another, each of which has *its own* quantitative dimension. A single variable only changes quantitatively, not qualitatively into another variable. Nevertheless, some proposals for theorizing success on balance beam problems took precisely the single-variable quantitative approach. One such approach produced a log-linear model, where problems differ from each other in terms of difficulty (Spada 1978). Thus, there is one variable, one quality (problem difficulty) that is allowed to vary continuously. The probability of success on some item is a function of ability associated with a particular developmental level (Fig. 6.2). More difficult questions require greater ability so that the logistic function will be further to the right of the graph. Rather than the qualitative differences in the cognitive operations that we see in Piaget's theory, the log-linear model assumes quantitative changes in the individual's cognitive ability—as seen in the continuous nature of the variable denoting development (Fig. 6.2).

Alternatively, the items in the log-linear approach may be seen as proxies for tasks of different developmental levels. As a result, we obtain a curve of success rate over time that we can easily associate with the mundane expression of a "learning curve." Although there appears to be a step between the bottom and top, which becomes more pronounced when the steepness of the curve increases, the curve does not model development; at best it models learning. Yet, these models continue to characterize the way in which psychometric tests and measurements are designed, thereby influencing not only our conceptualizations on what it means to learn and develop, but also the (political, educational) actions we take based on the scores obtained through those measures. One neo-Piagetian theory does indeed model cognitive development in terms of a continuously varying biological parameter: short-term memory (Pascual-Leone 1970). In that theory, the fact that the short-term

memory of an individual increases from birth to adolescence from 1 to about 7 or 8 units—measured, among others, by means of a test that evaluates the maximum length of a digit sequence that a person can recall (digit span or backward digit span)—is taken as the biological feature responsible for developmental change. Tasks in a domain may be analyzed in terms of cognitive difficulty, and the theory predicts correlations between individuals' digit spans and the tasks they can solve (e.g. Roth 1990). The empirical observations seem to confirm this approach, as the success rates on balance beam problems increases dramatically with age to reach about 50 % in late adolescence with a corresponding increase in short-term memory.

A single variable does not address the issue of a qualitative change in behavior that we observe, for example, on Piagetian tasks when an individual moves from the concrete to the formal operational stage. A single-variable model is more consistent with a learning paradigm rather than a developmental paradigm. That this is so can be seen from an experiment using an artificial neural network to model changes in the correctly solved proportion of problems that correspond to different levels of cognitive development according to Piaget (Roth 2000). For each developmental level, the artificial neural network increases its success rate in a learning curve of the linear logistic type, with correlations $.93 < r < .99$ between curve and data. The difference between the problems from different developmental levels lies in the steepness of the curves, so that the success rate on problems typical for the pre-operational level is much steeper than those for the problems typical for the concrete operational stage, which again is steeper than the increase in success rate for problems from the formal operational stage. These results are indeed consistent with a neo-Piagetian model that assumes qualitatively different forms of reasoning between stages but continuously varying (biological) changes within each stage (Case 1985). It is a biological model of change (as in Piaget's maturation of the nervous system). The continuously varying parameter is short-term storage space—measured using certain tasks that require the individual to keep information in memory while doing something else.[3]

A review of the empirical evidence of reasoning on the balance beam exhibits curious variations among studies (Roth 1991). There are studies where up to 38 % of second-grade students did standard balance beam problems, whereas in other studies only 23 % of college students solved such problems; and in one pilot study, none of the 43 students involved solved the problems. However, when research participants are allowed to interact with the devices or other kinds of feedback, they often arrive at appropriate ways to solve balance beam problems. In most studies the participants eventually state a *product–moment (multiplicative) rule*—i.e., $w_1 \times d_1 = w_2 \times d_2$—rather than the ratio-based rule (Eq. 6.1) that Piaget had postulated. In

[3] For example, one task involves cards with dots of three colors. The subject counts the number of dots of two colors and calculates their ratio. The test determines how many of these ratios the subject can remember. This "ratio span" test determines the subject's position within the formal operational stage.

such studies, individuals appear to have developed on their own by interacting with a task and independent of the social situation.

Interesting and curious is the fact that a large fraction of adults participating in studies on balance beams, though initially unsuccessful, eventually do solve the tasks at all Piagetian levels. One would assume that the kind of development Piaget and Vygotsky are interested in—which achieves its pinnacle with biological maturation during adolescence—would have been completed by all the participants in studies such as ours, where the mean age was about 27 years and ranged from 22 to 42. If such individuals are not successful on balance beam tasks, it may be because of lack of familiarity and exposure rather than because of cognitive development. An early suggestion pointing in this direction came from the work that A. R. Luria and Vygotsky conducted in Uzbekistan with illiterate peasants (e.g. Luria 1979). They investigated, among others, how peasants classified perceptual categories providing them with different two-dimensional geometrical objects of various outline types (solid lines, broken lines, gaps). The categories they used included "plate" when there was a circle, "tent" when there was a triangle (tip missing), or "mirror" when a solid square was presented. However, peasants who had been part of literacy classes or had experience participating in organized collective farming techniques would predominantly use corresponding names from geometry. Similar results were obtained when the peasants were asked to classify colors. Thus, the results exhibit differences arising from the degree of schooling and familiarity with particular kinds of technological contexts rather than from cognitive and developmental deficits inherent to the participants' biology. These cultural aspects, however, are left out from the explanations that Western developmental psychologists had provided prior to becoming familiar with Vygotsky's work. In the following sections, we consider ways in which the cultural environment comes to be considered as integral to learning and development changes.

Reasoning on the Balance Beam in a Classroom Setting

Educational psychology is particularly concerned with the changes individuals undergo when they participate in formal educational settings. The studies of reasoning on the balance beam reported in the literature generally were conducted in laboratory rather than school settings. One of our own studies, a *design experiment*, took place in a mixed sixth and seventh grade, with students 11–12 years, just about the time that developmental psychologists use as a marker for the onset of adolescence (Roth et al. 1999). This setting allowed us to use clinical interviews before and after an intervention that provided many opportunities for students to learn and develop over the course of a 4-month curriculum in which they conceived and built prototypes of machines that would facilitate accomplishing certain tasks (e.g. lifting weights).

Reasoning in Context

A first remarkable phenomenon was noted during the pretest, where students were given balance beam tasks in two conditions. In the first condition, the lever arm was unmarked, that is, there were neither notches nor numbers on it: there was simply a pivoting bar. In the second condition, the beam was sectioned by means of equidistant markers, and unit distances were indicated starting with the first mark next to the fulcrum {1, 2, 3 …}. The weights were in the form of hardware nuts. The analysis of the clinical interviews yielded responses that varied widely within and between students (Roth 1998). Most surprisingly, not one student used the same solution strategy and reasoning in the two conditions. About 15 % of the students did use the form of reasoning that Inhelder and Piaget had described as emerging during the critical age. Other students used the numbers on the beam as ordinals marking different positions farther and farther away from the pivot point. Yet others used the numbers, but not as a *quantity* of distance. The numbers were things to be used in arithmetical operations—like adding and subtracting. On the other hand, when there were no distance markers and numbers, one quarter of the students used the thumb and index in a caliper configuration to measure the distance of the weights from the center of the beam (fulcrum). An equal amount eyeballed the distances providing qualitative indications thereof (e.g. "about half").

We learned in this investigation that *the students were not at all geared towards the entities* weight *and* distance *that previous research presupposed*. Therefore, the things that students were processing were neither qualitatively nor quantitatively the things that scientific perception and reasoning uses to predict how a balance will behave under specific conditions once released. In other words, the students reasoned in and in terms of a different world, a world populated with different entities than those appearing in the world of the investigators. In philosophy and other fields, the ensemble of objects that make a (segment of the) world constitutes an *ontology*. To distinguish the world (environment) as described by science and the world (environment) as experienced and acted upon by individuals, the term *lifeworld* is frequently used. In the following, we characterize lifeworlds in terms of sets of entities that subjects differentiate by means of language or actions; each set constitutes an ontology that goes with a particular lifeworld. Thus, for example, the ontology {A, B} is characterized by two entities. If another entity C is added, the ontology expands to {A, B, C}. This expansion also means that the lifeworld, in the given context that the ontology describes, has become more complex. In this approach, we take into account the suggestion that the relevant environment to be considered in educational and developmental psychology is not the objective environment, not the one that scientists describe and theorize, but the environment in the way that it appears and is salient to the individual, in her *perežívanie* [experience].[4]

[4] The category *perežívanie* was developed during a lecture only a month preceding Vygotsky's death (Vygotsky 1994). It found relatively little attention in the research literature. While writing this book, we also contributed to a special issue of *Mind, Culture and Activity* entirely devoted to this category, particularly focusing on how to use it in empirical studies (Roth and Jornet 2016).

We suggested in the past that the students' lifeworlds differ from those of researchers, teachers, or science and that therefore the very form of analysis that have been applied to developmental tasks is inappropriate. The preceding results show that not only are the students' lifeworlds different and populated with different entities, but also these lifeworlds change as a function of the context. This suggests that to understand performance we need to take into account person and experienced environment. In the following we see how one student, Don, during the clinical interview built up the qualitative measure (i.e. variable) "distance to fulcrum" as a relevant attribute to be used in reasoning together with its quantitative measurement. Initially, he did not have experiences with the device so that it is not surprising that the observed behaviors were at Level 3 and Level 4 in terms of cognitive complexity (Fig. 6.1). During the posttest situations, behaviors at the Level 6 and Level 7 (Fig. 6.1) were observed.

Distance, the feature of the balance beam that appears in the literature as the variable students act upon and use in reasoning, in the beginning was not an aspect of the student's lifeworld and the associated ontology. Initially, Don answered the interviewer's questions about where to put a weight to balance the lever in terms of locations by using the deictic term "here" and then also included the term "there," which maps onto Level 2 of our category scheme (Fig. 6.1). In each case, the term coincided with a pointing gesture to a specific aspect of the material configuration of the balance. The use of indexical terms, therefore, left it to the interviewer to find in the material configuration any relevant fact.[5] That is, in the beginning of the clinical interview, the salient entities were specific locations so that his lifeworld may be described by the set {here, there, POINT[position]}, where an action is denoted by means of small capitals.

Distance, as a qualitatively new discrimination function, only became reality for Don (and his peers) in the course of the clinical interviews or in the subsequent lessons. Thus, for example, during the interview Don changed the position of the weights along the arms of the beam. He thereby operated on specific aspects, thereby changing what he oriented to and acted upon. His lifeworld now included a new movement, MOVE[weight], resulting in the ontological set {here, there, POINT[position], MOVE[weight]}. This behavior would be characteristic of Level 3 (Fig. 6.1). In response to further interview questions, the replies changed to include the verbal descriptor "from here to there," thereby expanding the ontological set describing the balance beam-related world to {here, there, POINT[position], MOVE[weight], from here to there}. The two position markers "here" and "there" came to be connected by means of the action MOVE[weight] (from one location to the other) to form a more complex description. This description was not merely verbal but included material aspects. The task-related world expanded and became more refined with the generation of a new discrimination function that was the result of connecting already existing features. Importantly in theoretical terms, the new feature arose from the combination of a verbal and a material action. Thinking

[5] This is not unlike the situation observed in Chap. 3 where the students working on the heat pump problem refer each other to the display, inviting others to "see."

here literally was handwork, and we observe neither a gap between body and mind nor a possible reduction to mental properties. But the result was not yet the variable "distance"; it was a change of position.

The next addition to the lifeworld was the distance of the weight from the fulcrum, which is characteristic of Level 4 (Fig. 6.1). This new discrimination was observed in the justification of an answer to one of the interview problems.[6] Don suggested basing himself on the comparison "*between* 'here' [position left weight] and 'here' [position fulcrum] and then *between* 'there' [right end of beam] and 'here' [position of right weight]." Simultaneously, his thumb and index finger formed a caliper configuration while saying "between." Thus, the lifeworld now included "between here and there," which resulted from the action MOVE[weight] that linked the two positions "here" and "there" so that the entire set of things evolved to {here, there, POINT[position], MOVE[weight], *from* "here to there," *between* "here and there," CALIPER SPAN[here, there]}. On the balance beam with distance markers and measures, Don also included these to name the positions (e.g., "put it on five") or to provide a measure for "between here and there."

In the course of the clinical interview, existing features were integrated to produce new ones. These features were either of the same type (e.g., "here" and "there" or MOVE[weight] and SPAN[here, there]) or of increased complexity (e.g., the construction of "from here to there" from its constituents "here," "there," and MOVE[weight]). That is, the lifeworld not only became more differentiated but also came to include new discriminating functions of a *higher complexity*—not, we insist, as if it were the result of something in his mind, but in this particularly configured setting and the relation with the clinical interviewer (see next subsection). During the interview prior to the unit on simple machines, Don did not talk about distance as a measure, which includes a particular quality and its associated measurement—even though the interviewer can be seen asking him about it. However, later during the 4-month unit, immediately after completing specific teacher-designed tasks with levers, he began verbally referring to this newly emergent quality. During the tasks, he added "close" and "far" from some reference point (e.g., fulcrum, scale that measured effort) resulting in the ontological set {here, there, POINT[position], MOVE[weight], from here to there, between here and there, CALIPER SPAN[here, there], close(r), far(ther)}. This lifeworld included the marker for magnitude "between here and there."

In the end, Don explicitly used the notion of distance in the context of lever problems. His lifeworld relative to the property of distance had expanded to the set {here, there, POINT[position], MOVE[weight], from here to there, between here and there, SPAN[here, there], close(r), far(ther), distance, CHANGE[distance], MEASURE[distance]}. During the posttest Don explained how he found the corresponding weights and distance by saying, "distance is … " and moving his index finger from the weight to the fulcrum on the drawing in front of him. The set {SAYS[distance], MEASURES[distance], GESTURES[distance]} was associated with the movement of weights along the beam. Even though he already used the multiplicative

[6] The effect of such calls for justification is described in Chap. 5.

rule to balance the beam[7], his explanation included material actions. This situation thereby was analogical to the ones we show in Chap. 2, where petrified movements become things. Here, the movement from one position to another, "MOVE[weight] 'from here to there'" became the thing "distance[weight, fulcrum]." There is no need, however, to attribute this qualitatively new shift in the reasoning to the individual, as if it was *his* construction. Instead, the action of moving the hand between two points and the associated talk was *for* the clinical interviewer and as the second turn in a {query | reply}, which constituted each part of the pair as social rather than individual action (see Chap. 4). The petrified version also is part of a {query | reply}, inherently presupposed to be intelligible and therefore a manifestation of communicative possibility. In this regard, the example also is reminiscent of the case presented in Chap. 3, where a group of students develop new perceptual and conceptual differentiations as they engage with, modify, and talk about a digital animation. Along with those differentiations emerge new possibilities for talking about aspects that no longer needed to index the specific situation. This allows for the attribution of higher levels of cognitive complexity. In the case of Don, the change from reasoning without distance to reasoning with distance was of the qualitative kind, which arose in a context of quantitative expansion of the lifeworld. Those changes could be accounted for in terms of individual construction but took place in and through the {thinking | communicating} dialectic.

Many scholars have accepted the notion that cognition is situated—as had been described for the differences in performance when adults were making best buys in the supermarket, in a simulation with some products arranged on a table, or in paper-and-pencil format (Lave 1988). But very few scholars have drawn the consequences of that notion. One educational psychologist who did integrate person–situation transactions into his theory was R. E. Snow. He called that union of person and situation *aptitude*; we may also denote the unit as {person | situation} or {person | environment}. Snow suggested that "to understand the effects of person characteristics on performance, one must specify the performance situation" and conversely, "understanding situation effects on performance requires knowing the personal qualities capable of influencing response" (Corno et al. 2002: 216). *Trans*action means that we cannot undo the {person | situation} unity/identity and reduce it to smaller elements. This is so because understanding one part (person, situation) requires understanding the other (situation, person). In our account of Don engaging with the balance beam, we observe changes in the relation between the person and the experienced environment (lifeworld). That is, Don, like the students in Chap. 3, did not act in a constant world but in a world (i.e. situation) that became more differentiated and expanded, thereby affording more and more complex actions. As a result, the entity marked "Don" is not a constant but continuously changing aspect of the {person | environment} unit. Even though some actions were more complex, up to this point we did not see a change that would qualitatively change the form of

[7] The multiplicative rule in fact calculates the torques on each side, which have to be the same for the beam to be balanced: $w_1 \cdot d_1 = w_2 \cdot d_2$. Empirical studies show that subjects are more likely arriving at this rather than at Piaget's (INRC-based) ratio rule.

reasoning, an example of which would have been if Don had used the schema of proportions that Inhelder and Piaget were observing among their research participants. One important aspect that was left out in the present account, however, is the role of the social relation and how it made possible forms of reasoning that are observed for the first time in a particular individual. That is, what has not yet been shown in our account is how a social relation is at the origin of the observed development. What has been shown so far, on the other hand, suggests the need to consider the relation as a {person | environment} unit for understanding the reasoning practices observed.

Reasoning and Social Relations

In the preceding subsection, as in much of the literature on cognitive development, changes are presented as if they occurred in the mind of the student. In the preceding analysis, we focus on the changes in the perceptual discrimination that resulted from the increasing familiarity with the device. That is, we focus on the differentiations that occurred within the {person | environment}. In the analyses we do not show whether or how the ongoing social relations become constitutive of the *reasoning* observed. Some researchers, for example, have come to recognize that the social context also figures into the results of clinical interviews, suggesting it to be something like a context that configures responses. Such researchers thereby provide an expansion of the Piagetian notion of the social to constitute a context that fosters certain phenomena to be provoked.[8] In contrast, we suggest in Chap. 5 that such expansions in the theoretical accounts do not make the forms of reasoning that result in such contexts any more social but remain within the individualistic scheme. Here we exemplify how the relation with the clinical interviewer is not just a context but integral to the phenomenon of development. That is, the relation itself *will have been* what is later observed as a higher psychological function in the individual—which, in the present context, comes to be articulated in the form of proportional reasoning.[9] In this way, we observe how a social relation becomes not just an instance of learning but also a phenomenon of development.

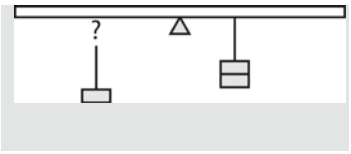
In the task that the participants are discussing, there is a 1-unit weight to be hung on the balance and the interviewer begins by asking whether there is a way to predict how to set them, emphasizing the feature “how far” (turn 01). The reply suggests to begin by making the distance the same as on the other side and then moving it outwards to balance the beam and adds, “the farther it is the more weight it wants to pull it down” (turn 02). Invited to continue (turn 03), the reply then states what we might gloss as measuring wherever the weight comes to balance the beam. The

[8] We note above that for Piaget, the social constitutes context that may hasten the inherently biologically driven development.

[9] The presence of a future developmental stage in the life of a person has been referred to by the term *prolepsis* (Cole 1996).

reply to this turn takes the statement to be about two identical weights, and then restates the current task in which there are unequal weights (turn 05). The reply suggests using instinct, which, when queried in turn, leads to the statement that it takes more time to measure than to simply "see if it works" based on instinct (turn 08).

Fragment 6.1a



01 Int: So is there any way that we could um predict how to set these? Like you just moved it out farther, but do you know how
→ far to move it? Is there any way
→ we can predict how far?
02 Asl: Well, if you had both of them on the same, then see how if it's the farther it is the more weight it wants to pull it down.
03 Int: Right.
04 Asl: If you just measure that.
05 Int: So when we have an equal number you measure them and you can see how they are. If you have an unequal number is there any way you could measure to get them to balance?
06 Asl: Well, you don't really need to measure you just have to use your instinct.
07 Int: Measuring doesn't really help you can just use your instinct?
08 Asl: It takes longer to use it to measure it then it does to just put it there and see if it works.

The task here is treated to be one of getting the weight in the right place to make the balance beam equilibrate rather than to predict where the weight should go or at what distance from the fulcrum. Until that instant in the clinical interview, Aslam (12 years of age) has been moving (or trying to move) the weights. This is exactly in the way that Inhelder and Piaget described those of their research subjects when they were in Stage 1 (pre-operational). But here we have a student who, in terms of age, is supposed to be at the brink of Stage 3 (formal operational). That is, had the interviewer stopped here, the results would have suggested a particular stage of reasoning. But the interviewer did not stop there.

We then observe an offer to change the conditions in which the problem is being approached or framed: Instead of trying to balance the beam by operating it, the interviewer offered the context of a bet with a classmate thereby stipulating that Aslam only had one try at stating where a weight should be placed to balance the beam. As seen in Fragment 6.1b, Aslam did not take up the challenge in the way the interviewer might have possibly intended but instead proposed an action that would allow him to win: to mark the beam before the bet so that he would win (turn 12). This offer was taken up and described as cheating, which found a reply in the pragmatic statement that it works (turn 14). When the interviewer invited the stu-

dent again to state how he could anticipate the right distance in just one try, Aslam replied by saying that he did not know (turn 16).

Fragment 6.1b

09	Int:	Okay, well what if it maybe in class somebody made you a bet that you couldn't figure out how to do it in just one turn. If you just had one turn, is there any way you could figure it out?
10	Asl:	One turn?
11	Int:	If you only had one chance to try it. You couldn't keep moving it around to see where it is. Is there any way you could increase your chances of getting it closer to where it is when there is a different number?
12	Asl:	Well, before it, you should make that person the bet. You make a little mark on here to show that that's where it is and then you get the bet.
13	Int:	Oh, but that's cheating.
14	Asl:	It works.
15	Int:	Is there any other way to do it without a bet, without a mark?
16	Asl:	I don't know.

In this fragment we observe an offer to configure the task in a particular way. That is, we have an invitation to view the task as a bet done prior to giving it the one and only try that turns 09 and 11 propose.[10] It is not the individual we observe but an individual-acting-in-setting unit, offering possibilities that are not individual but inherently cultural.[11]

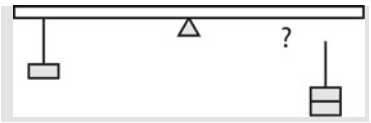
The interviewer then places the 2-unit weight on the outer end of the right beam and invites a reply to the query where to place it (so that the balance beam would be equilibrated). Before a reply proper, there is a {query | reply} concerning the relative weights of the hardware nuts (turns 18–19). The reply states, verbally and performatively, the inverse relation between weights and distances (turn 20). As if this were not enough, the next turn requests an account for the statement of a doubling of distances corresponding to the halving of the weight. That is, there is an explicit invitation to provide both action and an account thereof, a linking that we suggest in Chap. 5 to constitute the basic structure of a social phenomenon. That is, the form of reasoning exists *as* (not merely *in*) the relation; and the particulars of the content also are offered up in the task.

[10] This is a move not unlike the one Pasteur made to get the same research results in the cattle stables in the French countryside that he had obtained in his laboratory (Latour 1988).

[11] The disadvantage of the term "person-*acting*-in-situation" is that it fails to make sufficiently thematic that the person also *undergoes* the situation, that is, is not only subject but also subject and subjected to the situation.

Fragment 6.1c

17 Int: So if we put two [nuts] back on here again. So now where could we put it? You just get one chance to put it to guess where.



18 Asl: Okay, see how it's. These are . . . all of these [nuts] are the same weight?

19 Int: Yea they're all the same.

20 Asl: Okay, so okay. See I'm just moving that ((*two nuts on right, moved to about half of left distance*)) into here. There's that ((*pointing to the beam on the right side*)) and you have to double that, so that ((*points to left side*)) and that, that much.

21 Int: That's pretty close. How did you know to double it?

22 Asl: Because you've doubled the weight on the bottom ((*points to right side*)).

Here, Aslam does not just somehow act in and on the world; nor does he just dump the contents of his mind. Instead, Aslam responds (a) by actively attending to what the interviewer does to the beam and what she says and (b) by replying verbally. Together, the two create and attend to a particular configuration of the life-world, which, after all the introductory work, produces the kind of replies that come to be treated as satisfactory (as shown by the movement to a new task) and thereby come to be constituted as proper scientific doing and talking. Aslam next solves other tasks with unequal weights not in integer proportions, such as having a 2-unit weight on one side and a 3-unit weight on the other. An earlier report attributes what had happened here to the individual, though making a point that the replies themselves depended on the social context (McGinn and Roth 1998). In such attributions, we explained the performances in ways typical of the (social) constructivist theories that we espoused at the time, including those of Piagetian, enactivist, and embodiment type. We thought that other human beings merely constituted a social context, which afforded or constrained individual development. Similarly, researchers drawing on Vygotsky's works often note in this kind of situation that something was co-constructed in the social context, which the student subsequently internalized.

Rather than having the social as its context, *the task in itself is social through and through*. Inhelder and Piaget have used it, as have many researchers since then. That is, what the interviewer and Aslam are doing is *recognizable as* a phenomenon: not just any interview but one typical for assessing Piagetian stages. If a knowledgeable educational psychologist had inadvertently opened the door, she would have immediately recognized that something like a clinical interview was taking place. This requires that all participants act accordingly: Participants' *joint* work exhibits all the features of a clinical interview. Some Piagetian scholars have moved to working in a more social-historical tradition and have suggested that the task "mediates" the relation between the interviewer and the participant (Grossen and Perret-Clermont 1994). But, as we point out in Chap. 4, it is not a mediation that we observe in this

situation.[12] If the task were not *common*, then the kind of phenomena described here could not have been observed. The same researchers also suggest that the adult mediates between the participant and the task. But this assumes that the task exists in a particular way. As exemplified here, the task conducted in the way required for Piagetian phenomena to exhibit themselves and to be recognized as such by Piagetian scholars has to be established as actual and recognizable through *joint* work. What results is social not merely because the interviewer and Aslam are doing it *together*; instead, it is social because the work itself is and, thereby, any of its parts (i.e. the contributions on the part of individuals). All those turn pairs of Fragment 6.1 are irreducibly social phenomena.[13]

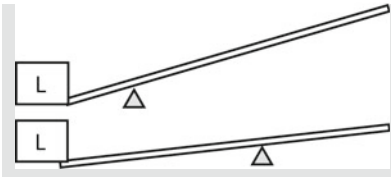
Some Vygotskian scholars might suggest that there is something like a zone of proximal development at work, whereby Aslam has been enabled to exhibit behaviors typical of a new kind that he had not exhibited when working alone. But in the case analyzed here, an adult was not required for actions and statements of a new kind to be observed in some instances. Thus, in previous studies we noted the evolution of complex responses as (and in) relations among students that had been asked to work together (Welzel and Roth 1998). This may be observed in situations such as the following, where Dan and Don were asked how they would free a jeep that got stuck somewhere in the woods, when the only tools to be found are trees and sticks. The fragment begins when the clinical interviewer follows up on the term "leverage" that Dan has used without explaining it in the immediately preceding turn. In the give and take that follows, simple earlier statements come to be combined and related to form more complex later statements. Change is occurring in the form of expansion without a reorganization of consciousness, that is, in the qualitative kind of discourse that we would have associated with *development* as distinguished from mere cumulative changes.

Fragment 6.2

01 Int: What is leverage? This distance here is that what you are talking about?



02 Dan: Well if you move it back down here the whole thing right here goes down. So even if you tip it up you'd go higher.



03 Don: But its a lot easier to do
04 Dan: It would be higher
05 Don: It's easier than over here where its harder.
06 Dan: But you just need to lift it. Up a little bit.

[12] It has been noted that "Being … is mediation without any instrument," but such "mediation without a mediator mediates nothing" (Nancy 2000: 94).

[13] Because an individual phrase could be anything, it in itself is in fact nothing of social or psychological import.

We can represent what happens in this fragment in the more abstract terms of classical logic, which makes the emergence of something qualitatively new stand out. In this debriefing situation, students used three kinds of statements (*s*) about a lever: s_1 concerning the closeness of the fulcrum to weight, s_2 pertaining to the load being higher, and s_3 being about easier pushes. The students then began to combine the statements in response to one another, such as when Don produced a compound statement $s_4 = (s_0 \rightarrow s_1) \cap (s_0 \rightarrow s_2)$ after Dan stated $(s_0 \rightarrow s_1)$.[14] That is, Don took up and thereby affirmed what Dan had stated and, making a logical connection, added a second observation. By beginning his turn with the connective "but" ("but it will be easier to push") Don asserted the conjunction of the two assertions and their contrast leading to the claim. The connection itself was an aspect that had its origin in the social relation, and, indeed, it *was* a social relation because {statement | corrective reply} is not a linguistic but a sociological category. Subsequently, and again following up on Dan who repeated his earlier statement, Don produced another compound statement that also included an inversion: $s_5 = (s_0 \rightarrow s_2) \cap (\hat{s}_0 \rightarrow \hat{s}_2)$. That is, two implicative statements came to be connected, the second one stating the inverse of the first. Dan responded by explicitly connecting a variation (var) in the primary statements to each other: var $s_0 \rightarrow$ var s_2, in other words, bringing the fulcrum closer to the load makes it easier to lift it. Here, a new form of reasoning emerged and its genetic origin was a relation of two students *at the same level* rather than one of them, at a lower level, learning from someone else at a higher level. Whereas the involvement of institutionally designated teachers may be important in the constitution of affectively charged evaluative work that further contributes to the development of practice-defining forms of reasoning, the social origin of learning and development change is here shown as immanent to social relations. Rather than being the outcome of mediations that involve more knowledgeable others, where learning and development take the form of transmission from the outer to the inner, people are capable of changing because of the cultural changes that their participation in societal relations brings about.

A Monist Account of Reasoning on the Balance Beam

In the two studies from our own research, the participants were either around the onset of adolescence (~12 years) or considerably past it (adults). In both events, because of the short period of time, biological changes likely would have been minimal. Nevertheless, we observe qualitative changes in the contents and form of reasoning on the balance beam. These changes not only are of the discursive type but also include changes in actions and perceptions, which inherently are bodily and material. Our account of learning and development, therefore, must not limit itself

[14] We use the sign $\cap$ for the logical and and "$\rightarrow$" for a logical implication "if/then." The caret is used to mark a logical negation (e.g. $\hat{s}$ = not-s).

to changes in the content of the replies, but needs to take into account changes in the bodily manifestation of communication. We take communication as a unit that cannot be reduced to thinking, especially not to thinking that precedes the reply (see Chap. 3).

The replies we observe can be categorized somewhere in the middle of the ten levels (Fig. 6.1). Although Vygotsky takes replies provided in the psychological laboratory studies as legitimate proxies for the development of an individual, there are in fact no guarantees that the children or adults in our studies would have picked up a balance beam if it had been in a location where they spend their everyday life. Even less so can we expect individuals to act in ways that they normally do when, in experimental conditions, they are coaxed during clinical interviews. It is easy to make observations that many individuals do not engage with everything found in a clinical interview when that same thing is encountered in the everyday environment. In fact, a visit to any science museum allows observing all sorts of behavior that have very little to do with the expected behaviors in science classrooms or clinical interviews (e.g. jumping, playing). Visitors may even simply bypass a particular exhibit. Such situations therefore would fall at Level 1 of engagement (Fig. 6.1), where the person does not identify whatever the investigator (or teacher) is interested in. Even if such a thing were noticed, the particular features that are salient to the teacher or investigator may not stand out at all for the person, including the quality *distance* on balance beam problems. Indeed, some studies show that students may work with a device for many lessons before identifying and acting upon one of its specific features (e.g. Roth 2006).

In the preceding account, we describe changes in the way our participants acted towards and with the balance beam. Thus, for example, Don pointed to specific locations on the arms of the balance beam saying "here" or "there." But then we noted a change when he began moving his hand and stating things like "from here to there." A shift occurred because now there were new kinds of opportunities for working with the device. In fact, because the {person | environment} constitutes a transactional unit, the task no longer is the same. This is so because "a person who shifts from verbal analysis to spatial visualization midway through a task has changed the task *psychologically*" (Snow 1994: 6, emphasis added). Conversely, "a task that affords such learning has changed the person psychologically" (1994: 6). Changes of this type in the person and the task environment will have ripple effects not only later on in the same task but also in other task sequences. Such ripple effects are easily understood when we think in terms of *perežívanie* [experience] (Vygotskij 2001), a category denoted here by means of {person | environment}. In effect, Snow says that experience in one task situation becomes a resource in other task situations. We observe learning and development (but not biological maturation) in the doing of a task. As a result, "learning in the task can change both the types and the levels of abilities that apply to this task performance, and to other task performances, and can do so differently for different individuals" (Snow 1994: 7). From an analytical point of view, it therefore appears to be illegitimate to pin abilities to persons. Instead, as our research shows, we observe different abilities and performances depending on how the task is presented and, therefore, we are assess-

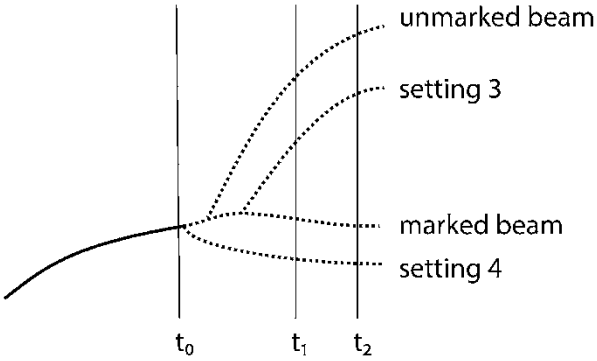


Fig. 6.3 Depending on task and task history, different performances and therefore abilities and developmental levels are observed

ing person–environment transactions. The parts of this unit are not *in*dependent but *inter*dependent and, therefore, cannot be defined independently. This also means that we need to think the person in different terms, neither as "*having* an ability" nor "having *an* ability." This being so because ability is not a thing that can be had. Instead, we have to think {person | environment} as a *singular* that manifests itself differently, even contradictorily—such as when observe additive reasoning in balance beam settings when the beam is marked and associated with numbers but observe proportional reasoning when the beam is unmarked. The singular therefore is in fact a *singular plural* or, equivalently, a *plural singular*. This insight has already been articulated in the nineteenth century in the statement that "what individuals are depends on the material conditions of their production" (Marx and Engels 1978: 21); and these material conditions include the real relations with other people (Vygotsky 1989).

We may draw on the catastrophe theoretic model described in Chap. 2 to depict the situation. Accordingly, there are multiple levels that we might find in the {person | environment} unit (Fig. 6.3). On the marked beam, the system under consideration exhibited behaviors at a lower Piagetian level, the concrete operational one, whereas on the unmarked beam, a higher Piagetian level of behavior is observed (formal operational). We also show how very early in the task, behaviors were observed that are characteristic of the pre-operational level in Piaget's theory. Moreover, in the course of the task situation, we observe change within the same form of presentation. That is, there are changes between two points in time (e.g. t_0 [beginning of clinical interviews], t_1, t_2 …). When presenting the model in the field of cell evolution, we refer to the multiple evolutionary pathways as epigenetic field. If we want to hold onto saying something about a person, we need to specify a field of competencies (aptitudes). The person no longer can be specified along one dimension, such as intelligence or developmental level. Instead, we need to think in terms of a field of performance dimensions. The type of learning described is therefore not a function of the individual but a function of the type of operation observed. Our observations of the system—i.e. {person | environment}—will then depend on when, where, and how we look.

We do observe the emergence of behaviors across task settings. Following the design experiment, students were tested not only with balance beam tasks (class 1 lever) but also with other classes of levers, across task types (paper-and-pencil, practical problems), and across social configurations (alone, with peer). Following Don's case, we observed the use of the multiplicative strategy as it emerged while working with the balance beam (class 1 lever). At the end of the design experiment, he treated balanced levers and drawings of them as members of the same class. Second, we observed the emergence of a general class of levers. Finally, we observed the same multiplicative strategy in the context of a second-class lever (wheelbarrow). That is, although we can no longer simply trace the person along a single-variable or continuum, it is possible to observe continuity of growth across contexts. This continuity, which in individualistic frameworks is associated with the notion of transfer, is not the result of a person carrying some*thing* across, or of different settings presenting the same structural features in and of themselves. What develops is not just the person but the {person | environment}. We can no longer speak of learners internalizing whatever exists in a social relation. There is a (mathematical) cultural practice that is broader in scope than any of the single behaviors observed; and it is familiarity with that practice that allows us to see growth in the transactions analyzed rather than stagnation or disconnection. There is no cognitive development outside of the practice not only because, as it has been shown here, it is in and as social relations that new cognitive competences emerge, but also because the cognitive competence falls within and exists as such precisely as part of the historical practice, which also grows and develops.

Coda: What Changes in Learning and Development

The relation between {teaching | learning} [obučenie] and development was a central concern in Vygotsky's thinking. Educational psychology handbooks today are full of references to both learning and development, often associating both notions to Vygotsky, but their difference or relation is rarely problematized or described. As a passionate Vygotskian scholar has noted, now "that Vygotsky is a frequent guest on the pages of numerous psychological and educational textbooks, the words of his classic works that used to sound as an exciting revelation are now fading, getting trivialized, too common and stale" (Zuckerman 2014: 177). Among those words from Vygotsky that are trivialized today, we find phrases such as "education leads children's psychological development" or "developmental education." If learning and development are not the same, if there are certain aspects of education that may lead to changes but are not merely the quantitative addition to an already existing quality and lead to the emergence of qualitatively new ways of functioning, then what are their differences and how are they related? Throughout this chapter, we address these questions using as our example the classic case of reasoning on the balance beam. We show how there are both quantitative and qualitative changes that can be disentangled from the reasoning performances observed. These changes

always take place in context and as the result of social relations. The special social situation that has a crisis-like qualitative change as an outcome is designated in Vygotskian literature as the zone of proximal development.

Studies of cognitive development have made it appear as if the participants were somehow developing a form of reasoning independent of the context and its social, cultural, and institutional characteristics. This, however, is contrary to what Vygotsky was pointing out in his writings on development and the relation between person and environment according to which

> [on]e of the major impediments to the theoretical and practical study of child development is the incorrect solution of the problem of the [pereživanie] and its role in the dynamics of age when the [pereživanie] is considered as something outside with respect to the child, as a circumstance of development, as an aggregate of objective conditions existing without reference to the child and affecting him by the very fact of their existence. (Vygotsky 1998: 198)

In the illustrative cases presented above, we exhibit how context is not something external but becomes internal to the changes observed. Participants apparently exhibit or evolve to exhibit the use of a multiplicative or product–moment rule. But by the very fact that they have not done so initially, we see that they do not arrive at such rules on their own in their "natural" (everyday) contexts. When they come to the laboratory or school—environments configured socially in very specific ways—they find themselves in particular relations with others, including the researcher or teacher and sometimes peers. There are also material contexts that in the case of the balance beam involve actual devices, two-dimensional electronic versions thereof (as in Roth 1991), or paper-and-pencil drawings. Depending on the characteristics of these devices, there are additional perceptual opportunities and constraints, such as when the lever arms are marked, with or without numbers, or unmarked and when the weights are given numerically or qualitatively in terms of the size of objects. These aspects of the environment, which may not involve others, nevertheless become cultural-historical structures through and through when seen as forming part of irreducible person-environment relations. Thus, when there are numbers on the weights and lever arms of the physical device, and the context is (perceived as) one of testing, then, and at the same time, using numbers in one or another way may become more salient than going about the tasks in more qualitative ways.

In our case studies, learning and development are initiated and observed in the same situation. Learning and development, though very different in kind, may be conceived together as moments of one and the same dialectical unit: {learning | development}. Within such a unit, quantitative changes denoted by the term learning lead to qualitative changes denoted by the term development and vice versa (as in Fig. 2.4). It thereby captures the dialectical law of the transition of quantity into quality (Marx and Engels 1975). We retain that whereas the two manifestations of the unity/identity of learning and development are different and must not be confused, they are indeed manifestations of the unity/identity of person and environment that allows us to theorize them together.

In the preceding sections we not only emphasize the role of context but also show how the emerging functions that subsequently will be observed as constituting

a new stage of development first *were* social relations, relations that researchers often gloss as having constituted zones of proximal development. Yet, all too often, the zone of proximal development is conceived as external context, as something that the participants need to construct and in which only the less capable changes. Even well-read Vygotskian scholars tend to use a discourse that assumes the primacy of the individuals' intentions and constructions as constituting the felicitous zones of proximal developments. These same scholars tend to attribute the source of development not to the relations but to "the mediators" that learners are said to appropriate. Thus, instances of {teaching | learning} where development occurs are characterized as "lucky and infrequent event[s] where the *intentions, initiatives of the child and the adult overlap and materialize in some sign, symbol, or a tool"* (Zuckerman 2014: 182). However, and as we elaborate in detail in Chap. 11, in the Marxist reading of Spinoza, this way of phrasing and theorizing is problematic because it falls back into the characterization of the social as the result of the joining of individual forces. Instead, we need to seriously consider the primacy of the social and produce theoretical and empirical descriptions that are consistent with it.

The monist view on learning and development elaborated here requires that we do not consider the zone of proximal development as a means to account for how individuals learn *in* or *from* the fact of engaging in relations with more capable others. Indeed, in a zone of proximal development what develops is not just one person, but *life* develops, resulting in the unfolding of both cultural and personal possibilities. In the classroom, other students and teachers are part of a particular student's environment; and the student is part of the environment of others. A corresponding minimal unit of life exists in the {person | environment}. The zone of proximal development is "simultaneously that life space in which and how we all live, i.e. society-in-history" (Newman and Holzman 1993: 81). The zone of proximal development, therefore, denotes a principled account of distinctively human activity rather than a special kind of educational technique. In the preceding sections, we observe changes in the {person | environment} when persons work on their own, with peers, or in relation with the clinical interviewer. The replies and individual contributions are produced, as pointed out, in joint *work*, or, to use a term that Vygotsky takes up from Marx and Engels (1962) in joint *labor*. Here, "the production of ideas, representations, and consciousness initially is immediately interwoven with material activity and the material intercourse of men" (Marx and Engels 1978: 26). Humans do not just do work: while doing work, they change. This change is related to what they change, which is the natural and the social world: "what [individuals] are thus coincides with their production, as much with *what* they produce as with *how* they produce" (1978: 21). Throughout this book we repeatedly cite this quotation as a means to anchor our arguments to the Spinozist as well as Marxist dictum of the primacy of (social) life and its manifestations. That is, operating on a balance beam not only gets something done but also, and simultaneously, changes the person; acting upon another person during communication not only makes available content but also changes the actor (see also Chap. 3). We therefore observe a *social* event that also is labor. Laboring always occurs at the level of participants' current capacities. Shown in the example of Aslam, some new behavior

first is observed *as* a social relation and then the student exhibits the whole behavior on his own. What *was* a social (transactional) behavior now is an individual one, though no less social.

What develops is not an individual's competence or skill but a possibility of engaging in and further developing a given way of doing things. In the aptitude field that is developing in the cases analyzed above, there are developments over time; and different persons may be developing differently yet exhibiting competence in the same class of tasks. We observe, for example, in the case of Aslam that once he responds to the task drawing on proportions, he always uses it afterward. In the case of Don, he begins using a multiplicative approach in the course of the design-based curricular unit on simple machines; and afterwards it is observed consistently across task contexts. That is, out of the continuously changing task- or curriculum-related "labor," which inherently occurs at the present level of development, *emerges* a consistent new behavior, the onset of which is unpredictable across tasks and persons. Vygotsky refers to the revolutionary changes—those that bring about qualitatively different forms of consciousness—as *crises*[15]. Our observation of the unpredictable nature of the emergence of new, *qualitatively* different behavior is consistent with the observation that "the boundaries that separate the beginning and end of the crisis … are not at all definite. The crisis arises *imperceptibly*—it is difficult to determine its onset and termination" (Vygotsky 1998: 191). That is, as accounted for in the catastrophe theoretic model presented in Chap. 2, transitions emerge from variations in the units that tend to be too small to capture. Accordingly, developmental changes cannot be the result of the overlap or sum of individual intentions (intentions themselves being subject to a sociogenetic investigation, as shown in Chap. 8). Precisely because development is not a process that concerns the individual but the irreducible {person | environment} unit, personal growth is always in excess of current knowledge and intentions. In Chap. 13 we elaborate on the huge implications this has for educational practice and for transforming how we conceptualize learners.

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[15] These crises are the elementary catastrophes in Chap. 2.

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Part II
Case Studies

> One of the basic principles of our will is the principle of division of functions among people, the division into two of what is now merged into one, the experimental unfolding of a higher [psychological (psixičeskogo)] process into the drama that occurs among people. (Vygotsky 1997b: 106)

Vygotsky's project to construct a new psychology was grounded in the dictum that human nature was not to be found as "an abstraction inherent in the single individual" (Marx and Engels 1978: 6) but as the real "ensemble of social relations" (Vygotsky 1998: 570). Thus, paraphrasing Marx, Vygotsky describes the "[psychological (psixičeskaja)] nature of man" as "an aggregate of social relations transferred within and becoming functions of the personality" (Vygotsky 1998: 170). The empirical study of those functions could not be pursued by means of a method that relied on abstract categories because the latter takes "the movement of categories for the real act of production … whose result is the world" (Marx and Engels 1983: 36). It could not rely on introspective or behavioristic (reflexological) methods because these represented one-sided versions of the dichotomy that are at the origin of psychology's crisis (Vygotsky 1997a). Most important, the method should be such as to capture not functions as final products but to describe an "experimental unfolding process" in the way the opening quotation articulates. To capture the real act of production that led to the emergence of those functions, the new psychology was to "proceed from the basic assumption that intellectual production is determined by the form of material production" (Vygotsky 1994: 177). A *genetic* cultural psychology was to be conceived.

Marx, who developed the dialectical materialist basis upon which Vygotsky was to build this project, was concerned with movement, the real processes of production and consumption as they are relevant to an ever developing political economy. In his *Introduction to the Critique of Political Economy* (Marx and Engels 1983), Marx goes on to demonstrate how, when such processes are approached as attributes or achievements of individuals, the resulting picture is one in which "production appears as the starting point; consumption as the ending point; and distribution and exchange as the middle" (1983: 24). In this picture, "society assumes the part of go-between of production and consumption," becoming thus a feature external to

the whole process, just as each of the phases named above appears as external to each other. The individual, however, cannot be the starting point, as if it were the product of some abstract nature. Instead, the individual needs to be approached as a result of history. When the point of view is not the individual but society as a whole, which exists in and as history, production comes to be seen as a unit encompassing all other moments (i.e., production, consumption, distribution, exchange) in transaction, which is how elements relate in "every organic whole" (1983: 34). The connection is thereby not given by external analysis, but is indeed internal to the system, which generates all that can be distinguished within it. Accordingly, the method of study of any subject coincides with its method of production as a concrete reality.

In the first part of this book, we focus on developing the theoretical aspects associated with Vygotsky's turn to Spinoza. But there are also consequences pertaining to the method of study. Whereas much of Vygotsky's earlier work was laboratory based, he later recognized that the main problem of traditional psychology was its tendency to divorce thinking "from the full vitality of life, from the motives, interests and inclinations of the thinking individual" (Vygotsky 1987: 50). In his earlier studies, readers will not find accounts of the possible effects that studying thinking in the laboratory has on experimental results. However, taking the consequences of his complaints necessarily would have led to studying human behavior and thinking "in the wild," that is, while persons participate in the everyday activities that constitute their lives.

The Turn to Spinoza Necessitates a Change of Method

Vygotsky pursued the goal of establishing an integrated psychological science that would overcome the division between the two existing forms of practicing psychological research, that is, scientific and interpretive psychology. The new psychology would be a dialectical science based on the principles Marx articulated for political economy. However, Vygotsky does not blindly apply Marxist principles to psychology. In his pursuit to create psychology's own *Das Kapital* (Vygotsky 1997a), he begins with a critical analysis of the history of psychology and its methods, only to conclude that all experimental methods used during his time "are constructed … according to one scheme: stimulus-response" (Vygotsky 1997b: 28). With this scheme, Vygotsky complains, only elementary processes can be investigated, the method being incapable to distinguish "the qualitative difference between the history of man and the history of animals" (1997b: 38). To find a method adequate for the study of the higher (cultural) functions that are unique to humans, Vygotsky chooses to begin analyzing those "rudimentary [psychological (psixičeskimi)] functions" that "are documents on development, living witnesses of ancient epochs" (1997b: 41). These functions, which were primary in the past but have now receded onto a secondary plane, "supply a point of support for a historical approach to higher [psychological (psixičeskim)] functions and for connecting the psychology of primitive man with the higher psychology of man" (1997b: 42).

It is in this context that Vygotsky turns his attention to those *instrumental acts* in which cognitive actions (e.g., decisions, memory) are resolved by means of *auxiliary stimuli.* Thus, for example, a person who finds herself struggling to make a decision may resort to throwing bones or dices. Vygotsky contrasts human decision making with animal behavior: the animal is stuck in the face of contradictions.[1] In such a situation, the human is not bound to and by the situation in the same way the animal is but introduces a secondary stimulus that can be used to control her behavior from without. In this way, a "new and completely unique relation between stimuli and responses" (Vygotsky 1997b: 47) emerges. This relation is taken as the proper subject and method of research, and referred to it as a process of *signification.* Humans create and use artificial signals, unlike animals, which nevertheless share with humans the basic and most general principle of signalization (conditioned reflexes) and are thereby capable of adapting to their environment. Thus,

> if the basic and most general activity of the cerebral hemispheres in animals and in man is signalization, then the basic and most general activity of man that differentiates man from animals in the first place, from the aspect of psychology, is *signification*, that is, creation and use of signs. (Vygotsky 1997b: 55)

Much of the empirical research that Vygotsky and his associates conducted consisted in the experimental reproduction of *the emergence* of such processes of signification, that is, of the emergence of the creation and use of artificial signs. That reproduction was achieved by means of the method of *double stimulation* in which "the child under examination [is given] not only the fundamental series of stimuli which copes with the problem set to him, but also a second series which plays a functionally different part and which serves him as an instrument in solving this problem" (Luria 1994: 48). The method thus allows observing the process by means of which the initially neutral stimulus becomes significant to the child's activity. Using this method, Vygotsky and his colleagues investigated and provided important insights to the development of complex functions such as memory, attention, and concept formation across age.

Vygotsky's early studies, however, did come with a number of limitations. Being run in carefully designed laboratory situations, they hardly could be seen as instances of the real "drama that occurs among people" that appears in the opening quotation. Perhaps more problematic is the fact that the empirical approach exhibited an instrumentalist bias that presented an intellectualized picture of human thinking and doing. Vygotsky would recognize this limitation later in his career, were he complained having focused "on the sign (on the tool) to the detriment of the operation with it, representing it as something simple" (Vygotsky, in Zavershneva 2010: 41). This realization was particularly salient when considering the role of language, where "the relatively simple scheme of an instrumental act such as 'stimulus – sign-mediator – reaction' was apparently not sufficient to explain the special status of the word and language in the development of consciousness" (Zavershneva 2014: 70).

[1] Vygotsky draws on the example already employed by Spinoza, Buridan's ass. This ass is confronted with the problem of being hungry and finding itself at equal distance from two sources of food. The ass will starve unable to decide whether to go to one or the other food source.

The problem is one of theory and method. During the last years of his life, Vygotsky shifted towards a more holistic, less intellectualized theory, moving away from the focus on instrumental activity and its associated analogy of mind as a technical device. He turned to a conception of *word meaning* as the living cell that retained the fundamental features of human consciousness first, and to the idea of the semantic structure of consciousness later (Zavershneva 2014).[2] To study "word meaning" required taking into account the full vitality of life:

> Among the most basic defects of traditional approaches to the study of psychology has been the isolation of the intellectual from the volitional and affective aspects of consciousness. … Thinking was divorced from the full vitality of life, from the motives, interests, and inclinations of the thinking individual. (Vygotsky 1987: 50)

Although this quotation derives from the introductory chapter,[3] the remainder of *Thinking and Speech* generally focuses on results gained from laboratory studies of thinking. Vygotsky himself therefore did not study the thinking individual in "the full vitality of life." He did not take into account the "motives, interests, and inclinations of the thinking individual."[4] But he realized that "[b]y isolating thinking from affect at the outset, we effectively cut ourselves off from any potential for a causal explanation of thinking" (Vygotsky 1987: 50). To escape his own critique, Vygotsky would have been forced to take into account the fact that his studies were conducted in a laboratory, which would have required studying the effects of participating in a psychological study has on the forms of thinking identified.[5] He would have been led to study psychological processes in the everyday world. Thus, for example, rather than studying reading in the laboratory, where the performance inherently is *for* the psychologist, he might have initiated studies of reading in the everyday

[2] The excessive focus on word meaning fits the metaphysical underpinnings of the theories of learning and development in classical, Western psychological paradigms. Vygotsky himself increasingly turned to sense, because "the child is oriented towards sense virtually from the very first days of her life; her first questions are about sense rather than the meaning of her surroundings" (Zavershneva 2010: 44).

[3] Together with the seventh and closing chapter, the first was written after all the others were completed.

[4] In the German edition of Marx and Engels (1978), which is based on the edition originally published in the Soviet Union (1932 in German, 1933 in Russian), the foreword uses this phrase as part of explicating how the work serves as a foundation for psychology:

> Marx and Engels explicate the nature and role of thinking, the intellectual needs, interests, inclination and feelings of man, they show that in the decisive causes for their change and development are founded on the material life of society, and thereby lay a foundation for the Marxist, dialectical-materialist psychology. (Institute for Marxism-Leninism of the Central Committee of the Communist Part of the Soviet Union, in Marx and Engels 1978: x)

We do not know whether this statement was made in view of Vygotsky's work (unlikely, according to A. Yasnitsky, personal communication, April 1, 2016), or whether this part of the text already existed in the first edition so that Vygotsky would have read it. The coincidence is striking.

[5] He might have been interested in the "place-based" approaches that are of increasing interest especially to science and environmental educators (e.g. van Eijck and Roth 2010).

world of a family, where one or the other parent reads with a child (or several children). This is precisely the methodical move we enact in this second part of the book, where we investigate a number of phenomena of interest to educational psychologists; but instead of remaining in the laboratory, we move into the everyday world where such phenomena normally occur.

Studies of Thinking in the Full Vitality of Life

> A deterministic analysis of [psychological (psixičeskoj)] life cannot begin by ascribing to thought a magical power to determine human behavior, a power to determine behavior through one of the individual's own inner systems. (Vygotsky 1987: 50)

Marx and Engels (1983) suggest that the object of study should be the real movement of life, which has to be captured by means of categories; and they exhort us not to mistake the movement of *ideal* categories for the movement of *real* life. Vygotsky, too, is interested in movement. But in his case, the movement is one of (ontological) development. In the way "the idea of development" runs through "all of [the] investigations" reported in *Thinking and Speech* (Vygotsky 1987: 51), all of the investigations presented below have development as their common thread. In contrast to Vygotsky's experimental approach the studies in this book are conducted "in the wild," that is, in everyday social life (rather than in the special social life of the psychological laboratory). Covering a variety of settings and ages, the events analyzed here present the everyday "drama that occurs among people" in real, everyday situations that are relevant to educational research and practice. Our approach in each case consists of a naturalistic inquiry employing the *sociogenetic method* (see Chap. 5) to study the emergence of some phenomenon of psychological interest.

We begin this part II of the book with an examination of the *practice* of reading, which we study in the context of child–parent relations and in professional scientific research (Chap. 7). Conceiving of reading as a practice that has social, cultural, and historical dimensions, we exhibit the sociogenesis of reading by means of an *anthropology of reading*. Here, reading is shown to be an inspectable and learnable concrete cultural practice, one which novices have access to precisely because its visibility and joint production in a public arena. Though the distinction between higher and lower functions had been important in Vygotsky's earlier developments, during his later works he shifted to focus on *interfunctional relationships* that involve consciousness as a whole (Vygotsky 1997a). Through our analyses, we demonstrate how operational functions constitutive of the practice of reading—such as the coordination of attention and the articulation of sounds—first develop as transactional features of the sequential organization of turns in reading events.

A concern present throughout most of Vygotsky's career was the problem of freedom, the capacity of the individual to have and master his own intentions. In his early studies, Vygotsky identified the creation of artificial signs as the basic structure of this capacity. Near the end of his life, he realized that his work has had a strong intellectual bias (i.e. rational operation and reflection) and social drama and

emotions were relegated to a secondary plane. Vygotsky spent the last years of his life trying to overcome this bias (Zavershneva 2016), searching for an adequate unit of analysis where intellect and affect would be truly united. He found that unit in *perežívanie* (experience), a category that captures the unity/identity [*edinstvo*] of personal and environmental characteristics, and which irreducibly comprises practical, affective, and intellectual dimensions (Roth and Jornet 2016). A category such as *perežívanie* can be useful for rethinking the sociogenesis of intention. In Chap. 8 we discuss such an effort in an empirical examination of how fourth-grade students engage in an inquiry-based curriculum designed to develop basic notions in algebra. We show how such a rethinking not only provides a way out of the classic *learning paradox*—the question of how can learners orient towards that which they have not yet learned—but also bears implications relevant to contemporary research on motivation in educational psychology.

Concept development was one of the areas that most centrally occupied Vygotsky's empirical research. In the contemporary educational psychology literature, this topic is investigated in the field of conceptual change research, where a deficit model still has currency that opposes the misconceptions of students and the correct understandings of teachers (experts). In most cases, and even when the deficit model is rejected, concepts are seen as things that people have in their minds and which underlie observable behavior/expression. In contrast to the dominant mentalistic approach, and in line with a Vygotskian framework, we exhibit in Chap. 9 conceptions as an inherently cultural phenomenon. We examine the historical origin of the mentalistic treatment and attribute it to a dualistic (Saussurian) view of the sign, where a part material, part immaterial signifier (word) is seen as standing for some immaterial content ("meaning"). Against this position, we note that the language researchers draw on to infer the existence of underlying concepts first exists in society-specific situations that are cultural through and through. To illustrate and empirically examine this point, we analyze a mystery transcript and show how a conversation concerning astronomy becomes intelligible to an anonymous analyst not because the participants are expressing in words what otherwise exists in their heads as concepts, but because they share a cultural and historical language that they also have in common with the analyst. That language—in the form of speech sounds and writing—is an integral aspect of the material world so that finding one's way in and with language is indistinguishable from finding one's way around the world. In line with Vygotsky's turn towards a holistic view of the unity of culture, intellect, and affect, we discuss how conceptual language develops in the *sense-giving fields* that emerge in concrete social transactions.

Related to the early Vygotsky's intellectual bias was his focus on the sign as an instrumental device that *mediates* between nature and culture, an idea that "gradually shifted to the background of the theory and was virtually replaced by other notions" (Zavershneva 2014: 74). An important instant in the constitution of a new concrete human psychology that overcomes this bias thus passes through a theoretical and empirical study of the natural history of the sign. Sign-use always is a social and situated event that cannot be reduced to "one of the individual's own inner systems," as Vygotsky suggests in the introductory quotation of this section. We

conduct such a study in Chap. 10, where we analyze the emergence of sign relations in two contexts: school mathematics and adults (scientists) reading graphs. Contrary to the extended view in current educational psychology, where the sign is seen as something that becomes constituted in the inner sphere of the mental (intellect), we analyze the emergence of signs as a situated, social, and bodily practice that requires transactional work in each of its stages. Our analyses thus exhibit the *natural history* of the sign, one that no longer dichotomizes between nature (biology) and nurture (culture), and where signs are seen as constituted by the unity/identity of the individual and the social.

The afore-mentioned unity/identity of individuals and their world does not require mediators to bridge the gap between each other or between them and the world. As shown in Chap. 4, intersubjectivity is not an outcome but exists as an irreducible and integral whole in the social relation. An important implication of this is that the ways educational psychologists have for speaking about the role of teaching in the development of their students becomes problematic. In Chap. 11 we address this problem and present a sociogenetic analysis of the zone of the proximal development as it emerges in the context of a computer-supported task in physics. We describe instructional situations by means of the {teaching | learning} dialectic, where we use {teaching | learning} to translate the Russian expression *obučenie*. As part of this dialectic unit, there is not an asymmetrical relation in which learners learn and adults or more competent others teach. Instead, there is a symmetrical relation in which all participants have opportunities to learn and develop. This is so because there is a coincidence between the change of the historical and material conditions of human activity and the conditions in which further experiences are had—consistent with Marxist theory and with the pragmatist principle of continuity of experience.

Together, the case studies presented in Part II provide instances of the kind of analytical practices and insights that result from thoroughly rejecting Cartesian dualism and seriously pursuing the primacy of the social in the way that a Marxist reading of the ***Ethics*** (Spinoza 1883) allows. In each instance, a concrete practice and not an abstract category is examined as it endogenously generates itself and everything that can be recognized to be part of it, including the persons staffing the irreducibly social phenomenon. The sociogenetic method thus coincides with the concrete phenomena of interest and the investigation does not foist upon them external factors. There is therefore no one single method but a multitude of forms or modes of being that need to be approached rigorously, paying due respect to the dynamics that makes them intelligible. The cases presented here, all relevant to educational psychology, are by no means exhaustive. A lot more remains to be investigated following a late Vygotskian approach. However, the cases do constitute a good starting point in that they exemplify how the actual production of life can be investigated in a way that informs and potentially transforms educational research and practice.

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Chapter 7
The Social Nature of Reading

> Writing had reconstituted the original oral, spoken word in visual space. Print embedded the word in space more definitively. This can be seen in … the use of abstract typographic space to interact geometrically with printed words. (Ong 1982: 123)

Many, though by far not all people in industrialized societies read. Reading tends to be treated as an individual skill to such an extent that the adjectives social or cultural do not appear in an entry on the matter of reading in an encyclopedia of cognitive science (Garrod and Daneman 2003). Here we take a different stance by following investigations in other fields that consider reading as a cultural and historical practice through and through. Reading is acquired and perpetuated in culturally and historically specific relations with others; alternatively, when someone comes to read we may say that reading acquires another individual.[1] As practice, *reading* is work and consists of practical actions. As such, reading is observable and naturally analyzable; and, in analyzing reading, we therefore find out not only about reading but also about how culture works: It is possible to study reading *anthropologically* (Livingston 1995). This then allows us to make reading the topic of study without having to look for it in the individual mind (brain). The challenge for the educational psychologist will be to find situations where aspects of reading emerge for a first time in the life of a child, that is, to find situations where reading reproduces itself. These will have been, suggests Vygotsky (1989), real social (societal) relations with others. To repeat what we say elsewhere in this book: He does not say that the higher function (here reading) first occurs *in* a social relation. It always does so. But this is only a trivial aspect of the social. Instead, reading first exists *as* a social relation. The fact that neither feral children nor untutored individuals read testifies to the fundamental role that the social plays in the genesis of reading. A child always and already finds itself in a world where reading occurs and is a fact of

[1] This turn of expression is equivalent to that of saying that L[earning] D[isability] acquires a new child (Varenne and McDermott 1998) or to saying that the discourses we use "use us as much as we use them" (Bourdieu 2000: 182).

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life. Understanding the social, indeed *instructional* situation in which reading emerges is the way to understand reading as individual practice.

On most occasions, competent reading unfolds without problems. While reading the news online or in the printed newspaper we seamlessly move our sight across the texts and images, often without having to stop and think about it. Arriving at the BBC world news site, for example, we may notice an image of children in ballet outfit apparently in a gym, below which there are the words "Education & Family" (red type), and below which there is the phrase "Warning on unqualified ballet teachers" (black type). The page provides reading with resources to organize itself. Thus, that "Education & Family" names a class is apparent from the fact that neighboring terms in the same colors including "Business," "UK Politics," "Health," and others. Above each red text there is a photo; and below each red text there is text in black. The content of the black text can be related to the image. On the website, therefore, there are material consistencies that reading can find and follow. Reading can find that the red-font texts are class names, because in every instance, the black text appearing beneath it is a special case of what the red text names. For another example of organization consider the lack of quotation marks. In the following, reading finds what has been said and who has said it when coming across the phrase: I'll vote to leave the EU, says Fox. Specialists see in this an instance of an otherwise rare use (in English) of quasi-direct speech, where narrative elements from direct speech are inserted without quotation.

Competent reading denotes the fact that we are doing the work that the text describes (Livingston 1995). In the BBC world news site example given above, competent reading follows the material resources that the text offers; it is neither the eye nor the text but the relation that binds eye and text into a given praxis that emerges as the work of reading. This work is cultural and historical through and through. It is public, as evidenced by the fact that while observing others doing this work, we are able to judge the level of competence the individual has achieved. When children engage with books at early ages, they are somewhere along the way to becoming competent readers. By the time they read their first texts for comprehension, they have been part of many social relations (generally with parents) that are the first instances of reading.[2] It is especially in troublesome situations—when reading does not unfold seamlessly but requires repair—that the *work* of reading is exhibited, whatever the age. It is in such situations that *instruction* may take place and, indistinguishable from it, the social relation that will have been the genetic origin of reading. In this chapter, we provide analyses of reading relations involving (a) children at the age of 1+ and 3 and (b) mature scientists wondering how to read a particular screen display that they are looking at during data collection. In all situations, we observe the same kind of process: reading as a relation with others and, therefore, as a social event through and through. Reading, thereby, is just like writing, which is social even when an individual writes for herself into a personal diary (Vygotsky 1989).

[2] This is particularly the case in middle- and upper-class families but not so much in working- and underclass families.

In this chapter the sociogenesis of reading is exhibited. This takes us to the social nature of the work of reading (even when, after having been in many social relations of reading, we read for ourselves). As the opening quotation describes, written text is but a visual arrangement of a practice that first and foremost is social, the original oral, spoken word. It is therefore quite appropriate to study reading anthropologically, that is, as a cultural phenomenon that belongs not to a private individual mind but to human history.[3] We here pursue an anthropological project of reading because its feasibility "lies in restoring to reading its concreteness as a real activity—the inspectable, cultural practices of a community" (Livingston 1995: 5). This is consistent with Vygotsky who, to study inner speech, did not attempt to look into the brain but instead chose egocentric speech—"a process … accessible to *direct observation* and experimentation" (Vygotsky 1987: 258, emphasis added)—as the method of study. More generally, our approach is consistent with the larger project of a evolving a *concrete* human psychology capable of explaining how we learn to read without having to construct it in the private, solipsistic minds that constructivist approaches attribute to us.

In the following, we consider reading situations very early in the life of children at a time when they are not yet accessing formal educational settings. In both instances considered, the children (1+, 3+ years) sit in their mothers' laps; the pairs are doing reading together.[4] Some of the fundamental aspects of the practice of reading are encountered here. The work of reading is made visible especially when there is trouble of some kind. The trouble is resolved by means of joint work. It is through this joint work that changes in praxis and in persons can occur, and it is this joint work that we focus on in our anthropological approach. Importantly, these relational (instructional) forms of practice are not specific to children. Instead, as subsequently shown, it is also possible to observe these aspects in the exchanges among the most highly trained individuals: research scientists. These occasions, again, include trouble. It is precisely when there is trouble that the work that goes into a practice such as reading, work that normally remains invisible, is made (becomes) visible again.

From the Origins of Reading

Texts on educational psychology tend to present reading as some skill located in the individual (brain), so that if there are problems—e.g. "reading disabilities"—the reasons are attributed to mental or individual processes. These might include deficits in visual processing (now discredited), phonemic processing, or issues with the

[3] Similarly, it is also possible to study *graphing* anthropologically (Roth 2003).

[4] We insist on the formulation "doing reading," the reasons for which are apparent later in this chapter. This may actually be the gloss that the parents provide when showing the video to a member of the extended family: "Here I am reading with «the child»," where reading is a witnessed and witnessable doing.

automatization of reading skills (e.g. Sternberg and Williams 2010). In the monist approach developed in this book, it is not the individual that we consider but the {person | environment} unit. With respect to reading, therefore, we are not dealing with structures inside the skull that function independently of the environment—even if it is true that brain structures and functions are relevant to enable people engage in reading praxis. Instead, each time we observe reading, there is also a material *text*, a term that we here use to refer to whatever people read, including not just words, but also images, graphs, sheet music, or film.[5] Reading then always appears in conjunction with a material text so that our phenomenon is a {reading | text} pair (Livingston 1995). Between the two parts of the irreducible pair there is a mutually constitutive relation. On the one hand, the nature of the text depends on the reading; it is what reading identifies as readable. On the other hand, reading itself is shaped by whatever material traces there are that give themselves as things to the reading eyes that follow them. Accordingly, we cannot begin with reader on one side, and text on the other. Instead, we need to start from the material practice of reading itself. The text, whatever kind of text, once read, then is a description (account) of the work of reading.

Reading is a phenomenon that has cultural and historical aspects. It is social through and through. We learn to read in relations with others. It is one of those functions that in all cases were social relations before they became functions attributable to individuals. If reading is a cultural practice that forms and transforms in social relations, then there will be certain kinds of work required for reading proper to begin. For example, to read something at all requires the joint attention to the thing read. A child would not be able to read the letter "A" unless there existed the joint attention with another so that a relation between the ink trace in the form of "A" came to be related to the specific sound /eɪ/ (as in "*a*"), /æ/ (as in "m*a*n"), /ə/ (as in "comm*a*"), /ɔ:/ (as in "w*a*rm"), or /ɑ/ (as in "f*a*ther").[6] That reading is cultural can be seen from this great variation in sounds for the same vowel in English, which contrasts the constancy of pronunciation of the same letter in German or French.[7]

Joint attention to get the work of reading requires—but not in all instances—a particular orientation to the medium so that the textual (read*able*) structures may reveal themselves for the reader. Reading footprints of game on the part of an aboriginal hunter, for example, does not require the same kind of orientation between the reader and the "text" as reading a book requires. Similarly, poets have not always stuck to the ways in which poems tend to be presented, having gone beyond established cultural ways of ordering. Instead, a poem may be presented in an image resembling words on concrete blocks (Fernbach-Flarsheim 1967a) or may

[5] Scholars concerned with discourse even treat architectural landscapes and (Victorian) gardens as texts that can be read and interpreted. In detective novels, sleuths are reading the environment for clues; and aboriginal hunters read animal tracks.

[6] The conventions of the International Phonetics Association are used to represent the sounds.

[7] This may make it more difficult for English speakers than for German and French speakers to move from the written to the sounded word. In German, once the letters are known, reading may proceed and develop by means of sounding out the letters found.

consist of letters splattered all over a page, oriented apparently at random and with different densities (Fernbach-Flarsheim 1967b). Such poetry "presents exquisitely complicated or exquisitely uncomplicated visual displays of letters and/or words some of which can be viewed but not read aloud at all" (Ong 1982: 129). In each case, the text demands an orientation that reading needs to work out in situ for it to take place. In the following examples from the very early reading sessions of a boy who does not yet speak—i.e. make sounds that constitute recognizable words—we observe the work related to those fundamental requirements for the work of reading, and which indeed constitute its earliest part. These aspects of reading, as any other social practice, here exist *as* social relation.

When Fragment 7.1 begins, we are already more than 20 s into the video. The boy (Bo) sits in the mother's (M) lap gazing at the book in the Bo's hands without speaking.[8] Bo then turns the book by 180°. It had been in—as per Western culture—the wrong orientation, though the fold itself was correctly aligned with his body (turn 08). Over the next three turns (see shaded part in the transcription), Bo gazes at the book while his mother provides a description of what can be seen, "right now you look at upside down" (turn 09). There is a pause, the mother notes, "okay," while turning the gaze toward the camera and its operator, then states: "upside down" (turn 11). In the speaking pause that follows, Bo turns the book by 180° and into its right-side-up orientation. Here, it is precisely when competent reading identifies trouble that part of the normally invisible work of reading is made visible: orienting the text.

Fragment 7.1a

08 B: (1.31) ((*Boy turns book upside down*))
09 M: right now you look at upside d*o*wn?
(1.03)
.hh okay.
10 (1.54)
11 *u*pside ↓d*o*wn.
12 (4.66) ((*Boy turns book 180 degrees*))



On the surface, we do not observe a difference in the orientation and apparent intensity of Bo's engagement with the surface of the book spread in either orientation. We do note, however, that following the mother's description of the current state of affairs, Bo turns the book right side up. That is, the description also functions as an (accepted) invitation (instruction) to return the book into the state so that whatever offers itself up for reading can become the material for a

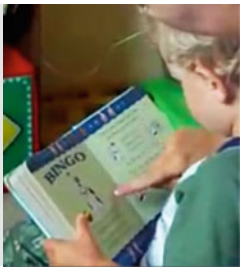
[8] Transcription conventions are available in the Appendix.

{text | reading} pair. Indeed, the two descriptions initially function as evaluations: something currently is wrong. Reading can and does continue once the prerequisites for reading have been established. Here, then, turning the book so that reading proper can begin already requires the identification of the text orientation. It has been noted that the work of reading exists in "finding the organization of that work that the text describes" (Livingston 1995: 14). Thus, the text already provides the reader with clues for orienting it so that reading may proceed. For Bo, who does not yet read, those clues need to be made visible in and through concrete praxis. The joint work of orientation here exists *as* a mother-boy relation. In the description of the state of affairs that the pair is producing, Bo finds what his own actions have produced in and for reading. Even though there are no descriptive rules articulated for recognizing the correct orientation beyond the assertion "upside down," Bo surely will come to identify correct orientations over time. This is not unlike learning to queue, which we learn by participating in the work of queuing, occasionally corrected when our behaviors are "out of line." Queues, as texts, do come to be recognized as straight or as not straight by virtue of our encountering them rather than by reference to an abstract rule. We also learn to form grammatically correct sentences without first learning grammar.

Reading together presupposes *joint* attention to cultural objects (letters, words, and images). Those objects are cultural precisely because of the work that marks them as such, which here involves the specific spatial orientation with respect to the reader. Mother and Bo have just established proper orientation, when, after articulating what we hear as a question, "is that doggy bone?," she points to and rhythmically taps five times the image of a doggy bone.

Fragment 7.1b

15 M: is that doggy bONe?
16 (1.36) ((*Mother taps rhythmically five times on picture*))
17 ees there doggy bone?
18 (1.87) ((*Bo moves head back and forth, then to the right*))
19 whatcha looking at.



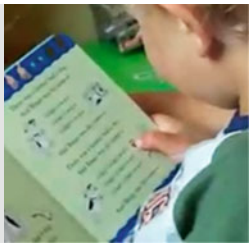
In the finger tapping on the image, we find an orientation to an object, which goes with the sound /'dɔgi boʊn/ (doggy bone). Following the speaking pause, there is another offer for producing a {query | reply}; but a pause unfolds (turn 18). Bo is moving his head back and forth, as if directing the gaze from the left to the right page and back again. In response to the unfolding situation, we witness the offer of a query that seeks to find out what Bo is looking at (turn 19). In turn 15, we observe the offer of an orientation to a particular feature of the page: the drawing of a doggy bone. There is the action of tapping the part of the page where the drawing can be found; and there is naming. Whatever offers itself to Bo's percep-

tion also offers itself to be associated with the sound /'dɔgi boʊn/. Bo's visible changes of gaze are articulated and problematized in turn 19. Whereas the mother offers a location of attention, we do not see it being taken up, as Bo's gaze moves rather than looking steadily in the direction where Mother's index finger points. That Bo does not gaze in the offered direction is not just observable but made salient by the mother, who produces several actions that address this situation, including a query concerning what the boy is looking at (turn 19). That is, the *joint* reading of an area of the page associated with /'dɔgi boʊn/ is uncertain because the work of jointly orienting has not yet been completed and evidenced. Only seconds later, there is then a counter-offer for an object of joint attention that this time is initiated by the child and that is not unlike the one we find in turn 15 and 17. What follows may be glossed as the work of finding what is to become the joint object of attention.

The fragment begins with a sequence of sounds. Bo's right hand, which apparently holds the book, also places the thumb on the drawing of the dog with a ball on its head. A description of the object of attention is offered, "a ball on his head." That is, the phrase here treats the thumb as pointing to the ball on the dog's head *as* the focal point for joint attention. But even before Mother finishes, Bo produces another sound, which may be heard as "queen" but starting with a "g" (turn 28). This offer comes to be paired with a similar sound that the mother produces, as if it were to be a confirmation or acceptance of whatever was presented. We then hear a sound that apparently repeats the earlier one, only that the pronunciation of the opening consonant has become harder: /kju/ (q).

Fragment 7.1c

25 B: oong gue da dis (0.45) a BOO::
26 (0.15)
27 M: a ball on his [head?
28 B: [ea:]guee::EEn
29 (0.44)
30 M: u*eee*a.
31 (0.36)
32 B: quee:::::::aaaeen,
33 (0.18)
34 M: oueeea
35 B: a guee
36 M: aao green [okay. you tELling me the cOLors hu.
((*Bo moves thumb away from image*))



As the transcription shows (grey highlight), Bo's thumb is not moving over the course of the 12 turns. There is another reply on Mother's part, and another offer that Bo provides (turn 35). We hear the mother articulate an interjection of surprise—a blending version of /ɑ/ (ah) and /oʊ/ (oh)—and then the word "green." There is an interjection of assent, and then a statement describing what the boy has

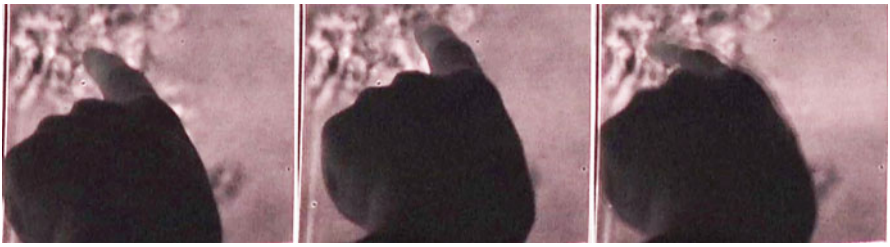


Fig. 7.1 "See there's some cones back in there" (movement during the grey-shaded speech)

done: telling colors (turn 36). As soon as Mother names the color green and *formulates* what Bo has done, the latter moves on to something else. That is, during the entire time between the offer and the repeating of sounds when the first identification ("ball") obviously was not confirmed, Bo held the thumb on the ball; but he moved it when the sound-word /gri:n/-green was produced. This sound-word had a great resemblance to the sounds Bo has made in the course of the event (i.e. /gwi:n/).

We observe here the joint work of identifying and finding the common object of attention. As the transcription shows, it takes a while until the joint nature of the object is confirmed. We notice that a first hearing of what Bo has "read" does not come to be accepted. It is not treated as accepted on the part of both. Bo does not repeat the "BOO," which may have been treated as "ball," but produces a different sound, that is, /gwi:n/. The mother makes similar sounds, as if confirming the preceding sound by means of repetition. But there are more offers, which are distinguished from the mother's sounds by the fact that they all begin with similar consonants /kw/ and /gw/, whereas the former only produces vowels. The sequence may be glossed as follows: there is an offer (on the part of Bo) to attend to the color green and to name it appropriately, which initially is not taken up (on the part of Mother). But as soon as it is indeed taken up, there is a change in Bo's bodily orientation (including the thumb). The work establishes the relation between a perceptual object—the green-colored part of a ball—and the sound-word /gri:n/-green describing this color. As shown below, this same process is at work when the text consists of written words rather than here, in the drawings. The fragment exemplifies that *joint orientation* requires work. It includes making visible the orienting and the object oriented to. The work also includes sounds, which constitute the *accounts* that something has been appropriately oriented to. This work is not merely observable in the teaching of little children, but happens every day without requiring specific noticing. For example, it occurs when someone apparently points into a direction to find something that can be seen ("See?") and our experience of failure when we do not see whatever it was that we were to see.

Searching and locating the object of joint attention is work that can be observed even among the most highly trained scientists in their daily work. Take the situation displayed in Fig. 7.1, where a research scientist—who has worked for 30 years with the retinal tissue extracted from fish eyes—points his fellow inquirers to something

to be looked for and to be seen. While saying that there are "cones"[9] to be seen somewhere in the back, his hand moves up from the desktop until the index finger touches the computer monitor on which the contents of a microscopic slide are displayed. The finger then moves around a small part of the monitor, thereby limiting where the point of joint orientation is to be located. The image at that point contains many features and structures. But the descriptive phrase "cones back in there" also constitutes an instruction what to look for (i.e. the cones that the recipients of the talk are familiar with) and where to look for them. Whether the joint attention is achieved requires actions on the part of the recipients. In this instance, they acknowledge to have seen whatever they were invited to see.

Both examples reveal that the identification of the locus of joint attention is not naturally given and therefore cannot be presupposed on the part of the analyst. The mother and her son exhibit the work required identifying just *where* reading can find the features that constitute a readable text. In their case, the question is whether it is the ball or the color. Whereas the offer of the ball as focus is not accepted, color is. This highlights the dialectic process of pointing, which, in analogy with reading, can be formulated as a pair: {pointing | object}. A body movement, often but not always involving a specific finger or the hand, is seen as pointing when something in the trajectory of the movement offers itself to be seen. In the reading situation, both ball and the color offer themselves to be seen. But the pointing thumb does not distinguish them; it is not enough in and of itself.[10] Instead, it comes to function as a resource within the overall structure of the work produced. The object is required to perceive the hand movement as doing part of pointing as well. The work of pointing therefore also requires doing the work of finding in the perceptual plenitude a situationally appropriate thing that gives itself to be seen as an indexed thing, that is, something that has a place in the unfolding relation between the participants. The work of pointing is successfully achieved only when something on the monitor reveals itself to the recipient scientists as something that may count as a cone (or several cones) that is (or are) in the back of other things. The work is completed when there is an acknowledgment or, alternatively, when there is no problematization (e.g. a recipient saying, "Where?"); that is, the work comes to an end when one (or all) of the participants can say, "Now I can do it … Now I can go on!" (Wittgenstein 1953/1997: 59).

The work of orienting described in this section is an integral part of reading. As joint work, reading is social in nature from its very beginnings. These beginnings, as shown here, may exist even before the child actually speaks. We clearly observe biological features, such as orienting the body and moving a part of the body into place that will be and is serving as the locus of joint attention. Biological processes, too, constitute the foundations of perception. The practice of reading thus is material because inherently tied to the material nature of the text to be read. Reading also is social because the tie between (a) whatever material trace there is to be read (ball,

[9] The retina of vertebrates includes rods and several kinds of cones.

[10] This phenomenon also is apparent in the episode from the science classroom described in Chap. 3.

color green, cone, or front and back in an image) and (b) some name, verbal index, or deictic gesture first exists as social relation. The boy points, the mother produces a sound-word, and the boy evaluates it; or, the mother points, the boy changes gaze directions, and the mother evaluates. The link between text and reading, therefore, does not exist in any of the actions taken independently. It comes to exist *as* social relation.

In this episode, Bo also is learning to speak. Here, too, biology is involved in the development of the capacity; but participating in a culture where people speak—i.e. participating in the social practices of communicating—is at the origin of developing those biological capacities that enable speech. Thus, we know that Japanese speakers have difficulties articulating the consonant /r/, which they tend to treat as the consonant /l/. As it turns out, they do hear /l/ instead of /r/. Biologically, there is no reason for the Japanese to lack a capacity for the pronouncing the /r/. Children of Japanese immigrants born in Canada (or any other English-speaking country) do distinguish the sounds perfectly well. Consistent with what we expose in Chap. 2, that biological capacity to hear and distinguish the /l/ and /r/ has been shaped by culture.

Reading Aloud

> Each night after dinner, he closed his dorm-room door, reached under his bed, and opened the box. Resting his head against the blanket his grandmother had made him, he pulled out the books: "First Grade, Level 1, Ages 6–7."
>
> Quietly, so none of his teammates would hear, he read aloud, moving his finger across the page. (Wolverton 2012)

In the introductory quotation, we come to know about a college student who has decided to address the fact that he was reading at a first-grade level. The second paragraph describes aspects of reading characteristic for early reading lessons: reading aloud and moving the finger across the page. Reading aloud is not something children spontaneously invent. Children come to find reading in the same way that they come to find speaking (and, thereby, language). Instead, they participate as recipients in reading aloud events, then they read aloud with someone else being recipient, and finally they read silently and for themselves. Reading aloud and moving the finger across the page—pointing to the words read in a sequential order from left to right to the end of the line—are two ways in which reading is organized. This organization is visible even if the reader is biologically more mature, as is the case in the quotation above. These forms of organization are prerequisites for reading to understand. As the finger moves from left to right, reading's work comes to be organized; and listening to the words provides feedback from the outside whether what has been read is indeed a familiar or possible word.

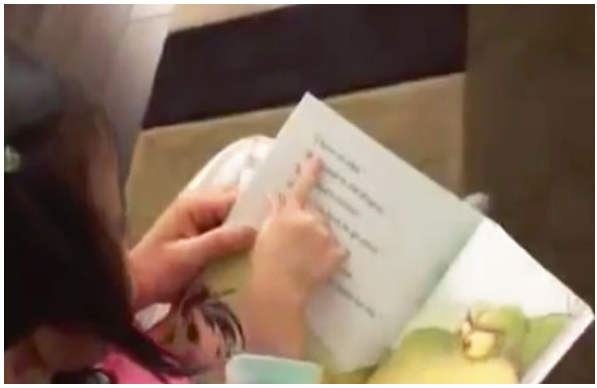


Fig. 7.2 A 3-year old child reads a story about a dragon. The text on the page reads:
"I have an idea,"
Holly said to the dragon.
"Let's have a contest.
If I win, you have to
go away."
"Okay," said the dragon.
"But if *I* win, then everyone
has to work in the berry
fields for me."
(Albee 1998)

Texts, even in our Greco-Roman tradition, are not always organized such that they can be read from top left to bottom right. The above-mentioned poems by Fernbach-Flarsheim are but one example. Texts also have been constructed of random phrases organized such that one column of letters—marked by capitalization against everything else in small letter—constitutes series of repeating concept words (cf. Cage 1990). In this case, the capitalization provides a structure for reading to organize itself where the format of the text does not follow standard Western practice.[11] There is therefore a reflexive relation between reading and text, so that in each case the work of reading structures the work of reading such as to follow the organization that the text exhibits. It is for this very reason that competent reading and text form a {reading | text} pair, where the text constitutes an account of (i.e. describes) the work of reading. In the preceding section, mother and child pick the object of reading anywhere from the page so that we do not yet observe the order that is characteristic of reading the newspaper. At that stage, visible work is conducted to bring the book into the orientation that is required for fluent reading to occur. In the following fragments, we do observe the work of organizing reading so as to move sequentially at a particular pace and in a particular direction.

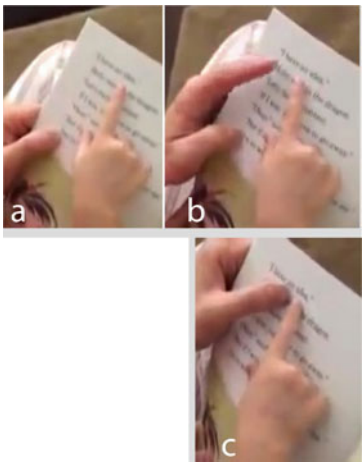
In the following reading event, as in the case of Bo, the child (Rita) sits in the mother's lap (Fig. 7.2). Rita has opened a new page in the story about a dragon and, beginning with the finger on the first word, begins to read, moving the finger (which just covers the line below) to the right (line 01). There suddenly is a longer pause (line 02), and then a drawn out /ɛn/. Then, following a brief pause, Dad, who also is present, produces a drawn out /an/ (line 05), which then is overlapped by Mother's pointing towards the pronoun on the page and articulating it verbally in turn (line 06). The child repeats (line 07). But already another pause unfolds before Rita rapidly articulates /ɪd/ and then stops. Mother pronounces in a louder than normal voice the sound /aɪ/, which lasts over 0.5 s (line 11). Another pause unfolds, and the mother then pronounces a long /aɪ/, which stops before being followed by a brief /d/.

[11] In other East Asian scripts, vertical orientation may occur; texts may be organized from right to left or left to right; and the orientation even may be bottom to top.

She then stops. Mother's thumb moves from its position (line 01, a) to near the beginning of the word "idea" (turn 13, c). Following a clear pause she continues with a drawn out /i/ that leads into the final /ə/. The whole word "idea" is articulated over a period of 1.80 s.

Fragment 7.2a

01 R: i::=ha:ve
02 (1.05)
→ 03 e:n::
04 (0.31)
→ 05 D: a:n:[n
06 M: [a] n::: ((*b*))
07 R: an:
08 (0.94)
→ 09 >id<
10 (0.49)
→ 11 M: I::::
12 (0.49)
→ 13 i:::()d (0.32) <*e:::*:y:a>
14 (0.73)



15 R: i::(0.21)de:a:: (0.45) holly sed (0.35) >to the dregon< .h (0.24) le°d° .hh (0.15) have ä () contest.

After a pause, Rita then articulates the word. Here, Mother accentuates the sequencing of the sounds, clearly separating each phonetic part of the word, using the thumb as an index that orients to the word read. Rita, too, has her index finger placed directly below the word. Hearing the word, slowly, the child is provided with an opportunity to find in their joint reading the *sound*-word corresponding to *that* printed word.

There is a function to reading aloud. It is only in being read aloud that the child can actually acquire the practice of reading silently—in speaking, a mark on the page comes to be related to the sounds from an already familiar world. Without the reading aloud there would not be reading. And it is precisely in the fact that reading is first done together that reading can (and has to) be aloud. In being aloud and in being done together, reading is social through and through. This also is an indication to the primacy of speech over reading because reading presupposes speech, which again is social.

The ink trace "idea" is linked to something familiar through its instantiation in a sound-word: /aɪdiə/-idea. If this alignment between the printed and the sounded word were not to exist, many problems would be encountered in the attempt of finding out what a text is about. Thus, for example, if Rita had sounded /idəa/ (like ee-dea) then she might not have recognized a word that she is already familiar with.

Texts constitute a world of their own (Ricœur 1986).[12] Words are related to function and sense only when they return from the page to the world, that is, "their always insistent actual habitat, which is not as in a dictionary, simply other words" (Ong 1982: 47). It is in their connections to the everyday lifeworld of the person learning to read that the words come to be part of situational *contextures*. These contextures also include gestures, prosody, facial expressions, body movements and positions, and the always-characteristic features of the specific settings associated with particular forms of societal activity.

The alignment between the words (text) and the lived, sonorous world of the child takes place across several modalities. Reading thus emerges as a unitary event. We see that in the way both mother (lines 06 and 13) and child point towards parts of the page. They point to what can be recognized as the word read. The girl also moves her pointing finger along the words, so that there exists an iconic relation between the line of the text and the trajectory of the finger. Such work of pointing and finding its target object we already encounter in the preceding section featuring Bo and his mother. Its presence here shows that it still has the function of orienting to that part of the page that is to be read. But it also differs in that in Rita's case, there is a structure exhibited in the finger *movement*. It is this structure that in competent reading later is exhibited in the movement of the eye alone. Pointing itself is a *social* practice that for a child first exists *as* a social relation rather than being something it constructs on its own (Vygotsky 1997). Pointing makes sense because it allows something to show itself from itself (i.e. the text, objectively exhibiting itself for every reader), and the finger is a sign to look for something that is motivating it. The finger tracking orients and accounts for the direction reading takes. It exhibits to the parents that Rita is indeed following the line, and, together, the line and the moving finger provide the guidance to everyone's gaze in its attempt to move along. The line and finger provide the first organization to the perceptual orientation of reading. When the finger later disappears, the eyes act on their own. But in cases of trouble, the finger might reappear for the purpose of guiding the eye. This can be seen when competent readers stop reading to attend to something else, and they point with their fingers to where reading has stopped only to remove them when reading has started again, orienting itself along the lines.

The organization of reading as a movement from left to right also manifests itself phonetically and becomes salient precisely when this movement comes to a halt or leads to the uttering of phonemes that do not correspond to what is being pointed at. In line 02, a pause is unfolding that will have been longer than normal, which flags the arrival of trouble only on the assumption that reading should proceed continuously. We find confirmation for our hypothesis, as the pauses that precede other instances of trouble and as the pauses in more fluent periods generally are less than 0.5 s (e.g. lines 15, 25). There is another longer pause in line 08, followed by what is a culturally incorrect pronunciation of the first part of "idea"; and it is in the

[12] This world of the text, its internal structure (e.g. plot and character), has been referred to as $mimesis_2$ to distinguish it from $mimesis_3$, the movement from the textual to the inhabited world, a movement also referred to as "application" (Ricœur 1984).

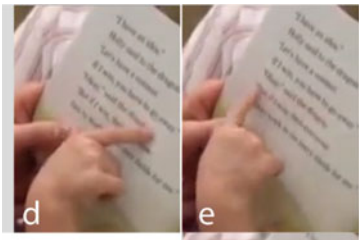
emerging pause that Mother then takes as an opportunity to offer her reading. The pause still allows for a self-correction to be started. Similarly, following the articulation of the /aɪ/, another opportunity emerges for a correction on the part of Rita. It is only when this correction does not begin that Mother provides a reading of the word in its entirety. The breaks or troubles thus manifest themselves across different modalities: pauses are pauses in the finger movement as much as they are pauses in the articulation of the indexed word. Both operations are part of the larger reading situation that is unfolding in the then-and-there of this reading event. In the future, and with practice, the different manifestations likely will no longer be observed, having receded into a (qualitatively) new stage of reading development.

Some reading education researchers differentiate between the method of reading instruction, on the one hand, and the process of reading, on the other hand. With this, the aim may be "to set aside questions about instruction, and try to achieve a clearer view of the reading processes that instruction is intended to develop in students" (Ehri 1998: 4). However, the sequence analyzed here suggests precisely the opposite: the process of reading and the process of instructing reading fully coincide. That is, reading, the process of reading, exists first in and as {teaching | learning} situations such as the one observed here. In the fragments analyzed here, the corrections that we observe do not come articulated as something apart from the reading. When trouble emerges between turns 01 and 04, there is not an interruption and an elaboration *about* the trouble, such as we might observe if someone were to state what the trouble is and perhaps stated a way to overcome it. Instead, the correction takes place in and as the reading itself: Dad seamlessly utters the word as if it was part of Rita's reading. They are indeed reading *together*; or, expressed differently, reading distributes itself across the participants. The corrections thus do not thematize the reading sequence, but *are* the sequence itself: they exhibit reading as a continuous and material organization. Indeed, as soon as we shift from the individuals—Rita, Mother, or Dad—all we notice is the {reading | text} couplet constituting a social relation.

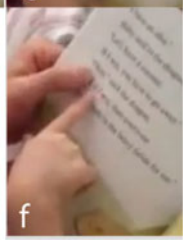
Rita then continues, the finger moving below and near the word read until it comes to the end of the line, moving then to the left of the line below and continuing to read from there. This goes on until the end of the fourth line of text, at which time the index finger rests on the last word of the line below (line 17, d). During the brief pause that follows the word "away," the finger heads to the beginning of the next line below. Rita begins to read, "but," when Mother's thumb moves to cover up the word next to Rita's finger that already has moved on to the next two words (turn 19, f). Mother then says very softly, "Not done that" (line 21, f). There is a long pause, reading taking the time to find the place where it is to continue. In fact, by covering up the first word of the line, the thumb makes it impossible to read the word and keeps open and orients to the line above it. Reading then takes up with the word on the last visible line and continues uninterrupted until it reaches the end of the printed page.

Fragment 7.2b

15 R: i::(0.21)de:a:: (0.45) holly sed (0.35) >to the dregon< .h (0.24) le°d°
.hh (0.15) have ä () contest.
16 (0.70)
17 if (0.25) <i:=win=you (0.48)
have toosh (0.34) go=ä:way [d]
18 (0.39) [e]



19 but
20 (0.31)
→ 21 M: °not done that°
22 (1.09)
23 R: o: k ay::: (0.13) said
24 (0.88)
25 da dragon. (0.19) bụt .hh (0.18) if (0.53) i:::winn
(0.52) then (0.19) any (0.35) °b°wan (0.48) hhha:v.



In this fragment, another aspect of reading becomes visible: finding the continuation of the text once it has reached the end of a line. Here, too, the finger movement provides a resource for the eye to follow. To find the continuation, the reading eye follows the finger. It is in the finger movement that trouble is apparent, so that Mother begins remediation even before reading has restarted. That is, the finger movement constitutes an instruction for the eye to follow; and the finger movement is an account of what reading does. What the finger does here is not unlike the hand-arm movement of the physics professor while seeking where to place the next line in his drawing (see Chap. 3). There, too, the hand-arm movement provides a resource for organizing the reading to come by anticipating what reading will be able to find even before the line to be read has actually been drawn.

In the opening parts of this chapter, we suggest that the same phenomenon may be found among the most educated in society, research scientists in the course of their work. One example among many that we could have chosen from our database features a PhD scientist new to the research conducted in an experimental biology laboratory. In the event, he questions a resident scientist (Theo) about the reading of the data. Theo earlier had already talked about "removing baseline" so that the scientists could read the real data by taking away some background noise (Fig. 7.3). In Fragment 7.3, Theo teaches the new scientist to their group how to read the image so that it revealed "baseline." Theo first locates the curve the biologists are interested in with his thumb and finger in a caliper configuration. This curve looks something like a Gaussian superposed on an incline (Fig. 7.3a). While formulating what reading has to do as "locating the linear, the line," he moves the index finger to the right arm of the Gaussian hump and then follows it across the images to the other end of the hump. The finger actually moves along a linear trajectory, so that if they

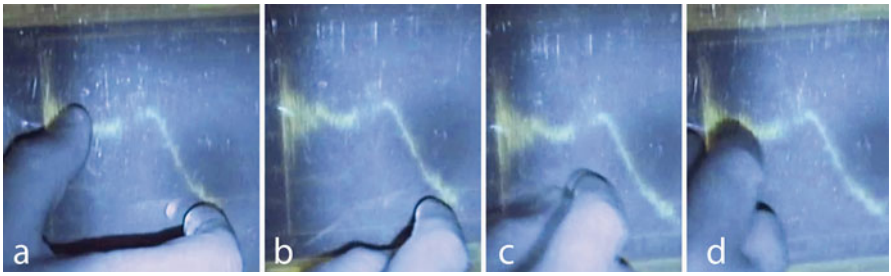


Fig. 7.3 A scientists instructs another on how to read a graph to find "baseline"

eyes had followed, reading now would find in its own action the equivalent of "linear" and "line." The new scientist (M) acknowledges hearing (understanding) the instruction.

Fragment 7.3

01 T: all you do it is that um [locate the] [...] [uh] [the] a linear– a line
((*Fig. 7.3* [*a*] [*b*] [*c*] [*d*]))
02 M: uh hn

Having spent some time with the scientists, we found out that the scientists actually did not abandon the aids to the identification of a line. To the contrary, when processing the data Theo used the cross-hair-shaped cursor to click on the points he had identified and, thereby "told" the software where to place the line that was to be subtracted from the data so that the Gaussian hump would sit on a horizontal base. But the line did not only instruct the computer which line was to be deducted from the data. Instead, that same line also assisted Theo to check his own reading. Only when the drawn line *looked* appropriate was it actually accepted. That is, the line was an a posteriori account of the perception of a linear feature and this account was then used as a check against whatever was available in the perceptual field. That is, in this, the scientific practice exhibited precisely what reading practice has done in the case of Rita: it has Theo reading "aloud," that is, it has him materializing what has been read in graphical form. It is in this form that reading had an opportunity to check itself by taking "a second look."

Coda: Reading Is a Mode of the Thinking Body

We entitle this chapter the "The Social Nature of Reading." We intend the adjective *social* and the noun *nature* to be read together dialectically, that is, to indicate that *reading* manifests itself as a biological (nature) and as a cultural phenomenon (social). As in other chapters, we emphasize that nature is not parallel to nurture, in the way another text on educational psychology makes it appear (see Chap. 2).

There, the innate (nature) is said to *inter*act with the (cultural) environment (nurture). Instead, the social is *for* the natural, selected as an advantage over other ways of relating to the environment; and the natural that is brought to bear in reading is selected *for*, and *in support of*, the cultural practice.[13] In the present case, a finger pointing, which already is cultural, moves along a salient feature (text) that also is cultural. In the process, the eyes are guided to move (biological) in a specific way (cultural). That is, finger pointing and textual structure configure the culturally specific movement habits of the eyes. In the case of the college student, the eyes apparently did not yet have these habits, so that he still had to use his fingers to guide his eyes. In competent reading, the eye movement intermeshes the biological and cultural. Thus, not biology in general matters but the biology that is *for* and supports the social processes. Similarly, the social is *for* the biological process, which it guides to become independent of the support. It is for this reason that in the evolution of the human species, its particular activities fostered the growth of those parts of the brain that supported its special activities. Thus, for example, the biological properties of the human hand changed in response to the special activities humans conducted, thereby furthering the special use of the hand. In the same way, the biological features supporting reading develop in reading, which is social through and through. This is a very different take on the relationship between biology and culture, nature and nurture, than we find in other approaches to educational psychology. It is an approach that builds on the Spinozist direction taken in the works of the later Vygotsky and the monist understanding of the thinking (reading) body.

At the time the video of the little boy Bo was taken, he did not yet speak but rather squealed. For this reason, he was not ready biologically for reading to reproduce itself in his actions. On the other hand, the 3+ year-old Rita did speak at the time of the video recording, and, therefore, biologically was ready to read aloud. But reading (aloud) is a social practice. That is, reading is a manifestation of the body (nature) and it is a manifestation of culture (nurture). Without culture, there would not be reading aloud; and without biological development, there also would not be reading (aloud). Again, reading (aloud) is a mode of the *thinking body*, a mode irreducible to biology or culture. In fact, once we consider reading as irreducibly socio-material, our anthropology of reading allows us to follow and document each new instance when the practice acquires a new subject as a way of sustaining itself.[14] Our analytic gaze then has moved from focusing on the single individual to considering the social. We take this social as a phenomenon sui generis, existing as and reproducing itself by means of societal relations between real people.

There is also a political dimension to such work. In the preceding examples, reading involves parents and their children. However, not in all social classes do parents read with their children or have the time to do so; and even when reading is actively performed at home it may not lead to positive child reading development in certain (low income, low education) families (Mol et al. 2008). The upshot of this is

[13] The emphasized words exhibit the relational nature of biology and culture.

[14] This is the sense in which we read ethnomethodological studies, which focus on social phenomena such as *reading* that are "staffed" by endogenous population cohorts (e.g. Garfinkel 2002).

that in those social classes where parents do not read with their children at an early age or do so poorly, considerable differences with respect to learning and development in reading should be and are indeed observed. These differences eventually may be so large that special school programs cannot make up for them. This then partially accounts for the differences in academic achievement between students from different social classes.

In Chap. 4 we suggest that from the advanced monist perspective, intersubjectivity is not a problem, even if participants always need to produce work to be, so to speak, "on the same page" and talk "about" a common world. The fact is that such work always is *joint* work and therefore always already presupposes a shared world—though the latter may be contested and oriented to in many different ways. In the reading cases analyzed here, we observe that a child's ability to participate in a practice is already presupposed even though he does not yet speak. Bo's gestures and sounds find their reply in the social relation, and, therefore, have a communicative function normally attributed to the sounding of words. The sounds are indeed treated as words, as are the gestures that go with *talking about* a thing. The same phenomenon is exhibited in the scientific laboratory. It is precisely because reading exists *as* a social relation that it can reproduce itself from one scientist to another and from one generation of scientists to another generation.

In different places of our analyses we show how the practice of reading manifests itself differently across different modalities (gesturing, lengthening of phonemes) and participants (the child begins an utterance that one of her parents continues when reading exhibits trouble) and yet takes place as a unitary event. Consistent with the view on learning and development sketched in Chap. 6, it is precisely because the competencies presupposed in talking and reading exist not just as single variables (the skill of talking or reading) but involve a complex intermeshing of different modalities (orienting, articulating different sounds and at different paces) that there exists the possibility for reading to develop itself. As reading develops, some of the observed features recede and others become more salient. Thus reading eventually does no longer require the finger guiding the eye and eventually stops reading aloud and turns into silent reading. This process, as might be obvious to the reader by now, is structurally equivalent to the one Vygotsky observed concerning egocentric speech and inner speech, the latter not just disappearing (quantitative change) but rather receding into a qualitatively new form. Accordingly,

> it is as much an error to view the drop in the coefficient of egocentric speech as a symptom of its disappearance as it would be to assume that the moment when the child stops using his fingers to count—the moment when he moves from counting aloud to counting in his mind—indicates that counting itself has disappeared. (Vygotsky 1987: 261)

Once we think about reading as a function that whenever we observe it already *was* a social relation with others, we realize one important implication for the study of traditional problems in educational psychology, for example, reading disability or illiteracy. We might begin asking ourselves questions about the kinds of social relations with others in the lives of these individuals who do not read fluently or that exhibit related problems. We might then find out why illiteracy has captured yet another individual. That is, we might as well follow the method-related advice of an

anthropologist to begin investigations by examining the various ways in which people relate over and about a variety of texts "before attributing any special quality to the mind or the method of the people" (Latour 1987: 258). Moreover, in recognizing reading as a *social* phenomenon we no longer dissociate the notion of reading process from that of reading instruction, and instead become aware of their unity/identity. We then come to understand that the process of learning to read is not a skill that pre-exists in the child and that can never be directly accessed. Instead, we realize that the skill itself is public and visible, and therefore entirely examinable and subject to (cultural) change.

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Chapter 8
Intention—A Product of Joint Social Work

> We posit labor in a form that makes it exclusively human. A spider performs operations that resemble those of the weaver; and a bee puts to shame many a human builder in the construction of her waxen cells. But what distinguishes a priori the worst human builder from the best bee is that he has built the cell in his head prior to building it in wax. At the end of the labor process is a result that already was present in the imagination of the worker in the beginning, that is, it existed ideally. (Marx and Engels 1962: 193)

The chapter "Consciousness as a Problem for the Psychology of Behavior" (Vygotsky 1997a) begins with a quotation from the works of Marx and Engels that overlaps with the one provided above. The quotation, taken up again in the earlier work of Vygotsky, serves him to write about the doubling of experience that occurs in labor, which allows human architects and weavers to anticipate the outcomes of the labor process—from and even before the beginning of the work: "In the movements of the hands and the transformations of the material, labor repeats what was first, as it were, done in the worker's imagination with models of these movements and this same material" (Vygotsky 1997a: 69). Vygotsky is led to conclude that human behavior follows a formula: *historical experience, social experience*, and *doubled experience*. He then identifies the *sign* as that which "multiplies" inherited experience with personal experience; and it is embodied in that text with the conditional reflex. Vygotsky sets out to find that sign, which connects the former with the new formula of human behavior to go from historical experience to doubled experience. Without the doubled experience, intention is not possible, an idea that Vygotsky attributes to Spinoza:

> [Spinoza] said that we can do nothing with respect to spirit if we do not remember it. Actually, the decisive role of memory in the study of intention shows to what degree all of our intentions are linked to the recognized apparatus of memory which must subsequently realize it. (Vygotsky 1997b: 190)

Here, intention is explicitly related to memory and is "a slave" (1997b: 190) thereof. For Vygotsky, then, the key problem to pose is that of how the three different forms of human experience—historical experience, social experience, and doubled experience—come to be connected, given that he already knows the way in

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which the two forms of experience in the animal world connect—which is by conditioned reflexes. He seeks the solution in particular signs.

There are at least two issues that require our attention when we consider Vygotsky's approach to this question. First, if consciousness arises in labor, as Vygotsky notes following Marx and Engels, then there is a time, before the first labor process, when the end cannot already be present in consciousness. If consciousness is the product of the labor process, then there have to be instances when the product of labor does not already exist before and at the beginning of the labor process. Consciousness *follows* being, because "consciousness can never be anything else than conscious Being, and the Being of humans is their real life process" (Marx and Engels 1978: 26). If it were otherwise, we would end up explaining the being of humans in terms of their consciousness, as idealist philosophers do and historically have done. Rather, in the materialist history to which Vygotsky subscribed, we must explain consciousness in terms of the Being of humans. Situations where consciousness follows being certainly are true for creative activity, where persons are involved in a process at the end of which they find themselves being able to do that they had not been capable of doing before. Thus, whereas "the craftsman typically knows what job he needs to do before picking or inventing tools with which to do it," a poet in the widest sense, "someone like Galileo, Yeats, or Hegel … is typically unable to make clear exactly what it is that he wants to do before developing the language in which he succeeds doing it" (Rorty 1989: 12–13). Learners, in the constructivist discourse, are involved in an auto*poeitic* process, that is, a process of self-construction. But how can they construct themselves and their knowledge—and in which image (according to which plan) would they construct it—if they are poets in the wider sense that Rorty describes?[1]

The second issue to be considered pertains to the solution of this problem. Vygotsky seeks the interconnection between the three forms of experience (cultural, social, and doubled) by means of signs. That is, after positing the three forms of experience as external to each other, he then requires other (material) entities to serve as mediators to connect them again. The model used is that of a triangular relation (cf. Chap. 4), where the relation between two phenomena is mediated by a third that stands between the two. Vygotsky himself certainly changed the way in which he wrote about the sign later in his career. "Consciousness as a Problem for the Psychology of Behavior," from which Vygotsky's quotations described above come from, dates from 1925. During this time, he was working with the idea of the mediating nature of signs. However, by the end of 1932, he had become highly critical of his own previous work with respect to the sign and was aiming at a radical revision of his position in regards to it (Zavershneva 2010). In which direction might a revision be developed when it is subject to the Spinozist approach? We offer the beginning of such a revision in this chapter using empirical materials that exhibit the genesis of intention in joint activity and as a product of joint social work.

[1] Readers certainly are aware that some aspects of the constructivist discourse are expressed in terms of the autopoiesis of the individual and development as an autopoeitic project (e.g. Maturana and Varela 1980).

Rethinking the Genesis of Intention

The formula Vygotsky borrows from Marx and Engels concerning the presence of the labor product in consciousness certainly is true for craftspeople and those who are already in the know, familiar with the form of activity in which they participate and the products that the associated labor produces. Others do something only to find out what they have done after the fact and in the thing they have produced.[2] Let us consider the following vignette describing the circumstances in which the two-and-one-half-year-old Clara, who enjoys drawing and painting, becomes conscious of the fact that she has drawn a troll.

> Since she was very small, her parents encouraged her to color, scribble, and doodle on blank pages, and many of her paintings hang on her house's walls. Often, she asks her parents to draw figures for her, such as animals, landscapes, flowers, and the like—figures that she cannot yet draw on her own. Lately, her parents have begun to show her how to draw geometric shapes. They take her hand as she holds the crayon, and they guide her to draw circles and squares on the paper while they say "See, Clara, we draw circles!" or "Look there, that's a square." One afternoon, Clara is sitting with her dad, ready to draw some random lines on the paper, when she wonders (aloud) what they could paint. Clara then spontaneously begins to draw an elliptical shape. Suddenly, she looks at the shape and, with an expression of great surprise in her face, says, "Look, Daddy, it's a troll!" She then draws two circles that can now clearly be recognized as the troll's eyes, and then the nose and the mouth. Her dad then encourages her to continue drawing the troll's ears … and hair. Clara has just drawn her first ("troll") face. (Jornet 2014: 1)

This vignette exhibits two phenomena that are of interest for understanding the emergence of intention. First, there are social relations, and *drawing* is such a relation first, prior to it becoming a behavior that Clara exhibits on her own. Clara and her parents produce the relations that are also the conditions for relating generally and for realizing the work of "doing [drawing]" and "doing [painting]." The parents guide Clara's hand that holds the pencil, which moves about while producing pencil traces; and they account for the recorded movements as "drawing circles" or as "squares." By the time the notable afternoon arrives, there already exists a capacity to act such that Clara can indeed anticipate something to issue from her movements with the pencil pressed against the paper. Whatever it might be that appears in her intellectual consciousness,[3] Clara does begin to work with the pencil being familiar with the fact that traces will be left on the paper. She is also familiar with the fact that following the tracing there will be accounts of what has just been done.

In later stages, when the relation between intended and actual movements still is precarious, one may observe changing intentions. As one of our colleagues once

[2] The issue is actually more complex because of the research that has exhibited the abyss between plans (intentions) and situated actions (Suchman 2007). Thus, for example, scientists have been reported to work an entire day thinking that they have acted according to a plan only to find out in the evening that what they had done was not what they had planned to do (Roth 2009). Whether people do what they have planned to do can be evaluated only afterwards. The cases described in Chap. 3 also testify to this.

[3] This may just be something similar to what adults are aware of when they doodle without a plan.

described, his child began with the intention to draw a stroller. But after she started, whatever she had done until that point allowed her to change the intention to make it a portrait of her newborn sister. A little later, it was to become a portrait of her mother, which turned into the intention to make it a turtle only to end up having drawn an octopus.[4]

Second, it is notable that Clara *first* draws and *then* finds she has drawn a troll. That troll appears in consciousness *after* she has finished drawing the figure. Clara's experience is not uncommon among children of her age—but as the Rorty quotation above shows, this form of experience is also found among adult "poets." We have observed the same phenomenon in early mathematics classrooms, where children involved in building shapes from tangram pieces find out only after the fact that they have made a particular geometrical form (e.g. Roth and Maheux 2015). In fact, in those instances on record, events are always colored affectively in terms of surprise. Like Clara, students find that they have done something that they had not anticipated. Instead, they find something as a product of their own actions. Now that they have done this something for a first time, it may also serve them as the object in consciousness that guides their subsequent actions to do the process again in the hope of producing the same—without, of course, as many will initially find out, there being any guarantee that they will actually achieve.[5] In Chap. 3, we describe the efforts of J. D. Watson to find the structure of DNA. But he could not construct it precisely because he did not know it. So, just as Clara was drawing shapes, Watson moved about the shapes of the bases until the instant when he became consciously aware of the identity of the shapes of two base pairs. He was searching for something rather than constructing it; and he knew what he was searching for when he had found it. From then on, Watson was in a position to construct the DNA model intentionally—whenever and wherever he was.

The formal structure of practical action may be expressed by a pair of terms, which includes (a) the work of doing something and (b) a public account of that work (Garfinkel and Sacks 1986). This pair may be denoted in the formula "doing [account]." If we use this description of practical action, then what Clara has done can be expressed as "doing [drawing a troll]." The account is elaborated here by naming the drawing. In that naming, both the recognizable troll and the language that goes with it function in the accounting, just as the pointing and the object pointed to in an indexical gesture presuppose each other. We note that Clara is doing something unspecified before, which becomes an instance of drawing a troll only after the figure has emerged. The same order is preserved that Marx and Engels articulated, whereby consciousness follows labor. The second important aspect here is the recognizability of the figure and name ("troll"). These are recognizable because they are a form of what Vygotsky calls the *historical experience* that is typical of the Norwegian culture in which Clara grows up.

[4] We thank Jean-François Maheux for telling us this story.

[5] Even engineers might succeed in building some device only to find out that they are unable to build the same device a second time (Sørensen and Levold 1992).

The drawing event also makes visible the interlacement of biology and culture. Holding things like a pencil and pushing the pencil tip against a paper to produce traces are biological capacities. Without the physical body that holds a material entity, pushes it against some other material, and moves to leave material traces there would not be anything like drawing. But the movements come to be shaped in particular ways. We note that the parents are moving Clara's hand about, and those movements are such that culturally recognizable geometrical forms emerge. Those movements required for producing something recognizable as a circle, square, or troll are cultural through and through—as are the movements of the eyes that are required to see traces *as* a circle, square, or troll.[6] The same can be said of the complex set of operations involved in reading that we describe in Chap. 7. That precise mechanism in which biological and cultural features affect each other already is available in Vygotsky's text on the history of the development of higher psychological functions. There, as we describe in Chap. 2, the emergence of the pointing gesture is used as illustrative example (Vygotsky 1997b). In that instance, too, the movement—whether intentional grasping or beginning of a new repertoire of movements—precedes the pointing properly speaking.[7] The object that the mother reaches the child is the "account" that comes to be associated with the hand/arm movement trajectory, the prolongation of which meets the object. That hand movement is biological first, and it becomes cultural in its connection with obtaining the object that initially lay in the extension of the movement and arm. That is, after the fact we may say that the pointing movement is the consequence of an object that initially was too far away to reach to come into the possession of the child. The initial doing without purpose receives a recognizable purpose, "pointing," when the object of pointing becomes the object of possession, it comes to be *objectified*. Objectification, in turn, is a social phenomenon: the movement is social precisely because it acts upon others—a social relation—such that the child obtains what it does not already have. Of course, it remains a biological aspect, too.

In schools, students are supposed to learn. For this purpose, they are provided with instructions and tasks. The very idea of instruction already presupposes that the learners do not know initially what they are supposed to know once they have accomplished the instructional task. Learners inherently are in a predicament where they need to engage in doing something ("constructing") without knowing its result. That is, the *what* of their future knowing is unavailable to guide them along. Such knowledge could serve, among others, as a framework for checking whether they are on track. It comes as little surprise, therefore, that students frequently are heard addressing their teacher, "Am I doing it right?" or "Am I on the right way?" The

[6] If the eye does not move with respect to an object, the visual field turns grey. To see a line, for example, the eye saccades back and forth from line to ground while doing a global movement from one end to another (Yarbus 1967).

[7] Neuroscientific research confirmed this by showing that the neurons mirroring the activity of those neurons that produce an action fire when monkeys observe the same action; these same mirror neurons are required to understand the intentions underlying the action (Fogassi et al. 2005). But those mirror neurons do what they do only after the individual can execute the action itself.

formal structure of practical action exhibits the fact that the account of the doing, the thing made, is available only after the doing. Thus, another common complaint heard in classrooms pertains to the question whether the end of a task has been reached. But if the thing ultimately made is *inherently* unavailable at the beginning of the activity, then the only way to have any hope of learning is to launch into a process without knowing what will result from it. Launching into a process of exploring unknown territory, confronting the unknown also has affective consequences that are frequently not formulated and researched under this light. Only when already in the know can we look back at our own doing and relate it to the outcome. It is in this move that we can begin orienting intentionally to produce again what we have done before.

In the following, we provide a case study of this essential paradox of learning as it exists in school settings, where we have to engage in doing without knowing what we do and without knowing that or how whatever results from our labor will be something useful. But once we have achieved something—as sanctioned in social relations and according to the results of historical experiences—then we can begin to intentionally orient to it in the way that Vygotsky, following Marx and Engels, articulates it in his discussion of the problem of consciousness.

The Paradox of Learning-motivated Task

In this section, we present a case study from a mathematics lesson in a fourth-grade classroom (ages 9–10 years) where the two resident teachers work with a researcher implementing an experimental curriculum designed to develop elementary notions of algebra.[8] On that day, one of the tasks is based on the story of a girl that decides to save money in the piggybank that she has received for her birthday (Fig. 8.1). The task states that she has received $6 together with the piggybank, to which she will

Problem
For her birthday, Marianne receives a piggybank containing $6. She decides to save $3 per week. At the end of the first week she says to herself, "I have $9!"
Questions:
a. Model the problem by means of boxes and chips until the sixth week
b. Fill up the table of values below

Number of week	**1**	**2**	**3**	**4**	**5**	**6**
Amount saved ($)	6	+6				
Or	6	2x +6	3x +6	x +6	x +6	

Fig. 8.1 The task on which Mario and his classmates work

[8] A full transcription of the event in the original French and its translation into English is available elsewhere (Roth and Radford 2011). The transcription has been modified for present purposes.

add $3 every week. The first question asks to model that situation using what turns out to be goblets from clear plastic and colored chips, one color to be used for the $6, the other for the $3 amounts to be added each week. Readers will easily note that the students are to find out that the amount of money in the piggybank A after some number n of weeks can be calculated by taking the number of weeks, multiplying it by the $3 that are saved each week, and adding the initial amount (i.e. $6) to it. That lesson goal is explicit in the bottom row of the table that the students are to produce, where, when filled up correctly, there should be a sequence of cell contents beginning with $3+6$, $2 \times 3+6$, $3 \times 3+6$, and so on. In general, the amount then is given by the function $A=n \cdot 3+6$. It goes without saying that the children in the classroom cannot yet orient towards the production of this equation or some verbal equivalent thereof. The whole task is set up such that this realization is the outcome of the task that the teacher and the researcher have planned; and when this outcome is produced, it provides a new perspective on the preceding actions in that it also provides students with a reason for doing what they have done. This reason may be expressed as "I do what I have done *in order to* … ," that is, the reason becomes the object of the intentional mobilization of certain actions that are now known to produce what already exists in consciousness.

Some readers may want to object and ask, "Why did the researcher and teachers not tell the students what to do?" Such telling, however, does not guarantee that students will be able to use or understand what they are told. We know this to be the case from all those instances where people fail to produce some dish from a cookbook recipe or fail to follow some other form of instruction. Our only hope exists in actually doing something so that we can find out from the results what the relationship is between our actions and the account (recipe). Only if the results are consistent with what we ought to have done can we say that we have followed the instructions (plans). To develop the capacity for doing algebra, the children have to act before they can know with any greater precision how to act so that something recognizably algebraic results; and they are actually doing algebra when the results of the doing are those that typically are obtained when people do algebra, even before they become aware of this.

After having counted out the number of chips standing for the amount of money in the piggybank and putting them into the numbered goblets for each week, Mario (Fig. 8.2) and his two peers at the group of desks shown in the video orient towards their worksheet for the second question (see Fig. 8.1). But not long after beginning to gaze at the worksheet, Mario turns to Thérèse asking her what she is doing because he has no clue. He then sits up, raises his hand, and turns around as if looking for the teacher. After sitting like this for a while, he turns back to his worksheet. He shakes his head. He raises his head, again looking around when the teacher (Jeannie) approaches. In reply to Jeannie's initiation, Mario states pointing to the sheet, "this is dumb. I don't understand."

It is apparent that Mario tries to accomplish the task; he exhibits for others to see that he is working. But he says he does not understand. He invites others to state what they are doing; but he does not receive a reply. He cannot even articulate where to go and cannot orient towards constructing something because that very thing that



Fig. 8.2 Mario works on the second question of the task with five of the goblets in front of him

he is supposed to come up with, as stated above, must be inaccessible or he is not in a learning-motivated task (i.e. the kind of tasks that characterize educational activities).[9] As the intended (stated) *outcome* of the *learning* task, what Mario is supposed to do cannot be available to him at that time—though outcomes of other forms of activity are indeed part of the forces driving the event. Because Mario does not know in which direction to look and search for the ultimate outcome, he is not in a position to judge whether he is "on the right track." If he already knew where to go and what the outcome is to be, then the task as stated would no longer be a *learning* task in the developmental sense because he already would be in the know. In that case it might be a task designed to make him more fluent in what he already knows to do, much as we become more fluent in cooking by cooking more or as we become more fluent in teaching by teaching. Instead, Mario finds himself in a situation as if he had to look for something in a haystack without knowing what he is supposed to look for. Unlike the craftsperson that Marx and Engels refer to in the quotation that Vygotsky picks up on, Mario finds himself in a quandary, manifest in his actions of trying to find out what to do. It comes as little surprise that we witness his seeking the assistance of the teacher. With or without assistance, the only hope Mario has for

[9] The kind of situation we are examining is typical of institutionalized schooling. Although this type of situations share with any other learning situation the fact that we are always confronted with the unknown in coming to know something new, the way in which {teaching | learning} is organized—and the kind of affects involved—may differ substantially from the type of learning situations observed in apprenticeship. In the latter type of settings, instruction often takes place without the curricular assumptions of "intentional transmission" (Lave 1996: 151) that underlie many of the experiences that take place in formal education.



Fig. 8.3 Mario and Jeannie; the two girls of his group are just outside the *left* boundary of the image

getting unstuck and, for eventually uncovering the intent of the task, is to move on in the absence of knowing in which direction to go. It is only in moving on that there lies any hope of finding the instructional object, which then would allow him to intentionally orient to it.

There is a longer exchange involving Jeannie (teacher) and Mario, of which we present only two fragments. Jeannie takes seat on a chair so that she faces Mario (Fig. 8.3). The first of these fragments exhibits the joint work they do in the apparent attempt to get Mario back on track. We witness {query | reply} occurrences that apparently do not produce satisfactory results, as seen in the evaluations that follow. Those familiar with algebra and who already know the pattern in which the contents of the goblets are to be transcribed into the first row of the table of values—i.e. 3+6, 3+3+6, 3+3+3+6, and so on—can see this pattern as a possible intention that would account for the querying pattern. There are two different reply turns completing the initiated query, one stating that there should be 15, the other that there should be 12. The second reply is the subject of a repeated query of how much there should already be in the piggybank in week 3. This is taken up in a repetition of the reply: 12. The turn, too, is taken up in another query, this time requesting an explanation, which is further constrained by requesting a reply that addresses the composition of the contents. In reply to the apparent frustration that expresses itself in Mario's face, Jeannie further elaborates the query, now specifying the components: the $6 plus the money in each of the 2 weeks preceding week 3 (turn 166).[10]

[10] Transcription conventions are available in the appendix.

Fragment 8.1

150 J: how much money is there in, how much money
→ (0.92) ((*she lifts the third goblet*)) (2.50)
how m*uch* money is *ther*e (.) *in*, (0.29) already in the third week
151 (0.79) ((*raises goblet, jingles it, places it back*))
152 T: um um u::m.
153 (1.12)
154 M: u: [m::
155 T: [fifteen]
156 (0.30)
157 M: °t*wel*ve.°
158 J: =how m*uch* should th*er*e already be.
159 T: u:h:
160 M: twelve
161 (0.21)
162 J: w*hy*. *it*s composed of what.
163 (0.68)
164 M: what well l*ook* ((*expression of frustration*))
165 (0.27)
166 J: twelve d*oll*ars cont*ain*s the::?
→ (1.48)
six d*oll*ars that we start w*ith*? (0.46) and how m*uch* money in the other
two weeks be*for*e ((*Jeannie places right palm on goblet 1 & 2*))
→ 167 (2.01)
168 M: what? (1.56) that makes- (0.80) i dont underst*an*d (.) th*ou*gh.

Throughout the fragment we observe long pauses, providing opportunities to and constituting time taken to reply (turns 150, 151–155, 166, and 167). Mario not only fails to see where the task is going, and therefore is unable to intentionally orient towards producing what he is supposed to produce. But he also fails to understand (as he says) where the present questioning is taking them. In the end we observe bodily manifestations of frustration[11] and an explicit statement of failing to understand ("that makes" may have been something like "that makes no sense" in the making, but which would not have been respectful). They continue trying, but the signs of frustration and statements of failing to understand repeat themselves. Eventually, Jeannie, too, manifests frustration—despite all the work they complete together, they are not further ahead.

Jeannie and Mario appear stuck. Yet their only hope to get out of this hole and for Mario to eventually see and grasp the object of instruction, they have to continue working. If they stop, then Mario inherently will not come to the intended end of the task. This end is stated in the lesson plan in terms of understanding the generative mechanism that allows calculating the money in the piggybank after any given and arbitrary number of weeks, especially when the number is large (as it would be in subsequent parts of the task). At that time, when the task involves larger numbers,

[11] In Chap. 12 we elaborate on how affects, such as those that we name "frustration," manifest themselves such that they are witnessed.

Mario and his peers would not be able to count out chips, and other forms of counting out would take too long. Whereas the teachers might have considered telling the students that the ultimate goal is to be able to figure out the amount of money after an arbitrary long amount of time, we cannot take for granted that the students would grasp this goal in the way those do who are already familiar and at ease with algebraic forms. In a way, Mario will have had to experience both the doing of this algebraic work and an account thereof, where the latter can function as the object of intention towards which the person orients in future doings. For example, one of the "suggested achievement indicators" in the British Columbia mathematics curriculum of the seventh grade states the students to be able to "demonstrate an understanding of oral and written patterns and their equivalent linear relations," which would be manifested in the ability to "formulate a linear relation to represent the relationship in a given oral or written pattern" or "represent a pattern in the environment using a linear relation" (MoE-BC 2007: 54). Thus, whenever students like Mario will have produced what these indicators describe, they can be assumed to have done the required work according to the structure of the associated practical action: "doing [formulating a linear relation to represent the relationship in a given oral or written pattern]" or "doing [representing a pattern in the environment using a linear relation]."

Mario and Jeannie continue, though one of the two girls at their group of desks has already abandoned; and no attempt is apparent to involve her in the lesson sequence that unfolds.[12] Fragment 8.2 presents the final instances before Jeannie makes a gesture as if she was saying, "You got it," after which she leaves the group and after which Mario will eventually stand, "Me, I now understand." When the fragment begins, they have arrived at a point where the joint {query | reply} actions have led to the statement that at the end of the third week, there are $3+3+3+6=15$ dollars in the piggybank. A query is offered, which, when paired with a correct reply, would lead to a relation subsequently called "shortcut" between the second and third row of the table of values (turn 210). That is, it would lead the student to actually do the shortcut represented in the movement from $3+3+3$ to 3×3. That second part is partly available in the table cell as 3 x_, where the slot seeks to be filled with the appropriate number (dollar amount). As the third in the sequence of turns 210-212-213 shows, the reply in turn 212 ("six") does not appropriately pair with turn 210. There is a pause during which the teacher's index finger moves between the two cells for the third week until there is a self-correction, "no, three times three" (turn 214). This time the evaluative turn confirms the correctness of the reply with respect to the offered query.

[12] An analysis from a societal-historical perspective focusing on mathematics and affect, which the girl who abandoned repeatedly manifested in various ways, can be found in Roth and Walshaw (2015).

Fragment 8.2

→ 210 J: or*ig*inally you started with s*ix*. (0.39) so; instead of writing three plus three plus three ((*points to second row of table of values, Fig. 8.1*)), what would you be able to do. (0.27) three t*imes*? ((*points to third row, Fig. 8.1*))
211 (0.84)
→ 212 M: s::*ix*:?
→ 213 (0.88) ((*J moves finger sideways repeatedly between two cells*?))
214 no three times three
215 J: y*es*::.
(1.21)
its just on the bottom its a [shortcut
216 A: mad*ame*:]
217 (0.42)
218 J: your fourth week; (.) how m*any* three dollars do you have.
219 (1.00)
220 M: u:m::: (1.73) fo. ((*Fills table, Thérèse makes noises*))
221 (9.48) ((*writes four 3s*))
222 J: °°kay°° (0.97) instead of doing three plus three plus three plus thr*ee* wh*at* are you doing to wr*ite* here? ((*Points to the bottom row, Fig. 8.1*))
223 (0.66)
224 M: uh:m:: (1.36) four times thr*ee*?
225 J: ((*two-handed gesture as if saying, "you got it"*))
226 (3.83)
227 J: i think you now understand. uh?

The statement "it's a shortcut" in fact functions as an account of the work "doing [going from $3+3+3 \rightarrow 3 \times 3$]." Whatever Mario has done as his part of the joint {teaching | learning} work[13] has become a form of experience that he finds accounted for in the expression "making a shortcut," which stands in a reflexive account with the doing that produces what the shortcut describes. Now that he has seen the result of making a shortcut, and has named it as such, he can intentionally orient towards making further shortcuts. This is so not because he has to make some intellectual inference; instead, he has lived through and therefore felt making a shortcut prior to knowing it was a shortcut.[14] Now that he has seen the end result of such doing on the paper, the loop has been closed at least once: "doing [making a shortcut]" turns a series of additions into a single multiplication. As the events show, the next time Mario accepts the invitation to respond to making a shortcut ("instead of writing … "), he does reply in a way that is then evaluated positively by means of a gesture that can be seen in lieu of saying, "You got it." After a long pause, the evaluation also occurs verbally (turn 227). Jeannie leaves and Mario continues. A little over 50 s

[13] As in Chaps. 6 and 11, we use {teaching | learning} to translate Vygotsky's *obučenie*.

[14] This kind of events constitutes "*an* experience." In *an* experience, there is "something that stands out as an enduring memorial" (Dewey 1934/2008: 43), so that from now on events can be named and oriented to in the future. A meal, storm, or rupture of friendship them become "that meal, that storm, that rupture of friendship" (1934/2008: 43).

later, we witness Mario stating in what might be seen as an expression of confidence, "Me, I now understand."

Mario arrives at a point that allows him to state that he understands. In fact, in saying "I now understand" he is commenting on the fact that he now can orient towards producing something specific, which, in this situation, are shortcuts for all the cell contents in the second row. He completes the third table row (Fig. 8.1) in this manner because he knows how to do it; and this knowing-how is itself the result of having done it at least once before. Mario, as anyone else, cannot know how to do something prior to actually participating in the joint production of the work of doing it, which then can be refined through further doing—here without requiring further exchanges with the teacher. The group mate who is sitting back while Jeannie and Mario are talking never gets to that point. In the end, she will copy whatever the third person in their group has noted in the table of values.

By now our readers can see that the shortcut first exists *as* the exchange relation including Mario and Jeannie. It is as a {query | reply} that the shortcut is produced to be evaluated in what comes to be the second member of a {reply | evaluation}.[15] After *doing* his part of the joint work another time, a sense emerges that he can do and accomplish the entire work and exhibit this form of mathematical behavior alone. This sense finds confirmation after having filled up the last two cells that remain in the third row when Jeannie leaves the group.

The episode from the mathematics lesson shows that intentionality is not entirely absent. If Mario continues, he does orient towards the situation in a way that we might gloss by saying, "He intends to participate in the exchange." Thus, we do not suggest that intentionality first exists as social relation, because participation in the joint work itself requires a form of intentionality. However, those actions required to fill up the table, which later are denoted by the term "shortcut," and which lead to the formulation of a pattern, cannot exist as object of intention precisely because this object does not yet exist. It comes to exist while Mario responds to something that initially is alien. He does not know what the task demands from him; and he does not know initially what the questioning is all about.[16] Responsivity therefore transcends and exceeds intentionality; and this "transcending of the sphere of an intentional or patterning constitutive sense accomplishes itself in responding to an *alien appeal, which neither has sense nor follows a rule*" (Waldenfels 2006: 58). To the contrary, the appeal by the alien, the object of learning that I can know only after

[15] The evaluation fruitfully may be described as reply to a reply, consistent with the description of all actions as replies (Waldenfels 2006), where a (teacher) query then is a reply to the current state of {teaching | learning}.

[16] As noted above, the situation is the same as the one designers face at the beginning of a design project, where the outcomes of the work process cannot (and should not) be known in advance of the *creative* process. Yet, an important aspect of the craft of doing design consists in orienting toward this uncertainty in ways so that instrumental and cooperative work can go on successfully. How students in school settings come to master the craft of being subject to uncertainty in classroom situations, as *craft,* is seldom addressed in the educational research literature. A reason may be the tendency on the part of educational researchers to take the social context as an unquestioned given rather than as something that needs to be worked out.

I have learned and come to understand, disrupts any common sense and pattern Mario is familiar with. Instead, in responding, new forms of sense and patterns come into being. The sense of his response does not pre-exist the responding, but, as our fragment shows, the sense—as shown in his comment "Me, I now understand"—is the consequence of having responded. It is in the evaluative feedback that he can find out about the relation between his responding and the *what* to which he was responding. In the case of a positive evaluation the {query | reply} comes to make sense. As a consequence, each of the two parts of that joint social work comes to make sense.

Coda: Motivation and the Unity of Affect and Intellect

In this chapter, we articulate a fundamental dilemma and paradox: learners cannot intentionally orient towards the thing to be learned, for if they knew it, they would no longer need to learn it. This paradox has implications for educational practice in a double sense. On the one hand, it has implications for how we conceptualize intellectual understanding and development, where the view of the individual who either constructs or comes to discover knowledge on his own becomes problematic. On the other hand, the paradox has implications for questions of motivation, because if students cannot orient towards what they are to learn, how could there be motivation or lack of motivation towards that learning? Of course, these questions and the entire learning paradox make only sense if we reduce the unity between the individual person and her social and material environment to the opposition of two elements, where for the person to be conscious and orient towards the environment there must be something inside her that intends to or mirror-like reflects the outside. As soon as we shift to a non-dualist approach, we clearly see that there is no gap between person and her social situation that is part of the environment. Instead, persons and the environment to which they respond and towards which they act form an indivisible unit that has a dynamic of its own. We show here how intentional orientation towards a particular object first exists *as* a social relation with an Other by providing a specific classroom case as an example in addition to describing the case Vygotsky made. Intention, in the same way as other higher psychological functions, is possible after the successful completion of an {initiation | reply | evaluation}-type event. It is *as* this joint work that a cultural and historical action with the structure "doing [account]" first exists. In other words, the work first exists *as* a transactional order. The sequence is social and is itself the context for and result of social work: "people make the conditions as much as the conditions make the people" (Marx and Engels 1978: 38). As a consequence, intention is social through and through. It is recognizably social such that experienced mathematics educators watching the Jeannie–Mario exchange can see it; they see it even if they were to come upon such a situation already in its course and outside of the specific context of a mathematics classroom (e.g. a parent and a child).

Views of intentions as having an individual origin are closely related to the extended discourse on there being a motivation that can be gained "intrinsically, extrinsically, or through some combination of the two" (Sternberg and Williams 2010: 351). The picture is that there are external motivators that relate to individuals in terms of behavioristic laws, internal motivators that are best described by means of cognitivist models, where a human and social view of motivation concerns a mix of the two previous approaches. In this way, intellect and affect, praxis and mind, remain unbridgeable. The kind of theory that Vygotsky was building near the end of his life, however, was explicitly designed to overcome this perennial dichotomy between behavioristic and mentalistic models. He intended to do so not by means of a combination, but through a qualitatively distinct paradigm that should overcome both. One important category that belongs to the new psychology that Vygotsky began outlining in *The Historical Meaning of the Crisis in Psychology* (Vygotsky 1997a) but which he only started formulating at the very end of his life is *perežívanie* [experience], a unit that denotes the unity/identity of person and environment. In perežívanie,

> on the one hand, in an indivisible state, the environment is represented, i.e. that which is being experienced—a [*perežívanie*] is always related to something which is found outside the person—and on the other hand, what is represented is how I, myself, am experiencing this, i.e., all the personal characteristics and all the environmental characteristics are represented in a [*perežívanie*]. (Vygotsky 1994: 342)

Because it always and at the same time is constituted by the real situation, and how the situation presents itself to the person, *perežívanie* does not admit external or internal motivators, nor allows for a combination of the two. Rather, it exhorts the analyst and educator to approach motivation as an internal feature of social situations rather than as a feature of individuals. It has to be approached not as something that involves intellect but through the {person | environment} unit, which also is shaded by practical and affective colorings. Thus, in the case described above, we observe how in the course of intellectually orienting to a given object, there is an affective dimension that manifests itself as frustration sometimes, as satisfaction at other times. Those affects are thus immediately enmeshed with the social relation, and with institutional framework of evaluative practices that characterizes institutional schooling at large. In part, affect resonates with affect, such as when frustration (Mario) leads to more frustration (Mario, Jeannie); but affect also vanquishes affect when Jeannie exudes satisfaction when Mario "got it," and when Mario states knowing that he understands. It is to Spinoza Vygotsky (2010) attributes the insight that affect may vanquish affect. Motivation is not about what is outside in relation to what is inside, but becomes an emergent quality that unfolds as people make and engage in relations. Accordingly, "one should give up absolute indicators reflecting the environment" (Vygotsky 1994: 338) and instead focus on the intrinsic unity/identity of person and environment. But motivation is not first outside in the social relation and later becomes internalized. Instead, it becomes an emergent property of the situation. It is in and through participating in social relations that both learners become moved and change with regard to how they further orient to {teaching | learning}.

Through our analyses we exhibit how a teacher-intended learning outcome emerges in the course of practical work with others rather than being individually constructed by the child. Despite its possible appearance, however, we should not think of the object of intention as something existing (only) ideally. Cultural-historical studies traditionally tend to emphasize the ideal (e.g. "meaning"), whatever appears in consciousness given the description of the members to a setting. This also is the case in Vygotsky's earlier writings, where he draws on the work of Marx and Engels (1962) to make a case for the presence in "the head" of the end result of labor. In the works of these scholars, we find the distinction between the real and ideal, the latter of which constitutes an object in consciousness. In idealist approaches to psychology, the entire focus is the ideal at the expense of the real (material). On dialectical materialist grounds, however, we have been advised that the real and ideal are *not* psychological categories (Mikhailov 2006). Instead, the ideal and the real, consciousness and material activity, are but manifestations of what is to be regarded as societal activity and material human labor. Thus, we may as well heed the advice that the question of the concrete reality of human thinking is a practical rather than a theoretical question. This is so because "in praxis man has to prove the truth, that is, reality and power, the this-sidedness of his thinking" (Marx and Engels 1978: 5).

In this chapter, we show that intention first exists *as* social relation, which produces not only learning outcomes but also the very relation as the condition of the joint work. If the intention exists *as* social relation, then it exists really, in public, and accessible by all. Intention, therefore, is not something we make up ("construct") in our solipsistic minds but something that we find in the conjunction of work and its account. Once we have seen this relation between doing and its account, sanctioned in the relevant cultural and historical setting, then, together with this relation, the intention to repeat is also given. Whether we repeat something that we have done once before depends on the relation between the two products, which serve as accounts of the doing. When the two products can be said to be the same, then we can also say that our doing has been the same—or at least a structural equivalence thereof.

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Chapter 9
Culturing Conceptions

The Ur-ark Earth does not move. (Husserl 1940: 307)

In the introductory quotation, the philosopher who established the branch of philosophy called phenomenology states that the earth does not move. On the envelope in which the manuscript was found, the philosopher also noted, "Revolution of the Copernican teaching in the mundane worldview interpretation" and "Foundational investigations to the phenomenological *origin of the corporal nature of the spatiality of nature* in the first scientific sense" (Husserl 1940: 307). "Wait a minute," the reader might say, "the earth does *not* move? Isn't this one of the classical misconceptions?" The reader would be right, for stating that the sun moves around a stationary earth is one of the classical ways of talking that educational psychologists and educational researchers refer to as *misconceptions*, structures in the mind of individuals that make them say what they say. At times, the term *naïve conception* also is used synonymously; and sometimes a researcher or teacher might talk about the "wrong ideas" that students *have*. In their basic courses on educational psychology, educators in training may then hear (read) that "a science teacher must know how to correct students' naïve theories and misconceptions about subject matter" (Sternberg and Williams 2010: 9).

On Misconceptions and Situated Language Use

Misconceptions have been presented as structures of the individual mind. Such structures can be represented in *concept maps*[1] that the researcher creates based on clinical interviews (e.g. Chi 1992) or that the research participants themselves

[1] In a concept map, the most inclusive and therefore most general concept is located on the top and the least inclusive, most specific concepts are placed on the bottom. The concepts, usually nouns, are linked by means of verbs so that statements are formed when the map is read from top to bottom.

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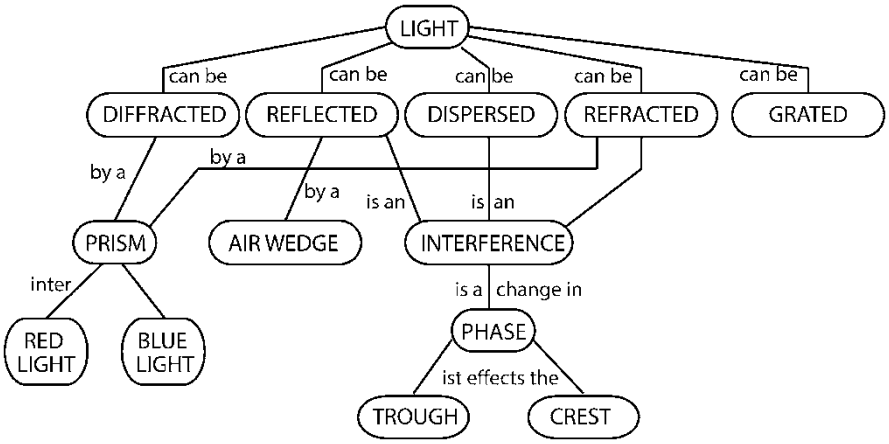


Fig. 9.1 A student-produced concept map that a physics teacher used to assess his students' conceptions of a variety of phenomena involving light following a related curricular unit

generate (Novak and Gowin 1984). Take, for example, the concept map that a physics student produced during an exam following a unit on light and related phenomena, including the concepts of diffraction, reflection, and refraction (Fig. 9.1). The concept map represents a totality of statements in a particular domain; and, because it forms a structure, it is easy to see that investigators have come to use it as a representation of mental structures (mind). Indeed, teachers refer to this and similar representations also as "mind maps." Just as a road map represents all the ways in which we can navigate a geographical area, the mind map represents all the ways in which a student might respond to test questions and clinical interviews. When a conceptual change occurs, it will be reflected in the map that the person produces or that someone else draws based on interview data. Sometimes conceptual changes are *radical*, in which case there are reorganizations in a person's way of speaking that are so dramatic that the concept maps based on prior interviews and those following the change do not even contain the same concepts (Chi 1992). In *non-radical* conceptual change, existing concepts change their place in the hierarchy (laterally or vertically).

In the literature, misconceptions tend to be attributed to the individual research participants, most frequently students. Unsurprisingly given the dominance of the constructivist metaphor—according to which mental structure is the product of individuals' (private, solipsistic, or subjective) constructions—these generally naïve conceptions are incompatible with those that populate official science textbooks. We may say alternatively that the ways in which students speak about phenomena of interest to science is different than the ways in which scientists (professionally) speak about them.

Texts in educational psychology do not always consider the implications of the difference between non-radical and radical change and the associated phenomena of learning and development, respectively. Thus, new teachers are asked to "*build carefully on what students already know*" so that "students can integrate new knowledge with the old, and see in some cases how to correct misconceptions they may have had" (Sternberg and Williams 2010: 50). If, however, a misconception is something that requires a radical, that is, a qualitative change and reorganization of consciousness (in the sense described in Chap. 6), then *integrating* new knowledge with the old will not assist them. Instead, the scientific ways of talking about phenomena frequently require a demise and complete overturn of the old, which only continues to exist as the sedimented ruins on which any emergent scientific language is built (Husserl 1939). Alternatively, the two discourses may exist side by side. The continued presence of two different ways of talking is particularly salient in astronomical phenomena: Even the most advanced astrophysicists can marvel at the beauty of a sun*rise* or sun*set* in the Australian outback, or talk about the sun moving across the sky rather than emphasizing the illusion of a solar movement that in reality the image is created by the rotation of the earth. Such scientists know how to talk when they find themselves in particular settings. It would be quite curious indeed if our astrophysicist were to reply to the statement, "What a beautiful moonrise isn't it?" by saying, "Do you want me to respond as an astrophysicist or as an ordinary person?" In this case, no alternative conceptual frameworks are required.

Readers may note in the preceding paragraphs that—in contrast to the mental things that other researchers attribute to the minds of individuals—we state our own position in terms of the language in use. This language inherently is a cultural-historical phenomenon (see Chap. 4), always already found in and given by the world that we inhabit. In which way does language give us a different approach to talking about what uninstructed and often even instructed individuals say?[2] The notion of the sign, widely used in Vygotsky's writings, may advance us a bit.

In the history of scholarly discourse, the linguistic sign was conceived as a psychological entity [*entité psychique*] with two sides: (a) an acoustic image and a concept or (b) a signifier and a signified (de Saussure 1916/1995). The classical example is that of the Latin sound-word for tree, *arbor*, and the image of a tree (Fig. 9.2). Here, the sound-word is the signifier, and the tree is that which is signified. It is easy to see how the misconceptions and conceptual change literature are based on this conception—even if unacknowledged and unattributed to de Saussure. Thus, because from this view of the sign there is a strict correspondence between concepts and words, the latter provide us with access to what goes on inside the

[2] A classical report appears on a widely distributed video featuring Harvard graduates talking about our universe in ways that are inconsistent with science. The website advertising the video on CD states: "With its famous opening scene at a Harvard graduation, this classic of education research brings into sharp focus the dilemma facing all educators: Why don't even the brightest students truly grasp basic science concepts? This award-winning program traces the problem through interviews with Harvard graduates and their professors, as well as with a bright ninth-grader who has some confused ideas about the orbits of the planets" (http://www.learner.org/resources/series28.html).

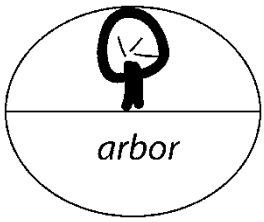


Fig. 9.2 F. de Saussure defines the linguistic sign as a two-faced entity that includes a sound-word (here the Latin word *arbor* for tree) and the concept (here the image of a tree)

mind. Vygotsky however critiques the idea that words are in the mind, that they have semantic value only independent of the sounds that we hear as words. In fact, considering words to be independent of their implementation in actual speech is a typical way of thinking about cognitive issues, where logical relations are said to hold independently of the ways in which they are implemented in/by computer software and hardware or by (human) "wetware." It is the same kind of conflation that allows researchers to state that gestures and other bodily phenomena somehow *enact* mind, concepts, schema or whatever alternative mental entity that is stipulated to underlie concrete action.

To change perspective, consider a question like "Where do children first encounter language?" Of course, it is not in their mind. Language is materialized (historical, cultural) consciousness (Vygotsky 2010). The sonorities of language and the sounds particular to a society and culture are encountered while the child is still in the womb. As soon as the infant is born, it is exposed to regular sonorities as much as it is to the visual environment—and, not to forget, it is exposed to what reveals itself in all the other senses as well, smell, taste, and touch. As infants develop into toddlers, their worlds also begin to contain things that they later come to know as written words, which populate the child's landscape as seen in an image from the same French culture that provided de Saussure with his life experiences (Fig. 9.3). As one of his critics suggested, language (signifiers) is not or not just in the head: it surrounds us everywhere in very material ways (Lacan 1966). Just as we become competent in navigating the material world (stairs, ladders, pedestrian crossings), we become competent in navigating the sonorous world, that is, competent in the use of a (spoken, written) language in association with the social and material situations where it is an integral part. The two competencies are so intertwined that knowing a language becomes indeed indistinguishable from knowing one's way around the world—as we insist throughout this book.

It was Aristotle who noted that speech (*logos*) lets something show itself from itself; and that something is what speech is about. In this function, living language, the semantic field, constitutes the accented visible (Mikhailov 2001). We know this to be the case in our everyday exchanges with others, where we do not experience ourselves as interpreting or trying to figure out what someone else wants to say. We would never be able to construct the world unless it was already giving itself to be seen, heard, felt, smelt, or tasted. If parents produce the sound /'æpl/ ("apple") every time they give their child something, then whatever gives itself to be seen is associated with that sound, and, of course, with the feel, smell, and taste that comes with



Fig. 9.3 Language is part of the world that children learn to navigate very early in their lives so that knowing a language becomes indistinguishable from knowing one's way around the world

it. Eventually, upon hearing the sound, the child can anticipate the visual experience to be possible. The child will be associating the particular sound not merely with its perceivable features, but indeed with its appearance as part of a given context of action, such as an apple section brought close to the child's mouth during lunchtime. Association,[3] therefore, is just a weaker name for the fact that we live in and form part of a world that changes us in its becoming. Our world becomes structured because of the specific relations we entertain with others, in which the semantic field contributes to accent the visible in affectively and practically characteristic ways. This makes the (life-) world of an Asian, Australian aboriginal, North American, or African child different. Our lifeworlds are the results of societal

[3] Vygotsky (1987) saw in associationist theories on the development of conceptions "the basis for the whole of traditional psychology" (1987: 196). By focusing on associations between sensuous experiences, associationist researchers are unable to see how (qualitatively distinct) developmental changes emerge as part of larger social contexts within which experiences are had. They also become unable to account for the unity of intellect and affect, which is achieved by means of the Vygotskian categories of *perežívanie* and social drama.

relations and the associated cultures—which may vary even when the language apparently is the same.[4]

We entitle this chapter "Culturing Conceptions" to underscore two important points. First, whatever educational psychologists have denoted by the term (mis-) conception is not an individual feature. Rather, "conceptions" are cultural features and a function of language as it is encountered in the everyday world. Indeed, the fact that this phenomenon is so pervasive should have already suggested its cultural nature. "Eradicating" misconceptions, as some scholars have suggested, would amount to eradicating part of the world as it is made relevant to and by the people inhabiting it. Any so-called "misconceptions" are so pervasive precisely because they are part of our culture—so much so that they are sufficiently intelligible to the converted (scientist, educational psychologist). Second, *culturing conceptions* denotes our theoretical move to return conceptions to where they belong: culture. This means that we do not have to search for conceptions in mental structures or in the mind. Instead, we can look for them in language, in actual conversations, and recognize in them stable linguistic features. Without language and other forms of signs (gestures, drawings), investigators would be hard-pressed to identify cases of this interesting phenomenon; and the practice of eliciting "conceptions" involves a social relation so that whatever is attributed to the participant in a clinical interview (commonly used in research on conceptual change) inherently has the characteristics of that relation. Both phenomena are involved in the following section, because it is culture that speaks through the voices of the participants, and is that same culture that allows us to hear how participants hear each other. Our analysis, therefore, presupposes the same kind of cultural competence that these participants exhibit—which, of course, is the case of all (mis-) conceptions research, even if this is generally unacknowledged.[5]

On Finding Conceptions

> What [individuals] are thus coincides with their production, as much with *what* they produce as with *how* they produce. (Marx and Engels 1978: 21)

Imagine finding a piece of transcript from a conversation without knowing where or when this conversation happened, and imagine yourself trying to figure out what the people speaking were doing, who they were, and so on with nothing other than

[4] Consider the differences between Austrian and German cultures, which exist despite their common language (though regionally different accents); consider also the differences between the cultures of French-speaking Quebec and France.

[5] Misconceptions can be a research topic precisely because they are intelligible, produced in interviewer–child exchanges, which require cultural competencies to be understood (e.g. Roth et al. 2008).

the transcription.[6] Here, we imagine a culturally competent individual without special training in social science methods but with knowledge of transcription conventions, who, while walking in the park, finds a piece of paper containing Fragment 9.1. What would the lay sleuth be able to find out about the event that led to the talk transcribed? What would the lay sleuth find out *without* having been trained in the methods that are such a prized characteristic of classical social science studies? As recent work shows, there is quite a lot that can be said while holding one's analysis rigorously accountable to the text, without assuming that any interpretation goes. In fact, we could hold our lay sleuth accountable by testing the analysis against an actual recording, and she should be coming close to specifying the event (Roth 2015c).[7] Answers to these questions will allow us to identify the *cultural* (historical) and societal dimensions that go into the production of (clinical interviews about) conceptions.[8]

Fragment 9.1a

01	A:	so the question is very simple. (0.24) .hhh could you explain me: why:: (0.55) why*:* we have day and w*hy* we have night;
02		(2.69)
→ 03	B:	because if you d*on*t have d*ay* and n*igh*t .hhhh we cant sleep at *all* and if you dont have s*un* it would really be *co*ld.
04	A:	so w*hy* do we have d*ay* and n*i:g*ht?

The first turn in Fragment 9.1a begins in an interesting way, stating that the question is simple, which is followed by something that we recognize to be a question because of the interrogative term "why." The first part of turn 01 in fact announces that a question is to come, that is, it *formulates* the arrival of a question. Moreover, the statement uses the definitive article "the" rather than the indefinite article "a." If the indefinite article had been used, then one might anticipate some question that the person asks out of interest, "I have a question," but here it is a specific question to come. That question already has an answer, as the predicate describes it to be "very simple." Such a predicate might also be used to put the respondent at ease. After the announcement of a question, the type of reply expected is formulated: it is to be an explanation ("explain [to] me"). Finally, what has been marked as the question-to-come indeed arrives: it concerns the reason for having day and night. In fact, what does arrive is not in the grammatical form of a question, as in "Why *do* we have day (and night)?" Moreover, we note an oddness about "could you explain me," which appears to be missing the preposition "to" before "me." The reply turn does take up day and night in what we can easily hear to be a reply so that the {turn 01 | turn 03} pair constitutes a {query | reply} concerning an astronomical fact that is to be

[6] In our own teaching practice, we use classroom tasks based on this idea, where students engage in (conversation, discourse, content) analyses of *mystery transcripts,* the origin of which they do not know.

[7] Roth (2015a) shows what such analysts do and how they do it.

[8] Transcription conventions are available in the Appendix.

explained.[9] The explanation provided has something "child-like" about it, because the existence of night is justified by the need to sleep, as if it required night; and as if day, because it is associated with the sun, is required for experiencing warmth. Definitely, the response does not sound like the sort of explanation one might expect from a scientist.

Our culturally competent individual now might ask the question: What kind of situations in everyday life produce openings of this sort, or, if the transcription actually picked up in the middle of an ongoing activity, in what kind of activity would such a {query | reply} occur? We have enough information to be able to state that the fragment derives from a situation in which the person asking already knows the answer; and, as the question is simple, the individual responding is presupposed to be capable to answer it easily. We may describe such situations as involving a person in the know (A) and another person being tested (B). We also note that the pause is relatively long[10] so that B has been given, and is taking, a considerable amount of time to reply. This opening already allows us to hypothesize some possible forms of activity that might have produced the talk as transcribed in the fragment: formal or informal education or testing. It is less likely to be an interview of the kind that we tend to observe on television, where the journalist asking the question does not already know the answer.[11] That is, even without knowing what kind of situation produced this talk, we are able to constrain its possible nature. Those participants, however, already know what kind of activity they participate in, and they therefore participate in doing and orienting to the kind of joint work that allows us to see what they are doing. Walking into certain situations, we do indeed have some inkling of what is going on—e.g. we open a door in a school and we immediately see whether a class is taking place, a faculty meeting is held, or a smaller group meets apparently including student, parent, teacher, and someone else.

The important thing we learn from the first three turns is that the participants produce a recognizable activity—and it will be only with respect to *this* activity that the contents of their talk will make sense. Whatever B says not only is *in reply to* A but also part of *the response to* the situation as a whole.[12] That first turn pair is an integral part of the situation, being a recognizable part of some event types rather than others. If it is recognizable, then they must be acting in concerted ways to make the (irreducibly) social situation look in those ways so that other culturally compe-

[9] To reiterate the point from Chap. 5, {query | reply} is *one* irreducibly social (i.e. *trans*actional) phenomenon. Its staff is not an individual but a dyad. Our perspective is made thematic in expressions such as "a community has *its own* dynamic," which acknowledges that even though individual participants may have their private agendas, what happens collectively is a process that exceeds any combination of all private agendas present in the room.

[10] Research suggests the standard maximum silence to be around 1 s (Jefferson 1989) and research in classrooms reported less than 1 s being given for students to reply (Tobin 1987).

[11] This is so unless the journalist and respondent are staging the actual {query | reply} occurrences because the former already has found out whatever is to be contained in the reply turn.

[12] The italicized terms are an expression of the relational nature of query and reply.

tent people do indeed recognize it as such—as if witnesses themselves could have produced the situation.

The fragment opens with a *formulation*: the question is very simple. This formulation is part of the work that exhibits what is going to happen. That is, in a *recognizable* way turn 01 produces a description of what this verbal exchange is to be. Formulating an action makes available a frame for what the *joint* work is to produce. It is part of the work done jointly for the purpose of exhibiting an orientation to get *this* rather than some other social phenomenon accomplished.

After B has replied, A speaks again. We recognize another invitation to reply to an offered query. That is, something is missing here that we tend to observe in formal educational contexts: an evaluation. *If* this fragment were part of the transcription of a (science) lesson, then in many but not all cases there would be an acknowledgement or outright evaluation (okay, right) or the invitation for someone else to reply. That an evaluation or continued solicitation is absent decreases the likelihood of this transcription to be the result of A and B doing part of a lesson—although restating the query may also be heard as an evaluation: whatever has been provided is not an adequate explanation and therefore another explanation is needed. On the other hand, in a clinical interview, where the educational psychologist tries not to bias the reply, we would not anticipate any "feedback," evaluative or otherwise. Whichever the case, our culturally competent reading already affords conjecturing between a more or less definite set of possible situations as part of which the conversation may have been produced.

We recognize a reply as a reply because it is the second part of a {query | reply} transaction. Alternatively, we recognize a turn as not constituting the reply to what we have heard as a question; and we hear in a response that what we thought to have been a question was indeed an insult. That is, *how* it is said (i.e. the saying) and *what* is said (i.e. content, the said) takes into account the situation, returning to A in a transposed form whatever that person may have initially produced. If this is a fragment of classroom talk, then B might be a student responding to a teacher; if it is a clinical interview, the child, invited to be part of the study as part of the consent process, responds to a researcher; if it is a parent–child situation, the context might be the joint reading of a book where the topics of night or day have been made salient; or if it is a visit to the science museum involving a child and a chaperon, then the verbal exchange might have been recorded at an astronomical display or some time later during a "debriefing." All situations share that A would be "in the know" and B would be the person tested. The content of turn 03 is a function of the situation in which the talk is taking place and of the specific activity that the participants *recognizably* produce and subject themselves to.

We now may focus on the contents of turn 03. Rather than jumping to the conclusion that the speaker is a child with a *mis*conception, as conceptual change investigators tend to do, we may ask ourselves whether there is a frame within which that response is the most reasonable way to reply to the query "Why do we have day and

night?" The reply may then not be so unreasonable after all.[13] For example, the second part is a conditional statement, "If there is no sun, it would really be cold." There is nothing wrong with this phrase as a statement. It constitutes a legitimate reply to many queries. It may be more problematic when turn 03 is linked to the statement in turn 01 offered as a query, "Why do we have day?," in the way an adult might do when first repeating, rhetorically, the query and then the reply. But if we do not let ourselves get fixated on the saying but instead focus on the active reception part—not transcribed here according to the procedure in Chap. 4 (Fragment 4.2)—then the reply actually gives us clues about what has been heard. What if the query had been received as something like, "Why do we need the sun?," then even the staunchest educational psychologist could not quibble with the reply and could not classify it as a misconception. Of course, it is likely that we would have observed something different in the transcription if the first turn had stated something like, "Where is the sun at night?" Children around the age of 6 years often reply by saying something like, "Behind the clouds" or "The sun moves down in the ground" (Vosniadou and Brewer 1994). But some children may not reply at all or provide "logically inconsistent" (1994: 134) answers.

The content of turn 03 might also have been completely different. What if it had been "You are kidding me!" More strongly, it could have been "You are insulting me. Do you think I am so dumb that you have to ask me baby questions?"[14] In all cases, our observation points to the fact that when we consider the conversational event as a social event, each individual turn cannot be reduced to a given "meaning" or "conception" but needs to be seen in relation to an emergent social order. Within that order, individual turns cohere with each other not by virtue of the ideas or conceptions they represent but with respect to the larger social situation that is in the making.

The fragment continues with what a culturally competent individual recognizes as a repetition of turn 01 (Fragment 9.1b). There again is a longer pause before B begins with an acknowledgment term, and then there is another long pause, time that B takes and A allows for the reply to come forth. The reply turn elaborates on the activities requiring dark (i.e. sleep) and light (i.e. play, eat). Without light, we bump into things.

[13] The replies are actually of the same type as those that we read in an online support community for the use of computers. The following {query | reply} occurs:

01 E: I'm must setting up my new MacBook Pro and I'm supposed to choose between a U.S. and an English Canadian keyboard layout. Does anybody know what the difference is?
02 K: Yes. One is if you live in Canada. The other is if you live in the US.

[14] For those who have worked with adolescents in inner-city schools, such a reply would not have been so unexpected, where a student rejects the invitation to respond to a question by adult saying, "You speaking so loud I have to … " (Roth and Tobin 2002: 56).

Fragment 9.1b

04 A: so w*hy* do we have d*ay* and n*i:g*ht?
05 (1.28)
06 B: kay (2.06) ((*licks lips with smack*)) be (0.16) cause .hhhh (0.84) we need d*ay* to pl*a:y:* >anweneed< night to sleep. (0.69) .hhh and then if we dont have d*ay* we dont have the lunch light or we can bump to °something or something °; (0.47) .hh=yea; (1.04) °we can bump to something°;
07 (0.75)
08 A: why is it h*ot*ter (0.19) in the s *um*mer.

We observe the same pattern only that this time there is a pause following the reply and then another query is offered up. If we hypothesized A (Andy) to be an educator or educational psychologist and B a child (Bea), then the conversation would immediately be intelligible as producing a clinical interview. But rather than suggesting that there are *mis*conceptions in the mind at work—i.e. that Bea does not have a consistent concept of day and night—we recognize features in the (public) speech field that goes together with the environment where the participants find themselves. Thus, if the content of the talk is designated to be a misconception, then it is first of all a feature of talk and the language in play, because it is precisely here that we locate the phenomenon. Andy and Bea are part of this speech field, generating it with and from the possibilities of the English language. Children do acquire language not by making it up in their heads and then spilling what they made up. Instead, they learn a language by finding themselves within the speech field and participating in language use. That they can eventually begin to talk to themselves—i.e. Piaget's *ego*centric talk—is a *result* of the verbal exchanges that they have had rather than its condition (Vygotsky 1987). If Bea was a child, she could produce the replies even if she had never thought about the queries or about the reasons for day and night. Instead, a certain linguistic competence and worldly experience—e.g. the parent saying, "It's dark, you got to go to sleep"—allows the generation of statements such as "We need night to sleep" (because it is hard to sleep when there is light) or "We need light to play" (because it is hard to play when it is completely dark).

Any person who apparently contributes to participating in the joint work of doing the current activity is acting rationally. If individuals respond in ways that appear to investigator as irrational, wrong, or inappropriate, we gain more by seeking to understand the lifeworlds within which the reply is the most rational thing to do or say. Rather than assuming that the response is the result of some deficient model in the head of the respondent, we may ask, "How has the question been heard so that the answer given is a reasonable one?" "Hearing," here, would not mean something like processing or decoding the question. Hearing a question in a given way involves hearing it against a given background, not as a text but as a *con*text (Bateson 1987). Only then do we get to take the perspective of the learner and understand her lifeworld and enter the kind of context to which she attends and in which she is operating.

Continuing with our analysis of the mystery transcript in Fragment 9.1c, the lay sleuth who has found it further observes what constitutes an invitation to change the topic. That is, up to now the queries and replies have been concerned with the reasons, explanations, or statements about day and night. Now a question is offered up as to the reason for why it is hotter in summer (turn 08). There is a pause and then the second part of a {query | reply}: "because we orbit the sun." Without doubt, that statement is part of what scientists would provide as an answer, though, perhaps for different reasons than even Harvard graduates do. There is a long pause (turn 11), as if Andy was pondering what to do next, and then there is another query offered. It tells us a lot about what turn 12 is the reply to. This may be glossed by saying that he possibly heard that the earth only orbits the sun in summer.

Fragment 9.1c

08 A: why is it h*ot*ter (0.19) in the s*um*mer.
09 (0.67)
10 B: because we orbit the sun
11 (2.63)
12 A: what about the winter we dont *or*bit the s*un* (0.35) during the w*in*te:r?
13 (0.23)
14 B: no. (0.47) cos the snow will melt.

We stop our reading at this point, given that the answer in turn 10 could be taken to be the "correct" answer that a scientist might have given. Would it be legitimate to infer from Andy's query in turn 12 that he "has a misconception" concerning what Bea had actually "meant" in her response? Although educational psychologists tend to take a deficit perspective on learners, the opposite is not true when they consider their own production of queries and responses. Rather than attempting to infer some hidden conception, we may pay attention to how the conversation offers resources to understand the context within which a given turn has been understood.[15] Thus, in another situation, we might have anticipated a follow up question in turn 12 where Bea may have asked Andy, "have you heard me saying that in winter the earth does not orbit the sun?" Instead, Bea's actual reply follows rather quickly, beginning with "No," as if she had stated something like, "No, we don't orbit the sun during winter." But of course, Bea had not stated this in the first place. Moreover, if "orbit" were to be synonymous with "close," then the received part of the response would be something like, "We are not close to the sun during winter," which would then be confirmed in the repetition of the negation. That is, if Bea had used the word "orbit" as functionally equal to "close," then her answer would make perfect sense from a scientific perspective.

[15] A study that analyzes a classroom instance where students call out "penis" ten times in sequence suggests that when the word is produced for first time, others have had to have the cultural competence required for recognizing that this is the beginning of a game rather than of something else (Roth 2015b). *Linguistic* competence does not explain the event.

We now turn to revealing to our imaginary amateur sleuth what is known about the origin of the transcription. In this instance, the exchanges involved a graduate student interviewing his daughter for a project. Andy and Bea therefore are both in a parent–child and interviewer–interviewee situation. We do not have a recording of how the situation was set up. But seen in the transcription, the two pulled off a situation that allows us to uncover a lot just by looking at how the exchange unfolds without having to attribute individual intentions, conceptions, or any other category external to the endogenous production of the actual conversation.

Lifeworld and Language

Language and the world in which it is used intermesh—a fact captured in the notion of *language-game*, which denotes language and the material activity with which it goes (Wittgenstein 1953/1997). The term *lifeworld* is used for the world in the way that it is relevant and salient to the ongoing activity. In this respect, we may learn two lessons from the preceding analysis. First, as soon as we ask the question about the nature of the lifeworld within which some reply is the most reasonable action, we do not arrive at *mis*conceptions but at reasonable statements about the description of the lifeworld within which that talk makes sense. To understand child development, it would be much more interesting to have descriptions of these lifeworlds than to state something like, "Children do not talk like scientists." Moreover, it would return reason and rationality to children, who navigate *lifeworlds in which language is an integral part* and where there are particular games—e.g. school, interview, sports, playing, and shopping—that come with particular forms of language. Our analyses show that just by looking at the language we find out a lot about the specific games in play.

Lifeworlds are not just abstractions in people's minds but involve real people doing real things in everyday encounters with others in situation. Here, persons and environment are transactionally related rather than like objects in boxes. *Trans*action implies the impossibility of separating person and environment characteristics (cf. Chap. 6). However, most research on (mis-) conceptions does not take this into account and therefore misses the fact that the material configuration of the interview—such as images presented or artifacts in the room—is part of the environment and therefore part of the unfolding reasoning. If it becomes part of the accented visible, the material configuration will change the responses. This is so because changes in the material setting are not just external to the engagement observed. Instead, the material configuration changes the very context against which any possible way of talking will make sense. In Chap. 6, research on the balance beam is presented where not a single student provided the same type of response in two conditions: the marked and the unmarked lever. A study of children's discourse about heavenly bodies reports a change in the content when a globe was placed on the desk where the interviews took place: those "misconceptions" that had been reported in the literature disappeared (Schoultz et al. 2001). An investigation of an

experimental teaching sequence designed to bring about change in the conceptions high school students articulate about chaotic systems shows that the very artifacts used led students to produce talk inconsistent with the curricular goals (Duit et al. 2001). The reason for these changes lays in the language available for the description of what students were seeing, which is also a function of the material situation. Thus, for example, one of the systems investigated consisted of a pendulum with an iron bob on its end that was allowed to swing above three magnets. The students, seeing the pendulum that was not swinging in a plane, were reminded of their trips to a science museum where they had seen a Foucault pendulum. Thus, the situation provided them with an appropriated frame for mobilizing the particular language they used. Their descriptive language in the curriculum and the descriptions of what they had seen in the museum matched sufficiently enough to produce an analogy. Students considered their task to be completed because they had found an explanation.

Investigators studying analogical reasoning tend to say that students who make associations with prior perceptual experiences tend to focus on surface features instead of the deeper (conceptual, relational) features and, therefore, produce "wrong" analogies and fail to "transfer" knowledge across situations. But, readers should ask themselves, what do students have available and what can they do when they first encounter some new phenomenon? The answer will contain at least two parts: (a) language and their general knowledgeability for getting around the world and (b) a more global perceptual experience with a novel aspect in their lifeworld, which differentiates only over time and with experience (Roth and Bowen 1994). Thus, returning to the interview fragment, Bea will participate in talk about heavenly bodies, in school as in other everyday situations. In the course of these situations, she will differentiate phrases that can be used legitimately from those that are not legitimate. She will produce more sentences like "We do not bump into things because we have light" rather than "We need light so we do not bump into things." Such shifts in ways of perceiving and speaking can be observed even within single science lessons (Chap. 3).

In the preceding analyses, our hypothetical amateur sleuth finds out a lot without actually getting into the heads of individual participants. For the sleuth to be able to come to any conclusions about the transcription and the situation in which the talk occurs means that parent (A) and child (B) make available in speaking more than the content of each word, somehow transmitted to the other. They also make available to each other everything required for the happening to unfold as a *recognizable* event: recognizable to others as to themselves. In so doing, their lifeworld and the language in use are manifestations of the same unity. Everything required for understanding the situation—which would have been augmented had we been privy to the talk that set this situation up and if we had visited the family and therefore known about the participants' relation—therefore could be derived from the *Said*. This event, where educational researchers may find conceptions, is a cultural event through and through. Rather than laying down representations of what they had in their minds prior to the conversation, the participants jointly orient so that the outcome is a recognizable phenomenon (fact) of their common (social) lifeworld. Here

we use the *Said,* an abstracted part of this world (i.e. the words articulated made available by means of a transcription) as the materials from which we reconstruct a lifeworld that possibly generated the talk. This *Said* is a verbal protocol of the work participants have been doing in the same way that a *think-aloud protocol* captures the work that an expert does while solving a problem in the psychological laboratory. Our amateur sleuth recovered so much in the analysis precisely because she took the transcription as a protocol of what was happening.

Past research has assumed the existence of "beliefs" in children, which they presumably form during participation in cultural activities, and which drive what they subsequently say (Vosniadou and Brewer 1994). But there are many situations, including clinical interviews, where a person asked states to have never thought about the issue and then immediately launches into a reply (Roth 2010). People talk about phenomena and respond to questions without ever having thought about these before, so that they could not have "constructed" some mental framework or conception prior to talking. As our analyses show, the fact that conceptions and misconceptions can be attributed to individuals is the result of societal relations with others in particular forms of (productive) activity where they draw on cultural resources (i.e. language and other forms of historical experience discussed in Chap. 8).[16] We may think of the situation using the analogy with arriving in an unfamiliar city. We do not have a map ("beliefs") and yet we begin to navigate the city. We may build something like an experiential map without ever having the image of a map in our minds; in fact, many people have trouble reading and following a geographical map and yet competently navigate a city without it. In the same way, many speakers are competent in their language without knowing any formal grammar; and many individuals competently navigate the world even without anyone noticing that they might be categorized as illiterate in other contexts—sometimes even "semiliterate" get by in college.[17] In sum, therefore, we do not require conceptions and mental frameworks to answer the questions that educational psychologists ask us about some (scientific) phenomenon. Instead, our familiar language is both context and tool (text) to generate any description and explanation on a topic that we may never have talked about before.

Misconceptions *From* and *For* the Other

> Language is consciousness that exists in practice for other people and therefore for myself … The word is the most direct manifestation of the historical nature of human consciousness. (Vygotsky 1987: 285)

[16] Here, we understand activity in terms of *cultural-historical activity theory*, that is, as the minimal unit for understanding human behavior that retains all the characteristics of society (Leont'ev 1978).

[17] One account of a student succeeding in university with first-grade reading level can be found at http://chronicle.com/interactives/dasmine-cathey (see also Chap. 7).

Ontogenetically, social relations exist before a child begins to talk (words and language). In our everyday lives, the language we use always is a function of the particular activity in which we engage; and if by chance a university professor was to speak to the carpenters working on his house using the forms of language typical at work, he would be considered odd, perhaps "stuck up," and very much out of place among carpenters and others building houses. We also do not make up stories and then wonder to whom we should tell them. Instead, when talking to children about our working day, our language forms address *them* and the intelligibilities that we associate with children. We do not even have to think about it but "naturally" talk about our working day in ways suitable for children of a particular age. The same happens with our partners, the people constructing the addition to our home who may be interested in what we make for a living, or the colleagues at the university. Each time our narrative and forms of talking change, always adapted to the current situation. Talk is *from* the Other and *for* the Other. The prepositions in the forgoing phrase (i.e. *from* and *for*) point us to the relational nature of talk, its content, its ways of reasoning, and its form. We therefore must not attribute talk to just one person, the one in whose mouth the sound resonates but we also have to account for the other for whose ears those sounds were made. In everyday life, we do not step into situations as if these were boxes where we become pieces of the furniture with behaviors that implement rules. Machines may do that—which is why their behaviors are "machine-like," "robotic," and inflexible.[18] Instead, we participate in the joint work that makes the social phenomenon happen wherever this might be, and we make this work visible to each other.[19] Thus, Fragment 9.1 could have been recorded at the home of Andy and Bea, in the park where they decided to go for a picnic, or in the laboratory of his research group. Together they would have pulled off the *clinical interview* through joint work. Bea being a first-time participant in a clinical interview could not have the relevant *schema* and associated *scripts* of the kind that is used in the cognitive science literature to explain human behavior (e.g. Schank and Abelson 1977). Bea could not have had a "clinical interview schema" that she would have enacted because she never participated in a clinical interview before. Yet without her participation, what they did together could not have been a clinical interview. If she had not been an active participant then there would not have been a situation at all. It is because the joint work actively produces the clinical interview that the unfolding talk can be taken to be the protocol (product) that allows anyone culturally competent to recognize the situation as a clinical interview.

[18] During the days of this writing, a feature on artificial intelligence broadcast by the Canadian Broadcasting Corporation both (a) emphasized the virtues of *AlphaGo*, the computer program that beat the human world champion of Go and (b) exhibited the failure of a humanoid robot when the journalist said, "Can I have a fist-butt?"

[19] If hitchBOT, the hitchhiking robot, was able to make it across Canada, then this speaks to the accommodating nature of humans rather than to the "innate" skills of the robot. (See, e.g., http://www.cbc.ca/news/canada/nova-scotia/hitchbot-the-hitchhiking-robot-to-travel-across-canada-1.2716476.) That hitchBOT was "killed" while traveling in the US reflects a society with the highest murder rate among industrialized nations ("developed countries").

The joint work, as we see in the fragment, involves making available to one another descriptions and other resources that exhibit *what* is happening right now. That is, in the case shown, Andy is not merely asking a question but indeed *formulating* the coming of a question; and he characterizes it to be an easy one. The joint work also includes ordered pairs, which, here, are {question | reply} occurrences. Those turns that we denote as questions (e.g. turns 01, 04, 08) also function as invitations, which, in responding—actively receiving what the other says and replying—come to be accepted. An invitation already will have had occurred before, when Andy would have asked Bea whether she likes to participate in whatever he called the activity; and Andy would have given her some reason to explain why he would be recording the session. Bea will have accepted so that the fragment could in fact begin in the way it does in Fragment 9.1a. Turn 01 also opens the session by stating what is to come next. It marks that whatever has happened before is finished and that they now begin doing what Bea has been invited to participate in.

The *joint* work also includes responding in ways so that what is witnessed corresponds to the type of situation that those present find themselves in or have been invited into. Thus, unless Bea's actions belong to a particular kind of socially available and recognizable repertoire, the result would not have been a clinical interview about children's conceptions of the heavenly skies. It would have been something different. When we look at what has actually happened, we see that Bea replies by addressing the queries in a particular way, speaking *for* Andy, addressing him, and producing content *for the purpose* of accomplishing and producing something, in the way she has been invited to. That is, we do not just have a memory dump, where Bea talks to reveal the content and structures of her mind. Instead, what she says is shaped by what can be supposed and anticipated to be the intended accomplishment. The words unfurling from her mouth are not hers (alone). They are not hers because the language has come to her, *from* the Other, some of it directly in this situation (e.g. day, night, hot, and summer) and other parts from the generalized other (i.e. the cultural context in which she has learned the language). If the words and phrases were not explicitly *for* Andy, then we would witness—as pointed out in Chap. 4—a situation of the type that we might gloss by means of the expression "dialogue of the deaf." Because the words are *for* Andy, the content and shape of the replies also bear *his* characteristics—he is part of the performance situation that we need to take into account to understand the words Bea pronounces.

In deriving misconceptions from clinical interview talk educational psychologists tend to abstract the responses of research participants from the situation and attribute words to the speaker. This is a double reduction, where the connection is lost to the *social* phenomenon (e.g. {query | reply}) of which any reply only constitutes the second part (Chap. 4). This practice also abstracts the phrase from a pair in which it constitutes the first part that is produced *for* the recipient. It is only after such a double reduction that statements can be attributed to the research participant—Bea in our example. A different and much more satisfying solution that does not require such a reduction would be to focus on the language and to analyze its syntactic and semantic features. In this way, we would then investigate the features of the discourse about heavenly bodies (Roth 2008b), the discourse as a cultural

possibility and not just as this one instance or situation. Indeed the two, the situational and the cultural aspects, presuppose each other. As a cultural feature, language constitutes part of a sense-giving field, a field that does not exist as an abstraction, but is really and concretely produced. Interview fragments then are evidence of the common use and intelligibility of the discourses on which any actually witnessed clinical interview is built. If the talk were not intelligible, the result would not be a clinical interview.

Even within the most traditional paradigm of communication (i.e. information transfer), the recognition, understanding, and categorization of a stretch of talk as an expression of a misconception requires the *general* intelligibility of the talk. The inherent intelligibility of such talk is a condition for its classification as conception or misconception. If stretches of talk are intelligible, and if not only children but also educational psychologists conducting clinical interviews take talk as the basis for their verbal exchanges, then why would we try to get into the minds of individuals to seek the origin of the "misconception"? It is precisely in language generally that conceptions and misconceptions are made possible. This talk therefore can be concretely realized in any actual social situation without, as seen in our fragment, causing any issue about lack of intersubjectivity—in the fragments presented above we observe no instance where a participant displayed incomprehension of what the other was saying. If such ways of talking are possible and intelligible, then culture and the speech *community* are the loci of any identifiable conceptions. It is here that they are given together with the language—sometimes directly, such as when a child repeats a phrase, sometimes indirectly just because of participating in the use of language. If anything, then Bea "borrowed" the misconception from language in general, and from the talk in the situation in particular. Thus, together with using the language, she returned the borrowings to the recipient, here the parent recording for an assignment the talk about day, night, summer, and winter. The misconceptions that researchers might be tempted to attribute to the child then may also be said to belong to the parent, who has jointly produced the required context for each of the utterances to be said and heard in those particular ways.

Readers also need to consider that children never studied methods for deriving thoughts and mental structures from the talk they hear. That talk is all they have. It is in the course of their lives that children become familiar with certain forms of talk and become fluent in language use. Together with language they also come to talk about such things as thoughts, which they never encounter other than in the form of talk about "thought." Their own internal monologues, which are competencies that result from participating in social talk with others—results that are nothing other than a form of social talk done by individuals with themselves—then also provide a model for talking about thought. It is not the children that make up this talk in their mind.

If talk is intelligible, then it is social. Only as intelligible talk can a misconception be identified and categorized. For other forms of talk, educational psychologist might have tabular cells with entries such as "logically inconsistent response," "No response, do not know, or ambiguous response," or "Anything" (Vosniadou and Brewer 1994: 141). When we look at any form of verbal exchange, then we have to

consider that "in consciousness, the word is what … is absolutely impossible for one person but possible for two" (Vygotsky 1987: 285). This statement, in essence, is a move on the part of the late Vygotsky in the direction of an updated Spinozist understanding of the world. Language here is treated as a field, a semantic or sense-giving field that both constitutes and is constituted in speaking. Apart from the field, no verbal interchange is possible; and any interchange is possible in and as aspect of the field. This field is where any "misconception," if we still want to use the term, is to be identified and where it has its genetic origin. The speech field, as Vygotsky points out in the introductory quotation of this section, is a historical one; and it is a concrete, material manifestation of the historical nature of human consciousness. Thus, anything Bea can be conscious of is available in that cultural speech field. There is nothing, as one philosophical reader of the late Vygotsky points out, that can be inside without already being outside of the individual (Mikhailov 2001). Again, it is there in the outside, publically accessible to the child and to the educational psychologist, where we find all possible misconceptions.

Against the Reduction of the Nonverbal to the Verbal

Over the past several decades, investigators have increasingly studied modes of communication other than the verbal one. The most frequent mode researched besides the verbal is the gestural one. People gesture all of the time, and even blind people have been reported to gesture when talking to other blind people. This suggests that gesturing is part of the communicative activity but differs from the verbal. Among sighted people, gestures are an integral part of the communicative relation. Take the following fragment from a clinical interview involving an adult (Celia) focusing on the same issues that Andy and Bea talk about in the first fragment. Fragment 9.2 comes from the part of the interview in which Celia replies to the invitation to explain the difference between summer and winter. She has already talked about the seasons making the difference and, responding to various invitations to expand and deepen her explanations talked about latitudes, about the amount of heat, and about the distinctiveness of the seasons as a function of the distance to the equator. She then stated that there is more sunlight at the equator, which the interviewer asked her to explain. In replying, Celia talks and gestures simultaneously. It is at this point that Fragment 9.2 begins. We can see how she positions and names the sun (right hand) and the earth (left hand) with respect to each other. We can see which hand to take as the sun, because there is a beat gesture with the hand prior to bringing it into position; a similar movement prior to its position defines the earth.

Fragment 9.2

01 C: may be the sun is here ((*beat preceding position of rH*))

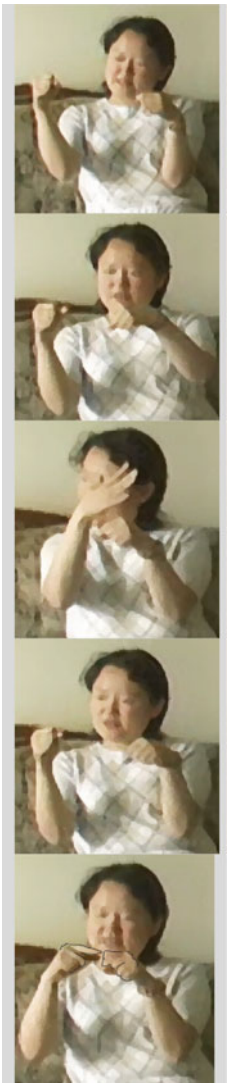
02 and the earth ((*moves lH*)) is not in a ((*moves wrist of lH*)) straight way

03 its a– there is a angle ((*rH moves twice down on the angle indicates*))

04 I: yea yea ((*nods twice*))

05 C: and the way it moves ((*rotation in wrist, moving center of fist around in a circle*))

06 this side didnt have the sunshine all the time.



While Celia says, "is not in a straight way," the left fist makes a rotating movement (line 02). We then witness a change in the hand configuration, because the right hand leaves its position and, while Celia says, "there is an angle," the right hand—which has moved from a fist into stretched out configuration (turn 03)—moves along a trajectory that is parallel to the plane that her hand configures. The right hand then returns to the previous configuration where it takes the position of the sun. Celia continues saying, "the way it moves," while rotating the hand around the wrist joint, which makes the center of the fist describe the motion on a circle (line 05). The right hand then leaves the sun position again, takes a pointing

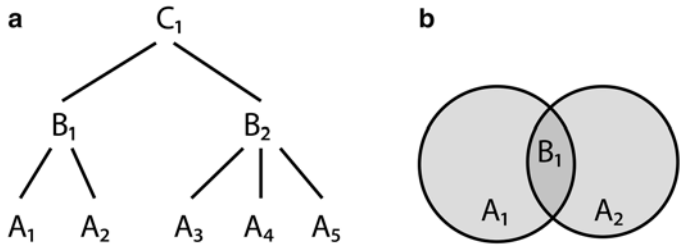


Fig. 9.4 Classification of concepts following classical logic. (**a**). Hierarchical order of more and less general concepts. (**b**). The higher concept as that which the lower concepts have in common

configuration towards the fist named "earth," while the verbal mode states, "this side didn't have the sunshine all the time" (line 06).

Most research concerning conceptions has not reported on the gestures research participants use. We know from having worked with researchers interested in conceptions and conceptual change that researchers tend to use words to state what participants such as Celia *meant to say* but expressed by means of gesture. But there is no evidence that Celia did not mean to say something that she does not already say. Instead, we witness her gesturing; and watching the video does not require us to begin interpreting what is being communicated. In viewing the tapes, we do not have to translate the gestures into words. To understand we do not require translation or interpretation at all. Everything communicated is right there, in the world, to be witnessed as is. On the other hand, translating the nonverbal aspects of communication into the verbal reduces the former to the latter. The legitimacy of such a reduction requires a particular theoretical framework; and this framework is inconsistent with the Spinozist approach to psychological phenomena that began to emerge in the last works and notebooks of Vygotsky.

A debate about these issues already exists (see review in Roth 2001). There are (a) suggestions that gestures and speech are different externalizations of one underlying concept; (b) other researchers suggest that there may be two different conceptions at work, especially when the verbal expression does not coincide with the (translated) gestural expression, which is also taken to be an expression of the readiness to learn; (c) still others suggest that there is a common origin to speech and gesture but the externalization taking different routes; and (d) some investigators propose that gestures only serve to increase the activation levels of the brain (see Chap. 3). The research relevant here includes the first three types, which accepts some definite relation between the two modes of communication. It is possible to think of the relation between words and gestures in two distinct ways, one grounded in classical logic and the Kantian position on concepts, the other one in dialectical logic.

In the classical, Kantian approach to concepts, we observe a hierarchical order (Fig. 9.4a). A higher concept includes all the features that the concepts below them have in common. The higher order concept (B_1, B_2) has been *abstracted from* the lower order concepts (A_1, A_2, … A_5). This is precisely what underlies the approach

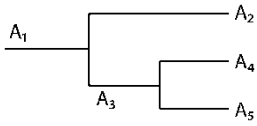


Fig. 9.5 Classification of concepts following dialectical logic

to conceptual understanding outlined at the beginning of the chapter (Fig. 9.1). It goes without saying that the highest concept is the one from which nothing else can be abstracted without completely losing the phenomenon; and the lowest concepts are the most specific because they do not summarize any concepts below them. Any higher concept therefore arises from the commonalities of the cases that they generalize. This paradigm underlies the classical studies on concept learning (e.g. Bruner et al. 1956). If we were to adopt this paradigm to the relation between speech and gestures, then we might argue that there are different conceptions being expressed, or that the conception is whatever the two modalities have in common (Fig. 9.4b). Their differences then are just noise or not directly connected to the conception being expressed.

In the dialectical approach the situation is very different.[20] In our situation, the relation is a historical, *genetic* one. Thus, a more general concept genetically precedes a more specific concept, such that A_1 may be the precursor that has given rise to both A_2 and A_3; and A_3 has given rise to A_4 and A_5 (Fig. 9.5). As a result, A_2, A_4, and A_5 may have no external (surface) features in common with A_1 and A_3. Yet they are related through filiation, that is, by the fact that they are part of a common history of development. This then explains why some psycholinguistic research reports finding alternative conceptions in speech and gesture (e.g. Church and Goldin-Meadow 1986). There is an inaccessible phenomenon of the thinking body that manifests itself inherently differently in speech and gesture. Sometimes the two manifestations may be said to be consistent and to fit the same conception, whereas at other times, the two manifestations are incommensurable. Working in this way on his project to articulate a theory of the psychology of art, Vygotsky began by analyzing a fable. He did not begin by looking at all art forms or at multiple fables to extract what is common to them. Instead, he saw himself looking at the fable as if he had A_5 in his hands, and then set his task as one of identifying A_1, which would contain those aspects that are expressed, in the development of human culture, in other art forms (e.g. A_2 and A_4) but in very different and even contradictory ways.

It is immediately apparent that in this approach all instances are concrete, A_1 as much as A_4 or A_5. These instances are not abstracted and, therefore, more or less abstract. Vygotsky did proceed and test his conjectures in two other written genres, a short story and a drama. The supposition in the dialectical approach is that the genetically earlier generalization will manifest itself differently in the different contexts where it concretizes itself. Using this way of thinking in the context of gesture and speech, these would then be inherently manifestations of the one phenomenon.

[20] Vygotsky used this method from the very beginning of his career, such as in *The Psychology of Art* (Vygotsky 1971).

But this phenomenon is neither the intersection of the two nor their sum or synthesis. It is not a verbal schema or expression of verbal thinking. The manifested phenomenon definitely does not only consist of those aspects that gesture and speech have in common, as if some material parts of talking and gesturing belonged to the concept whereas others were irrelevant or impure. Instead, both gesture and speech, in all their detail and materiality, are concrete manifestations of one thinking body. Each person is a manifestation of this thinking body. Just as words cannot be reduced to gestures, gestures cannot be reduced to words without loss and denaturing.

Coda: From Concepts (Meanings) to Sense-Giving Fields

We begin this chapter noticing that much of the extant literature on conceptual change in general, and its associated discourse about misconceptions in particular, stem from a specific (Saussurian, dualistic) way of conceptualizing the sign. From this view, any verbal expression (word) is taken to constitute at the same time signifier and signified, its most central function being that of representation. Representations then are assumed to become concepts in the learners' minds that form coherent webs or loosely connected pieces of fragmented knowledge (di Sessa et al. 2004), which underlie or cause the words and gestures that are heard and seen in clinical interviews or classroom situations. The notion of "conception" in the classical literature about conceptual change is indeed structurally analog to that of "meaning." Words and gestures stand for concepts in the mind in the same way that they stand for meanings. The position advanced in this chapter is radically different than that; one could say it is incommensurable with it (Roth 2008a). This is so because of the asymmetrically alternate view on the sign that the monist Vygotskian approach proposes.[21] In this view, signs do not stand for some underlying meaning that pre-exists within the person's sight (as something that is in-sight), but always relates to another sign, another communicative feature that sequentially precedes or can be anticipated to come next in the course of an ongoing communication. Thus, the often-invoked "meaning" of a word (sentence, utterance) "is always and necessarily *another* linguist sign—or, better, set of such signs" (Dewey 1946: 87). In this way, and as we show in the previous section concerning the thinking body, the relation between the different modalities of communication observed in clinical interviews, classrooms, and everyday situations exist not as a function of each modality's own features (word, gesture), but as they stand in their sequential relation with the developing whole. Thus, "there is no such thing as a sign in isolation, every sign being a constituent of a sequential set of signs" (1946: 88). Consequently, the Kantian classificatory framework that underlies many of the current theories of thinking and learning does not adequately describe membership (e.g. of a sign as part of a concept) simply because "apart from membership in [the sequential set of

[21] We provide a more detailed description of this different approach to the sign in Chap. 10.

signs], a thing has no meaning—or is *not* a sign" (1946: 88). The relation between signs and concepts, if anything, is a historical relation.

There are considerable implications for research on conceptions and the instructional practices that may derive from the Spinozist position advanced here. A critical response to a cultural view on conceptions often is framed in terms of the problems that we may face in fully dropping the idea of mental representation. Some articulate the fear that we cannot talk and think about something that is not present in a given situation unless there exists a "mental model" (Vosniadou 2008). Making present aspects of the world that are not present surely is a core feature of human communication. The critique is grounded in two premises: (a) that to think and talk we require models that need to be brought to bear *before* we think and talk; (b) and that the model we require is mental rather than just a material thing. In Chap. 3 we offer an empirically grounded discussion of the relation between thinking and communication, where we make the case that thinking and communication do not mirror each other in a relation of one-to-one correspondence—contrary to the premises of the critique spelled out here. Their correspondence is not that of a mimetic relation between inside and outside world because these are the results of a "continual coming and going of one into the other" (Mikhailov 2001: 20). The relation between inside and outside is intransitive, where *to correspond* is not synonymous of "standing for" but denotes the movement of growing together (e.g. Roth 2016). Growth takes place precisely because thinking and communicating are two different lines of development that constitute a unity/identity. Thus, when we observe Celia speak and gesture, visibly and audibly changing the material situation in which she finds herself, we do not see the external part of an internal (thus invisible) thinking. What we witness is a thinking-*for*-communicating and a communicating-*for*-thinking: the doings of a thinking body. The talk we observe, an aspect of the speech field, is the materialized consciousness of both participants. Whatever conception may be identified in Celia's talk and gestures needs to be thought of in its relation to the communicational context: coming *from* and being produced *for* another.

Bea and her parent, too, jointly produce a context where anything about concepts that can be said is laid out in the public sphere. The public appearance is a requirement for the conversation to unfold in the way it does. A monist approach to the study of conceptions, therefore, does not reject the idea that there must be some materials, let us call them models, that participants draw from to produce coherent and reasoned accounts for whatever purposes. Yet, the model is not "mental," but cultural, publicly available in fully visible and material form. Whatever is not made visible is so not because it exists as a mental model but because it already forms part of the participants' repertoire of knowing their ways around this part of their common world. In the same way as we do not need a map (neither physical nor mental) to walk the streets around our homes, participants in talk do not require models of what can be taken for granted.

Taking such a position, we can begin to think the teaching of concepts in a new way: not as a teaching or straightening out of incorrect meanings or misunderstandings but as an education of attention. In this education, what is learned are not con-

cepts but forms of orienting within lifeworlds. Rather than seeing students as having to somehow jump across a gap that separates their understandings from those of the scientific community and teachers, {teaching | learning} means entering shared sense-giving fields, where lifeworlds are not divided by virtue of bearing different self-enclosed meanings. As discussed in Chap. 4, participants to conversations produce sense-giving fields that are not their own but are cultural possibilities of being, suffused with affect and not just intellect. Studying conceptual change then turns into the study of personal and cultural change. There no longer is a divide between the formation of concepts and the formation of persons, a move that calls for radical shifts in the way educational institutions are organized today (see Chap. 13).

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Chapter 10
Natural History of the Sign

> Each time answering by means of auxiliary stimuli—the signs, the child organized its active attention from the outside and adapted to the problems that it could not solve by direct, elementary forms of behavior. (Vygotskij 1984: 65)

> The history of development of higher [psychological (psixičeskix)] functions and their genetic connection with the natural forms of behavior—we designate as the *natural history of the sign*. (Vygotsky 1999: 50)

The sixth volume of the collected works of L. S. Vygotsky—in the original and English editions—includes two great works that are attributed to be his scientific legacy: *Tool and Sign in the Development of the Child* and *The Teaching about Emotions* (Vygotsky 1999). Both of these, although most clearly the latter, are the beginning of a reworking of theory in terms of the Spinozist approach that Vygotsky envisioned. The move to a Spinoza-inspired monist approach allowed Vygotsky to "complete an extremely important step away from his initial logical-methodological *mediating* intentions to a more consistent pursuit of the idea of the *fundamental* identity of the two allegedly polar … forms of human life" (Mikhailov 2001: 16). This comment on the part of a Russian philosopher with a specific interest in Vygotsky is revealing, for it makes problematic the way in which Vygotsky's work on the function of signs is represented in the Western literature. In that uptake, the sign is theorized to have *mediating* function. That is, Mikhailov suggests that Vygotsky, though he previously had indeed theorized the sign in terms of its role as a mediator, actually was stepping away from it near the end of his life. Indications that Vygotsky was making such a step do indeed appear in a note from 1932, which was recently found in his family archives. Here he states dissatisfaction with his own work concerning the sign:

> The necessity of a new stage of inquiry does not stem from the fact that a new thought has occurred to me or a new idea has caught my interest, but from the necessity of developing the r[e]se[a]rch itself—new facts prod me into searching for new and more intricate explanations.… We focused attention on the sign (on the tool) to the detriment of the operation with it, representing it as something simple[,] which goes through 3 phases: magic.—ext[e]

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> rn,—intern. But the knot is extern.** and the teenager's diary is ext[e]rnal. Hence we have a sea of poorly explained facts and a desire to delve more deeply into the facts, i.e., to evaluate them theoretically in a new way. (Zavershneva 2010a: 41)

He specifically notes to have missed attending to the operations with the sign (and tool), having focused instead on the sign as a thing. This quotation in particular has been recognized as marking a "radical revision of [his] previous achievements" (Zavershneva 2016: 112). This radical revision therefore comes several years after the manuscript *Tool and Symbol in Child Development* was written by Vygotsky and Luria in 1930, a manuscript that was partly reproduced in the widely cited *Mind in Society* and where the mediational triangle was presented on which all the arguments about the mediational nature of sign and tool are based.[1,2] Those arguments certainly are not what the late Vygotsky was working on after announcing a new stage of inquiry oriented towards understanding human beings in their everyday contexts.[3] In this chapter, we take up this re-orientation Vygotsky anticipated for his own work concerned with investigating the genesis and life of signs. We articulate the approach in a Spinozist sense in the way it emerged in Vygotsky's last notes and sketched in his final works.

Problematizing the Sign

To introduce his readers to the function of signs, Vygotsky (1999) writes about typical experiments in which his collaborators and he investigated the use of signs. In one of these, the participating children are given a task that presents them with different stimuli and requires them to press down a corresponding key (there are five). When the research is conducted with children between the ages of four and five, the task constitutes a near insurmountable challenge. After receiving a stimulus, their index finger apparently hovers over the key, moving from one to another in the apparent attempt to find the one that they need to push down on. When the same task is presented to a child only a year older, between 5 and 6 years of age, the initially confused child solves the problem rapidly as soon as the experimenter suggests facilitating the task by "placing before each of the keys corresponding auxiliary signs to serve as supplementary stimuli to guide and organize the process of selection" (Vygotsky 1999: 32). Importantly, the additional stimulus placed before each key does not *complicate* the operation required to solve the task. Instead, a fundamental reorganization is occurring: "The structure of the [psychological

[1] The triangle is also sketched in a previously unpublished manuscript dated from 1929, first published in Russian in 1986, and later in English under the title Concrete Human Psychology (Vygotsky 1989).

[2] *Tool and Symbol* was first published integrally in English in 1994 (Vygotsky and Luria 1994), only edited fragments having been reproduced in *Mind and Society.*

[3] A focus on the pragmatics of everyday life, of course, is consistent with the pragmatic take on signs and language (Wittgenstein 1953/1997).

(*psixičeskogo*)] process is reconstructed radically under the influence of the new ingredient, and the primitive, natural operation is replaced here by a new cultural operation" (1999: 32).

In the literature, the sign relation often is depicted in a triangular form, which Vygotsky had used in about 1929 when he wrote the fragmentary Concrete Human Psychology and again in 1930 (Vygotsky and Luria 1994), from where the editors of *Mind in Society* (Vygotsky 1978) picked it up to be used in the text they produced.[4] That diagram builds on existing stimulus–response theories, where there was a direct relationship between what the animal perceives and its action (e.g. the dog salivating when it sees or smells food). In this work, another *auxiliary* stimulus, which he refers to as a sign,[5] is entered and said to stand between the stimulus *S* and the response *R*:



But, as shown in the quotation from *Tool and Sign* that opens this chapter, Vygotsky actually writes that the psychological process has been fundamentally restructured when the secondary stimulus enters the activity. This activity is of a new type, and consists of an internal reorganization rather than of something that has been made to intervene between two things external to each other. What Vygotsky calls the sign, then, must in fact be part of the same material world as S and R, and so it does not stand in between.

In the common way of approaching human action as stimulus and response, the former is an aspect of the environment whereas the latter is an operation (action) of the organism, with the psyche (mind) making the connection. Because the psyche generally and the mind specifically are thought of as immaterial things and therefore transcending the physical world, a connection is needed between the two. That connection, in the history of philosophy, has been termed a *mediator*. Whereas the pineal gland was for Descartes the mediator between the physical world (biology) and mind existed in the form of the pineal gland, in the modern tradition it is the sign that takes this role between the human mind and the physical world—as seen in the expressions *internal representation* and *external representation* that populate much of current psychological and educational psychology literature. The sign is special because it can be thought of as physical (e.g. letter on the page) and non-physical simultaneously (e.g. letter in the mind). The view may be based on our everyday experience, where we can imagine something figural that has apparent,

[4] This construction, though widely cited in the Western literature, is highly contentious, as shown by scholars sufficiently familiar with Vygotsky's work and the Russian language (Yasnitsky and van der Veer 2016).

[5] Generally, the term *sign* is not used consistently. Some scholars use it to refer to a signifier–signified relation, whereas others employ it synonymously with the signifier.



Fig. 10.1 The letters on the keys are Vygotskian signs aiding in finding and pressing the keys when a typing individual hears or imagines a word (Photo courtesy Wolff-Michael Roth, used with permission)

iconic resemblance with a drawing on a piece of paper. The thing drawn may then be thought of as having immaterial (mental) and material (traces on a paper) features. As the reader may have noticed, this whole rationale is consistent with the Saussurian view of the sign introduced in Chap. 9 (see Fig. 9.2).

In Vygotsky's earlier work, the relation between the external and the internal relates to the dual function of the sign, which first is a means for social relation, and then a means to relate to oneself. Whereas in the external phase the auxiliary sign, which first is indistinguishable from the stimulus, comes to be separated from and *mediates* (as per Vygotsky's usage) it, in the phase that he refers to as of "interiorizing" (Vygotsky 1999: 54) the auxiliary sign no longer mediates. Thus, "it would be improper to think that mediation by means of certain external signs is a perpetual form of higher mental functions" (1999: 52–53). If we take Vygotsky's later category *perežívanie* [experience] as a unit designed to capture the unity/identity of person and environment, then what he calls the sign, the additional stimulus, does not enter *between* two entities external to each other (i.e. *partes extra partes*).[6] They are not external to each other because they both are integral part of the *same* unit; each therefore is part of the other. The task without additional stimuli and the task with additional stimuli are not the same. These are different tasks because we are concerned with different instances of {person | environment}. They are not just different, but different in a crucial way: the task with additional means involves an organization of higher order and therefore constitutes a higher psychological function. But the difference does not consist of the fact that the second tasks inserts a mediator between the stimulus (sign) and the response. In fact, what Vygotsky describes as the function of a sign may disappear again and the task unfolds in the same immediate way as it has before. Consider typing.

Keyboards are labeled with letters and numbers, arranged in different ways according to society and culture (Fig. 10.1). If we do not take typing classes, we

[6] There are extended recent meditations on the relation of body and psyche, which S. Freud, on his deathbed, characterized as extended, *partes extra partes* like the material body (Derrida 2005; Nancy 2008).

tend to learn typing by visually searching the key that has the letter printed on it corresponding to the letter to be typed. Readers see that this is precisely the task that Vygotsky describes, where a typist is to hit certain keys in response to the word that the superior dictates.[7] Those who type their own texts have to move from the words they imagine, find the keys corresponding to the letters in the word, and press them. For those of us who eventually—with or without taking classes—come to use the keyboard without actually having to look for the printed letters, these no longer exist in the consciousness. They are no longer required for getting from a word heard or imagined to the printed word. In fact, those of us who really come to be proficient no longer need to think of the word in mind prior to making it appear on the page. Here, the process of writing resembles that of proficient speaking, where thought realizes itself in print without having to cogitate (be conscious of) what is to be communicated prior to communicating it.

Sometimes there is trouble. An error occurs in typing, especially for those who never formally learned to type. Then, what appear on the page no longer are *words* but "eptfd," senseless strings of letters, when the hand trying to type "words" has moved one character to the right on the QUERTY keyboard). However, following a quick look down onto the keyboard, a reorientation of the hands on the keyboard, typing gets back on its tracks producing what it is supposed to produce. In this case, the original work of getting the fingers to type is made visible again when there is trouble: looking for the "sign" that will allow us to hit the right key. How should we think of this historical process?

The first observation we make is that for the expert typist, the letters on the keys no longer are required for getting the correct keys pressed. Even for those thinking about human behavior in terms of mediation need to acknowledge that the letters no longer play a role in finding the right key. The letters on the keys have become "transparent," much like wearers of glasses do not tend to be aware of them but view the world as if there were no glasses at all[8] or like the cane in the hands of the blind that come to be integral to their world (Roth 2007). The letters on the keys no longer are required because the hands and fingers are moving in ways that have been shaped by the physical layout of the keyboard and the particular location of the keys.[9] That is, the body movements have been shaped by and in the image of the keyboard. What has happened then is a transformation of the {person | environment}, where the behavior and what appears in consciousness changes over time. This is exactly like the example that has been used in cultural-historical activity theory, where a series of conscious actions—hitting clutch, moving gear and, releasing clutch—become one: shifting gears (Leont'ev 1978). What have been actions, each in pursuit of conscious goals, now have become unconscious operations subject to the overarching action in the service of which they appear without having to

[7] In contrast to Vygotsky's task, where the auxiliary sign is arbitrary, the one printed on the keys and the one to be produced stand in an iconic relation.

[8] Those with contact or intraocular lenses (implants) may notice those implements even less.

[9] This is a fundamentally Spinozist recognition that our behavior is shaped by the forms of the world.

be thought about. As in a melody that we hum once started even without having to remember individual notes, shifting and typing unfold as *kinetic melodies* that bypass all intervention of conscious signs (e.g. Luria 1973). Very experienced drivers no longer have to think about shifting, but shifting occurs in response to any present situation. As we know from our experience of driving 5-ton trucks, the most proficient of us do not even require the clutch but can shift silently on feeling that the conditions are right. In these situations, the conscious deliberation has the same fate as the sign in Vygotsky's experiment or in our keyboarding example: it disappears over time.

Critical readers might suggest that there is a form of "automatism" that explains why touch-typing is possible. Automatism is attributed to the body, as if it were to exist independent of the mind. The example of the incorrect strings of letters appearing on the monitor shows, however, that something else is occurring. As soon as there is trouble, the invisible work becomes visible again. It has not disappeared. In fluent typing, the work is simply no longer visible. It remains as the invisible ground that makes touch-typing possible. It returns to the visible when touch-typing gets itself into trouble. The shifts are not between two different things, the body and mind, but different manifestations of developments within one and the same *thinking body*. In fluent touch-typing, that body, inherently biological, is cultural through and through in the movements that it makes within the lifeworld to act in recognizable ways and to produce recognizable things.[10] The thinking body is but an expanded, indeed extended thinking system.

Just as there are shifts in the activity that occurs in typing, from the searching and hitting of individual keys to the touch-typing of the expert typist, there are shifts in what people do with other material forms that first are part of communicative exchanges. Among those material forms are sound-words, bodily gestures, things we shape, and traces we produce in a variety of mediums (e.g., paper-and-pencil drawing, images on a tablet using an art application). What initially appears in consciousness for the purpose of doing something and that thereby is visible (i.e. salient), later disappears because it has become an invisible part of the system—though it can become visible at any time and invariantly does so when there is trouble.

Before getting into the issues of the natural history (i.e. birth and life) of signs, some clarifications are required. The earlier Vygotsky uses the term sign [znak] to refer to a thing that stands to something else in an indicating relation (in the figure above it points to the response *R*). Thus, he is concerned with "the connection between sign and meaning, between the word and the object it designates" (Vygotsky 1999: 9). Sometimes the psychologist also uses the term *auxiliary* stimulus to distinguish it from the initial stimulus (*S* in the diagram above). However, in the sciences of the sign, *semiotics* and *semiology*, and particularly in the light of C. S. Peirce's semiotics, the sign does not concern a relation between two separated con-

[10] The same is said about the movement of the eyes that are structured to become cultural in the work of reading (Chap. 7) and about the movement of hands and arms in the drawing of culturally specific geometric forms (Chap. 8).

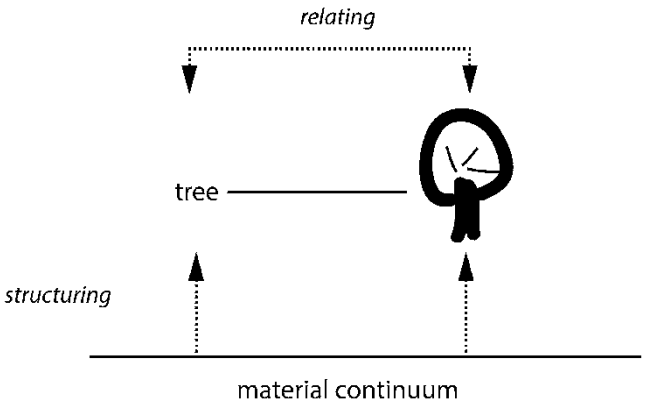


Fig. 10.2 A sign is the relation between two segmentations of the material continuum. It requires two forms of work: structuring makes form stand against ground, and relating establishes the association of two forms

tinua, one for the expression and the other for the content. Instead, the sign is a relation between two segmentations *of the same material continuum*, each consisting of matter and form (Eco 1984). The relation therefore is not between two different substances, one material, and another mental, but between two segmentations of the same world: "the interpretant, in Peirce's usage, is always and necessarily *another* linguistic sign—or, better, set of such signs" (Dewey 1946: 87). If the sign is the relation between two segmentations of the continuum with specific form, then there are two kinds of work required: *structuring* makes form (figure) stand against everything else that is ground and *relating* creates that association between two forms (Fig. 10.2). From a Vygotskian perspective, the perceptual structures (percepts) are the lower functions, whereas the relationship constitutes a higher function. Structuring work of course already involves a relation: the relation between figure and ground. But here there are not two separate aspects. There is one sign that makes present a form in and of itself; and it does so precisely because it already *is* a relation between figure and ground. This sign, therefore, does not stand for something other: it makes itself present.[11] Relational work then involves a second order relation, one that connects two segmentations of the continuum. That relation may be arbitrary, such as the relation between the ink traces or electronic pixels that produce the letters of the word "tree" and the thing tree in the garden or an image/drawing thereof; or it may be iconic, such as the relation between the "Q" on a QWERTY keyboard (Fig. 10.1) and the letter "Q" produced on the monitor when we hit that key. Each of the two parts is a signifier standing in for another. In Fig. 10.2, there are only two forms (signifiers). But there could be a large and even infinite number of them.[12]

[11] It is only because of this self-relation that there can also be a relation to something else (Roth 2012b).

[12] In semiotics, this is known to be the result of infinite semiosis (Eco 1984).

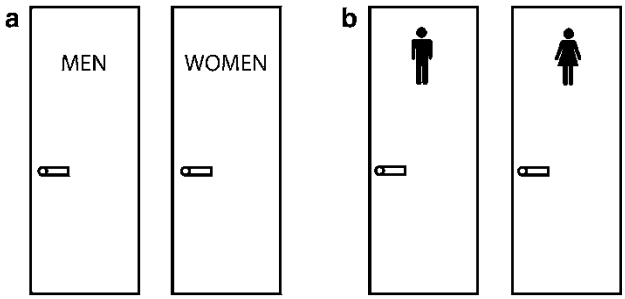


Fig. 10.3 Signs—linguistic (**a**) or pictorial (**b**)—are found everywhere in our lifeworlds, and the constitute (noted) differences that make a difference in our behavior

Another issue that needs to be considered pertains to the use of the sign. Its definition in terms of two segmentations of the material continuum orients us towards a pragmatic approach, for there are no metaphysical "meanings" possible: everything in the sign is material. Rather than focusing on the sign as a thing, we therefore are better off approaching it in terms of verbs and ask, "What are people doing when they use this or that signifier?" This is the direction in which pragmatist philosophers point us when suggesting that what matters is whether the helper brings a "" when the master craftsman makes the sound /slæb/ ("slab").[13] This is more consistent with the kind of *concrete* human psychology that Vygotsky envisioned when focusing on the *real* (material) relations between people that will have been the first appearance of a higher function in ontogeny. Thus, any use of a sign, verbal, pictorial, sonorous or otherwise on the part of the individual was an actual, social relation with another person[14]; and even the creation of novel signs in communicative exchanges are premised on its intelligibility for others. We already orient our readers to the use—the operation with the sign—in the discussion of keyboarding. *Use* simply means that there is a {person | environment} unit; and the resulting unity/identity cannot be understood by bringing together some person and the environment, as if these were separated elements from which a compound is to be made. *Using* is the phenomenon of interest, which requires units of analysis that are of the relational type.[15] Readers see another example of the pervasiveness of verbal and pictorial forms in the world that change and orient the ways in which we behave—or which of two doors we open—when a particular biological need urges itself upon us (Fig. 10.3). Between the stimulus, the urge, and the response, our walking towards place of need satisfaction, there is no metaphysical sign. We go to the appropriate door without needing to *interpret* signs, be they verbal (Fig. 10.3a) or

[13] The example is that of Wittgenstein (1953/1997).

[14] In Chap. 2, we describe the frozen pickup movement that becomes the baby bonobo's sign for his mother to pick him up.

[15] In *hammering*, neither hammer nor nail appears in consciousness; the hammer becomes an object to a cogitating subject only when something is wrong (Heidegger 1977).

figural (Fig. 10.3b), just as the fluent touch-typist does not need to consciously think about which fingers to push down onto which keys to produce the image of a particular work on the page.

Genesis of Signs in Practical School Activity

Signs and the methods (rules) for using them do not just exist—arrived at by logical means or invented/discovered by the child. Being presented with some auxiliary stimulus, the child does not intuitively comprehend, as if drawing on some deep inner intuition. Both approaches, the one drawing on intellect the other on a priori intuitions, "essentially eliminate metaphysically the question of the genesis of symbolic activity" (Vygotsky 1999: 49). An understanding of sign-use requires studying its genesis, which occurs in and as practical activity rather than being arrived at by deduction from the world in which the child knows its way around. In this section, we heed Vygotsky's advice and look at the work required for establishing the relation between two segmentations of the material continuum, one standing for a perceptible phenomenon, the other one a signifier to be used in place of the inaccessible original. For this purpose we return to the event presented in Chap. 5 where the children are asked to shape plasticine pieces in such a way that they may stand in an iconic relation with a mystery object. Here we account for the event such as to emphasize its contribution to understanding the natural history of signs.

The children have been asked to reach into a shoebox and feel with their hand the mystery object and then to shape a piece of plasticine so that it can stand in for and take the place of the object (e.g. in communication). The task in fact requires the fundamental relation between any form of experience and the human capacity to make it present again. This relation always is delayed, for something happening is inherently incomplete until it has ended; and it is only after it has ended that we can grasp (comprehend and name) the event as a whole. Such a grasp therefore presupposes the event to be present again; and it is only in the re-presented form that the event is available again. It is not in the initial touch that the mystery object gives itself as something; instead, there is an extended touching movement. In each moment of this movement, something reveals itself to the hand (e.g. an edge) but the whole object cannot be given as such and in a single instant (e.g. Merleau-Ponty 1945). Only after this movement has ended is the result of the touching event available as a whole. Com*prehension* of some happening implies a dehiscence between occurrence and grasp; and grasp of a past event requires the means and capacity to make the past present again (i.e., re-present it). An instance of this is the phenomenon of object permanence, which does not exist in the first several months of a child's life. Shown an object, the child initially focuses on it but then attends to something else when the object is pushed behind a screen as if it had never existed. An 11-month-old toddler, however, would likely begin looking for the object behind the screen (Sternberg and Williams 2010). In our design experiment involving the mystery object in the shoebox, the children are to produce the signifier after having

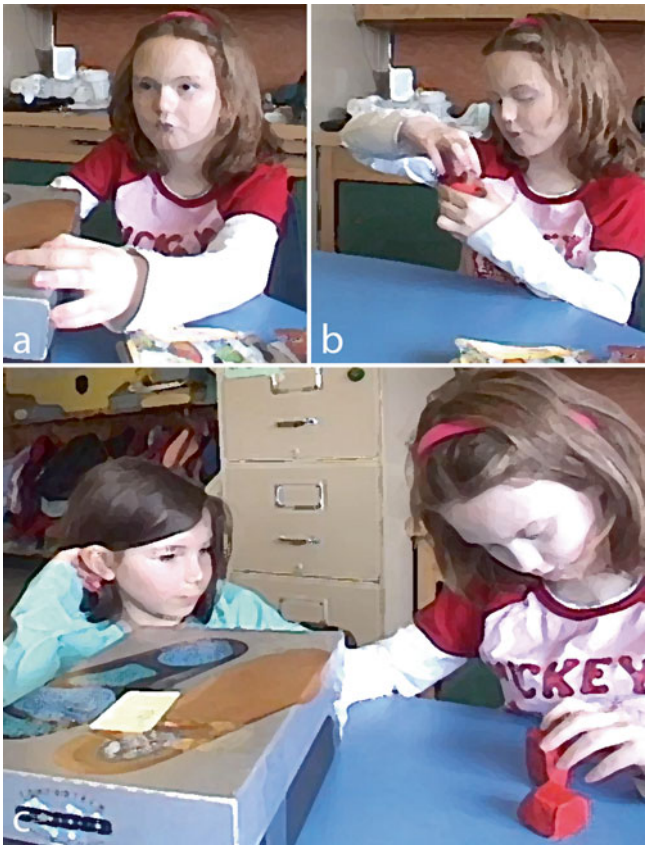


Fig. 10.4 Three instances from the natural history of a sign. (**a**). Exploring the signified by means of touch. (**b**). Shaping and demonstrating the signifier. (**c**). Simultaneously exploring by means of touch both signifier and signified, thereby verifying the relation

felt out what is to be the signified (the object). As our model shows, a sign relation is to be established (Fig. 10.2). This requires the work of structuring, here by means of epistemic movements that produce feelings, and a second active shaping of existing material to take a form so that the called for sign relation exists.

In a first phase, the children reach into the shoebox to feel the nature of the mystery object (Fig. 10.4a). This corresponds to all the other ways in which a person becomes familiar with and evolves a lifeworld. Finding out about the world that will later become the topic of talk in our social exchanges with others involves two aspects. First, there is an active willingness to engage with the unknown (i.e. the alien). These children do not know what is in the shoebox and, therefore, cannot intentionally construct it (see Chap. 8). They venture into the unknown without a preparation for what to expect other than that it will be some object. They cannot anticipate what will give itself to their feeling movement. There is therefore another, second aspect, that nonetheless is simultaneous with the first. The children have to be willing to *receive* whatever will *give itself* to their feeling touch. That experience

of their hand in the shoebox then is to be captured in the shaping of a piece of plasticine (Fig. 10.4b). Sometimes the children in this classroom have a word to name what they feel (abstract signifier); at other times they do not have a name but simply create a shape corresponding to the experience (iconic signifier).

In one of the groups trouble emerges. Melissa (Fig. 10.4a, b) has shaped a cube. She says that the mystery object *is* a cube. She supports the claim by stating a procedure: using thumb and index finger in a caliper configuration, she holds it to three, mutually orthogonal edges of the plasticine cube and says that these have to be the same. But the other two girls in her group have shaped their plasticine into slabs. The teacher points them to the different shapes they have made and invites them to come to an agreement, because there is only one mystery object and there cannot be two different shapes depicting it. The children initially struggle, each stating some particular from the experiences with the hand in the shoebox. But then a procedure is offered and accepted for testing the *relationship* between the plasticine shape (signifier) and the mystery object (signified). Jane is the first to put one hand into the shoebox, presumably touching and handling the mystery object, and places the other hand on a plasticine shape. Witnesses cannot see what is happening within the shoebox, but everything in the situation is such that what happens inside can be seen as a copy of what we see outside. On the outside, Jane feels the plasticine, rotates and feels it, and does this twice more. She then invites Melissa to do the same. When the latter follows the invitation, it will be the eighth time that she is reaching into the shoebox. Intently gazing at Jane's plasticine slab, Melissa feels it (Fig. 10.4c), rotates and feels it again, and does so three more times. She then raises the head, puckers her lips, sheepishly grins, and begins reshaping her plasticine cube into a rectangular solid similar to those of her two peers.

Prior to that point, we observe the postulations of two competing sign forms. In both cases, there is the same target object to be signified; but the signifiers differ. With the differing signifiers, therefore, different signs are postulated. At issue are not the forms of the plasticine shapes. Instead, it is the relationship between these forms and the common mystery object. But that object only exists as the endpoint of an extended experience of touching. One observation we can make here is that of a temporal delay between the experience of touching and the account of this experience, which is produced in the shaping of the plasticine. The plasticine shapes come to be used as accounts of the work, both done and undergone, of the hand laboring in the shoebox. Seen in this way, *sign* then is another form of stating the relation between work of doing something (here, exploring an object by means of touch) and the associated account (here, the shape of the object). This relation has come to be known as *Lebenswelt pair* (Garfinkel 2002). The contrasting positions that oppose Melissa, on the one hand, and her group mates Jane and Sylvia, on the other hand, is captured in the opposition of two Lebenswelt pairs, "doing [feeling a cube]" and "doing [feeling a rectangular solid]." Framing the issue in this way immediately shows the dialectic nature of the sign, which manifests itself in very different ways (as work, as account). It also allows us to make thematic what studies of the natural history of the sign can and need to investigate: the work and its evolution over time, the accounts provided thereof, the changes therein over time, and the relation between the work and the associated account.

Genesis of Signs in Adult Activity

Signs, as relations between signifiers and signifieds, do not simply exist but need to be established through the forms of work identified in Fig. 10.2, structuring the material continuum to obtain forms and relating the different forms obtained. These forms of work generally are not made thematic but simply assumed, for example, when writing about what laypersons or experts say and do after being asked to explain what a particular graph in their domain of expertise expresses. The same kind of work can be observed in research laboratories, when scientists plot data and then figure out what can be learned from the displays they created. Sometimes people just create signs on the fly, such as the case referred to in Chap. 2, where two researchers begin using a hand-arm gesture that imitates a professor's movements during a physics lecture. We note that the gesture, as used communicatively by those two researchers, evolved over time, eventually being reduced to a mere flick of hand and finger. We also note in Chap. 2 that simultaneously, there were changes in the signified, that is, in how the gesture was used as part of the communication. In that case, the gesture, though social and cultural through and through, never became a widespread form of communication. It endured over a few months, having currency only between those two researchers, and then it disappeared again. Because it was not recorded—other than in subsequent descriptions—it has been an ephemeral means of communication.

One area in which the emergence of signs has been reported is in the context of interpreting graphs (Roth 2003). Consider a task that might be found in an introductory biology course, which asks for a discussion of the implication when the death rate and birthrate of a species take the shapes depicted in the graph (Fig. 10.5). Students are asked to make statements specifically concerning the conservation of the species. The task also instructs focusing on particular parts. In this situation, we

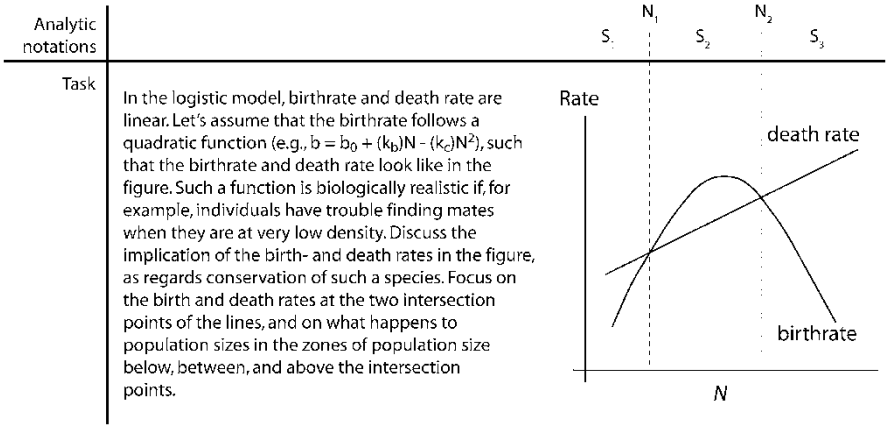


Fig. 10.5 Task used in a think-aloud protocol with research scientists. It requires identifying specific signifiers that stand are to stand in a signifying relation with biological phenomena

may think of the graph as a field of signifiers that can be related to some population with a size or density *N*. For example, if we consider an intersection of the two curves at a particular population size N_1 as a signifier, then one signified is a constant population size (density); this is so because death rate and birthrate are the same at the point of intersection so that there is neither an increase nor a decrease in population size. It is apparent that what a person will say and discuss depends on what she takes as signifier; and what she perceptually isolates (a form of *structuring*) as signifier depends on the possible signifieds available to form a sign *relation*. Such tasks also have been used in research on graphing expertise (Roth and Bowen 2003). The studies with practicing scientists asked to do the task exhibit some surprising results that can be described and explained within the framework articulated here (i.e. Fig. 10.2).

In this task,[16] all of the university scientists ($n = 8$) identified the left intersection (at N_1, the signifier) to stand for an unstable equilibrium (signified) but only four of the eight public sector scientists did so. In the case of the right intersection of birthrate and death rate (at N_2), seven university and three public sector scientists identified the correct signified (stable equilibrium). When they were done with the task as stated, the scientists were also asked to respond to a query in which a signified was provided and they were to locate the associated signifier in the graphical display (Fig. 10.5). The question was: "Which part of the graph corresponds to the greatest increase in population size *N*?" Here, the signified is stated as "the greatest increase in population size *N*." Only one university scientist and no public sector scientist located the correct signifier—which is that point where the function $N \cdot$(birthrate – death rate) is maximized. The study was repeated in an expanded form with physicists, who responded to the same tasks as the biologists and to structurally identical tasks in their own field (Roth 2012a). The comparison shows that they were generally less successful in the graphs from biology, where they were out-of-field, than the public sector biologists, who had been less successful than the university-based biologists.[17]

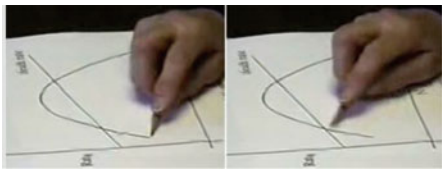
In this task, the participants were explicitly directed towards possible signifiers; when they were not directed in this manner, success rates dropped drastically. One issue identified among biologists and physicists was related to the work of structuring. Thus, a 30-year veteran physicist (Annemarie) said, "I cannot help but seeing slopes." This is apparent in the following fragment where she articulates what she is *seeing*.

[16] This task turned out to be one in which the 16 scientists of an initial study were more successful than on the other tasks that they were asked to solve.

[17] Because the task requires identifying possible signifieds, and physicists likely are less familiar with the domain of biology, the results make sense.

Fragment 10.1

well here the *b*irthrate (2.32) the birth of *ra*te (0.31) in numbers per year presumably (1.38) is still below the death rate (8.18) but it (0.43) s:o (1.10) but it is *r*ising– what i see is– there wa–this is increasing.



Whatever gives itself to Annemarie's perception, figure above ground, is indeed what she can take as a signifier. We generally do not make ourselves see some physical feature differently—unless prompted to see something else than what we see, as this is the case in the many examples of images that can be seen in two or more ways.[18] We perceive whatever offers itself to be seen. That seeing then comes to be made present again in iconic form by means of a gesture, whereby the pencil tip moves along the birthrate curve showing that it is rising. That is, she is seeing the increase (i.e. the slope), which, as she states elsewhere, is greater than the increase in (i.e. slope of) the death rate in the same area of the graph. Struggling with the task, she asks the research assistant to give her a clue. He replies by stating what can be identified to be her problem: "Well, I think what's confusing you … you are talking about the birthrate as slopes of those curves … but those curves are the rates of change." The research assistant instructs her what to look for and look at; and he relates it to the signified change in population. That is, her struggle, already identified in situ by the research assistant, pertains to the form that offered itself as a signifier; and it is the relation of this signifier to another form that cannot be established as a result. In this situation, a sign does not exist in the form that allows something to be related to something else. As a result, a sign does not develop. Instead, Annemarie will ask the research assistant for more clues, which will lead to a tutoring sequence of how to look at the graph so that the relevant signifiers come to stand against the ground ready to be related to the relevant biological phenomena. It is this labor that we refer to as structuring work.

The fragment begins after the research assistant instructs Annemarie to focus on the area to the left of the left intersection (at N_1) and to tell him what she sees. In effect, he is asking her to engage in the work of articulating the perceptible structure (signifier). She accepts by stating that the birthrate is less than the death rate (turn 01). After a pause, she offers a signifier: "the population is decreasing" (turn 03). There is an acceptance particle ("right!"), and a query then is offered asking for a statement about the direction in which the population size changes (turn 04). This is accepted in a reply that consists of a verbal index ("this way") together with a hand-arm movement to the left (turn 06).

[18] Wittgenstein (1953/1997) presents a duck-rabbit, that is, an image that can be seen as a duck or as a rabbit. An Internet search will produce many other examples.

Fragment 10.2

01	A:	°the birthrate is less than the death rate?!°
02		(0.77)
03		so the population is decreasing [to that way.
04	R:	right! so what] where are you headed
		then on the graph.
05		(1.17)
06	A:	u::m: this way again. ((*Gesture to left.*))
07	R:	yea (0.21) [okay,
08	A:	t– to] zero pop [ula] tion (0.30) [
09	R:	so] [so draw arrows–
→ 10	A:	yea i really] wasnt
		seeing that at all not at all.

The two begin to speak simultaneously, as part of which the research assistant offers an instruction to draw an arrow, which Annemarie subsequently accepts by drawing arrows to the left and right and away from the N_1 at which the two rates are the same. The reply "I really wasn't seeing that at all" is a gloss of what she has come to see, which may be the direction in which the population was headed, as arising from the relevant {query | reply} (turn 04 | turn 06)—though the transcription does not reveal what it might have been definitively.

In this case, we observe *the genesis of a sign*. In the beginning of Fragment 10.2, Annemarie apparently is still seeing the slopes of the curves. One can see and hear her struggle, because she asks four times for a (little) hint or clue, which initially meets resistance, but then leads to the conversion into a longer tutoring sequence. Repeatedly there are formulations of not having seen something, sometimes referring to a feature of the graph, at other times "seeing" a signified (i.e. the movements in population size at the points specified in the task, Fig. 10.5). The sign—i.e. the signifier-signified relation—first exists *as* social relation, and specifically in the sequence of turn 01 (Annemarie), turn 04 (research assistant), and turn 06 (Annemarie). It is here that an association is made between the signifier (turn 01) and the signified (turn 06), held together by turn 04, which is both an acknowledgment and acceptance to the preceding turn 01 and an invitation to identify the signifier that finds its partner in turn 06. The positive evaluation of this identification is provided in turn 07. Here, the relation between the two segmentations of the material continuum is produced by and is reflected in the social relation between two people—i.e. the sequentially ordered transaction. That is, what later shows up as a sign, the relation between two segmentations of the continuum, *was* a social relation first, just as a concrete human psychology à la Vygotsky would have it.

The natural history of signs may be studied in other contexts as well, for example, in science classes. Here, elements of the curriculum may be thought by curriculum designers and educators as standing for and in relation with given scientific concepts. From this perspective, students may be said to fail to "understand" those meanings and relations. But rather than taking a deficit approach, researchers might be better of studying what students actually do that leads to the emergence

and evolution of signs. Interested researchers might draw on the ways such studies have been conducted among scientists, who, by the very nature of their discipline, constantly are involved in the work of evolving signs that exist in the relation between the data often depicted in graphs and the phenomena that these graphs stand in for (e.g. Roth 2013). Such scientists are constantly learning; and yet many educational psychologists are not interested in the implications of "learning in the wild" that may have possible implications for designing school-based learning environments. Consider the kind of work done while a scientific research group attempts to grasp what the data they have produced and plotted in a graph (signifier) stand for (signified).

Over a period of 5 year, we followed the scientists of an experimental biology laboratory (e.g. Roth 2014). The biologists intended to establish a method for fish hatcheries to optimize the date at which they were to release the young salmon smolts[19] into the wild. The optimization method was based on a Nobel-winning theory according to which the composition of the retinal cells changed when salmon migrate to the ocean from a high of more than 90 % of one constituent to about 5 % (Fig. 10.6, dotted stepwise curve). After having for a while collected data on young salmon from one geographical area, the scientists are puzzled. Their data do not fall onto the expected (predicted) curve at all. More troubling, 21 data points seem to follow something like a sine curve; but four data points lie considerably away from that pattern and closer to the original curve that they had intended to confirm. In this stage of their research, they have one part of the sign, the signifier, but they do not have the other part, the signified. They therefore have no sign at all, at least not in the sense of a signifier–signified relation. Their data analysis meetings show that they cannot *infer* the signified from the data points and graph. So they engage in investigating some of the relating work they have done. Even before there is closure in the production of the sign, they are trying to find out what the signified is and, in so doing, give birth to a sign.

When the scientists are at the point of publishing their data, it is quite apparent that they talk about them and their graphs as if "'look[ing] through' the measurement points seeing … the real events in the hatchery where they get their fish, and in the river and estuary, where they capture additional specimens for sampling purposes" (Roth 2013: 95). This "looking through" is like our everyday use of any concept or text: when we read the newspaper, we are seemingly transported to the event that the text is about. In reading "An investigation into the disappearance of $40,000 from School Parents' Advisory Council has resulted in charges announced today," everything—the investigation, the theft, the victim, and the charges laid—is present to us without requiring effortful interpretation. It is as if someone pointed to some phenomenon visible in our immediate surrounding. But because the scientists do not see what their decontextualized data stands for, they have to engage in the

[19] A *smolt* is a salmon during a juvenile stage in the life history of this fish. When salmon are *smolting*, their scales turn silvery and there are physiological changes that prepare it for migration from the freshwater (where it is born and lives the early months of its life) to the ocean where it grows to adult size and readiness to return to the freshwater systems to spawn.

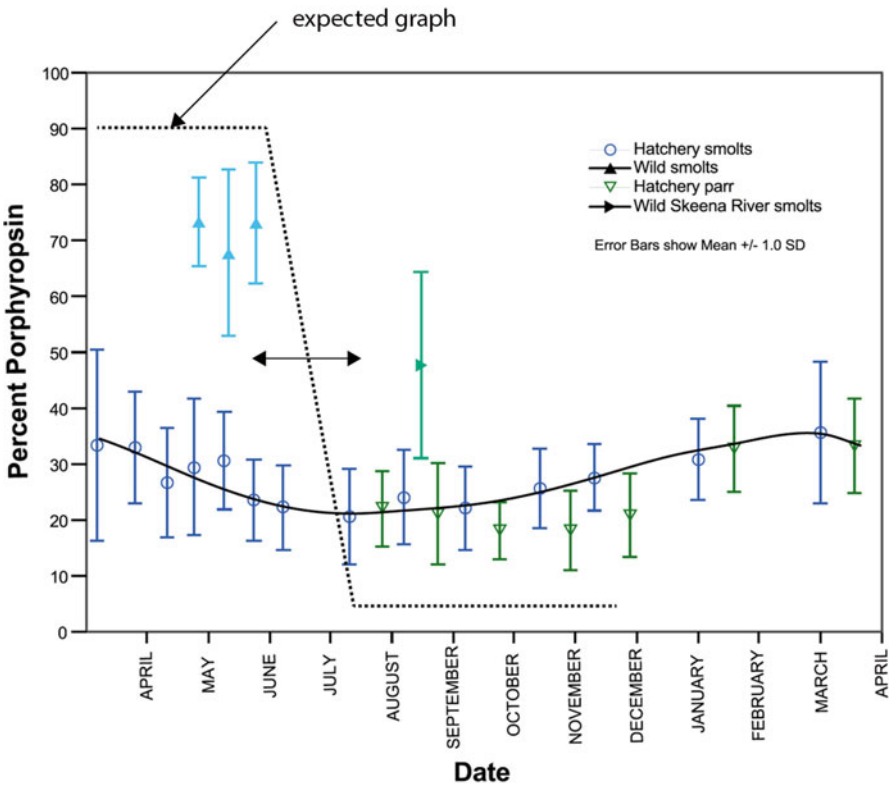


Fig. 10.6 The data of an experimental biology laboratory are plotted differ from the curve expected from the standard theory, and four data points are far away from the apparent pattern relating the 21 other data points

work of reconstituting the context of the data collection and the source of their specimen for the purpose of finding the partner of the signifier–signified pair to the one they had in hand. In the process, they talk about the ensemble of environmental factors that might have influenced the specimens from which they took their retinal samples—including climate, the nutrient concentrations in the water bodies of the geographical area, or the number of specimens that had migrated into the river systems during the previous season. They also investigate the ages of the fish, which could be for unknown reasons either bigger first-year or smaller second-year fish. They investigate whether there is a link between the amount of retinal composites and the weight of the fish. In the end, after having conducted a lot of work to find a signified, the scientists do not publish those data that deviate from the sinusoidal pattern (i.e. the data including the four data points observable in Fig. 10.6). But they do publish those data where they were able to reconstitute the entire process that have led to the ultimate creation of the graph, from the initial catching of the fish at a particular time of the year through the machinery of scientific research to the plot on the computer monitor. In this case, therefore, the researchers' investigation coin-

cides with the investigation of the natural history of a sign, which began with different forms of structuring work and the making of connections between the results—leading to the eventual birth of the sign (i.e. the sinusoidal graph).

Coda: Investigating the Sign as Historical Process

Historically, educational psychology has been little concerned with semiotics, the works of important semioticians such as C. S. Pierce, G. Bateson, or U. Eco having been surprisingly absent from educational researchers' literature (Cunningham 1992). During the last decades, and partly due to Vygotsky's increasing influence on the field, this trend has begun to change. A theory of the sign is crucial because, as we show in Chap. 9, how the function of signs is theorized has direct implications for how we describe learning and reasoning processes. The common, Saussurian view of the sign (see Chap. 9) conceptually supports the existing dualistic discourse on external and internal representations, a discourse that in turn leads to a deficit approach where students are seen as misconceiving or failing to grasp given "meanings" that learning materials presumably represent. The sign, however, is not a dead object, somehow given once and for all so that it can be discovered or deduced in an intellectual pursuit. Instead, we exemplify in the present chapter that there is an entire life process, from the point in time when the pieces of a future sign relation initially are conceived through a gestation period to the birth of the sign. The life of the sign continues until it may end in its death when nobody uses it anymore or during its momentary disappearance in ongoing activity (e.g. the letters on the keyboard keys).

The common Saussurian approach to the sign leads to a dualistic view where some material thing comes to stand for something mental and immaterial. Such a view constitutes a form of Cartesianism. Near the end of his life, Vygotsky actually recognized a dualism in his own earlier conception of the relation between lower and higher functions,[20] which existed in the distinction of percept and sign (i.e. signifier). The dualism allows for conceiving knowledge and all those processes presumedly leading to knowledge (e.g. inference or interpretation) to be mental and *immediate*. However, our examples here show that there is no immaculate or miraculous conception. Instead, (material) labor is involved in all of the stages of the life history of the sign. When the sign is finally born, it is both the end result of a process and an index to that entire process. As a result, in the case of scientists' production of a research article, "the ultimate graph is constituted as a synecdoche (part) of the research process (whole), as scientists learn to connect the data with the original settings (contexts) from which they extracted these" (Roth 2013: 103). That is, the signifier—or rather the field of signifiers—is described as a synecdoche of a process

[20] He writes: "the higher and lower functions are not constructed in two tiers … but our previous understanding does not [work] … because this does mea two tiers" (Vygotsky, in Zavershneva 2010b: 72).

that led to the production of the signifier and to the constitution of the sign. The entire scientific research process constitutes the work that produces a signifier, much like the work that Melissa and her peers do from feeling the mystery object to the production and revision of the signifiers in their hands.[21] It is in and through such productive labor that the sign comes into existence. Saying that the sign constitutes a synecdoche is another way of expressing what we earlier refer to as a Lebenswelt pair, where the ultimately produced account points back to the productive work. Even though the lived work occurs in and through the bodies of individuals, the results are public and shared. The objectivity of the sciences derives from the fact that productive work processes consistently produce the same result.[22]

The view of the sign advanced here requires distinguishing between two fundamental modes of being, the conflation of which has historically lead to the belief that underlying all human action there is a corresponding mental (immaterial) process. On the one hand, there are situations of *absorbed coping* (Dreyfus 2002), in which we are so familiar with the means–consequence relations of our own actions that we do not need to make the situation present again, mentally or by some other means. We may encounter smoke and immediately treat it as an index to a fire, where the former appears in consciousness as something that stands for the latter. However, this is only "because of the recurrence of a certain problem in common sense, [where] this particular signifying connection becomes familiar and habitual" (Dewey 1938: 528). There are other situations in which we encounter smoke but cannot immediately be certain of its origin and reason for its presence. In such situations, "inquiry is required to determine the *kind* of object of which that which has been determined by controlled observations to be smoke is a sign" (1938: 528). The confusion of these two kind of situations "originates in the fact that in matters of familiar use and enjoyment past habits have instituted a relation that can be immediately referred to" (1938: 528). Yet, educational psychology cannot take the researchers' or educators' familiar world as the starting point. Rather, we need to study the history of sequences of joint inquiry developing into habits. Initially, material features emerge and are treated as sign relations, and finally the materials no longer are salient but form an inherent part of the functioning system. That history is not just material but also, and at the same time, social and cultural.

In the example from the mathematics class, the three girls initially are not in agreement about the contents of the shoebox. Their "doing [feeling out the mystery object]" is leading them to different accounts (cube, rectangular solid). This is not just some phenomenon that we may be tempted to brush aside as the result of "child's play"; instead, it is a phenomenon quite common in the sciences involving

[21] A graph therefore can be said to black-box this work (Latour 1987). Any critical inquiry into scientific research requires labor to open the black box and reconstitute the work that has gone into producing the graph (sign). This is true whether the inquiry is performed by scientists themselves, as is the case in the biology scientists discussed above, or by social scientists interested in the production of scientific facts.

[22] It is precisely because the work of different people in different part of the world leads to the same geometrical objects—i.e. accounts of doing geometry—that geometry becomes an objective science (Husserl 1939).

the most educated of this world. Thus, when different scientific research groups report different findings, their methods come to be interrogated. Other research groups will attempt to reproduce the contested results by doing the work described in the research paper. If no other research group can reproduce some finding, it will be disregarded as an irregularity or as a hoax. In some instances—such as concerning some surprising findings with respect to the quality factor (Q) of sapphire (Collins 2001)— researchers participate in an experiment together with the investigators who had reported the anomalous findings. In the case of the quality factor of sapphire, the point was to find out if there were unarticulated variations in the work of doing that could explain the different findings (i.e. accounts) of the Soviet team. It was only when other, Western research groups learned how to reliably reproduce the measurements of the Soviet team, leading to the establishment of a common sign (Lebenswelt pair), that the research findings came to be accepted as a matter of fact.

Ordinarily, when educational psychologists and educational researchers investigate signs, they are concerned with things like the concept words that children use; and they postulate meanings that are to go with the words. The words are taken as something fixed, and the research objects are those things that the child or student is to "construct" or internalize after they have been produced *in* a verbal exchange with others. Moreover, signs are thought in relation to some kind of biological or natural function of the intellect that understands or somehow converts signs into meanings. The present chapter orients us to something else. The chapter title is not just incidental but actually points to a core feature of our argument: it is the *natural history* of the sign that needs to be understood. As something *natural*, the sign is not something over or beyond nature or biology; as something *historical*, however, it is also and at the same time cultural.[23] The only reason why signs may be taken for granted as a natural competence of the intellect (cogito) is that the historical development of habits are accepted and obviated in the ensuing descriptions.

In this chapter, we show that signs, the relations between two segmentations of the material continuum are social achievements that require of some form of instruction. The word, as any other signifier, pertains not just to something *said* but is in fact a synecdoche for its entire history. This history simultaneously has individual and cultural aspects—as we suggest in chapter 1, the word reflects the whole rather than merely individual consciousness. These are to be thought not in terms of the individual child appropriating a cultural (social) signifier, which would lead us to a conception of the child in a process of socialization.[24] Instead, the individual and the

[23] In the experienced typist, the hand and finger movements, having been shaped by the keyboard shape and layout, are cultural through and through. As psychological research has shown, *what* we see—unbeknownst to us—depends on the movements of they eyes, which, in the case of the vertical line of the letter "I," includes saccading horizontal movements while the eye also moves vertically from top to bottom (Yarbus 1967). The movements are shaped by the cultural objects that surround us; and our movements shape new objects that constitute and populate our environment. Thus, seeing, too, is cultural through and through.

[24] An alternative view would be if we related sign and child in the way that some scholars related learning disability (LD) and child (McDermott 1993). Just as we may replace saying that a child

social (cultural) are irremediably fused into one, as signs only live in use, and living means changing. It is precisely this nature of the sign that we articulate in Chap. 4, where the word is shown to have intersubjective (social) and intrasubjective (individual) aspects. Each use of a sign (signifier–signified relation) also points to its own history, which includes the many experiences of the individual person using signifiers as an integral part of experiencing, a word pointing us to the complex unity/identity of person and environment.

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is/becomes learning disabled by saying that LD has captured another child, we may replace saying that a child has learned a sign by saying that the sign has acquired another child. The sign would be doing so to keep itself alive—for language only lives in use and becomes a dead language when it is no longer spoken.

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Chapter 11
Genesis of the Zone of Proximal Development

The zone of proximal development … is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers. (Vygotsky 1978: 86)

The opening quotation may be the best-known piece of text from Vygotsky's works, and *Mind in Society,* from which it comes, is indeed his most widely cited work (see Chap. 1). Even scholars who apparently are not familiar with much of Vygotsky's work feel compelled to quote this part of the text or to refer to it. However, compared to later articulations of conceptual categories that emphasize the {person | environment} unit (i.e. *perežívanie* [experience]), the quoted section is particularly asymmetrical. This is so because the child is as much an integral part of the environment of the adult as the adult is integral part of the environment of the child. So why should we not also emphasize learning and development that the adult undergoes? Already around 1929—at about the time the fragmentary text "Concrete Human Psychology" (Vygotsky 1989) was written—Vygotsky exhorted his readers to focus on social (societal) *relations*. Because relations are soci(et)al, they require the *cooperative* (joint) work of participants. Yet the statement in the quotation may be read as being one-sided in a number of ways.

On the one hand, there is an individual child, who is said to perform differently alone than when solving problems under the guidance of an adult or a more competent peer. It is the child that is guided by the action of another person, who is doing the guiding. As a result, a child—who on its own performs on a standardized test at the level of an 8-year old—may, with guidance, perform at the level of a 10-year old. In this case, there is a potential for the child to perform on its own at the higher level. The term *zone of proximal development* denotes the difference between the two levels of performance. Appropriately designed {teaching | learning} sequences will take the child to that level; but the testing situation itself may be sufficient to assist the child to get there. In some ways, the child is passive in this depiction. The child is here depicted like a plant that can grow upward only with a trellis, though

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in the case of humans, the idea is that the child will not need the support at some later time. In this context, the metaphor of the *scaffold* often comes to be invoked. It functions like a trellis; but, in the same way scaffolds used in the building of houses, it can be taken away once the construction is completed. Whereas the child is passive in some ways, the adult is depicted as agential, responsible for establishing the scaffold. This concept therefore fits into an educational ideology where the teacher's job is to teach and the students' job is to learn. If students do not learn, then we may blame the teacher; alternatively we may find problems in the learner.

Contrasting this first point is the observation that the members of clubs can, without a teacher or more competent other, reach levels of performance that are beyond those of *any* individual member (e.g. Collins et al. 1989). So why is it that we observe learning and development in such cases and yet there is nobody around to build and hold up a scaffold to allow these members to learn? We do observe, however, that even if formulated in terms of the absence of more competent teachers or peers, there are social relations that apparently allow learning and development in situations such as the computer clubs. It may therefore be much more advantageous to think about social relations, some of which eventually show up as newly emerging higher psychological functions. We point to this idea in Chap. 5, where we show how the geometry-related behavior of a child at some point previously was a real relation between two people.

On the other hand, in the quotation there is no mention as to the changes that the adult or more competent peer will undergo.[1] Yet we do know that teachers get better at teaching *in* and *by* teaching. Teachers may actually not know what the issue is when a child does not seem to learn or develop and therefore are not guiding him at all in the sense of the person who knows the way around the land and takes others to the interesting spots in the area. That is, teachers do not just set up a scaffold and thereby establish a zone of proximal development. They themselves may have to learn and develop to become conscious of the kinds of issues that appear to be impeding learning and development in a particular situation. That is, "teachers," in a {teaching | learning} situation, may actually learn and even develop as much as those institutionally designated to be the "learners" (i.e. the students); and these, being part of the teacher's environment, may indeed contribute to the learning and development of those institutionally designated teachers. There have therefore been suggestions to take a more symmetrical approach to the notion of the zone of proximal development (Roth and Radford 2010). These suggestions include studying whole situations, comprising institutionally designated teachers and students, and to investigate changes in these transactional relations to see where and when teaching and learning become apparent. The division between the two may not at all follow

[1] The same can be said about studies that report instances of the zone of proximal development. For a different, more symmetric treatment of the topic with respect to teacher education see El Kadri et al. 2016).

institutional designations, so that we come to witness teachers learn and learners teach.

The formulation we arrive at in this way already is a step ahead; and yet, it still misses the mark. This is so because it attributes agency to parts of the whole—one person is teaching the other person is learning. Instead, we may gain traction by focusing on the changes in and of the whole, which is the social relation, and by identifying the irreducibly *social* forces and dynamics that bring about change rather than reducing our observations and descriptions to one or other moment of the entire developing unit. We then see that the individual not only contributes to such social forces but also is subject and subject to them at the same time. There is a passive dimension to life that the agential view does not articulate. Paraphrasing a popular diction related to committees, we may say that every {teaching | learning} situation has its own developmental dynamics, changing participants on the way.

One asset that may help us get closer to the kind of symmetric description suggested above is the Russian notion *obučenie*, which simultaneously translates the English terms *teaching* and *learning*. Rather than choosing one or the other and rather than combining the two using the connectives "and" or "or," we use the dialectical notion {teaching | learning}. It is dialectical because the social relation manifests itself sometimes as teaching, sometimes as learning; and it may do so in any one constituent member of the relation.[2] But we cannot move in the opposite direction, from independently considering teaching and learning for the purpose of arriving at the unity/ identity of teaching and learning by means of addition, combination, or synthesis.

The ways in which the zone of proximal development is commonly taken up and employed are missing something important, which we stress throughout this book. This something is the fact that people do not step into fixed social slots and social roles (implemented, e.g., as mental schemas), as if the world consisted of such entities to be stepped in and forcing people to do what some external machinery imposes upon them. Humans are not merely subject to conditions but, in acting, they produce and change their conditions (Marx and Engels 1978). This idea leads us to a critique of traditional conceptions of education, where teachers stand above students:

> The materialist teaching of the change of conditions and education forgets that humans change the conditions and the educators themselves have to be educated. It therefore has to separate the society into two parts—of which one is superior to the other.
>
> The coincidence of the change of conditions and the human activity or self-change can only be grasped and rationally understood as *revolutionary praxis*. (Marx and Engels 1978: 5–6)

[2] Stetsenko (2010) transliterates *obučenie* by means of the term "teaching-learning," which does not to the same extent as our term emphasize the dialectical aspects of the notion.

The consequence of a revised perspective is that what humans are coincides with *how* they produce whatever the current activity is to produce. Any {teaching | learning} is based on relations, and {teaching | learning} occurs *as* a soci(et)al relation while occurring *in* a soci(et)al relation. Such relations always are joint projects and require joint work; and this joint work sometimes leads to failure and sometimes to success. Because {teaching | learning} constitutes joint labor, the relations are symmetrical to the extent that without cooperation of the participants, they do not exist. This does not mean that the effect on the participants have to be the same.[3] Thus, for a zone of proximal development to come into being, a social relation has to exist as well. *Without social relation, no zone of proximal development*! We may then ask the question, "What is the (joint, social) work that brings about {teaching | learning} [obučenie] and the zone of proximal development?" By formulating the issue in this way, we open up a way of escaping the dead-end conceptualization of the notion as a normative, one-sided enterprise. Instead, we make a turn in the direction of a Spinozist understanding that aims at overcoming problematic dichotomizations, including those of internalization and socialization that frequently appear in the context of {teaching | learning} and the zone of proximal development.

{Teaching | Learning} and Social Relations

In this section, we investigate {teaching | learning} in the context of a physics class, where students do tasks involving computer software to simulate (model) kinematic phenomena. Consistent with the introduction, we do not assume that the "teacher" teaches and the "learners" learn. Instead, we focus our analyses on the unfolding events in the pursuit of answers to questions about how members to the setting make available to each other what they are doing and signal how they are doing it. We look for changes in the communication, especially in how things are described, and, therefore, how particular aspects of the setting are accounted for and become part of the accented visible. By investigating the connections between doing and accounts thereof, we get into the basic form of a social relation. This also allows us (a) to exhibit where the teacher (though known and evaluated to be exemplary) apparently does not have a ready answer and (b) to find out what the students *really* are acting upon in their lifeworld.[4] We therefore do not have to assume an internal and

[3] One may think of forces in physics, where Newton's third law states that for every action there is an equal and opposite reaction. Even though the gravitational force on the earth and on a pen let go above ground is equal and opposite, the effect is different: the earth does move, the pen does.

[4] In Chap. 6, we exemplify how the lifeworld may be characterized in terms of ontology, that is, the things that stand out from the environment for the person. It is these salient entities—objects and processes—that the person sees and towards which she acts.

invisible (mental) world but focus on the way that the world is made, accented, and accounted for in the public sphere.

In the simulation, the 11th-grade students have attached a full arrow to a circular object; there is also another single-line arrow (turn 184). The students have been asked to find out what the arrows stand for. To do this, they are to manipulate the two different arrows and, by hitting the RUN button, conduct experiments in the virtual world. Although the students also conduct real-life experiments on motion at the time,[5] they are not told the scientific names of the "arrows" in this task. Initially they do not know that—from the perspective of the curriculum—the full arrow represents a force acting on the object and the other arrow represents the velocity (speed and direction) of the object. The teacher has told the students that they are to "learn by discovery." To see the full arrow as force and the simple arrow as velocity requires first *seeing* (a) that the former arrow remains constant and (b) that the latter arrow changes, increasingly pointing into the direction of the former arrow and becoming increasingly longer. This may be taken as the basis for concluding that a constant something (i.e. force) "pushes" something else (i.e. velocity).[6]

Noticing a Problem of Seeing-as

When the teacher arrives at the computer station, he apparently identifies confusing talk about the events that the students are currently observing. The fragment begins with his offer to look at a situation that he has set up where the outline arrow points downward. From an instructional perspective, this potentially affords—but does not guarantee—an association of the outline arrow with gravity. The teacher has run the simulation. But we hear an offer to look at it in slow motion (turn 184). Other than the approximate repetition of the shortened "slo-mo," there is no verbal reply to the earlier statement inviting a description of the events on the monitor.[7]

[5] In these experiments, they analyze distance-time, velocity-time, and acceleration-time graphs.

[6] In more technical terms, the force **F** is a vector with a magnitude and direction (here down). It produces an acceleration **a** according to $\mathbf{F} = m \cdot \mathbf{a}$, where m is the mass of the object. **F** and **a** point in the same direction. Thus, if the acceleration is downward, it will act against velocity **v**, which initially is upward. Once the speed is 0, the acceleration and velocity vectors point into the same downward direction and the speed increases. From a physics perspective, the velocity **v** always decreases from some positive value—e.g. +10 m/s to 0 m/s and then to −10 m/s, where the + and − signs indicate the direction (upward and downward, respectively). Counter-intuitively, therefore, the physical description has the velocity decrease continuously.

[7] Transcription conventions are available in the Appendix.

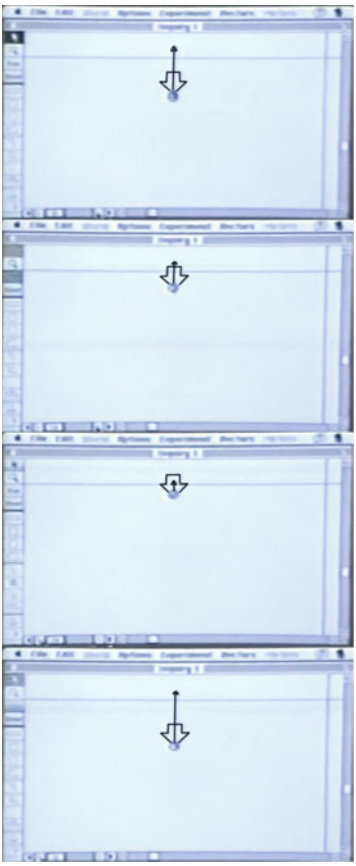
Fragment 11.1a

→ 184 T: okay we can replay that slowly (0.25) here (0.32) sl*o*mo. ((*Uses the replay button to move the configuration through successive positions.*))

185 (1.01)
186 G: sh::lo:mo:
187 (0.50)

→ 188 T: see (0.53) *look* (0.48) like (.) this–
189 (6.72) ((*Uses the replay button to move the configuration through successive positions.*))

→ 190 okay (.) this is where we started out ((*runs simulation*)) (0.56) three (0.15) two (0.24) one (0.32) yea? ((*Moves backward through the recorded loop*.))



Readers easily see the change in the length of the upward pointing simple arrow (turns 184–188). As the teacher moves stepwise through the event, he articulates an invitation to look (turn 188). He offers another replay of the recorded motion (turn 190). Why would this be?

We do not have access to what the teacher has in mind. But so do the students. We do not have access to their minds either, so that we cannot know what precisely they are seeing and hearing. But so does the teacher. If they eventually resolve the issue, it is because all they have and need is right there, publicly available to every one (otherwise joint action would not be possible at all). If we were to look at the situation through the teacher's eyes, then we might be seeing that there is apparently no reaction to the offered invitation. If there is an offer to revisit what has just been presented, then this also makes visible that whatever the teacher might have expected to happen has not happened yet. Therefore, a repetition is offered. Anyone hearing

a repetition of an invitation to view some event again may come to the conclusion that the repetition is related to the viewing and what might be expected to have occurred in association with it. But inviting to watch a replay of the recorded motion sequence also exhibits that whatever the teacher has done up to that point has not yet achieved whatever was to be achieved. That is, it could be said that the teacher has not performed the right teaching moves required for bringing about whatever should happen such that the lesson can go on. If the teacher invites repeating the event, then it also exhibits an apparent awareness of a problem. For such an awareness to be possible, the students must have made it manifest for the teacher to see the situation so that he could take it to be an issue (a problem). This form of analysis, therefore, orients us to the fact that the joint work of the group—students and teacher taken together—has not yet produced what is required before they can go on.

What may make it difficult for the students to see what there is to be seen from the perspective of the curriculum—i.e. a force pushing on the object and changing the velocity? The study of all student groups recorded in this lesson sequence suggests that it is the fact that the ball moves upward, slows down until it stops moving upward at the zenith of the flight (as in the offprints turns 184, 186, 188), and then accelerates but does so downward. Simultaneously, the simple arrow representing velocity also changes, becoming shorter and shorter while pointing upward until it disappears only to increase in the course of the events while pointing downward. As we show in Chap. 10, seeing the features just described already requires *structuring work* so that those features relevant to physics come to stand out and become visible. But once that perceptual identification is happening, further relating work is required so that the arrows can come to stand for force and velocity. That work is not always straightforward, as empirical studies in multiple representational settings show (see Chap. 3). To understand that work, we need to find out how the features present themselves to the participants and how the unfolding transaction leads to the establishment of relations between the objective situation and whatever scientific notion is to be established.

Searching for a Way of Letting the Phenomenon Reveal Itself

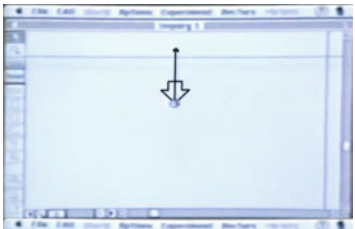
For the teacher, the issue appears to be one of students' failing to see in the display the configuration required for learning about the relation between force and velocity. One of the roles of language in use is its *apophantic function*: language makes manifest what it is speaking about (Heidegger 1977). That is, in this function language lets some phenomenon show itself. The teacher's problem therefore is one of finding a language that allows the relevant phenomenon to manifest itself in the students' perception. He cannot make the students see what they need to see; and the students, cannot intentionally orient to see because they do not know what there is to see. That is, the phenomenon needs to show itself, facilitated by the joint interactional work of students and teacher. As the event unfolds, we witness precisely this work required for the phenomenon to reveal itself.

In the next fragment from the lesson, there are repeated statements about where the simulation had started (turns 190, 196), a form of invitation to attend to the dis-

play; and there are repeated statements that can be heard as invitations to look and queries whether something had been seen (turns 192, 194, 198). That is, there are repeated invitations of the kind that already has been articulated before, and especially in turn 188. But we should not too quickly conclude that there is a problem with the students. Indeed, we know of researchers who (a) might have gone to the grade records and noted that none of the three students had high marks in physics and none of the three continued on to do more advanced physics and (b) concluded that the students are simply not smart enough for the subject matter. Instead, the problem might well lie in the form of the invitation on the part of the teacher: it is not such that the students come to immediately see what there is to be seen or what they are invited to see. Importantly, a zone of proximal development does not yet exist, at least not for the students. They apparently do not yet see what is required for the developmental step that takes them from the perception of entities to the intellectual assessment of a relationship between entities denoted by the concepts force, acceleration, and velocity.

Fragment 11.1b

→ 190 okay (.) this is where we started out (0.56) three (0.15) two (0.24) one (0.32) yea? ((*Moves backward through the recorded loop*.))



191 (3.45)

→ 192 do you see that?

193 (0.62)

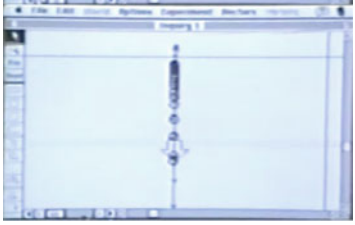
→ 194 do you see what happened? ((*Runs loop again*.))

195 (1.73)

→ 196 okay (0.81) this is where we started out. (0.52) *now* (0.14) lets go (1.61) oh.

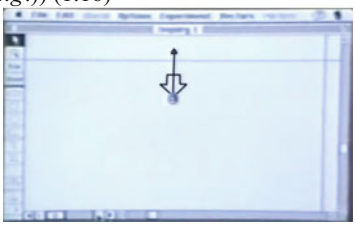
197 ((*Video loop was not at the beginning*.)) (1.16)

198 sorry (1.27) lets go to (.) the beginning. (0.30) okay now



→ (3.18) look what happens to that small arrow. ((*Takes simulation stepwise through its initial stages*.))

199 (0.98)



200 G: it (0.53) [its getting

201 E: [its getting] [to the arrow

202 R: [it gets big] smaller

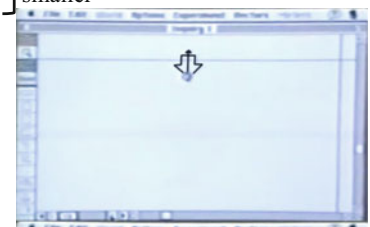
Indeed, looking at the transcription we do not see a verbal reply to the invitation until turn 200. This does not mean, however, that there is no attempt in actively receiving the invitation/instruction to look. We only have evidence concerning the reply part of the entire response. When the three students eventually speak, their words provide evidence that they had in fact attended to the invitation to look and they provide descriptions of what has revealed itself in their perception.

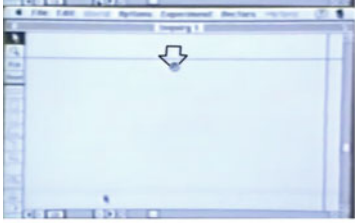
We see that participants apparently are doing joint work. There are repeated invitations, which would not be offered if there had not already been a social relation where others are expected to respond. The teacher and the three students are gazing at the screen. If the students do not respond, the teacher may suppose that there is some reason for it. The students do not state it here, but if they had been asked, they might have glossed the situation in some way. For example, they might have said something like, "I don't know what to look for" or "I am trying to see what I am supposed to see." That is, these requests and invitations pose a puzzle: if the students do not know *what* there is to be seen, they cannot orient to actively seeing *it* (Chap. 10). Although visual perception is a biological phenomenon, *seeing as* is cultural. Structure, having something from a visual display stand out as figure against everything else—i.e. ground that allows the figure to be itself—requires the capacity of the eyes to move in specific ways (Roth 2012). And those movements are not just biological capacities, but can be taught and need to be learned, which makes them cultural through and through (see Chaps. 8 and 10). To get to the event description relevant for physics, one needs to see that the change in the simple arrow (i.e. velocity vector) looks as if there was something pushing against it from the beginning through the top of the flight path and to the end of the simulation. This pushing force is precisely represented in the full arrow. That continued change appears to be articulated in turn 202, which includes two related adjectives, big and smaller, though in the movement displayed, the simple arrow first gets shorter while moving upward and then longer while the object is moving downward.

With a reply to the repeated requests to look, and therefore a completion of a {query | reply} (i.e. a joint, social action), the opportunity opens up for moving on. There is a pause following the student turns, the last one of which affirms the preceding, and then a positive evaluation (turn 205). There is overlapping talk, where elaborations to the description are offered, as seen in the temporal connective "and then" (turn 206) and an offer of a query (i.e. "What happened, did?") that comes to a stop before continuing after a brief pause. There is an invitation to associate whatever has been said just now to something that had been said previously (turn 210). But a pause is developing, a query is offered for clarification as if the recipient had missed the preceding turn ("What was that?"), and another pause. The pauses then come to be treated as a failure to recall, as there is a description of a ball thrown into the air that the talk between the four of them has produced earlier.

Fragment 11.1c

201 E: its getting [to the arrow
202 R: [it gets big] smaller
203 G: yea
204 (1.15)
205 T: yea
206 R: and then its
207 T: what [happened *did*?
208 G: [its like on the]
209 (0.25)
210 T: didnt you earlier on (.) eh eh liken it to somebody? (0.29) is:: to something?
211 (0.63)
212 R: °what's that?°
213 (1.27)
214 T: if you throw a ball up?
215 (1.07)
216 what happens?
217 (0.45)
218 R: it'll come [down
219 E: [comes] down, hehehe ((*laughs*))
220 G: yea
221 (1.14)
222 T: thats s: see. ((*Sets ball, which is at the top of its trajectory, in motion again*.))







Perhaps unsurprisingly, there is no response. The teacher has repeatedly spent considerable time with the group, and there is now an invitation to relate what is happening on the computer display to something else they have said and talked about earlier. The underlying problematic is similar to the present one: There is a query for producing and describing a figure. The absence of such a description shows that the task is not an easy one. Even though the teacher—in offering up the query about something else that they have said—appears to make salient that there is some analogical relation to be articulated between then and now. But the analogy does not offer itself automatically. There is a statement, which is both a hint and a query, as per the rising intonation towards the end (turn 214). The hint part exists in

the description of the situation, a ball being thrown into the air; the query is a repetition of the request to describe what they have earlier described. Again, there is a pause, and a repeat query in new form: "What happens?" (turn 216). It is at this point that there are three replies, two of which explicitly describe a ball coming down that completes what has been offered in "if you throw a ball up?"

We observe here again a phenomenon where there are repeated requests for developing the talk without a reply taking up the offer: "What happened, did?," "Didn't you earlier liken it to something?," "If you throw a ball … ?," and "What happens?" In this sequence, there is an increasing revelation of what the query anticipates as reply. In its first form, the query remains wide open but it narrows down when repeated to something that it presumes the students have seen before. In response to the non-appearance of a reply, there is then further specification and the query narrows the possible candidate situations to be remembered such that it has to include a ball thrown into the air. Finally, there is a query seeking a description in a way that it can be heard as an extension of the earlier query: "If you throw a ball up"+"what happens?"

The whole sequence, therefore, can be modeled by means of a developing set of phrases P, which begins with one member $P=\{$What happened?$\}$. This set is expanded by means of a differentiation operator D, which takes the form $D=$"In other words" or some equivalent (e.g. "that is" or "I mean to say that"). What is interesting about the set is that it contains a number of unlike members that nevertheless are used to say the same thing. It is a dialectical, generative operator that leads to different ways of saying (asking for) something.

Coming to See as the Phenomenon Reveals Itself

Why do we observe what can be recognized both as a repetition of a query and its increasing specification? We notice that there are repetitions precisely when an earlier offered query is not accepted by means of a reply; and when there is a reply, then the topic comes to be further developed. We witness here a dialectical situation. We cannot lay blame the failure of a missing reply on the students because we might equally say that the queries failed to be appropriate such as to solicit the sought-for replies immediately. There is a double learning problem, where the institutionally designated teacher needs to find out (i.e. learn) how to query so that the students *can* indeed reply, and the students need to find out what there is to be seen so that they can reply in the manner that the teacher will accept. Neither the teacher nor the students can "construct" the solution to the particular problem, for this would require that they already know the answer (see Chap. 8). But if the teacher knew what the issue was—i.e. why the students did not reply—he would not need to learn it. Instead he would articulate precisely *that* query that allowed students to take the next step required towards accomplishing the task. And if the students knew what they have to see, they would immediately reply rather than remain silent. To have any hope for solving this double contradiction, they must continue cooperating.

They have to produce the {teaching | learning} event such that each party will be able to come out of the event having learned or developed. It is their continued cooperation that leads to the emergence of a zone of proximal development. The last piece of the lesson fragment offered here may be glossed by saying that it achieves the sought-for perception, as per acknowledgment on the part of the participants.

Fragment 11.1d

222 T: ((*Sets circular object , which is at the top of its trajectory, in motion again .*))
→ °thats s: see°
223 R: itll slow down eve ntual [ly
224 T: [ok] ay
→ itslo- *look*
225 R: itll [itll
→ 226 T: [*look*] at it=
227 R: =itll pick up speed again
228 (0.31)
229 T: so (.) *look*

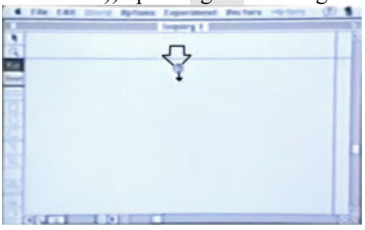




230 G: it picks up speed until it hits something (0.34) no (0.25) ((*simulation is stopped*)) like there
231 T: i[s no mo]re speed left= [okay]
232 R: [=now] [now] it will pick up speed again



233 G: yea, [then it picks up] ((*simulation continues*)) speed again thats right
234 R: [it accelerates]
235 (0.56)
236 T: it picks up speed, but in terms of:



In contrast to the preceding instances, there is now a step-by-step movement seen together with the insistent (as per intonation) call to look (turns 222, 224, 226,

and 229). The calls are repeated even though there is a description offered early on (turn 223), which does describe what can be seen: The object is slowing down as it moves upward. At one point, a description is offered that the object will pick up speed again, but on the display, the skinny arrow still points upward. That offer is paired with a request to look, and, in this way, is rejected calling instead for looking and redescription. There is another description offered, "it picks up speed until it hits something," but then there is a negation "no" followed by another description, "like there is no more speed left" (turn 230). This new description contradicts the earlier one; but it does correspond to the current state of the simulation on the computer display, where the object has arrived at the zenith (offprint in turn 230). At that time, there is an acceptance term "okay" followed by an invitation to state something that comes "now" (turn 231). This invitation is accepted, as seen in the repetition of the "now," which is followed by a description of the anticipated movement, "it picks up speed again" (turn 233), in turn overlapped by another description, "it accelerates" (turn 234). These descriptions are positively evaluated and accepted by means of being repeated. However, they are also marked as insufficient by the contrastive conjunction "but," which initiates the query for a particular way of describing the event, that is, to articulate what happens "in terms of … " (turn 236).

The exchange has finally arrived at a point that the original invitation (in Fragment 11.1a) apparently was seeking: a description of the movement of the object and the associated changes in the simple arrow—which the teacher knows to represent the object's velocity. That is, there is not one phenomenon but two: a moving object and two arrows, one of which is at issue in the fragments presented here. In the course of the exchange, there are {query | reply} moves seeking and receiving the association of the object with the analogical situation of a ball thrown into the air. That association is not inherent. A possible reason is that the microworld can be seen as a horizontal surface onto which the participants look from above, even though the teacher has set up the events in the vertical direction. Prior to the teacher's joining, the students have run simulations where the outline (force) arrow was pointing in different directions representing any form of push in horizontal direction acting on the object. The teacher, taking control of the mouse, arranged the force and velocity arrows in this particular up-down configuration. Whatever he might have thought, unavailable to the students as much as to the viewers of the video, the possibility to relate the up–down configuration to a vertical ball toss is taken up in the request to the students, who, when initially failing to make that connection, then are led to it in the repeated reframing of the query.

We may gloss the entire sequence as a search for (a) the reason for students not to see what the software developer and teacher intended them to see and (b) finding in the display whatever would satisfice the invitation to provide a description. Whatever the teacher might have thought in private, the last fragment can be glossed and accounted for by saying that a satisfactory description of the microworld event is provided, even if it is not yet connected to target scientific principles. More so, the underlying issue comes to be identified. This is so because replies are forthcoming precisely when the movement of the ball is slowed down to such an extent that there is sufficient time to solicit and provide descriptions. In fact, the motion is slowed

down to such an extent that it allows for extended pauses in the talk required to produce the outcomes.

Coda: The Zone of Proximal Development Redux

In much of the going literature on the zone of proximal development, the notion is used in the way that it fits the ideology of teachers as actors responsible for student learning and development. The chapter-opening quotation derives from *Mind in Society*. The book editors reveal that they had "taken significant liberties" and that they provided "not a literal translation of Vygotsky but rather [their] edited translation," leaving out materials and adding materials that seemed to make [Vygotsky's] point clearer" (Vygotsky 1978: x). Here, we are not interested in engaging in the debate concerning the extent to which what can be found in *Mind and Society* reflects the kind of work Vygotsky was pursuing towards the end of his life. It has been pointed out that (a) the notion of the zone of proximal development was published only after Vygotsky's death, by his students who compiled his lecture notes, and (b) Vygotsky himself attributed the notion to others (Yasnitsky and van der Veer 2016). Whatever the case, Vygotsky discusses the notion in the context of an educational problematic—i.e. performance testing—and its normative and one-sided formulation might in that regard not be surprising. It is fair to acknowledge that the notion has offered alternative ways to address a perennial problem in classroom assessment: Rather than focusing on end products, educators need to focus on educational potentials and processes. Yet it is also important to consider the notion in light of the transformative and thoroughly monist stance that Vygotsky's legacy affords developing, but which only a few scholars have taken up to expand (cf. Newman and Holzman 1993).

We take our starting point in the late Vygotsky texts and develop them in a way that is more consistent with the dialectical materialist approach that the psychologist himself describes as his method; and we draw on the dialectical materialist reading of the Spinozist position regarding the thinking body (Il'enkov 1977). We therefore pursue revisiting the concept of the zone of proximal development to reappropriate it for inscription within a monist theory. A key to such a move is the recognition that what marks humans from other animals is the fact that they orient their behavior towards the responses of others. They do so in "joint activity in communication" and using verbal language, which transforms the human lifeworld "into an objectively real support and into material limits on a special psychological space, the tense field of joint experience of a future action *externalized* for one another" (Mikhailov 2001: 26). The speech field *is* the consciousness that the participants in dialogue make available *to* each other and *for* each other *in order to* move the activity ahead. This field itself not only is the product of the participants' joint activity, but also results from the presence of human staff that enables the reproduction of life, of the {natural | cultural} world. The joint activity, achieved in

part by communication, "creates a borderline situation in which the alien is identical with one's own and one's own exists an experienced reality of Other" (2001: 26). This has immediate implications for our consideration of the physics lesson: We can no longer look at teacher and students as external to each other caught up in communication, where a third entity external to both, language, has to mediate to bring them together (see Chap. 4). Instead, whatever might be experienced as *Other* actually is identical with the individual's *own*, and whatever someone has to offer (teacher, students) constitutes the experienced reality of the respective Other (students, teacher). Whether students say something in reply to a query or say nothing are both treated as part of responses; and part of the joint work lies in figuring out whether a non-reply has its source in something related to actively attending (inattention, failure to hear, form of hearing) or to a missing capacity to reply.[8]

In the extended lesson fragment, we note the repeated invitations to look, as if the students had not been gazing at the display.[9] If there are repeated invitations to look and look again, then this is for a purpose: It exhibits that whatever there has been evidenced as seen is not what the invitation to look has invited to see. The repetitions may be glossed as the teacher's attempt to get students to see something but that he has failed to get them to see with just one or two invitations. Instead, it is as if he was trying to find a way to get students to see for themselves what needs to be seen so that the nature of the arrows can be articulated in the way that the curriculum specified. In the process, we observe a differentiation in the ways of asking *the same* question. In this situation, the teacher can be thought of as conducting an inquiry to find out (and learn) that form of the question that will produce the thought-after reply. As a result, he has learned. It turns out that the teacher used some of the new ways of asking he found in this group with the next group. We also witness that the subsequent exchanges with students from other groups are shorter than the one investigated here.

In the reported event, learning has occurred as the daily praxis of teaching, manifested in an expanded repertoire for eliciting particular responses. We know that it is precisely in the course of this event that the teacher came to the realization that his students were not seeing what the software package was created for them to see. The teacher suddenly understood that particular things needed to happen so that students could see precisely that which the theory explains, and not perceive all the other things that distract them from becoming familiar with the relevant physics discourse to be learned. Through this {teaching | learning} event, thus, the students have learned to orient to the visualization in a new way so that the required struc-

[8] In Chap. 4 we theorize *responding* in terms of its two irreducible parts: *actively receiving* and *replying*. Responding highlights the constitutive unity/identity of environment and person—i.e. *perežívanie*—because its first part, actively receiving, makes thematic the environment as experienced by the person.

[9] Similar invitations have been reported from a study of physics teaching in Australia, where the teacher expected students to see the phenomenon relevant for learning physics theory (Roth 2006). However, the investigation showed that students saw different phenomena, leading to misunderstanding of theory and observation.

tures became visible; and the teacher has learned to pose questions in such a way that those orientations are made possible. Out of this participation in the joint labor that produced this enacted curriculum, which occurred at the teacher's present level of ontogenetic development, there arose a qualitatively new form of consciousness that belonged to the joint work of the group (rather than to any individual).[10] Such a new form of consciousness, which manifested itself in the structure of generalizations made, is more than *learning*, for it constitutes a step to a qualitatively different form of seeing and acting in his lifeworld of the classroom.

Without exaggeration, the event had created an opportunity for the teacher to develop. The social relation with these students created a zone of proximal development. The change began with the emerging need of having to learn what impedes the students in stating what they are required to see so that the connection between the material object and the theory (arrows) becomes apparent. The students, too, needed to learn what it was that they were to see and state. Both forms of change are prerequisites for further learning and for development. The teacher underwent a change in consciousness, and, therefore, the learning in the situation led to a developmental step that changed his way of thinking about learning and teaching. It is in the relation with this particular student group that an opening was created between the teacher's current form of consciousness and the emergent one that led to a reorganization of his theory and instructional practice. There was also an opportunity for learning on the students' part, which occurs precisely at the instant when their reply receives a positive evaluation. At that point, they might have realized that all the other ways of asking, to which they did not reply, were actually members of the same set to which the last one belong. That last query became the key to situating all the other ways of asking a question. It is a situation similar to a frequent experience, when are driven to say, "Oh, this is what you have been asking me about?"

The students could appropriately respond only when they knew what the question was, and this response was the prerequisite for making the connection between two forms of description, one pertaining to the object and the other one to its explanation (theory). This, as the other part of the database makes evident, had not happened yet during this lesson; but it would emerge over the course of the two subsequent modeling tasks that co-occurred with the other investigations that these students conducted at the time. It is there that they would have further experiences with accelerating objects, such as a cart running up an inclined plane only to return to the bottom after the upward motion has ended.

The objectively real support, here for learning and development, and the material limits of the psychological space exist for all participants. If there had been scaffolding, it would not be something that the teacher put there for students to grow. And the scaffolding would not have been one-sided but rather would have involved all participants symmetrically (like the vines in Fig. 3.7). Without the objective presence of the communication in the public arena of group talk, no exchange could

[10] In the literature, we have seen many studies that do not distinguish between learning and development (see Chap. 6). As a result, even though the observed changes are of the learning type, investigators draw on the concept zone of proximal *development*.

have occurred. Unless there is *joint* activity, participants would not have a common relation nor could they achieve something together. But joint activity is one, not two activities external to each other—one teaching, the other learning—that somehow and mysteriously come together. It is because the participants inhabit a common world, and make available to each other the reality in which they live that {teaching | learning} [obučenie] irreducibly *is* joint activity and requires to be theorized as such. We may therefore say that a zone of proximal development is premised on the existence of a social relation, a common speech field, and the joint labor that transcends any attempt to make it up from elementary entities (i.e. "teacher" and "student"). But if there is a zone of proximal development in a symmetrized relation, then it exists for all participants irrespective of their current level of development. In fact, the episode shows that such a zone has to be established by means of joint labor and a common speech field, because it did not initially exist. The zone of proximal development first has to be born in and from the joint labor of teacher and students. A teacher, therefore, may undergo in the praxis of teaching not only learning (i.e. marginally improving what she does) but also development. Such development manifests itself, among others, in the revolutionary change in consciousness that participation in ongoing labor produces.

As in previous chapters, the fragment also gives testimony for a critique to any reductionism in the nature (physiology of perception) versus nurture (seeing as) debate. The biological processes of perception were intertwined with the cultural processes of *seeing as*. The fragment thereby provides us with more material evidence that a Spinozist (monist) position on the thinking body explains without the usual opposition of body versus mind, body and mind (in parallel), or mind above body.

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Part III
Implications

In the course of the first two parts of this book, we develop a set of foundational concepts that are often discussed in terms of dichotomies in constructivist and sociocultural literature, including the dichotomies of nature and culture (nurture) or thinking and speaking. Drawing on materials collected in a variety of settings, we articulate how an approach that takes seriously the primacy of the social overcomes such dichotomies, offering research avenues yet to be explored in educational psychology. Unlike other textbooks on educational psychology generally and other textbooks in which topics of interest to educational psychology are treated from cultural perspectives, we locate our theoretical work in practical case studies in which core topics are examined as they play out in real praxis taking place across a diversity of (educational, work) settings, and including people anywhere along the trajectory from childhood to adult life.

Near the end of his life, Vygotsky turned towards Spinoza for inspiration to develop a monist psychological theory that was to overcome what he had identified as the foundation of the historical sense of the crisis in psychology (Vygotsky 1997a): the split of the field into scientific psychology grounded in physiology and *interpretive psychology* grounded in and concerned with the idealistic and mental aspects of life (Vygotsky 1997b). The Spinozist turn is radical, as Vygotsky realized for himself in his personal notes, implying nothing short of an overhaul of his own work that he had conducted until about 18 months prior to his death. Here we offer a way of taking Vygotsky's final statements and ideas as a starting point to develop a monist theory to serve as a basis for the cultural psychology of education. The turn Vygotsky was making is not just a minor adjustment to what he had done but constitutes a paradigm shift. For any scientific paradigm shift, four criteria have to be met to facilitate the required conceptual change: *dissatisfaction* with existing theory, *intelligibility* and *plausibility* of the new theory, and *fruitfulness* in terms of generating new questions and areas of research. Throughout this book, we present evidence that going conceptualizations and theoretical approaches lead to contradictions, which should lead to raising doubt in the reader's mind (dissatisfaction). We offer ways of rethinking phenomena of interest to educational psychologists in the context of concrete data, supporting both intelligibility and plausibility of the

new conceptions offered. In this final section, we include two chapters to assist readers in seeing that the paradigmatic shift is fruitful as well. Both chapters offer implications for research, measurement and educational practice, but they do so from two different angles. Whereas Chap. 12 presents an extended and integrative case study and draws implications from micro-genetic accounts of actual {teaching | learning} practices, Chap. 13 takes a phylogenetic perspective that delves into the historical origins of schooling and into the kind of education that a Spinozist approach allows imagining and working out.

In the chapters of the first two parts of this book, we focus on specific issues that historically have been topics of educational psychology. We begin this third part of the book with a summary of the position on the thinking body that has emerged throughout those chapters. However, rather than doing the summary in some abstracting and abstract form, we provide an example of how a more holistic study of learning might be conducted so that it takes into account the thinking-body as a whole. We do not merely restate what has been said but extend our analyses to the role and function of the body and affect, two dimensions of knowing and learning that have not been developed at any depth in the preceding parts. Using exemplifying fragments from a tenth-grade physics course, we articulate a monist, one-substance approach. The premise for the study is that body–mind and individual–social dualisms can be found throughout the educational literature even in those studies that claim allegiance to the sociocultural and cultural-historical approaches designed to overcome dualism. Even in the earlier works of Vygotsky, the founder of the cultural-historical psychology, there are aspects—e.g. mediation—consistent with dualism. In his late works, however, Vygotsky began to develop, based on the works of Spinoza, a monist approach to knowing and learning in which body and mind, individual and collective, intellect, praxis, and affect all are manifestations of one substance. This approach solves three perennial problems that plague present-day research: (a) the separation of body and mind that is accompanied by the reduction of affective and bodily practical dimensions of life to the intellectual (mentalism); (b) the conflation of thinking and speaking; and (c) the separation of individual and collective subjectivity. Here we present a study designed to articulate the approach that takes its starting point from the late works of Vygotsky and twentieth century philosophical elaborations of the Spinozist approach, drawing implications for educational research and assessment as these become relevant to the analyses presented.

Chapter 13 (a) revisits most of the fundamental topics and empirical findings reported throughout the book and (b) places them in the context of current discussions on educational practice and assessment. In the analyses presented throughout Parts I and II, we examine aspects relevant to educational practice as they unfold in school or school-related situations. We approach the educational contexts from a broader perspective, which allows us not only to re-situate many of the issues discussed throughout the book in the context of educational practice and assessment; this also to perform a genetic and critical analysis of the place of schooling in society and of society in schooling. We begin our analysis by defining a notion of (learning) ***context*** that allows us position the Spinozist perspective among other competing

approaches. This notion of context does not involve a contrast between two different things (substances) but constitutes a generative process that re/produces persons and objects/facts. With this background, we examine schooling as a societal product and reproduction that objectifies a dualist epistemology, in which issues of inequality emerge both as objective and subjective phenomena. Vygotsky's non-dualist Spinozist approach offers an alternative epistemology for educational practice, one in which the focus on individual achievement and hegemonic reproduction are substituted with the values of freedom and activism.

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Chapter 12
The Thinking Body

Late in his life, Vygotsky turned to *Spinozism* to begin a new form of psychology. This was an important step toward a consistent pursuit of an approach that overcomes all forms of polar opposites and dichotomies in the theories of educational psychology. In educational psychology, we can find many studies in which (a) mind is treated separate from the body and (b) where the individual is juxtaposed to the social. This is especially visible, as shown in Chap. 9, in the research on scientific conceptions and conceptual change, which are attributed to and said to be characteristic of individual minds, and where social and cultural aspects are considered to be related but external to cognitive phenomena. But dichotomies are present also when researchers—often building on the sociocultural, sociohistorical, and cultural-historical traditions that Vygotsky's legacy has spawned—strive to overcome these Cartesian dichotomies (see Chap. 1). Examples of this can be found in the development of *embodiment* and *discursive* approaches to cognition. With regard to the former, and despite its frequent designation as a means to overcome the dualism between body and mind, philosophical and psychological studies have shown that the concept of embodiment only reproduces the very dualism that it aims to overcome because it draws on *schemas* that need to be *enacted* to produce movements. This is another instance of a "mediator," here a schema, standing between body and the body's action. The notion of "embodiment of knowledge" further suggests that phenomena that otherwise exist in and as the living movement are packaged within our bodies, thereby re-affirming the dichotomy between body and the world. Studies that focus on discourse, in turn, tend to examine students' and teachers' words as expressions (externalizations) of individual subjective understandings and misunderstandings without attending to the actual materials (things, bodies) and praxis involved in knowing and learning the subject matter. But how is discourse connected to, for example, the hand-arm movements required to do an experiment in physics?

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Tending towards a Spinozist revision of his own prior work and ideas, Vygotsky comments saying that Spinoza's teaching on passions constitutes "a turning point of the whole history of psychology and its future development" (Vygotsky 1999: 105). He does not take on Spinoza wholesale but suggests that Spinoza has not yet achieved what he had set out to achieve. He then sets the project to "Bring Sp[i]n[o]z[i]sm to life in Marxist psychology" (Vygotsky 2010: 93), a project that would surmount all intellectualism in the treatment of thinking and learning. Today, however, the dualisms between mind and body, and between individual and society that Vygotsky asked us to overcome, are still present in the literature, conditioning the methods and conclusions of those. In his last writings, Vygotsky argued strongly against mentalism and interpretive approaches to psychology, for example, in the context of emotions. Such mentalism, however, can be seen when investigators ask their students or teachers to keep emotion journals or to talk about their emotions during interviews or when educators assess knowledge using interviews or written tests, where everything a person knows and feels is reduced to words.

One reason for this situation may be that the western uptake of Vygotsky's legacy failed to appreciate or even note the turn he was taking in the end. Throughout this book we suggest that Spinozism, especially when read through the more modern lens of dialectical materialism, enables us to theorize the biological and cultural aspects of human learning and cognition as forming a *unit*. In such a unit, the formerly opposing and contradictory terms form a unity/identity (of opposites). Such a unit constitutes a radical departure from common theories and studies in education that either oppose the biological (material body) and the cultural or consider them as parallel, interacting planes.[1]

In the preceding chapters of this book, we investigate one issue at a time for the purpose of articulating in some detail the possible developments of a theory that a Spinozist turn implies. In this chapter we provide an example of how a more holistic study of learning might be conducted so that it takes into account the thinking body as a whole. We articulate a monist theoretical framework that builds upon the dialectical-materialist lens through which Vygotsky appropriated Spinoza's works. Spinoza had formulated the assertion that there is only *one* substance that manifests itself as body and as thought (mind). Thus, thought is one attribute of this substance, a mode of existence of the body; and its extension as body among bodies is another mode. If there is thought of (physical) extension it is because of the (physical) extension of thought. As a consequence, there is no mind, and then world, and then a mediating body that connects the two. Rather than three separated elements that need to be put together by external analysis, there is a unity/identity of parts from the outset. That unity/identity of opposites is a singular plural, one substance that manifests itself in a multitude of ways. In taking this approach, we overcome three

[1] Spinoza's thinking is sometimes referred to in the literature as involving a doctrine of parallelism. Vygotsky, however, argued against this view, contending instead that "Spinoza developed the antithesis to parallelims and, consequently to the dualism of Descartes" (Vygotsky 1999: 122).

perennial problems noticeable in the literature: (a) the separation of body and mind; (b) the separation of individual and collective subjectivity; and (c) the reduction of affective and bodily practical dimensions of life to the intellectual (mentalism). In this chapter, we pull together and present in lesson fragments from a tenth-grade physics course the different aspects of interest to a revised educational psychology in the spirit of the late Vygotsky. We present the singular plural approach grounded in the works of Vygotsky and the twentieth-century Russian philosophers E. V. Il'enkov and F. T. Mikhailov, who had worked out a contemporary view of Spinoza's ideas. In the course of our presentation, we summarize insights elaborated throughout the book and draw implications for educational research and practice. We end by setting readers up for moving to Chap. 13, in which we elaborate implications for the practice and assessment of education from a broader historical perspective.

A Lesson Fragment

In this section, we present and analyze a recorded lesson fragment for the purpose of exhibiting the multiple levels of insight that the monist position affords. This position may be summarized in the statement that there are not two substances—body and mind, biology and culture—but only *one substance*. As a direct consequence, individual subjectivity and collective subjectivity are not different but instead, as shown in Chap. 4, constitute only one *intra-intersubjectivity*. In other words, intrasubjectivity is but a form of intersubjectivity, which we express as an {intrasubjectivity | intersubjectivity} dialectic because it includes (and therefore perfuses) the whole person. To emphasize the analytical implications of the assertions exposed, we not only analyze the data but also present how other researchers from other theoretical traditions might view the lesson fragments and the competent features that they presuppose.

The following lesson fragment follows an investigation in which tenth-grade students, as part of their experimental physics curriculum on static electricity, charged a plastic ruler, which they brought close to the end of a metal rod that faced on its other end a suspended pith ball and that was insulated from the surroundings by resting on a plastic beaker (Fig. 12.1). The standard explanation goes likes this: The charged plastic ruler induces a charge separation in the metal rod, which in turn induces a charge separation on the metal-coated pith ball. Because like charges repel, the charges on the pith ball side facing the rod are opposite to the charges on the facing rod-side. There is therefore an electrostatic (attractive) force that makes the pith ball move toward and hit the rod, and then bounce repeatedly back and forth. The four male students in one group are sitting at their laboratory table around the equipment, while one of the two teaching researchers present stood next to them, asking them what they had observed and how they explained

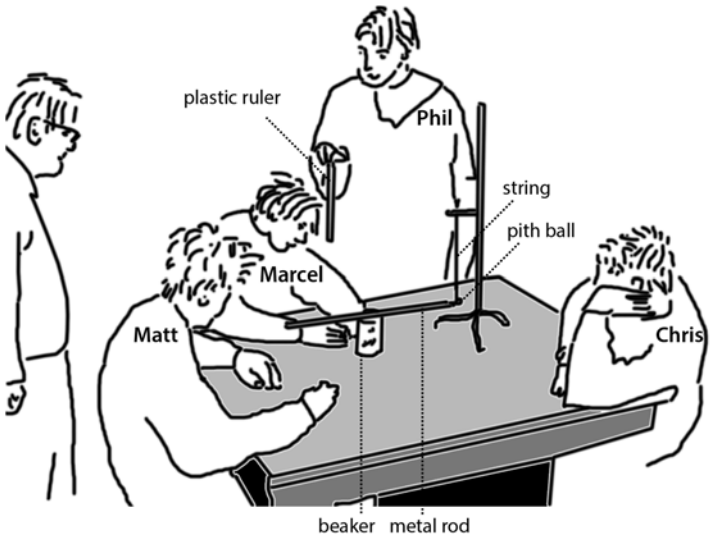


Fig. 12.1 Four tenth-grade students have conducted an investigation and now follow the teacher's invitation to explain what they have seen

their observations (Fig. 12.1). The students had pulled the instructions for this investigation from an envelope, which also included the question "What is happening and why?"

The featured fragment occurred after the students had conducted their initial investigation and now worked on the task of producing an explanation. One of the two coteaching researchers comes to the laboratory table and says, "So, you have problems with it?" He later says, "In your thoughts, go step by step through what happens, in every movement that you produce, perhaps this is going to help." The fragment is part of and reproduces the extended response to the teaching researcher's invitation/instruction. The teaching researcher returns repeatedly, standing next to the laboratory table, and his presence is observably addressed in Phil's body movements, which orient him to the former and allows him to make eye contact. In the course of this fragment, Phil (P) and Matt (M) are in the process of articulating one part of the descriptive and explanatory account of their investigation into a particular phenomenon frequently used in the teaching of electrostatic induction.

Fragment 12.1

01 P: so discharge [a]. we now hold this here [b];

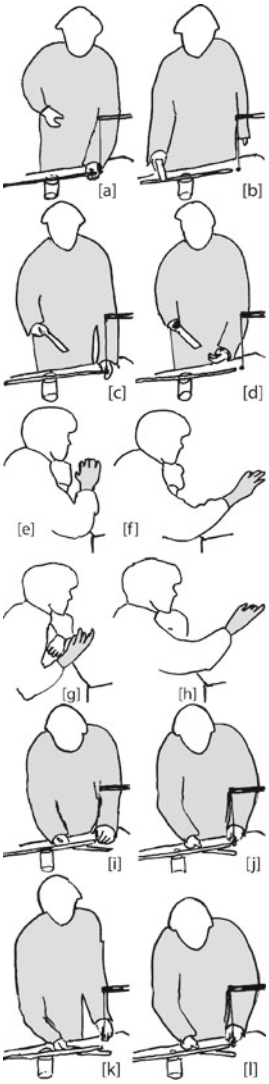
and in this way an overabundance [c] of electrons is created here. The subfluous electrons want to go there ((*rH moves right*)). So [d] it is attracted. ((*lH moves to right*))

02 M: so the protons?
03 P: yes, exactly
04 M: precisely, [e] the electrons, they put themselves [f] away

and the [g] protons [h] want to go there.

05 P: so then this is [i] coming here. a [j] part is transferred to here,

then it swings [k] back here, and then get's [l] to it here again



We see how Phil shows what is done experimentally (e.g., discharging the pith ball, holding a ruler charged by rubbing it to the end of the setup opposite to the pith ball [turn 01]), explains what the experimental preparation does (turn 01), and displaces the pith ball with his left hand and recreates its movement under experimental condition (turn 05). While he says "this is coming here" and "a part is transferred to here," he moves the pith ball to make it touch with the end of the steel rod. Matt, too, talks and uses hand/arm movements that can be seen as the actual movement of

the things named: the electrons in the rod move towards its pith ball end, whereas the protons "want to go" towards his end of the rod (turn 04 and Fig. 12.1). In this statement, protons are articulated with rising intonation, as if he was questioning whether Phil was talking about the protons (rather than the "subfluous electrons") (turn 02). Phil confirms.

Words and Relations

Remarking the importance of the social context and of intersubjectivity in learning has become common practice in the educational research literature, talk (and by extension culture) is treated as a tool that *mediates* between people. In other words, as a third thing it stands between two persons allowing an indirect connection. In this section, and different from the mediational approach just noted, we support the assertions that *talking (a) is intra-intersubjective and (b) manifesting, producing, and managing a (social) relation—rather than the latter being its context or input.*

In the fragment, one expression in turn 01 is treated as problematic (turn 02), and the fact that it indeed was meant to say something about protons is asserted in and through the pairing with turn 03. There follows what can be heard as an elaboration of turn 01, now including the term protons (turn 04). Matt's hand movement towards himself (turn 04, g) visibly shares features with Phil's right hand movement in the same direction when he says "subfluous electrons." Matt, however, offers the word "proton" instead, which comes to be accepted in the next turn ("Yes, exactly"). That is, even though the adjective subfluous does not exist in German (or English) but instead is created here in situ and on the fly, it is no obstacle in the communication as Matt immediately offers a replacement term, protons (which are positively charged). Here, we do not see a "negotiation of meaning," a "this for that" modeled on economic exchange—a notion that is theoretically problematic for describing classroom learning and development. Instead, at the level of the *con*versation, we see a development of the explanatory discourse. It occurs when an adjective that does not exist in the German language—which, together with the noun "electrons" was used to name some entity—is replaced by a noun that not only exists in German but also in the more narrow discourse of physics. We could also say that there is *one* irreducible conversation, where different voices constitute *interdependent* parts rather than independent parts that have been added together. This development in the living discourse that can be observed is a form of thinking that occurs in public. This public exchange is the real genetic origin of any inner speech and verbal thinking of individuals. In the following sections, we examine how, in and through the materials that the conversation offers, the participants produce all they need to jointly arrive at an intelligible account of the experimental phenomenon.

Manifesting, Producing, and Being (in) the Relation

In the fragment, there is not just talk as if individuals were emptying the contents of their mind while *in* relation with others. Instead, this talk *establishes* (produces) the relation. It is not merely *in* the relation of Phil and Matt that the first statement appearing in the fragment comes to be problematic. Thus, the problematic nature of the first statement *is* the relation, or, rather, the first turn is problematic because of its relation to turn 02. There is nothing apparently problematic in Phil's description until it is considered as a part of the larger sequence in which it appears. The ordered sequence of turns implies that the problematic and the social relation are produced simultaneously—consistent with the statement that development *first* is *a soci(et)al relation* before it is notable as a psychological function of the individual.

When participants are seen to be immanent to the relation, there is no need to recur to individual inner and private processes of "interpretation" and "meaning." When Phil provides an account by means of gestures, and using the materials at hand, there is no need for extra work to "interpret" what he "means." The recipients of the talk can see that the named transfer occurs between the rod and the pith ball and, therefore, do not need to "interpret" "Phil's" "meaning" in the same way that we do not need to "interpret" to appropriately act in the world. When a problem emerges (turn 02), the outcome is not a given meaning but rather the production of more material and conversational resources for the conversation to move on and, by the same token, for the thinking over and about the experiment to materially unfold.

A persistent claim often repeated in the literature is that of the social construction of knowledge. Thus, it is easy to find examples where researchers claim, in situations like the one above, that students constructed knowledge together, *in* their relation, and then constructed it for themselves. A collection of individuals, however, does not constitute the social. Instead, the social nature of a practice needs to be empirically shown rather than asserted. In Fragment 12.1, the addition of the word "subfluous" to the account—even though it is not according to standard physics—*is* inseparable from the relation. Indeed, none of the phrases articulated in the ordered sequence from turn 01 to turn 05 belongs to the individual speakers (Chap. 9). Instead, each phrase (statement) is produced *for*—it always addresses—the Other, and using words that do not belong to the speaker but are cultural possibilities available to all.

Addressivity and the Intra-intersubjective Nature of Talk

The social relation the students produce and to which they are subject is apparent in other ways as well. Rather than just listing features, contents or ideas in the public arena, each participant is talking *for* the other and *for* the teacher *in order to* move the task ahead; each is *addressing* the other, talking to be heard. Addressivity, the fact that "man lives in a world of senses and affects, addressed to himself and

addressed to him by others" (Mikhailov 2006: 39) is an important idea that in general has not been taken up, according to Mikhailov, by Vygotsky advocates. We can see that students are talking *for* the teacher, when Phil or others physically orient or look to him. They are talking *for* each other as well, in the process of evolving an account, a written summary of which would constitute their report. That is, if a statement were not assumed to be inherently intersubjective, already a reality for two, then it would not be reasonable to make it at all. A sound-word is a reality for two (and, thereby, a possibility for all members of a culture) or it is not a word at all. Even the "meaning" researchers tend to infer from words are not those of individuals but always already collectively possible ways of using words. Thus, subjectivity always exists in the {intrasubjectivity | intersubjectivity} unit. This is consistent with a theoretical approach according to which higher psychological functions—including forms of subjectivity and forms of "meanings"—initially *are* social relations. The social relation does not exist independently of or as preceding the individual, but includes the individual as one of its aspects. Its *inter*subjective character is not external, but internal (therefore the "intra" in the "intra-intersubjectivity") to the individual, because individual and situation *inter*mesh. It is an individual-in-and-for-a-social-relation, indivisible from the social relation. As suggested in Chap. 4, we represent part of the transcription in a way that takes into account the active listening on the part of the recipients, here exemplified by Matt:

Fragment 12.2

02 M: [((*says*)) so the protons?]
03 P: [((*hears*)) so the protons?] ((*says*)) yes, exactly

This form of presenting the transcription makes apparent that the statement "So the protons?" resonates not only in Matt's speech organs that produce the sound but also in the ears of Phil. When seen/heard as part of the longer sequence of conversation, the sound-word belongs to both at the same time—it is a sociological phenomenon. If it were not so, then there would not be a relation with others—and even if Matt were talking to himself, it would be as if he were to talk to the *Other* within himself. Thus, in contrast to Piaget, who emphasized the autism of the child that manifests itself in egocentric speech, Vygotsky emphasizes that egocentric speech has its origin in social speech. In the excerpt, there is a psychological dimension as well, which progresses in the horizontal dimension of, for example, turn 03. In the active attention to the words, a hearing unfolds and shapes the reply. The response therefore exists not in the words "Yes exactly" alone, but across the heard and spoken parts of turn 03. The function of the response is not contained in another (spiritual, mental) realm, but exists in and as—indeed *extends* across—the one substance that the social relation constitutes. The spoken part "Yes exactly" is but a one-sided manifestation of the whole response, which consists of active listening and replying.

This description of communicative exchanges is not unlike that of other material exchanges, for example, those material exchanges that make an economy. The com-

modity, the material thing exchanged, lies, in the exchange, in the hands of both; its value simultaneously is use-value and exchange-value. Perhaps fortuitously, the Russian word *značenie*, generally translated by "meaning" or "signification," also has the dictionary sense of "value." The "value" (or function) of the word in the exchange may be different for the participants just as it is in the case of commodities. It is different not because of the participants' subjective interpretations but because of an inner difference that allows the sound-word to manifest itself differently, a situation that is depicted in Fragment 12.2.

Despite the obvious orientation of the participant to address each other in conversation, that addressivity generally is not taken up in the literature. This can be seen in interview studies, which tend to disregard the fact that the participants address the researcher (research assistant) rather than empty their mind into the public sphere. But what participants say and how they say it takes into account both context and recipient. In a strong sense, what is said therefore cannot be attributed—in content or form—to the speaker. It is a societal-cultural and historical phenomenon. If either Matt or Phil was perceived as speaking to himself, there would be no relation; and this absence of a social relation with others would manifest itself in the lack of a take up by other members to the setting. Because the sound-words are cultural features that become part of a child's while she participates in relations with others (i.e. in her environment), even the person talking to herself would relate to herself as to another. The revised transcription shows that the psychological and sociological dimensions are inextricably interwoven, like the warp and weft of a fabric. The two, the sociological and the psychological are simply different manifestations or attributes of the same phenomenon: situated communicative exchange.

Thinking Body and Affects

In this section we show how communication not only is bodily material through and through but also that the bodily material is produced inseparably from sound-words and the affects that manifest themselves therein. Words, gestures, and body movements do not enclose or "embody" cognitions, concepts, emotions, and understandings. Instead, they are themselves both the subject and the matter of thinking and feeling. As we note above, in the Spinozist tradition that also underlies dialectical materialism (see Chap. 1), thought and the body's spatial configuration and physical position among other bodies are different manifestations of a single substance, which manifests itself in the thinking body of each individual human being.[2] In the following, we show how body and the public articulation of ideas about the investigation with the bouncing pith ball do not unfold in two different realms, but are manifestations of one and the same (thinking) substance.

[2] Manifestations always are one-sided, which is another way of expressing the singular plural nature of being: *one substance manifests itself in many ways*.

Body Position and Orientation

Body position and orientation are aspects of social relations that manifest and contribute to organizing conversations and participant relations. Analyses of lectures, too, show that body orientation plays an important role in the intelligibility of talk and the intelligibility of the concepts taught. They are materials that contribute to the mutual orientation of participants and constitute manifestations of forms of engagement in some event or with others. Thus, for example, in a data session analyzing the videotapes collected during the physics lessons analyzed here, the transcriber described Chris at one point as someone who "has sat there uninvolved for the whole time," something that the teaching researchers present accept upon entering the transcription into the database. That is, the non-involvement is an empirical fact that not merely can be seen but in fact has been perceived by multiple witnesses during the viewing of the videotape. The transcriber also noted that Chris "was annoyed" at some point in time, or that he was "disinterested," "*played* with [rather than used] steel rod," "played with the steel road for the whole time," "moaned in annoyment," "hits table in annoyed fashion," or "signals refusal in annoyed manner." The descriptive adequacy of such statements, for the research group that collected the data, exists in the final, accepted version of the transcription. Here, affects come to be treated as visible and objective facts. Such statements about the participants' states or intentions tend to enter research on the constitution of core educational research objects such as identity, interest, or motivation. Yet, the material procedures and assumptions by means of which researchers and witnesses alike arrive at such descriptions often remain unarticulated.

In part, the descriptions of a student being uninvolved may have their origin in the fact that Chris has not talked for a while, although he did in fact contribute several statements only about 12 turns before Fragment 12.1 begins. More important, perhaps, is the orientation and positioning of Chris' body (Fig. 12.1). Leaning slightly sideways—which might be seen as slouching, the left hand/arm support his head—for long stretches during the exchange, he is at a remove from the experimental setup. This is in contrast to the positions and orientations of others: Phil manipulates the equipment while talking, Matt moves the hands near and along the steel rod, and Marcel has the left hand at the beaker, leaning forward as if wanting to start using it.

Body orientation also is an important contextual constituent of talk, as it clearly marks the addressee. Thus, when one of the teaching researchers is at the laboratory table, then the student currently speaking often, though not all of the time, bodily turns to him, which thereby selects that particular person as the addressee. But body position/orientation and talk are not produced separately; nor is there any indication that it requires, on the part of the speaker or recipient, to engage in a special interpretive effort to understand. Understanding is there (immediately) present in the way that the participant's bodily position and orient with respect to each other and the materials in the situation.

Changing Functions of Hand/Arm Movements

Hand/arm movements are an important aspect of the fragment because they allow the visibility of aspects of the situation that are not made present by means of words—not in the least because they are apparent to everyone, highlighted in the pointing, and therefore do not need to be said. These movements are part of the overall characteristic of communication to accent the visible or, in other words, allow phenomena to show themselves.[3] When Phil says, "We now hold this here," while bringing the plastic ruler to the end of the steel rod opposite to the pith ball (turn 01), all recipients can see and hear what is made apparent. There is no need to interpret what is happening for the purpose of constructing an ideal meaning. The statement orients recipients in a particular way to the concrete, material situation at hand to see what gives itself to be seen. Similarly, when Phil says "so discharge" while grabbing the pith ball, the discharge by means of the grounding that the body of the speaker provides exhibits itself to everyone watching him.

Some of Matt's hand/arm movements are *pointing* (deictic) gestures, such as when Phil places the rule in the experimental set up where it was held in the investigation (turn 01, b); and Matt's hand is close to his body when he articulates the protons (turn 04, g) and close to the other end of the steel rod while saying that the protons want to go there (turn 04, h). Other hand/arm movements are of a type characterized as *metaphoric*, though in this context, where the talk is enmeshed with the particular nature of matter, there also is an iconic aspect. The hand/arm movement is metaphoric because the language in the talk constitutes electrons and protons as particles that freely move about in the steel rod. In their concurrent presentation with talk, the electrons and protons are featured to have intentions and agency, which allows electrons to "put themselves away" and protons to "want to go there."

Phil's hand/arm movements are also *iconic*: They let be seen what the group had seen before because of a perceptual resemblance. Thus, for example, when the verbal account comes to the discharging of the pith ball, Phil does precisely what he had done during the initial investigation. Previously, the hand/arm movement had done work, a form of movement that is denoted by the term *ergotic* movement. At that first time, when they were doing the investigation, this hand/arm movement did not have (primarily) *symbolic* function. Instead, it was all work. The "freezing" of work-related movements into symbols constitute the origin of signs and language (see Chap. 2). They constitute a way in which being evolves into conscious being, and, therefore, into consciousness (e.g. Chaps. 1 and 8). Other gestures are of the *epistemic* type, where movements serve the purpose of finding something out (Chap. 3). Thus, for example, Phil takes the pith ball into his hand, moves it closer to the metal rod until it touches, and removes it again. He reproduces with the movements the perceptual aspects of the moving pith ball but in slow motion. This allows the students to think (about), in and with their hand movements, the phenomenon.

[3] In Chap. 11, we refer to this as the apophantic function of communication.

They are afforded to *find* the perceptual aspects taken up in their observational and theoretical descriptions.

Later, however, the same hand/arm movements in the context of producing an account does have *symbolic* function (cf. Chap. 2)—but they also do exactly what it has done before, namely discharging the coated pith pall. We can see here a form of developmental (qualitative) change, whereby the same hand/arm movement changes its function. In subsequent accounts, especially when the equipment was no longer present, the hand/arm gesture disappeared and everything was expressed in the verbal modality of communication. In the present context, however, the symbolic function occurred in the presence of the original equipment, which, therefore, do not have to be expressed in words. They nevertheless are *present* rather than represented (made present again by other means) in the physical environment, equally accessible to all those in attendance.

In all of these gestures, a constitutive (dialectical) relationship between the gesture and the environment is apparent (cf. Chap. 7). Thus, a pointing movement, motivated by some feature perceptually available in the physical environment, orients the recipients such that what is there gives itself to be seen. In the case of the iconic gesture, recipients are provided with further assistance to find what there is to see because of a perceptual similarity between the trajectory of the hand movement and the rod's extension (e.g., the hand moves along the rod, thereby allowing the rod to stand out). The function of the gesture, whether deictic or iconic, is to let a feature be seen; in other words, the gesture allows a phenomenon to show itself from itself. The gesture aligns participants with respect to material phenomena in the immediate environment pertinent to the present talk. As can be seen from the fragment, the feature or location associated with the gesture is not even named; instead, the speakers frequently use indexical terms "here" (5 times) and "there" (twice). Recipients thereby are invited to attend to something that is happening or that can be found. Even apparently non-indexical terms, such as "away," function as indexical, because the recipients have to find, aided in this by the associated iconic hand gesture, where the "electrons put themselves" (turn 04). This idea about the coordination of a thinking body with its environment, of whatever kind, is fundamentally Spinozist.

Researchers have shown interest in the multi-modality of communication. Here, gesturing tends to be taken in terms of thinking that externalizes itself in multiple representations and modalities, including word and bodily gesture (cf. Chap. 9). Some psychologists suggest that thought is re-coded into words, others that thought has different modes, whereas still others assume a dual coding hypothesis. However, Spinoza's monist approach differs from all these approaches in that "there is not and cannot be the *cause and effect* relation between thinking and bodily action" (Il'enkov 1977: 34). This is so because the body and thinking are not two things at all, but simply are two manifestations of one and the same thinking body that cannot be reduced to (verbal) thinking (in other words, the same viewed from different angles). Body and thinking are related as an organ to its function (see Part I, introduction). Thus, in the monist take, the differences between gestures and talk are not due to different conceptualizations/mental representations but are different manifestations of the same living and moving thinking body (one substance).

Prosody

One important aspect that comes with speaking is prosody, that is, characteristics that are associated with the material nature of speech including pitch, pitch contour, duration, speech intensity (loudness), speech rate, stress, and rhythm. The separation of the semantic aspects of speech from the material sound carrier is not possible in the monist approach. Because when we do so, the "sound is divorced from human thought [and] it loses the characteristics that makes it unique as a sound of human speech" (Vygotsky 1987: 49). The features of the sound are enmeshed with the sense, signification, and function of the word. They reflect and are correlated with (a) emotions; (b) the function of speech (e.g., question, assertion, command, direct and indirect speech, or clause); (c) evaluations (e.g., empathy, sarcasm, or irony); (d) emphasis and contrast; and (e) other situated (pragmatic) aspects of speech, such as agreement (solidarity) and disagreement (conflict). These aspects are not accounted for if the examination of talk-in-interaction is reduced to a dichotomy between semantics (content, "meaning") and syntax of language. In fact, when there are disjunctions between the lexical aspects of speech and prosody, recipients tend to trust the latter more than the former. Thus, a student may say something like "It's so exciting!" while the science teacher presents a demonstration, but others in the class may hear it as an ironic commentary on the part of an individual who is bored or who shows disrespect for the teacher. An example of this can be found in the transcription of our lesson, where there is an exchange as part of which the transcriber notes that Phil is "playing being excited."

Fragment 12.3

01 Ma: have you finished the question?
02 M: course.
03 Ma: okay, then . . . try . . .
→ 04 P: ((*playing being excited*)) question ready.

Educational psychologists are interested in the ways in which students and teachers engage in the school subject of interest, and, thereby, experience pride, triumph, and positive affect. They therefore would be interested in understanding whether their participants exhibit excitement rather than merely speaking about being excited, the veracity of which is open to contestation. Asking students or teachers *about* affect intellectualizes it, allowing researchers to theorize only those dimensions that can be named and thereby manifest themselves in one or another way. It corresponds to a Cartesian approach to affect (emotions, feelings). Aspects such as intonation, speech rate, speech intensity, and other speech parameters that take place in actual engagement with others exhibit the affective tonality of participation directly and without requiring talk about practice, inherently are fraught with empirical problems. Prosodic aspects are material, and, as everything else material, constitute the context of the (classroom) talk. As the transcription shows, when researchers observe students (or teachers), they apparently see whether excitement

is real or pretended. The thinking body manifests affect without having to take the detour through the intellect ("interpretation"); but this requires consideration of communicational events as *material* events. The teaching researcher verifying the transcription did not contest the description of Fragment 12.3 as "playing excitement" and, therefore, accepted it de facto. That playing excitement, however, is not available in the lexical (semantic) aspects of the statements. Nor does it have to be derived linguistically by means of an interpretation. What then makes it possible to hear the statement "Question ready" as playing excitement? We pursue the answer by taking a look at a turn transcribed shortly before Fragment 12.1, which exhibits the central role of prosody in making it possible to discern grammatical features of talk-in-interaction.

Fragment 12.4

01	P:	((*turned to Marcel*)) all this is really relatively logical. ((*Turned towards the teacher*)) at least if it is correct in this way. so we now have, we supposed now, the metal rod lies on here ((*plastic beaker*))
02	Ma:	((*assisting Phil in placing rod on beaker*)) (?)
→ 03	P:	is insulated by the beaker, practically not grounded

Immediately before the fragment, Phil talked about setting up the experiment, which involves placing the metal rod on a beaker, which insulates it electrically from the surroundings. When we consider momentarily only speech intensity and pitch (of turn 03), we already observe a number of patterns (Fig. 12.2). Thus, for example, part of the statement functions as a subsidiary clause that restates, using different words, what the preceding main clause stated: the rod is practically insulated. Hearing the second part as a clause is brought about by the considerably lower speech intensity, which dropped from a mean of 61.5–55.5 dB, a fourfold reduction in intensity (each 3 dB corresponds to a doubling). The falling-rising intonation in the first part of the statement is heard in a way that grammatically, in the transcription, is implemented by the comma; it flags continuation, which then comes in the form of the second part that has an overall falling tendency to the end. This falling intonation would be transcribed by a period at the end of the phrase. Working together, intensity and pitch allow us to hear emphases on the second part of *isoliert* [insulated], the first part of *praktisch* [practically], and the second syllable of *geER-det* [grounded]. There are also rhythmic aspects, which, as studies in science and mathematics classrooms have shown, may have important contributions to the semantic function of speech by allowing recipients to hear parallels and co-variation between different parts of statements.[4] These can be observed here in the pattern that emerges from stressed (transcribed in capital letters) and unstressed syllables

[4] One study shows how the conceptualization of geometrical figures is intertwined with the rhythmicity of speech (Roth 2011); another study shows the function of prosody in the affiliation and disaffiliation with a particular science concept articulated during a discussion (Roth and Tobin 2010).

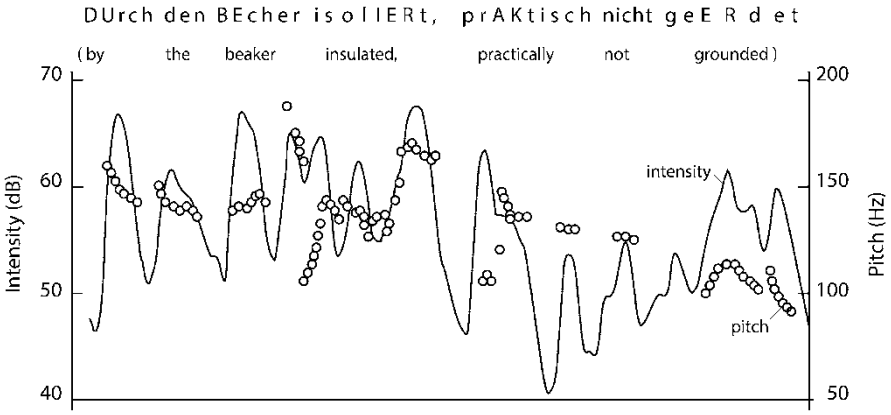


Fig. 12.2 An excerpt from one of Phil's turns exhibits the prosodic features of talk, which provide the recipients with context for how to hear the words

(transcribed in case letters). Overall, the transcriber—as the participants—treated the phrase as an assertion about what was done in the investigation and how it was to be understood.

The issues are not trivial, because, for example, it is important whether parts of a verbal statement constitute a main part or a subsidiary clause. It is important not just grammatically but also, and at the same time, for all practical purposes of the ongoing transaction (i.e. pragmatically). It is important for participants to be able to discern whether a statement is offered as a definite assertion or as a possibility—e.g. which would be realized if the pitch was rising towards the end as it does in a question. In this case the teacher or others might hear that Phil is not so sure about what he is saying and, therefore, allows them to make an assessment about his knowledge. The next turn or turns would reveal how participants have heard and taken up what Phil has said, for example, by asserting agreement or by stating that he was correct so far.

There Is but One Substance

In the preceding section, we analyze fragments from a physics curriculum that provided students with opportunities to develop a theoretical understanding of static electricity by engaging physically with a variety of investigations. Current theories do not answer the questions of how such *bodily* practical work leads to *conceptual* understanding, what the functions of body movements are in theoretical understanding, or how *hand/arm gestures* lead to *discursive* mastery of the subject matter. It cannot be, as constructivists often say, that learners construct it in their minds, for then the bodily aspects no longer are bodily but mental. These theories cannot answer the questions because, as in constructivist approaches, understanding is the

product of a *mental* construction, or because theoretical understanding is *discursive*, where the latter comes to be treated as being of a different kind than the material world including the material body. Our analysis exemplifies that there are *inherent, inner* rather than external connections between (a) communicative expressions (e.g., gestures, body orientations, or verbal deixis) and the physical environment, (b) individual and collective dimensions of talk (intersubjectivity as the condition for communicating and making sense), or (c) gestures, body movements/positions, and words. A dialectical materialist, monist approach inspired by Spinoza transcends dualism and uses a number of dialectical *categories* that manifest themselves in contradictory ways. In the following sections, we discuss (a) ways of going beyond the mind and matter dichotomy, (b) the unity/identity of the opposites thinking and communicating, and (c) the {intrasubjectivity | intersubjectivity} dialectic. We begin each section with an organizing and summarizing assertion that is then worked out in the text that follows.[5]

Transcending the Mind—Matter Opposition

Assertion 1. The natural, physical world and culture interpenetrate forming one substance that constitutes a single order of development.

In classical psychological theories, there is a separation between body and mind such that the question concerns how the symbols and signs of the mind are connected to the world. This classic Cartesian question reappears in education, where practical (laboratory) work frequently is contrasted with conceptual work, especially in the contrast between "cookbook mentality" and "problem solving" and ideas. In school practice, the former tends to be considered fun and for motivation, whereas the latter is treated as the serious part of instruction. A monist approach rejects all dichotomies that oppose the physical and the spiritual, all of which manifest themselves in body–mind, matter–mind, brain–mind, or biology–culture dichotomies. We pursue instead a *singular plural* approach in which the natural and the cultural orders mutually penetrate each other: there is *one* substance that manifests itself in *many* (very different and contradictory) forms. If these manifestations interpenetrate, they cannot be separated, because each has parts that also are parts of the other. Mind is not opposed to matter. Instead, the material and the ideal are two manifestations of the same developing structured system, two attributes of one thinking body. The implication is that signs (e.g., words) *are not mediators* between the person and the world, or between the person and others. Rather, they are integral part of the whole and therefore also a function of the other parts.

[5] It should be apparent that by dialectic we do not denote the triad *thesis, antithesis, synthesis* that often is ascribed to the German philosopher G.W.F. Hegel. We particularly reject the idea that the synthesis somehow builds something from elements—as in chemical synthesis of compounds—or that the synthesis somehow overcomes contradictions by reconciling them on the basis of commonalities. Instead, all categories and the corresponding analytic units pertain to singular plurals.

The Unity/Identity of Body and Mind

In the analysis of the episode, we show how the bodily (hand/arm gestures, body orientation to recipients, prosody) is integrated into a whole together with speech, an important aspect of which is bodily in nature. We note that the symbolic hand/arm gestures in particular have their historical roots in the same hand/arm movements that have developed in the course of the physical labor to make the experiment work; and it is the perceptual coupling between these gestures and the other materials in the environment that gives rise to the intelligibility of the communication. During our analyses, we also point to the results of associated studies, which show that the experimental equipment first was substituted by other physical materials that stood in for the former, until all equipment was unnecessary when the students reported their results to the class. Hand/arm gestures also disappear, being replaced by words. Although we can identify change across bodily and verbal dimensions of communication, these are not separate developments. Moreover, because the hand/arm movements develop out of work and in response to perceptual aspects of this work, there is no evidence of mental schemas that exist before and underlie the hand/arm gestures—in the way that this is often theorized to be the case, including in the embodiment and enactivist literature. In the monist approach, gestures (as other body movements) and words are of a different kind: the latter cannot replace the former. There is therefore no relation of cause and effect "between thought and body … but the relation of an organ … to the mode of its own action" (Il'enkov 1977: 34). We do not gesture because we think; instead, gesturing is one of the many manifestations of a thinking body. Gestures are part of thinking, not its outcome (cf. Chap. 3). Because gesturing (material) and verbal (material) aspects of thinking cannot be reduced to each other, research investigating and reporting episodes of (learning) action have to include visual means to improve the way in which communicative events are rendered.

In the monist approach, the body does not need and "is incapable of having schemes of present and future actions" but still is capable to move in patterned ways "in accordance with the forms and arrangement of the 'external things'" (Il'enkov 1977: 50–51). It is for this reason that thinking can be appropriate (the constructivist "viability") to the material and social reality outside of the body, even though it can be so in many different ways because of the plural nature of the one. Phil's and Matt's hand/arm movements precisely are appropriate to the situation at hand because they have arisen from, and are consistent with, the structures of their material environment, not of their brains. Their body movements literally have been shaped by tactile and perceptual possibilities of the empirical setup. These are not just any possibilities, but precisely those that are instantiated as body and world, thinking and object, and, therefore, come to *correspond* with one another. For this reason, researchers must go "beyond the bounds of considering what goes on inside the thinking body … and to examine the real system within which this function is performed, i.e., the system of relations '*thinking body and its object*'" (Il'enkov 1977: 52, original emphasis). That is, from a monist perspective, thinking in general can be understood only as the unity/identity of {thinking body | nature}.

In contrast to all approaches where the individual develops or constructs itself based on biological and maturing principles (e.g. Piaget), Vygotsky advocates the unity/identity [*edinstvo*] of biological and cultural development. In his approach, body and mind are manifestations of one and the same substance rather than two parallel and coordinated planes of different substances. He distinguishes the higher psychological functions from the lower functions, which constitute the biological roots and organic properties of the former; the higher functions are social, because they appear in the development of the individual first *as* (rather than merely *in*) real, concrete social relations. But he rejects absolute dichotomization. Scholars interested in learning and development during preschool and school years, therefore, *must* account for the biological/bodily as well rather than focusing solely on non-(meta-) physical ideas attributed to the words. The latter is typical of *interpretive* psychology and its presupposed primacy of the mind (Vygotsky 1997). Because this interpretive approach seeks to understand development hidden behind words it fails to differentiate nature, the biological, and nurture, the cultural in child development. This failure to differentiate makes the biological disappear in the mind, such as when affect is researched by asking people about how they feel, a method by means we only get affect talk. This is a sure path into metaphysics.

In contrast to the biological and interpretive approaches to psychological development, the monist approach takes "both orders of changes mutually penetrate each other and form in essence *a single order of social-biological formation* of the child personality" (Vygotsky 1997: 20). That is, there is but *one* order; there is but *one* substance. Because the different manifestations of this one substance *interpenetrate* each other, they can be distinguished but not separated. As a result, "organic development turns into a historically conditioned biological process" and "cultural development … is merged with organic maturation" (1997: 20). Development can be observed in tool use, body movements and perception, and conceptual talk: the whole organism-environment that constitutes a child's life. These are not developments on different, parallel planes. Instead, "their composition, genesis, and function (mode of action)—in a word, their *nature—are social*" (1997: 58, original emphasis).

The integration of bodily and psychological dimensions is exemplified in the instance of pointing, which "plays an exceptionally important role in the development of speech" (Vygotsky 1997: 104). As we describe in Chap. 2, there are an infant's hand/arm movements, perhaps even a failed grasping movement in direction of an object. When the mother takes the object in the prolongation of the infant's movement and reaches it to the child, she *treats* the movement as a gesture (sign) of the type that already is integral part of human social relations. Pointing here appears for the first time *for another*, even though the child itself does not intend the initial hand movement as such; pointing here *is* the social relation. Eventually, however, the child begins to intentionally point towards objects she cannot reach—perhaps making apparent the unsatisfied request by crying or some other means of expression. Only at that time has the movement become a gesture for the child herself. The function of the movement has changed; and this change in function is a form of development. Readers certainly note at this point that the functional changes in hand/arm movement are an important aspect of the preceding analysis.

Perežívanie [Experience]—The Unity/Identity of Person and Environment

In our analysis of the lesson fragments that are presented throughout this book, we point to the irreducible relation between the physical environment and communicative action that becomes in the phenomena of gestural and verbal deixis (pointing). Communication, which is material through and through, is an integral part of this environment and speech or gestures are incomprehensible if considered without this relation to the physical and social environment. On the one hand, verbal and gestural deixis accent certain aspects of the physical environment that thereby become visible (salient), the environment and the perceptual gestalts that it provokes thus lying at the origin of communication. On the other hand, communicating establishes and organizes the social relation, as it is always produced *for* the generalized other and therefore addressed to their needs in regards to intelligibility (see Chap. 3).

In the monist approach, there is an irreducible connection between humans and their environment: Whereas animals live *in* and are determined *by* the environment, humans (purposely) modify themselves by modifying their environment (e.g. Watson came to know the structure of DNA when he saw the configurations of the shapes that resulted from his movements, as discussed in Chap. 3). Humans actively change their own behavior by modifying their environment and control what they do from without. This fundamentally is a Vygotskian and Spinozist take to human behavior, according to which "to explain the event we call 'thinking,' … it is necessary to include it in the chain of events *within which it arises of necessity and not fortuitously"* (Il'enkov 1977: 37, original emphasis). Thus, it is not that a mind constructs (e.g. embodied) meanings, but that body and world (including other human beings) continuously correspond with one another. Because we actively *respond to* the physical environment and to others, the beginnings and ends of our actions "*are clearly not located* within the thinking body at all, but far outside it" (1977: 37, emphasis added). We see this when Phil's and Matt's gestures have taken the shape of the objects in the world. Understanding thinking and reasoning, therefore, requires the consideration of the environment and the relation that interleaves it with the whole (thinking, feeling, doing) person. We cannot understand thought (thinking) unless we take into account the environment, including the very social motives of the ongoing activity. Thus, what Phil, Matt, and the remainder of their classmates are doing and saying, their thinking, is a function of the fact that they are in a physics lesson nested within schooling, nested within the whole life of the students, their interests and inclinations.

Thinking, affect, sensation, and perceptions are inextricably related to the environment—they all manifest the same unity/identity that includes the person and its material-social environment. To capture this irreducible {person | environment} unit, the category of *perežívanie* [experience] was created. As category, it also is a unit [edinica] of analysis. That is, to understand the learning and development that occurs in science lessons such as those that we analyze above, categories and smallest units of analysis are required that retain the phenomenon as a whole. In our particular case, the smallest unit has to include, at a minimum, the material, social (society/culture-specific), affective, practical, and intellectual characteristics spe-

cific to human behavior. *Perežívanie is* such a special category (unit) and comes with considerable opportunities for educational psychologists.

Perežívanie is one of those categories that capture the biological body, the material and social setting, and the overall activity that is always colored by practical, intellectual, and affective characteristics. However, *perežívanie* is not a composition of these aspects, which are combined to form a whole, in the manner chemists put together elements to form a compound. Instead, each of these different aspects is a one-sided manifestation of a developing whole, of one and the same substance. Thus, a *perežívanie* always captures an irreducible unity/identity [nerazložimym edinstvom] of opposites; and this unity/identity has characteristics of the person and the environment in its subjective expression (Vygotskij 2001). This presentation always reflects cultural (i.e. collective) possibilities, one of which realizes itself in a particular way in a particular *perežívanie*. The objective environment appears differently to different persons; and, because *perežívanija*[6] continuously unfold and never are the same, it is different for the same person over time. Thus, the environment is not something fixed and external but a dynamic and changeable phenomenon (epitomized in Heraclites' river). Especially of interest, because classroom talk constitutes its own environment and because it evolves, what students say at the beginning of a lesson—and more so in an interview on conceptions and conceptual change—likely is not the same than what they say later, because everything said at some instant in time is said in the light of everything that has preceded. Rather than focusing on the outcomes of learning and development—as this occurs in pre/post studies of learning—we need to investigate the process of the genesis or establishment of the psychological forms of interest. Our analyses of the lesson fragment exemplify research findings on the development of scientific discourse, a higher (cultural) function, as arising from the bodily (ergotic, perceptual, sensory) engagement with the world. The continuously unfolding and changing {person | environment} unit encompasses, is reflected in, and is modified by {thinking | communicating}, which is another useful dialectical category.

{Thinking | Communicating}

Assertion 2. Thinking and speaking are different manifestations of the same singular plural phenomenon, which entails that signification always manifests itself in material and ideal ways.

In our analysis of the fragments from the physics lessons, we emphasize the role of prosody, which is but speech features of the actual production of words. These features contribute to denoting what is being done (e.g., asking question, making statement) in speaking, what is expressed (irony, excitement), and to the sense/signification of the said as it determines orders of clauses, emphases, and

[6] *Perežívanija* is the plural for *perežívanie*. Because *perežívanie* denotes {person | environment} dialectical units, these are particular to individuals and constitute dramatic, specific events.

consequences. That is, the function of the word does not exhaust itself in its dictionary sense(s); it is integral part of the setting in which it is used, and, therefore, is to be understood in the totality and what-for of the situation in which it is used and which it reflects. An important Vygotskian concept is "word-meaning" [značenie slova]. Although the term is ambiguous, and although some language philosophers have suggested abandoning the term altogether, it appears with great frequency in the Anglo-Saxon scholarly literature.[7] It is used to designate something that students construct but that is only pointed to by (but not existing in) the words they use. It is something beyond (transcending) the physical world, something metaphysical. Although Vygotsky may be invoked when the term meaning is used, this invocation tends to occur in the context of research programs that focus on ideas, thinking, discourse, and sign–sign relations in dualistic opposition to action, a view that the late Vygotsky rejected. The focus on meaning, instead, turns into an interest in the connection between sound and signification and how word-signification, as a microcosm of human consciousness, reflects all other parts of the situation of which it is an integral part (Vygotsky 1987). The scholar denounces the neglect to consider the connection between sound and signification as one of the serious errors of (psycho-) linguistics and psychology of language.

In Fragment 12.4, we show how prosody modulates not only the sense of what is said but also the grammatical relations, and, thereby again, the sense and function of the statement. But the material carrier *must not be detached* from the signification of the word specifically and of any sign more generally (e.g., gesture, percept). To capture the essence of the thinking body, which exists as a unity, as a {natural | cultural} necessity, we cannot partition learning situations into various elements and then try to reconstitute the whole (e.g. in terms of linear structural relations). One of our own studies shows that the dictionary sense of a word is completely irrelevant in the tenfold repetition of the word "penis" in a physics class (Chaps. 3 and 4). Appropriate units of analysis encompass an *inner* connection between intellect and affect, which Vygotsky was beginning to conceptualize in the category of *perežívanie*, in a theory that still awaits its development (Zavershneva 2010b). When the semantic aspect of speaking is considered on its own, the intellectual is isolated from the situated and situational function of the sound-word. As a result, it is no longer actual people what thinks, but only thought and brain. Thinking and thought are separated from life and anything characteristic of it, such as our motives for doing what we do, our interests, and our inclinations. The monist position is different because "all talk of thought first arising and then 'being embodied in words' … and later in actions, in deeds and their results … from Spinoza's point of view, is simply senseless" (Il'enkov 1977: 44). Readers easily see that much of the research published—e.g. on conceptions and conceptual change—enacts such separation of thought (mental, conceptual structures) independent of individual and collective life.

[7] In the Anglo-Saxon literature, the term is translated as "word-meaning," whereas in other languages, the term is translated into terms that correspond to "word-signification."

Studies tend to focus on the semantic relations and thematic patterns of classroom talk. Vygotsky uses the term "word-signification" to denote a unit that contains everything that is *also* manifest in thought or in speech. Thought is a reflection (like emotion, percept, or sensation) of the relationship between person and environment and, therefore, cannot be understood irrespective of this environment. Speech is an integral part of the environment that, through actions upon others, modifies this environment. Both, the environment and its modification come to be reflected again in thinking, which, because the environment no longer is the same, also has changed compared to what it was before. Thought is not a structure; it only exists as thinking, which is a living, material process. The word, too, is a living phenomenon, not a static thing. From a monist perspective, it is important to understand what speaking and thinking do rather than what the "meaning" of a word or statement *is*. This is why we are interested in thinking as a function of life process rather than in the (dictionary) sense of the word (thing). Thoughts have functions, they allow us to do things in the world; and the power of thought is revealed in the changes it can bring about in the world. In a note recorded towards the end of his life, Vygotsky would articulate this reflexive relation: "Consciousness determines life (the image), but it derives itself from life, and forms its component: ergo life determines life [itself] through consciousness" (in Zavershneva 2010a: 48). In the same way, we do not understand the signification or significance of a sound-word without considering the task and the task context.

In our analyses, we note that speaking has multiple functions. Phil describes what has been done and observed, and provides an explanation; but with the same statements, he also contributes to making the social relation. Each word, because it also exists in the ear of active listeners, is a manifestation of the relation. The *word-signification* unit gathers two functions of the word: means of social intercourse and thinking. Our analysis exhibits the co-occurrence of the two functions, which are irreducible to each other: the *development* of social intercourse and the development of thinking. Word-signification exists as a unity/identity of several pairs of opposites, such as communicating and thinking (Chap. 3). Thinking is not static but moves, and significations have specific functions in an ever-changing reality of the unfolding situation and life. Both speaking and thinking are manifestations of the situation as a whole: thinking is the reflection in consciousness and speaking materially manifests itself in sound without which there is no social intercourse. Moreover, intellectual awareness and elaboration constitute only one of the reflections of the thinking situation, the others including being affected, sensing, and perceiving. All these manifestations are fundamentally material aspects of the situation. Communication would be impossible if perceptual aspects of the setting were not revealing themselves when Phil or Matt use the indexical adverbs "here" and "there." In fact, the entire exchange in Fragment 12.1 is premised on the fact that the experimental configuration is *immediately* available to the recipients of talk, even if the ways each of them account for it may differ.

Many studies make claims about the relative changes in sign–reference and sign–sign links. Such studies have it that in learning and development what originally are relations with the world then turn into abstract symbolic relations. Underlying such

statements is the omission to recognize that knowing a language is inseparable from knowing one's way around the world (cf. Chaps. 9 and 10). Vygotsky was heading in this direction, as captured in his notes, which indicate a moving away from "meaning" towards the "semantic field," which "links impressions and intuitions of the sense of an event or thing to words" (Zavershneva 2010b: 63). That is, language use presupposes the relations of words, statements, and language in the intelligibility and familiarity of the everyday world. However, language is tied into concrete whole situations and connected parts; and so is thinking. With development, there is a progressive differentiation in the situation and in word use. But the basic functions never disappear. Instead, whereas they *seem* to disappear, they also are preserved constituting the sedimented foundation of the higher functions. Thus, as we show in Chap. 10, scientists do not simply interpret their data in the abstract but instead need to become familiar with the research object, the environment from which it was extracted, and the trajectory of the consecutive removals of context before they can relate a graph and a natural phenomenon. Here, too, descriptions of and familiarity with the phenomenon and its natural setting go hand in hand.[8]

In the fragments, a progression is observed from work to gestures and to language. Here, a general pattern is apparent: first there is action followed by speech, then generic speech followed by action, and finally a verbally articulated plan followed by the described actions. Talk about a situation presupposes familiarity and intelligibility. Thus, in the late works of Vygotsky, the sign (word) no longer functions in the way it had done in his earlier work, where it was a mediator as in non-dialectical theories. Instead, always already intimately subjective, the sign is both (a) subjective reality of an inner voice and (b) a manifestation thereof existing in its externalization for another, and therefore also for itself. The Other therefore always already is within the Self. As suggested in Chap. 10, Vygotsky was in the process of radically reworking his position on the sign, which no longer is a mediator between the person and her world.

The 'Other Within' for the Psychologist[9]

Assertion 3. Intersubjectivity and intrasubjectivity are not different but in fact manifestations of one intra-intersubjectivity.

In the fragments we provide above, the communicative exchanges unfold, which could not have happened if there were not already intersubjectivity. Each word in a verbal transaction is part of and constitutes the speech field. The speech field that is observed, which in the case study reported here concerns the description and explanation of an experimentally produced phenomenon in static electricity, inherently is

[8] Relevant here is also our discussion on the *Lebenswelt pair* in Chap. 10, which denotes the connection between the work of doing something, and the associated account thereof. In this book, the expressions Lebenswelt and lifeworld are used synonymously.

[9] We borrow this title from an article on the Spinozist turn of the late Vygotsky (Mikhailov 2001).

intersubjective (see Chap. 4). It is intersubjective even when a sound-word is produced that has not existed before (e.g. subfluous). But it is a word because, in its being a material, it immediately exists for two, the speaker (Phil) and the recipient (Matt), who in fact comes to replace it with a term that already has a place in scientific discourse. More generally, even and precisely when a statement is denoted to contain a misconception—as often is the case in scholarly literature—its intelligibility is presupposed (Chap. 9). A "misconception," therefore, is an intelligible stretch of talk (statement) that does not conform to some convention but is a *possible;* we ought not be surprised that it is a frequently observed and widely shared form of talk.

Research tends to problematize intersubjectivity, which classroom talk is designed to establish, generally through negotiation. However, "negotiation" presupposes that the participants already are in possession of what is being negotiated. The word (sign, sound, language) is taken to be a (mediational) *means* of communication/social intercourse. This is an error, for the very idea of individual subjectivities coming together to negotiate intersubjectivity is fraught with theoretical problems. Thus, as shown in the introductory quotation, Vygotsky emphasizes in his late works the idea of an intersubjective speech field, which is the very manifestation of intrasubjectivity (see Chap. 4). We find in the monist take an inherently dynamic unity/identity of intrasubjectivity and intersubjectivity. In Fragment 12.1, the speech field includes all the material equipment on the laboratory table, the student group, the teaching researchers who periodically come to interact with the group, and the overall task in the way the students orient to it and take it up. But not *all* physical aspects of a situation are to be included as part of the psychological event, it is not the "objective" environment in and of itself that is considered. It is those material aspects that come to exist as moments or phases of the larger developing unit: the social drama that comes about in the encounter of different people, who together participate in the transformation of life itself towards itself. In talking, students do not merely mirror but actively maintain the conditions for communicating, where they continuously recreate cultural forms and recreate new ones.

In the monist approach, all higher psychological functions, and personality, first exist *as* social relations before they can be ascribed to the individual. For this reason, anything specifically human that can be pinned to an individual—any specifically *human* form of behavior, specifically human form of activity, or specifically human behavioral trait—is intersubjective together with being intrasubjective. There is a common conception to social approaches that knowledge is constructed socially, within groups or communities, and then internalized (internally constructed) by individuals. However, a higher psychological function has its genetic origin *as* the social relations of which the individual has been an integral part. This is not that what the group produces later becomes the higher psychological function, but that the very relation between individual persons *is* the psychological function. The intrasubjective scientific knowledge, interests, identity, or motives ascribed to the individual *are* intersubjective knowledge, interests, identity, or motives—not in the least because articulation of knowledge, interests, identity, or motives requires communication, which inherently is intersubjective.

Coda: A Monist Approach for Educational Psychology

Throughout this book we make a case for a Spinoza-inspired monist approach, as started by the late Vygotsky, in which the bodily/material/physical and the psychological (mental) are but different, contradictory manifestations of one and the same substance. In this chapter we bring together what in many studies would be different takes on learning. It turns out that Vygotsky was not the only psychologist who turned to a monist take for understanding the human psyche. Only a few years after Vygotsky, the founding father of psychoanalysis comments on the extended (physical) nature of his research object: "the psyche is extended, does not know thereof" (Freud 1999: 152). That is, the psyche is oblivious to the fact that it is extended in space, which, in fact, is a manifestation of the physically extended nature of the psyche. In the late works of both Freud and Vygotsky, therefore, the dichotomy of body and mind is overcome, replaced by the unity/identity of one substance—singular plural Being—that manifests itself in very different, even contradictory ways.

The monist approach has considerable consequences for theory and method in research. Educational psychology, because of its historical interest in hands-on activity and conceptual understanding, is a prime field of research for advancing a monist approach. In this position there is a bi-conditionality in the development of tool use and the development of body movement and perception. The two developmental processes, though distinct, are manifestation of a single process of development. Just as development of speech should be studied comparatively in deaf and normally hearing children, where equivalent problems arise at very different biological age, investigators might want to engage in comparative study of the development of scientific discourse when children and youths have extensive practical engagement with natural phenomena versus when they only talk about such phenomena. This would then allow unpacking the inner relation between the material and discursive aspects of understanding. Educators and educational psychologists would thereby develop better empirical evidence and understanding for how the manual-practical aspects of doing (e.g. science) are related to the conceptual-discursive aspects.

In the monist approach, mind is not different from the body. Body and mind are but two manifestations of an extended, therefore bodily psyche. This approach, opposed to Cartesian dualism and the various forms of parallelism that reproduce dualism in new guises, requires theorizing a number of pairs of exclusive oppositions as contradictory manifestations of the same inner unitary phenomenon—as we have done in our analyses and throughout our discussion. From the dialectical perspective of the monist take, the contradictions do not arise because of the different perspectives that diverse participants can take on some phenomenon but because of the non-self-identity of the phenomenon itself: it is a singular plural. This non-self-identity arises from the dual fact of the (a) synchronic relations of a thing to all other things that make the world and (b) the diachronic relations of life. That is, the non-self-identity is the direct consequence of life as a moving phenomenon, so that all psychological phenomena—e.g. speaking and thinking—need to be understood as

processes manifesting the overarching life process. This makes whatever instance of psyche we investigate a *necessary* phenomenon, and not a capricious construction (even when the phenomenon under research may be "the capricious construction of reality by scientists"). These manifestations cannot be understood on their own, as if they were elements that could be theorized independently and could be put together to form the whole unit. Instead, proper psychological analysis needs to identify the smallest units that retain all the properties of the whole. It is illegitimate, therefore, to theorize speaking independently of speaking and thinking, person and environment, individual subjectivity and collective subjectivity, or the biological body and psychological life. It would equally be illegitimate to simply conflate the two members of each pair.

Theoretically, units are expressed by means of *categories*. Each category reflects a minimal unit of the material, ever-changing life of society. Vygotsky envisions psychology to operate like social drama, consistent with the Russian notion *category* that captures a way of talking about a *dramatic event* on the theater stage where the characters collide (Veresov 2010). A category therefore does not denote a thing but something moving, a process, which leads us to a process description of events and development rather than to a description in terms of differences between two points (things). This is precisely where Vygotsky is heading when he writes during his last year that "Everything in Sp[i]n[o]za breaks with mechan[ical] causality, with immobil[ity] … with disconnectedness, with p[a]r[a]ll[e]l[i]sm and demands an escape beyond their boundaries" (Vygotsky, in Zavershneva 2010a: 39). We are therefore asked to replace the analysis of elements and things by the analysis of unitary processes. Some categories consistent with a monist approach—that is, those used in a dialectical materialist manner—and proposed by cultural-historical psychologists include "word-signification [značenie slova]," "*perežívanie* [experience]," "drama (dramatic event)," "relations of social order," "activity," "consciousness," and "personality." These and other materialist dialectical categories offer promising paths to conducting research in education and educational psychology from a cultural-historical perspective. In Chap. 13, we articulate some of the implications of the Spinozist take for research in educational psychology, measurement, and educational practice.

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Chapter 13
"The Way to Freedom" in/for Education

> Freedom: affect in concept. The grand picture of development of the personality: the way to freedom. Bring Spinozism to life in Marx[ist] psychol[ogy]. The cent[ral] problem of all psychology is freedom. (Vygotsky, in Zavershneva 2010b: 66)

During the last years of his life, Vygotsky produced a series of documents entitled "Spinoza," which also included a document containing the phrase "The lightening bolts of Spinoza's thought" (Vygotsky 2010). In that document, we find the programmatic statements that open this chapter. Among these statements, three pertain to the same concept *freedom*, a concept that plays a very minor if any role in current educational psychology or sociocultural psychology. Yet for Vygotsky it was the central problem of *all* psychology. This problem was to be addressed by "brin[ing] Spinozism to life in Marxist psychology." In this final chapter, we elaborate on this implication of the Spinozist turn for educational praxis and, thereby, for a science of cultural psychology of education concerned with understanding learning and development under the light of the quest for freedom, a quest that has not yet been at the heart of the concerns within the field. Indeed, it has been suggested that the opposite is the case, where (bourgeois) psychologists of motivation, for example, have sought to find ways for making people do what they do not want to do on their own. Thus, it has been shown that "the entire bourgeois psychology of thought only stylizes interpretation as thought, the bourgeois psychology of emotion only knows internalized emotion, and bourgeois psychology of motivation only knows motivation by means of inner coercion" (Holzkamp 1983: 17). Psychology thereby only considers *restricted* forms of agency under bourgeois conditions and, thereby, only the ways in making do in (accepting) existing conditions—as opposed to concretize the real possibilities that exist with the human capacity to change their conditions. Freedom, the realization of the real human possibilities of changing conditions, life, and consciousness, ought to be the real problem of a cultural psychology of education.

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Vygotsky turned to Spinoza in the attempt to overcome all traces of Cartesian dualism present in (scientific and folk) psychology as well as in his own earlier attempts to build a dialectical materialist science of the psyche. Throughout this book we exhibit the need to conceptualize not the individual person, abstracted from the real situations and relations of which it is integral part, but the constitutive {person | environment} unit. The relevant object of research then exists in the thinking body, where the living, material body is related to thinking as an organ is to its function (e.g. the legs and walking). Considering {learning | development} in terms of the unity/identity of person and environment means rethinking the notion of context. As soon as we rethink contexts of learning, there will be radical consequences for the ways in which educational practice and measurement have to be theorized.

Virtually all researchers and educators today acknowledge the importance of the social and cultural context in discussions of education and learning. Yet very different conceptualizations of the nature of context co-exist in the literature without that researchers and practitioners always are aware of those differences. Whereas diverse teaching practices and goals that shall better account for students’ life contexts are envisaged, a prevalent focus on “what works” prevents researchers from questioning schooling as a social and historical practice. Schooling in the way it exists is accepted as an unchangeable condition. Such lack of questioning, however, runs against the approach advanced throughout this book, which demands a historical and genetic account of schooling and the context it provides for learning.

The dualism that Vygotsky was fighting against—which splits mind from body and the individual subject from objective society—continues to exist. It does so at the heart of what remains the most distinctive of all features of institutionalized schooling today: measurement and the economy of grades. Here, Cartesian dualism is not an abstract philosophical concern but a real organizing principle that determines aspects of practical life at both the institutional and the personal levels. The alienation of the *knowing subject* from the *object known* is a reality that exists in and as the organized production and exchange of concrete materials (e.g. grades); as forms of symbolic capital, it provides its owners differential access to one or other kind of life in society. It is therefore adequate to conclude our inquiry by discussing some of the implications that a monist, Spinoza-inspired approach has for educational practice and assessment. In this approach, the alienation of knowing subject from the object known must no longer exist.

In this chapter, and complementing reflections on teaching and assessment already presented in Chap. 12, we develop a genetic account to examine and discuss the historical conditions that lead to the production of the context of school as societal phenomenon. Important in such an account is the elaboration of the notion of context in ways consistent with the Spinozist approach. What results is a view of (learning) context that constitutes a dynamic and generative force that produces and reproduces (school) objects and (school) subjects instead of consisting of a static part–whole (individual–society) relation. Such a view of context allows a better understanding of the epistemology that underlies school failure and inequity and its social and personal implications. This is of particular relevance given the constant state of crisis in education, where calls for reform are invariably re-produced decade

after decade and where closing the so-called *achievement gap* remains an unachieved goal.

Once we understand schooling as a societal phenomenon that emerges from a bourgeois epistemology, we can begin to leave the question of achievement behind and address questions concerning the purpose of education. The tenth thesis on Feuerbach states that "The standpoint of the old materialism is civil society; the standpoint of the new is *human* society, or social humanity" (Marx and Engels 1998: 569). In it, Marx contrasts two different understandings of materialism, and associates each to the type of society they belong. The old (vulgar) materialism—one that identifies the material with "matter" and contrasts the later with the subjectivity—is the product of civil (bourgeois) society. In bourgeois society, the orientation is "that of an agent who sees the world as a set of objects to be manipulated to satisfy his individual needs" (Brudney 1998: 241). In the dialectical materialist perspective underlying the concrete human psychology that Vygotsky was striving for, the standpoint is that of *social humanity*, where there no longer is a division between individual subject and societal object. Social humanity "does not just manipulate an external datum but somehow recognizes the world around it as, in a sense, its own activity" (1998: 241). Such recognition of the surrounding world is important because it leads to *freedom*, that is, to the possibility of changing one's life conditions. Throughout this book we emphasize a *Marxist* reading of Spinoza as an appropriate starting point to restore *life* in and to Vygotsky's living legacy. In this chapter we conclude with a discussion of how this approach, in bringing social life to the core and source of our inquiries, demands a profound rethinking of the place and goals of educational practice, as well as offers otherwise unexplored research opportunities.

The Problem of (Learning) Context

In this book we repeatedly note that the social tends to be taken in a trivial sense in much of the existing literature. By this we mean to say that we do not get very far (e.g. Chap. 5) when we merely denote that individuals do things together and learn (internalize) during the process—even if we were emphasizing the increasing and important orientation of educational researchers and practitioners towards the importance of considering learning as a social process. Underlying this generalized treatment of the social there is a particular view on the very idea of *context,* the epistemological origin of which seems to escape researchers irrespective of their affiliation with a cognitivist, sociocultural, or situated cognition perspective. Rather than seeing the social as external context, Vygotsky's Spinozist approach takes cognition, learning, and development as social phenomena sui generis. To better understand how this is different from most existing literature on learning and instruction—including literatures that affiliate themselves with a Vygotskian tradition—we provide a critical analysis of the notion of context that goes beyond the individual–social opposition.

Historical Senses of Context

During the past several decades, two different views of learning have been opposed in terms of two associated metaphors (Sfard 1998). On the one hand, there is the view of learning as a process of acquisition. The knowledge to be acquired is abstracted from concrete situations (contexts) in the form of structures, schemas, or representations that generalize across contexts and occasions precisely because they are abstract. School knowledge is treated as a commodity that can be acquired, carried over, and exchanged for grades (Roth and McGinn 1998). Grades, in turn, may be further exchanged for access to higher education careers or positions in a hierarchically organized corporation or society. Whereas learning occurs in many different contexts, the process of learning itself is seen as primarily leading to the production of more knowledge. The process of production qualitatively changes nothing in the system of societal relations within which it occurs. In the view of learning as acquisition of knowledge, there are only quantitative changes.[1] It is this condition that allows researchers and educators to be able to *measure* learning outcomes, whether these are defined in terms of quantitative increases within a certain type of knowledge or constituted by surveying the diverse types of knowledge that an individual is said to possess.

The view of learning as knowledge acquisition is contrasted with the view of learning as changing participation in (changing) communities of practice (Lave and Wenger 1991). In this view, the person–context dichotomy is dissolved by the emphasis on the context-dependence of all knowing. Knowledge is not a thing that is carried across contexts, and *knowledgeability,*[2] which individuals exhibit as they competently participate in changing circumstances, better captures what it means to know. Because the focus is on the practices they engage with, the educational implications often are elaborated in terms of developing learning communities, for example, by treating and fostering classrooms as communities of inquiry. When carried to the end of its implications, however, the question in this view no longer is whether and what the learners *knows* but *who she becomes.*

Whereas the limitations of the acquisition view have been increasingly noted and arguments for the importance of attending to the situated nature of learning are commonplace in the literature, a number of tensions exist that seem to prevent scholars from fully abandoning the old metaphor. Concerns have been raised as to the kind of assessment practices that the learning-as-participation metaphor can offer. Thus, so the argument goes, "even if one agrees with the contention that any human action is a result of a dialectic between the situation and the actor … one may still believe that there is no satisfactory account of learning that does not take into account the actor's previous experience" (Sfard 1998: 10). Related to this point is the debate concerning the notion of *transfer*, which, consistent with the view of

[1] On the difference between quantitative and qualitative changes, see Chap. 6.

[2] The term can be read as ability to know whenever it matters, thereby contrasting the idea of knowledge that one has posses) and carries around.

learning as acquisition, denotes those instances where something learned in one (e.g. classroom) context is applied in/to another (e.g. supermarket) context. If, as the participation metaphor has it, learning is always bound to the social and material context of its occurrence, then how does something learned transfer to other situations? Of course, the question already is problematic, for it presupposes that both approaches ought to have compatible views of generalization. But this is not the case. Yet, in current educational psychology, "there is consensus that concepts and methods of both the individual-cognitive [acquisition metaphor] and the situative perspectives [participation metaphor] are needed in developing satisfactory explanatory accounts of human learning and cognition" (Greeno 2015: 248). In line with this latter argument, a trend towards complementing or integrating these two perspectives is evident in current educational psychology literature: there is both (a) an emphasis on improving learning outcomes and (b) an increased awareness of the importance of considering the latter as a function of social situations.

Bracketing and Rethinking Context

A question that tends to be left out of the discussions about the context-bound nature of learning is a precise definition of context. This is problematic because educational researchers risk building an educational science based on pre-scientific concepts that are borrowed from the very social world that it aims to account for—investigators then use concepts to explain (i.e. the *explanans*) concepts that have to be explained (i.e. the *explanandum*). To escape this vicious circle, the concepts of our scientific inquiries need to be interrogated critically (Bourdieu 1992). Such a critical questioning requires radical doubt and critique of ideology that bracket all presuppositions in commonsense and scientific use of a theoretical category. As part of our critical inquiry, the social *history* of the use of a category is clarified. The question thus shifts from "Does a particular view of learning include (or not) social context?" to "Can the same notion of context be used indistinctly in different views of learning?"

It is beyond the scope of this chapter to do an exhaustive analysis of the historical conditions that allow researchers to unproblematically and indistinctly use "social context" in discussing dualist and non-dualist approaches to learning, as if the word was unproblematically transferrable. It would involve examining discursive and peer-review practices endemic to educational research scholarship. But a review of the literature already reveals that the social context is most frequently treated in precisely this way, that is, as something that can be described alternatively as either external (objective) to the individual or as something so internal that context and individual become indistinguishable—a problem that plagues current theorizing of learning from a situative and sociocultural perspective (Stetsenko 2013). Thus, in the cognitive approach, the social context tends to be thought of as something external and objective that opposes the internal and subjective; in research claiming allegiance with the learning as participation, the social context tends to be treated as the

background against which the individual needs to be irreducibly considered. However, in both approaches context is treated as the ground against which learning-related phenomena stand as figure. These are not different definitions of context. Instead, there is a common epistemology within which context functions as either something opposed to the individual or as something indistinguishable from it. It is on the basis of such an epistemology that the two metaphors can be treated as opposite or alternate ways of theorizing.

From the dialectical materialist tradition that informs Vygotsky's theory, such treatment of social context is the result of an abstraction. To be useful as a functional category in the Spinozist approach, social context needs to be defined as a *concrete* category. Here, the concrete "is concrete, because it is a combination of many objects with different destinations, i.e. a unity of diverse elements" (Marx 1973: 101). Context, as a concrete category, then has to be thought as a combination of many objects with different *destinations*. That is, it is not a thing or substance but a *living process* that develops and leads to development and, therefore, includes the unfolding of time as one of its aspects. Rather than constituting ground against which the figure (text, individual) can appear, context may be better thought of as a piece of rope. This is precisely the way in which the American anthropologist R. Birdwhistell described context: as a rope in which "the fibers that make up the rope are discontinuous; when you twist them together, you don't make them continuous, you make the thread continuous" (Birdwhistell, in McDermott 1980: 4). Context here comes to be seen as a whole. Its dynamics are determined by the combining of multiple threads, which are threads because they have extension rather than being abstract or a-temporal. A review of the literature on Vygotsky's legacy proposes precisely such a view, which suggests that "students are like the *fibers* in a *strand* (the environmentalist community), itself a constitutive part of the *thread* (society) (Roth and Lee 2007: 196). Each student thereby is viewed also as part of the historically constituted context of their own becoming.

Important in this view of context as concrete category is that the multiple threads forming the rope (context) are not elements, but constitute *historical conditions.* Thus, in his description, Birdwhistell makes clear that he is "not talking about inside and outside. [He is] talking about the conditions of the system" (McDermott 1980: 15). A (social) context, therefore, is not a thing (e.g. culture) against which another thing (individual) or set of things can be understood. Rather, a context constitutes *the conditions of a system,* which are historical and have generative force. The metaphor of context as rope is not unique to Birdwhistell, but can be found in the works of a number of authors,[3] and where we also find the idea of threads as moving historical phenomena. Thus, "it is easy to see the world's history pluralistically, as a rope of which each fiber tells a separate tale" (James 1981: 67). The same idea of social context as a moving and generative category is found in contemporary anthropology, where the commonplace view of the social whole as a joining up of individuals (parts) is contrasted with the view of context as rope, which "always [is] weaving, always in process and—like social life itself—never finished" (Ingold

[3] We thank M. Cole for making us aware of some of these connections.

2015: 11). In each case, the metaphor evokes mutually constituting trajectories of development rather than an opposition of self-contained things. This returns the unfolding of time—i.e. history and life—to the notion of context.

The problem of the relation between person and societal context as it manifests in the discourse of educational research, at a meta-level, belongs to a particular way of conceiving the relation of humans and history, the conditions of which Marxist psychologists recognize in the organization of bourgeois society. Thus, "from the standpoint of the traditional bourgeois psychological approach to consciousness only what 'is found' in consciousness, or 'belongs' to it, is subject to study, i.e. separate psychological phenomena and processes and their mutual relations and connections" (Leontyev 1981: 223). Excluded from that study is the *history of formation* of human consciousness itself, a history that we tackle in Chap. 2 at the level of phylogeny and in other chapters at a micro-genetic level. When bourgeois epistemology is seen as part of that history, and then rejected, the question of learning context no longer is about whether and how context and person (i.e. whole and part) *inter*act with each other. The question becomes: What system of organization is such that makes it possible for *this* particular part to stand out as part of *this* particular whole, as *this* particular part–whole relation? It then becomes visible that the opposition of the acquisition and the participation metaphor, when they no longer share the notion of context, is not just one between two opposite paradigms that can be combined or integrated. When the two approaches correspond to the two views on context discussed here, they are not just alternate but are *asymmetrically alternate* views (Roth 2008). This is so because, having presupposed the Cartesian division between individual subject and societal context, the learning as acquisition approach cannot account for the emergence of that very division as a historical organizing system. A cultural-historical approach to context, on the other hand, affords the investigation of the emergence and development of the subject–object dualism, that is, of the historical conditions and real implications of the idea of a self-contained individual acting within a self-contained social context as if it were a box.

Considering social context as a concrete category implies including time as an internal aspect of our units of analysis. In doing so we no longer need to choose between rejecting the possibility of "transfer" or re-capitulating transfer in terms of person–environment mutual attunements that are transferred (Jornet et al. 2016). Instead, we get to a *trans*actional account, where the question concerns the historical conditions that make it possible for individuals to treat different situations as being of the same type. As transactional systems, social contexts are not things but *constitutive* orders (precisely as thought with the rope or thread metaphor), where both new persons and new practices continuously emerge. The notion of context no longer is the commonsense term but instead becomes a *scientific* concept. The social context as such no longer is the problem, because not everything in the environment is important to social life. Accordingly, a (learning) context cannot be adequately described by merely listing the (vulgarly concrete) materials or the abstract relations within. Describing a learning context always requires a *genetic* account, a telling of stories of formation and development, where description fuses with

explanation. A monist approach therefore allows seeing the question of context as a generative question. Such a view then affords a different approach to questions of (institutional) educational practice and assessment. These no longer are about relations between schooling practices and learning outcomes, but address schooling (context) as constitutive order: How does schooling produce and reproduce existing societal forms of relation, including societal inequity? How does it produce and reproduce individual learners (persons) and learnable differentiations?

Schooling and Re/Production

Central to a cultural-historical psychology of education is the question of the relation between education and culture. With the emergence of sociocultural and situative approaches in the early 1990s, awareness of the need to overcome dualisms between person and culture have led to a growing interest in conceptualizing and designing educational activities in terms of *learning communities*. Here, instruction involves the cultivation not of individual minds but of communities, where the focus is on practices rather than on bits of knowledge. However, implementation of this kind of environment has proven to be a challenging task for educators, who often experience difficulties having to build a genuine community while delivering a preestablished curriculum that transmits bits of knowledge. Contradictions also have emerged in research, where learning communities tend to be defined beginning at either the individual or the collective pole (Roth and Lee 2006), thus missing the dialectics between the two. In one version of activity theory, these dialectics have been captured in a triangular diagram where subjects, communities, and rules are seen as mediated by rules, cultural artifacts, and division of labor (Engeström 1987). Yet precisely because of its apparent ready-made form of analysis—where the elements (e.g., subject, rules) and relations between elements (e.g. mediation) are given in advance—the dialectical nature of {teaching | learning} phenomena (Chap. 11) tends to be lost and the person–societal context opposition is reified.

In contrast to contemporary approaches that continue to treat culture as external ground against which educational practices can be modeled or assessed, the relation is *internal* for Vygotsky: there is no gap between culture and persons but rather their unity/identity. As persons participate in social relations, they participate in culture and history, if only because “culture is the product of man’s social life and his public activity” (Vygotsky 1993: 164). Thus, “the very formulation of the question of cultural development takes us directly into the social plane of development” (1993: 164). Individual and culture relate like fiber and thread (or thread and rope). It no longer makes sense to set the individual person against the cultural norms and knowledge, which somehow are transmitted to or internalized by learners as an “outcome” of social (teaching) situations. As we develop in detail in Chaps. 4 and 11, in the social situation that the Russian term *obučenie* denotes, there are not two (or more) people, and then a social relation that mediates between the two. Rather, there is one whole {teaching | learning} event that manifests itself on the outside and inside of the person: as inter-intrasubjectivity. In line with the dialectical mate-

rialist account of *context* given above, Vygotsky saw the importance of considering the {person | environment} as a dynamic, developing whole. Accordingly, there are not numbers of individuals that come together and form society by addition. Rather, society, existing in and through social relations, provides for cultural possibilities of individualization. Here, the social context or environment "is the source of development and not its setting" (Vygotsky 1994: 349).

When educational contexts are approached from the dialectical materialist perspective advanced here, that is, as historically determined and determining generative forces, the dualist epistemology that separates subjects from objects is abandoned. In place of the dichotomy we find, in line with the foundations spelled out in Chap. 1, a {subject | object} unit. School, as a learning context, then can be thought as a generative historical force that manifests itself in specific forms of subjectivity and objectivity just as Spinoza's single substance manifests itself as thinking body and living body. We can then speak of societal contexts as processes of subjectification and objectification. This is so not because our theory decides this to be so but because labor, the production of our life conditions, is at the same time the production of ourselves: "as individuals express their life, so they are. What they are, therefore, coincides with their production, both with *what* they produce and with *how* they produce" (Marx and Engels 1998: 37). Accordingly, to understand learning in a school context we need to understand the processes of objectification and subjectification that characterize it, which will also be an inquiry into the kind of objects and persons that schooling leads to. But, if schooling can be thought as a rope—producing and being constituted by the threads (a) {objective | subjective} facts (objects) and (b) {objective | subjective] persons (subjects)—we may as well ask, "What is the rope of which schooling is a thread?"[4] We address this first question in the following section, by reviewing some of the literature that has examined the historical origins and functions of schooling. This involves the re/production of inequality and hegemonic relations. Whereas such re/production has been noted in other disciplines (e.g. Bourdieu and Passeron 1979), educational psychologists—other than those with critical psychological bents—have not attended to the phenomenon. Even less have they tended to the real transformations required to overcome inequalities—whether they arise along the lines of gender, race, socioeconomic status, or other traditional divides. We then examine the objects and persons that schooling re/produces. We thus approach schooling both as societal product and as means of societal re/production.

Re/Production of Inequality

> In psychology, to determine the actual level of the child's intellectual development, most of the time a method is used in which the child is asked to solve a number of problems of increasing difficulty and standardized for the child's chronological age level. The study always determines the level of difficulty of the problems that the given child can solve and the standard age corresponding to it. (Vygotsky 1998: 201)

[4] Such questions also are the consequence of a critical ethnographic take on schools and schooling (e.g. Varenne and McDermott 1998).

Vygotsky's words that open this section were written over 80 years ago. Yet, they quite accurately describe the situation in most present-day educational psychology and institutional education (schooling) around the globe. Everywhere national and international standardized measures of school achievement such as PISA are taken as a yardstick against which success is both measured and prescribed. As Vygotsky's work in general has become known in the West, there has been a shift in educational researchers and practitioners' perceptions on the role of measurement. Vygotsky's simple but insightful idea that we ought to focus on the learning potentials that emerge in and as social relations rather than on measuring already matured (individual) learning outcomes has motivated the emergence of more learner-centered practices. These include formative assessment, where the goal is not just to evaluate but also to assist learners to grow (e.g. Ash and Levitt 2003). Yet, whereas these and other laudable interventions to make classroom tasks more sensitive to the social and creative nature of {teaching | learning}, the most basic trait of institutional schooling continues to be the production of grades and grade reports (Roth 2015). The place of schooling and school tasks in the larger society remain unquestioned. From the Vygotskian perspective advanced here, this is problematic because learning and development need to be understood as moments of social production, both as products and as means.

Several inquiries into the historical origin and function of schooling agree that schooling is, paraphrasing Marx and Engel's quotation opening this chapter, a reflection of the standpoint of bourgeois society (Foucault 1977). On this account, schooling, as well as other institutions of control—e.g. prisons and hospitals—emerged as a means to inculcate *discipline* and, thereby, to institute and perpetuate the dominant relations of power. Schooling constitutes the "machinery by which the power relations give rise to a possible corpus of knowledge, and knowledge extends and reinforces the effects of this power" (1977: 45). The kind of power relation that school reproduces is made manifest in the kind of production means and ends: the production of grades through testing and assessment practices. Here, the view of learning as acquisition of knowledge discussed in the previous section is not an abstract epistemology but a real form of organization. Critical analyses of educational practice have shown how institutional schooling in effect functions on the premise that learning can be commodified, favoring the exchange value of school grades over their use value, and thus resulting in a form of "*estranged* ~~labor~~ *learning*" (Lave and McDermott 2002). Thus, and despite current efforts to develop more learner-centered curricula, when educational researchers and practitioners still approach schooling as a means to qualify people for the job market they still contribute to maintaining the established hegemonic organization of society while neglecting other important values. This is the case in many efforts to define curricula in terms of twenty-first century skills, where the focus is on the technological advances and the fluid nature of knowledge practices in a so-called knowledge society, while apparently ignoring the most important challenges that our civilization faces, such as the continued degradation of the natural environment and the ever-increasing gap that allows 1 % of the world's population to own more than the remaining 99 %.[5]

[5] As reported by Oxfam in 2016 (Hardoon et al. 2016).

In its origin, the establishment of modern compulsory schooling throughout Western countries at the end of the 19th and in the beginning of the twentieth century was a triumph of the labor movement (Holzkamp 2013). Widely accessible, school was to give everyone the same opportunities and thereby foster equity and democracy. The democratizing potential of schooling, however, has since remained an unachieved goal that has been a recurrent concern for educational philosophers and practitioners alike. Indeed, the very mechanisms that were instituted with the school to grant equity are at the heart of the reproduction of inequity: standardized teaching and testing. Thus, "the official purpose of school—to 'equitably' assign pupils to different professional careers/life chances—can, however, only be achieved where grading is shown to be strictly comparable and/or consistent" (2013: 117). This official purpose explains many of the characteristic features of modern schooling, including class homogeneity, standardized measurement, and surveillance. In this, however, there is an inherent contradiction, which concerns the fact that schooling—though organized to grant equal access and opportunities to learn for all—also is designed to fulfill the societal function of delivering persons to fill *different scholarly careers and professions.* Thus, and independently of the kind of instructional practices employed in classrooms, to access certain careers (e.g. dentistry) that in turn give access to better paid professions, higher grade point averages are required. Such obligatory points of passage, where grade point averages (and often also *where* they were obtained) can open doors, are ubiquitous in society.

In this analysis, schooling emerges as objectifying a contradiction that is not reducible to either of its arguments: Despite its alleged goal of equality, schooling can be seen as part of a larger machinery, that is, as part of a larger *context* that works such as to inculcate and reproduce social stratification in/of society. The organization designed to provide the same treatment and assessment to all students—who come with different backgrounds and have different goals and interests—also is the organization that makes their differences in performance to become an organizational and organizing object, thereby stratifying them, giving some privileged access to future careers, letting others get stuck. Thus, for example, children coming from different social classes engage in different parent–child relations, with children coming from more accommodated (bourgeois) classes having had more opportunities to develop the kind of discursive practices that are at work in classrooms (e.g. see Chap. 7 concerning the opportunities arising from early reading). By taking as starting point the equal provision of means and measures to all, these children already start with an advantage over children whose parent's had not been educated or had had much less time developing the kind of relations that matter in school. In this way, the U.S. "no child left behind" slogan also leads to testing all students equally—as if the same size were to fit all.[6] Such testing does not help but instead perpetuates the problem of differential achievement, with its further implications in professional/societal life after school.

[6] Using a perhaps hyperbolic analogy, we may liken current forms of testing to watermelon seed spitting, a very specialized sport. Collectively, we are not likely giving leadership positions to the world champion in this sport, but we do use performance in very specialized testing formats as criteria for access to tertiary education and jobs.

{Objectification | Subjectification}

In the preceding subsection we show how modern (compulsory) schooling, when examined in its historical context, emerges as objectifying a contradiction between the alleged aim of equity and its systematized reproduction of inequity. The contradiction is not specific to schooling but belongs to a larger historical context or form of organization. This historical context is that of bourgeois society, whose "old materialism" conceives all reality and sensuousness in the form of an object, "but not as sensuous human activity, practice, not subjectively" (Marx and Engels 1998: 569). As part of it, schooling, as any other *generative* context, produces not only social objects but also social persons, with all their intellectual, practical and emotional implications or circumstances. That is, schooling re/produces inequality, which manifests itself in differential grades (or commodified knowledge) and differentiated persons. Most importantly for the Spinozist approach advanced here, schooling re/produces specific societal relations of power, inequality, and class domination that do not exist in the abstract but play out as concrete (ruling) societal relations that then become functions of individuals.

Schooling, like any other *activity*, implies a complex set of ruling relations. These relations result in a distinct phenomenal organization in the individuals who participate in and constitute them; how learners think, perceive and act is part of those relations. From the dialectical unity/identity of person and society, instructional situations cannot be thought as external to and therefore as in a cause–effect relation with the students. Instead, in every instructional situation there is a unity of society and person.[7] It is in and through direct relations with others that individual persons develop and come to exhibit (uniquely human, cultural) functions that first exist as societal relations. This phenomenon, which we may refer here to as of *subjectification,*[8] is conceptualized in terms of *internalization* in most uptakes of Vygotskian theory. Yet, as we suggest in Chap. 5, such conceptualizations involve a recast of Vygotsky's basic insights into other dualist agendas. Rather than becoming something internal, existing inside learners, there is a double movement of *individualization* and *objectification.* Inequality then does not stand as something commoditized and opposed to the person but instead manifests itself in and as the person-in-context exhibiting subjective and objective character. Subjects become the subjects they objectively are for themselves, and for others, as part of the societal practices they engage in.

The relevance to educational practice and measurement of the irreducible {objective | subjective} nature of participation may be illustrated with regard to the diagnosis of learning disability (LD). The very term of disability already presupposes its opposite *ability*. The notion takes us straight into the heart of the same epistemology

[7] This unity/identity of individual and society is apparent as soon as we choose a {person | environment} unit for our analysis: the transactional relation of the individual person and the society in which she lives and which she co-produces interpenetrate each other.

[8] Vygotsky (1989) uses the term *personification* [personifikacija].

that would have treated knowledge as an acquirable good. Disability denotes the lack of ability, the presence or lack thereof stemming from the possibility of it being measured. Whereas learning disability traditionally has been conceptualized taking the individual child as the unit of analysis, the very observation that disability presupposes a practice of measurement already suggests that the proper unit of analysis is societal so that "without social arrangements for making something of differential rates of learning, there is no such thing as learning disability" (McDermott 1993: 272). Evidence that this is the case comes from studies showing that even the most highly trained scientists and science educators can be made to look bad on the simplest (school) tasks (interpreting graphs) if they are not familiar to the specific context in which the task has been designed (e.g. Roth and Bowen 2003). Similarly, it is not difficult to make disadvantaged students look good once the learning environments are totally changed (e.g., from traditional classroom to an environmentalist project) so that they do not just favor some very well defined and restricted skills. A reconfigured notion of context allows a change in perspective. Just as it is common in educational psychology to speak of a child who has a learning disability, we may now speak of *the acquisition of a child by a learning disability* (McDermott 1993). It is in the context where dis/ability is made an objective aspect of practice that people can be seen and treated as disabled.

Learning disability results when the outcomes of societal relations are pinned to individuals as their distinctive characteristics (Roth 2015). This is a process of subjective objectification, where a particular subjectivity is assigned to the individual in and through social practices. There is a technology of power at work, which exists in and through social transactions that define and treat dis/ability as a feature of this or that person. But the process is not only external; in its very objectivity as social fact (*event* would be a more adequate term), it also is internal to the person. Thus, being identified and treated as a disabled person has real practical, intellectual, and affective consequences for the person, who also participates in the societal relations that objectify her as such (Varenne and McDermott 1998). Thus, when a student tagged "LD" is separated from the group to receive special help (so that she gets "equal" opportunities as the others to learn the curriculum), she further participates in dis/ability producing relations, which has developmental implications for the person. Here, a societal relation does not only exist objectively but also has intellectual, affective, and practical dimensions. This is true not only for students diagnosed with learning disabilities, but for {teaching | learning} relations in general: as teacher and students participate in social transactions, they do not just realize cultural possibilities that are historically and materially determined. Those possibilities manifest themselves emotionally, intellectually, and practically in and for the participating persons, who may change in all these dimensions. This has important implications for the learners' motivation (see Chap. 8).

One Vygotskian category that captures the unity of subjectivity and objectivity in instructional situations is the *zone of proximal development* (Chap. 11). Contrary to the way it tends to be taken up in educational psychology, the child's development is a dynamic and irreducibly social phenomenon, where what develops is the {person | environment} unit. Vygotsky clearly saw that, in and through such relations,

not only the learners' "consciousness … and the whole system of relations to external reality and to himself" change, but also "the social situation of development … must also change since the social situation of development is nothing other than a system of relations between the child of a given age and social reality" (Vygotsky 1998: 199). Another important category he proposed was that of *perežívanie*: the {person | environment} unit. In the perspective of *perežívanie,* affect and motivation are neither internal nor external to the individuals. They are treated as societal achievements refracted differently in the person (e.g., in teachers and students). Each person also is part of the environment of others, so that all participants are subjects of and subjected to the ongoing event that they also contribute to producing.

Towards an Education that Matters

> Naturally, life determines consciousness. Consciousness arises out of life and forms only one of its features. But once awakened, thought itself defines life. Or more accurately, a thinking life defines itself through consciousness. As soon as we separate thought from life, from dynamics, and from necessities, we have deprived it of all reality. (Vygotsky 1993: 237)

Vygotsky's life-long interest in Spinoza most remarkably revolved around the question of freedom. This topic was so central to him that he wrote in a personal note from December 1932, "The cent[ral] problem of all psychology is freedom" (Vygotsky 2010: 92). The problem of freedom was at the heart of his investigations and theoretical developments during the 1927–1931 period, when he had taken an instrumentalist turn in his theory (Rey 2011). During that period he wrote: "In itself, most remarkable is the fact that man has exceptional freedom in the sense of intentional implementation of any action, even senseless action" (Vygotsky 1997: 87). To account for this exceptional quality, Vygotsky drew from Spinoza's monist approach that freedom could not simply stem from our will, but needed to be acknowledged in its "dependence on external motives" (1997: 209). In Vygotsky's view, freedom is not something that simply is given to humans but rather something that humans need to work out in and through labor. But, as humans transform the conditions of their own existence, they transform themselves. Here we do not see a human that is set over and above nature, there is no the dichotomy between biology and culture that is implied in the nature/nurture debates. Rather, culture is culture only to the extent that it forms a unit with nature (Chap. 2). The minimal cultural phenomenon, as identified by Vygotsky, includes nature as one of its manifestations. Without nature, the external motive that brings necessity, there is no freedom, and therefore no human being.

During his instrumentalist period, Vygotsky sees the "root of all culture" in "the instrumental function of sign use" (Vygotsky, in Zavershneva 2016: 204). He identifies the minimal unit that retains the whole of human culture as the production and use of artificial signs, which lead to the development of higher mental functions and human freedom (Vygotsky 1997). Later in his career, however, he critiques his own previous theory for having focused "on the sign (on the tool) to the detriment of the operation with it" (Vygotsky, in Zavershneva 2010a: 41). A focus on the instrument rather than on the operation as a moving whole had involved an intellectualistic bias, where external and internal motives were one in a unity/identity of opposites. The relation between intellect and affect also had remained unaddressed. Spinoza's monist philosophy would serve Vygotsky as a guide to build a new way of organizing his psychological theory that no longer would divide intellect from affect, praxis, and the emotions. But Vygotsky wished to go beyond Spinoza, whose "power of reason and freedom from slavery are not yet the highest" (Vygotsky, in Zavershneva 2010b: 65). Vygotsky quotes Spinoza's dictum that intellect and will are one and the same, but he wants to go beyond and "revitalize Spinozian thought in Marxist psychology" (Vygotsky, in Zavershneva 2014: 246). If in Spinoza the relation between nature and reason could be seen as a sort of idyll, for Vygotsky the relation had to be approached like a *tragedy,* that is, in terms of social drama:

> Language injects into consciousness not an idyll but drama, even tragedy (an insoluble one). In general, the life of c[o]nsc[io]usness—unlike the life of the org[a]n[i]sm—(this is what places consciousness outside org[a]n[i]c life)—is not an idyll, not Spinoza's serenity, but tragedy: *amor fati.* (Vygotsky, in Zavershneva 2010a: 54)

Such an outlook takes the *primacy of the social* as its starting point, and conceptualizes social life no longer as an instrumental act, but as a dramatic whole, where whole persons and their circumstances are transformed. This is not an "idyll," but involves drama, collision, conflict, and struggle. Such an outlook comes with new questions about freedom that Vygotsky's previous instrumentalist theory had not adequately posed with respect to education. One aspect concerns the question of revolutionizing practice, an *activist stance,* where human development (and therefore freedom) involves not the internalization of mediational cultural tools but consists precisely in the purposeful transformation of the Self through transforming practice. The outlook also concerns the unity of intellect and affect in praxis, where the subject matter of learning no longer is knowledge but the development of persons and, ultimately, of humanity. The emerging view, as the opening quotation describes, is one where life and human consciousness are not two separate substances but exist in dialectical relation. In this view, freedom exists in the awakening of consciousness, where "thinking life defines itself through consciousness." It is, however, possible to deprive consciousness of all reality by separating it from life and the dynamics of necessity, as may be the case when people are deprived from freedom and not allowed to act according to their (affective) life tendencies and necessities. The role of education, if it is to achieve its goal of fostering freedom, consists precisely in making people's life conditions visible and changeable.

Activist Transformation

> The materialist doctrine concerning the changing of circumstances and upbringing forgets that circumstances are changed by men and that the educator must himself be educated. … The coincidence of the changing of circumstances and of human activity or self-change can be conceived and rationally understood only as *revolutionary practice.* (Marx and Engels 1998: 569–570)

In his third thesis on Feuerbach, Marx points out that if there is coincidence of human activity and the conditions that allow such activity to continue and therefore change together then there is not just (evolutionary) practice but *revolutionary* practice. Acting means changing our world and the conditions in/under which we live and, in so doing, change ourselves. Whereas the focus on scholarly practice (both in academy and in schooling) has been on thinking *about* the world, the point, Marx writes, is not to *know about* but to *change* it. But changing the world does not seem to be what institutionalized education is about, as made evident by the critical studies reviewed above. Understanding and theorizing learning and developing while humans are changing the world is not what educational psychology has taken as its topic or goal. Exhibiting the standpoint of "civil society," to paraphrase Marx, schooling is more concerned with teaching *about* than with *transforming* the world. The very emphasis on creating curricula that shall "prepare" students for an increasingly complex and competitive society depicts a view of society as external and independent of schooling, something that schooling only changes quantitatively (giving more and better prepared human resources) but not qualitatively (as it would be the case if schools were designed so as to change society).

In Chap. 6 of this book, we discuss a distinction between (a) *evolutionary* changes, which are continuous and compatible with the maturing of an organism in its relation with the environment and (b) *revolutionary* changes, where the unity/identity of {person | environment} undergoes fundamental change to qualitatively new types of being. We suggest that *learning* better captures evolutionary change that is quantitative and continuous in nature, whereas revolutionary change means *development*. Although the two terms are often used interchangeably in the literature, the phenomena that educational researchers and practitioners describe more frequently concern learning rather than development. This situation is a result of the administrative organization of schools, where (a) the curriculum cuts up culture into knowledge domains (e.g. mathematics, science, or arts) and (b) students are grouped by age rather than by developmental considerations. This provides a context where the focus is on learning (tasks) and not so much on (human) development.

From a Vygotskian perspective, learning and development are two aspects of what it means to become human. In his view, there is an inherent relation between *obučenie* and development, where the person is considered in a unity with her (social, material) environment. Throughout this book, we show how what people learn and what they develop into first exists in and *as* the societal relations in which they are part. Ruling relations that exist in and as situated schooling practices become functions and attributes of individuals, who not only come to be regarded

and treated as marginalized but also participate in the production of their own marginalization (e.g. Roth 2016). Such a re/production, however, is possible only as long as the participants agree taking part.[9] But engaging and being able to participate in a practice does not necessarily imply comprehending the historical conditions of that practice and one's situation within it (Smith 1987). Thus, learners like Mario in Chap. 8 may find themselves participating in (inquiry-based) school tasks without knowing what to look for and what steps to take next precisely because they do not yet know the purposes of it, which is why they can be referred to as "learning tasks." Achieving an understanding of the conditions of production of one's own situations, however, is central for achieving what Vygotsky saw as most characteristic of being human: freedom. Here, "freedom is not *indeterminacy* of behavior, but conscious *determination* or the capacity for self-determination—*free will*" (del Río and Álvarez 2007: 377), where free will is another concept that figures centrally in the thinking of the late Vygotsky (see below).

The environment relevant in/to the actions of the person always also depends on the produced embedding conditions. These conditions, as seen in the case of Mario, are not necessarily apparent from within the lifeworld immediately given to the person. Revolutionary changes of the type that lead development, however, require conscious awareness of those conditions. Thus, "freedom of will is not freedom from motives … freedom is the recognition of necessity" (Vygotsky 1997: 210). Without such recognition, the participants remain caught within a given organization, which continues to reproduce but does not transform itself. In such a situation, there is neither freedom nor development—even though learners may continue to exhibit continuous growth within the given practice. On the contrary, in revolutionary practice, there is development because the change implies changing conscious relations with the environment. It is only then that "once awaked, thought itself defines life." But this is not a freedom that emanates from the individual rising over and above nature and life. Rather, "thinking life defines itself through consciousness." The person, in comprehending the conditions of existence, does not become independent from them but participates in their conscious determination and in the constitution of a capacity for self-determination.

The ideal of an education where students take more responsibility of their own learning and learn in and through tasks that are relevant to their everyday life has existed in the educational literature for many years, including ideas about problem-based learning and inquiry-based approaches. Whereas these approaches certainly offer more opportunities to engage in tasks that matter to learners' lives, their possibility to expand their consciousness is often limited by the larger societal context of schooling that continues to demand decontextualized subject matter contents and

[9] Whereas middle-class children and adolescents in industrialized societies tend to stay until the end of obligatory schooling, this is not so for individuals from working- and underclass families; it certainly is not the case for aboriginal students, where the dropout rate is four times higher than in the normal population; and it certainly is not true for youths in many of the developing countries, who often contribute to the family revenue by selling their labor. The graduation rate for first time graduates are only 45 % even for emergent economies such as Turkey and Mexico.

skills as reportable outcome. An approach that is true to revolutionary practice, however, is *activism.* In activism, learners engage in practices the goal of which are to make the world better place according to ideological convictions and commitments (Roth 2010). When people engage in activism, they do so moved by individualized, personally relevant general purposes and goals rather than by the goals of some external agent. Such engagement emphasizes the relationship of people and lifeworlds, an orientation that is actively taken up in some curricular approaches, including that of “place-based education” (van Eijck and Roth 2010).

In the process of engaging in activism, people learn not because they intend to learn—the paradox of which already poses the kind of challenges and problems discussed in Chap. 8—but because they intend to change something other than themselves. Learning and development occur as participants orient towards expanding their room to maneuver, control over condition, and action potency. Because this only passes through engaging in collaboration with others to question, understand, and change the conditions that sustain the participants’ situation in society, activism already embodies many of the ideals present in educational reforms. But the changes it requires are so considerable that it may require the de-institutionalization of education in the form we know it today (Roth 2015). In activism, participants engage in new forms of societal relations to deal with issues harmful to the wellbeing of social and natural habitats. Such relations increase the collective control over conditions and therefore also increase the individual’s control over her personally relevant conditions: there is collective and individual learning and there is *development*. Activism already is characterized by societal forms of consciousness that are of a higher order than those that dominate current educational practice. As a higher form of (revolutionary) consciousness, activism not only comes closer to the idea of a “social humanity” but also shifts the educational focus from the “what works” to the so much needed *what-for* of education.

Transforming Whole Persons

> The will is a concept that has become an affect. (Vygotsky, in Zavershneva 2014: 246)

Throughout this book we emphasize the Spinozist view that considers the subject of learning and development not to be the individual mind but the whole person in the fullness of her life. We do so even though much of Vygotsky’s theory could be critiqued for having been exhibited an intellectualist bias where the focus was on rational-instrumental action while neglecting other aspects of life (e.g. motives and emotions). Towards the end of his career, however, Vygotsky was abandoning the instrumental view of (tool, sign) mediation as the most central concept in human culture and began developing a more holistic theory in which intellect and affect are irreducibly connected. Vygotsky leans on Spinoza, who had developed a philosophy of freedom directly opposed to Cartesian dualism and which concerned the unity of man and nature. But Vygotsky saw a limitation in Spinoza, in whose theory,

"affect—des[ire]—thou[ght]—will have not been tied together" (Vygotsky 2010: 93). The internal unity/identity of these was to be sought in the real and concrete drama of (everyday) social life rather than in abstract theoretical elaborations. Here, the desire and will are important to the transformation of existing conditions through revolutionary practice, which transforms not only the conditions but also the person.

In the previous sections of this chapter we show how an epistemology that realizes a division between subjects and objects exists not as an abstract category but manifests itself objectively, as an immediate intellectual, affective, and practical reality for those who participate in institutionalized educational practices. We also argue for an activist focus in education, the boundaries of which are not pre-set by curricular standards but by life-relevant motives of societal import. We suggest that such an education constitutes a higher (freer) form of consciousness and therefore, a better starting point for the developing person. The key to all these arguments is the same: Societal relations that are themselves forms of cultural consciousness—and therefore forms of thinking—have whole persons as their outcome not just thoughts and objects. To account for this process, educators familiar with sociocultural approaches often use notions such as "meaning-making" and "internalization." But such notions do not get us closer to the social as social (Chap. 4); and they miss the generative aspects of {communicating | thinking} (Chap. 3). Most absent from these accounts, as well as from all forms of standardized (classroom) assessment, however, are the sensuous and affective dimensions that otherwise color and give sense to our everyday life. Such aspects are captured in *drama*. This category is the concrete societal unit in which affect, desire, thought, and will are united. Outside of the drama that emerges in and as social relation, none of these moments have personal relevance and signification. This is so because "as soon as we separate thought from life, from dynamics, and from necessities, we have deprived it of all reality" (Vygotsky 1993: 237).

The idea of drama and the associated category of *perežívanie* [experience]—the unity/identity of person and environment—lead to a new theory that distinguishes itself from that of language and tools as mediators that result in the development of culturally specific knowledge or skills in the individuals. Social drama occurs in and re/produces a sense-giving speech field (Chap. 9), that is, "a special psychological space, the tense field of joint experience of a future action externalized for one another with all the means of cooperation" (Mikhailov 2001: 26). Most originally, this space is one of joint experience, mutual orientation, and anticipation of future action. These aspects cannot be reduced to words or symbols but by definition involve the whole {person | environment}. In the drama of life, thinking inherently is permeated by sense and affect.

This is Vygotsky's final Spinozist take on the question of freedom, where the latter no longer is reduced to the mastering of nature by means of signs, but now concerns (social) life in all its fullness. In this conception, societal life conditions the person: "naturally life determines consciousness" (Vygotsky 1993: 237). But, "once awakened, thought itself determines life" (1993: 237). There is then no practice (life) apart from consciousness, and no consciousness apart from life (practice).

Instead, "a thinking life defines itself through consciousness" (1993: 237). Participants may be conceived as *living* practice or as *thinking bodies*. Vygotsky's Spinoza-inspired work thereby opens a field of inquiry on the role of emotion in learning and development that has not yet been taken up in educational psychology research. Emotions—frequently treated as affecting thinking from without—need to be examined in their mutual interdependence with thinking. This is to move "from the metaphysical to the historical study of [the] phenomenon" (1993: 240). Such a transition implies the need to "examine the relationship of intellect and affect, a relationships which forms the focus for all the problems which interest us, and we must examine that relationship not as an object, but as a process" (1993: 240). On this account, the relations that exist in praxis come to form part of a person's life not in the form of meanings or as internalized ideas, but as manifestations of real intellectual and affective relations. In this way, intellect and affect, thought and desire, form a unit that is a real *necessity* because the form part of real concrete conditions (i.e. not individual mental constructions). In this way, "the criterion of the unity of intellect and affect is the principal fundamental relation to the situation—in the sense of connectedness and freedom: this is the genuine unit of affect-intellect" (Vygotsky, in Zavershneva 2016: 225).

An historical approach to the study of emotions in the way Vygotsky's theory suggests may be particularly important to understand a core theme in educational psychology: that of motivation (Chap. 8). Educational philosophers long have noted that an education that matters and acquires moving force requires "the intellectual anticipation, the idea of consequences … blend[s] with desire and impulse" (Dewey 1997: 69). The categories of the sense-giving field and *perežívanie* provide new opportunities for scholarly inquiry in that they describe emotions, praxis, and intellect as irreducible moments of social relations. They require redefining the individual and how we approach the learner as an irreducible part of {teaching | learning} relations. If emotions, intentions, ideas, and other features of thinking typically attributed to individuals cannot be reduced to things that exist inside the person, then we need to identify those categories that allow for understanding processes of personalization as open-ended and as involving multi-functional reorganizations. Because the values of human development and freedom come to substitute those of acquisition of knowledge and adaptation to societal hegemonic demands, the notions of "teacher" and "student" also need to be reconsidered. Most generally, education needs to be rethought as a practice from which we address questions that matter to life. This means not so much approaching the world as something to be known *about* but as something to think with and through. In thinking, then, the learner extends beyond herself, as a manifestation of the thinking body that is life thinking itself. In these terms, and drawing from Spinoza, we understand that

> it is *in man* that Nature really performs, in a self-evident way, that very activity that we are accustomed to call "thinking." In man, in the form of man, in his person, *Nature itself* thinks, and not at all some special substance, source, or principle instilled into it from outside. (Il'enkov 1977: 33–34)

From Anthropogenesis to Freedom

Liberté, égalité, fraternité

The French national motto that opens this final section was born during the French revolution, which not only overturned the monarchy of that country but also triggered changes throughout the world that led to the adoption of democracy as the prevalent form of political organization. In this motto, freedom is associated with equality and fraternity, both forms and products of societal relation. Freedom here needs to be understood as something in the *general* interest rather than something that is only of special interest—for any general interest always also is my individual interest, whereas the opposite is not the case. Thus, personal freedom is possible only in the community with others (Marx and Engels 1998). Freedom never can come at the expense of another—such as when the citizens of industrialized nation obtain their freedom through the exploitation of those laboring under horrific conditions to be able to stay alive. Viewed in this way, a late-Vygotskian, Spinozist turn that focuses on freedom and the role human consciousness constitutes both a tremendous challenge and a great opportunity for cultural psychology of education. It is certainly no coincidence that these two themes from *The German Ideology* (Marx and Engels 1998), consciousness and freedom, would appear both at the beginning (Chap. 1) and end of the present project.

In this book we outline the kind of cultural psychology of education Vygotsky might have worked on in the wake of his Marxist re-reading of Spinoza. To produce this outline, we move from considering the conditions that led to the emergence of culture as the dominant function in the human life during anthropogenesis to an articulation of freedom as the most distinguishing feature between humans and other animals. If freedom is the most central phenomenon of psychology, it surely has to be the most important one for a cultural psychology of education as well. Across the book, we articulate some of the features that such a cultural psychology of education would have, including its categories and methods. Much remains to be done to change both educational practice and the kind of science concerned with theories of learning and development of whole persons, in the fullness of their lives, fully considerate of their needs, inclinations, motives, and emotions. Ours will be a science that not only understands the way to freedom but also provides the tools for transforming conditions that allow us to continue traveling on this way.

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Appendix: Transcription Conventions

In this book, we by and large follow the transcription conventions of conversation analysis as outlined by Jefferson (2004).

Notation	Description
(0.4)	Time without talk, in tenth of seconds
(.)	Period in parentheses marks hearable pause shorter than 0.1 s
((*turns*))	Verbs and descriptions in double parentheses are transcriber's comments
lH, rH	Left hand, right hand
[flip it you have] to flip	Square brackets indicate overlapping talk
[so flip it]	Grey highlighted text within square brackets indicates the extent of the gesture seen in the offprint presented to the right
°y'know°	Degree signs enclose words spoken with less than normal intensity
°°possibly°°	Double degree signs mark speech almost impossible to hear
jUST	Capital letters were spoken with louder than normal intensity
f*air*ly deep	Italicised letters indicate emphases, stress
:	Colons indicate lengthening of phoneme, about 1/10 of a second per colon
>i look at the<	Angular brackets inward mark faster than normal speech
<what happens>	Angular brackets outward mark slower than normal speech
(?)	Missing words, one word per question mark
(stash?)	Word followed by question mark indicates uncertain hearing
.hh	Noticeable in-breath
hh	Noticeable out-breadth
–,?;.	Punctuation is used to mark movement of pitch (intonation) toward end of utterance, flat, slightly and strongly upward, and slightly and strongly downward, respectively
=	Equal sign indicates that the phonemes of different words are not clearly separated, or latching by a second speaker
↑	Significant jump upward of pitch

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