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Re/Thinking 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 1979: 86, original emphasis)

Vygotsky had a strong sense that the cultural development of the child is a function of its interaction with others – within such institutions as the family or school – on tasks that exceed its current capabilities. He writes, aphoristically, 'what a child can do in cooperation today, he can do alone tomorrow' (Vygotsky 1986: 188). Thus, he critiques the work of educators who adapted instruction to the level of the child. With such methods, we fail indeed to make use of the potential for development that arises from sympractical activity generally and sympractical obuchenie activity more specifically. Some mathematics educators might challenge the idea of offering algebra tasks to young children. However, our description and analysis of a particular classroom situation (chapters 2 to 4) is consonant with current research in early algebra[1]; it shows that development not only *is* possible but that it is also possible in a situation where a student might initially exhibit considerable frustration and, quite apparently, cannot go further on his own. As an outcome of the institutional relation that Mario and Jeanne produced, the former was enabled to complete the task on his own employing the mathematical structure that was a societal relation before. We may think of the process as a way in which the world (societal relation, setting) comes to be reflected in its part (Mario), the world reflected in a raindrop that nevertheless is an integral part of the world: a self-reflection. The problem of traditional psychology has been that it has only studied the outward manifestation of development but never the real processes, the real

[1] See, for example, Becker and Rivera 2008; Cai and Knuth 2011; Carraher and Schliemann 2007; Warren and Cooper 2008.

societal relations that produce the higher cognitive-psychological but always already societal functions (Leontyev 1981).

As the introductory quotation shows, Vygotsky appears to be focusing on learning as a function of a gradient where knowledge is enabled by a more capable individual and then goes to the less capable person. A more fruitful approach, however, is to recognize that collective, sympractical activity opens up room to maneuver for all participants and, therefore, that there is always developmental potential for any person participating in a collective activity. In fact, the preceding chapters suggest that we need to take a more symmetrical approach in thinking about and theorizing the zone of proximal development because the teacher also appears to learn.

Another important aspect that is often forgotten pertains to just what it is that students learn. As the term 'back to the basics' suggests, there are forms of educational thought grounded in a belief that learning and development occur bottom up as if a child had to reconstruct the entire history of human thought ('ontogeny recapitulates phylogeny'). Many educational theories play into the hands of those who believe in development as a decontextualized feature of the cognitive apparatus. The cultural-historical approach, however, orients us to think very differently. If development means that a child does on its own what it has done in societal relations before, and if social relations change together with culture, then the development of yesterday's child no longer is the same as that of today's or tomorrow's child. As we see in the preceding chapters, Mario does not work or make sense on his own; he is not the builder of his knowledge and consciousness independent of the collective in which he is a constitutive part. His activity implicates both the mathematical cultural entities in front of him and the societal relations that he entertains as part of being a member of this classroom. Both the mathematical entities that he manipulates and the living and lived relations are cultural-historical (societal). Who he can become arises from these relations, inherently cultural-historical. That is, in his activity, Mario takes up previous parts of the experience of humanity. All of his psychic processes *unavoidably* obtain a structure that contains the cultural-historical (societal) means and methods that are 'transmitted' to the individual during interaction rituals with others in the surrounding world. This process has to occur in outer form and therefore has to be inherently an objective, material process.

Developments in cultural-historical activity theory that occurred subsequent to Vygotsky's death actually help us to better appreciate thinking about the zone of proximal development to make it more appropriate than some box-like situation within which some transfer occurs from the more to the less capable one. As our analysis in chapter 4 shows, the zone of proximal development is itself a result of the sequentially ordered turn-taking embedded in a process of objectification, that is, of the sympractical (outer) activity. When Mario does the remaining cells of his table, producing the additive and multiplicative structures on his own, we see how the previously real (external) activity now shows up on the ideal plane. It is this relation between the real and ideal produced in and as part of the zone of proximal development that constitutes the advance of the theory over others (Mikhailov

2001). In this, the dialectical materialist heritage of cultural-historical activity theory is quite apparent. Thus, the ideas about the zone of proximal development derive directly from Marx/Engels' idea that life determines consciousness rather than the other way around. The zone of proximal development, which really denotes a form of institutional relation, constitutes a form of life. Whatever occurs in this form of life determines the consciousness of it, which precisely is the argument about the individual being nothing other than a unique concretization and therefore unique reflection of 'man in general'. Thus, 'consciousness initially is mere consciousness of the closest sensual environment and consciousness of the limited relation with other people and things external to the individual who is becoming conscious' (Marx/Engels 1958: 31).

There is another quite frequent mistake in thinking about the zone of proximal development, where learning is thought to be a transfer from without to within the individual, whereby a distinction is made between inner and outer (Zinchenko 2001). Moreover, even cultural-historical approaches have been marked by the confusion of the inner and the outer, the confusion between teaching and learning, and the problematic conflation of learning action with teaching action.[2] From the perspective of cultural-historical activity theory that we are developing here, however, such a distinction between the internal and the external makes no sense, for any activity *always already* implies two *irreducible* moments: material and ideal. These are the two moments of *one and the same level of* development, two moments of the same event (Veresov 2004). Culture is the ideal form. It constitutes the general possibilities of acting, which come to life in concrete, real human praxis.

Toward an Alternative

As noted above, the zone of proximal development is frequently thought of and applied in a one-sided manner that juxtaposes a more knowledgeable teacher or peer and a less knowledgeable learner. In our analysis of the lesson fragment involving Jeanne and Mario, it is not just the teacher who produces utterances that are heard as questions. Mario, too, produces utterances that have rising inflections and are interactionally treated as questions. The interaction ritual therefore is not just triadic (IRE): there is a dynamic of give and take. There is not just the typical Socratic dynamic of questions that unfold the truth at hand. The zone of proximal development arises from Jeanne's and Mario's joint practical, that is, sympractical activity. Teaching here means not just mechanical selection and application of some pedagogy. Rather, to find out what the appropriate pedagogical moves might

[2] Holzkamp (1993), who provides a consequential formulation of learning from the subject-centered perspective Leont'ev had started to outline with his focus on consciousness and personality, exhibits a number of shortcomings that beleaguer, for example, the work of Piotr Galperin and Wassili W. Dawydow and work inspired by the two scholars.

be Jeanne has to engage, she must dive into the activity without knowing whether she *can* be successful. It is in the course of this engagement that her own goals can emerge, for she cannot select actions unless she knows their relation to the required activity. These goals arise from her place in the division of labor in the total activity, whereas Mario's goals are characteristic of his place in the division of labor of the same total activity. As for Mario, the object/motive of *his* activity emerge, which pertain to his sense and understanding of mathematics, so for Jeanne the object/motive of *her* activity has to emerge. Collectively viewed, they are in the same interaction ritual but in fact purse two different but intertwined refracted forms of an object/motive. However, the refracted object/motive of Jeanne's activity does not depend on her alone, for her teaching is to assist Mario and allow the refracted object/motive of his activity to disclose itself through activity. (Mario cannot aim at the object/motive of the joint activity, as he does not know it. Jeanne does not know it either, as the object/motive pertains to *his* relation to the world.) Thus, their mutual refracted object/motives can only emerge from their transactions – thereby radically changing our conception of the nature of the *zone of proximal development* as realized here.

For Vygotsky, learning precedes development – in fact, it creates the conditions for development. Thus, 'an essential feature of learning is that it creates the zone of proximal development; that is, learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers' (Vygotsky 1979: 90). When these relations come to be enacted independently of others, and when the societal relations are produced by the child on his/her own, then development has occurred.

In the featured lesson fragments, we see that a zone of proximal development does not simply come into existence when a 'teacher' and a 'student' get together, the former 'helping' the latter. In fact, in the early parts of the interaction featured here, it does not look as if new forms of action have emerged for Mario. He does not exhibit developmentally more advanced actions over what he has shown prior to Jeanne's appearance in the group. Quite the opposite is the case: As they interact, Mario becomes increasingly frustrated rather than experiencing an increase in his control over the task and rather than coming any closer to the object/motive of the activity. If there is any phenomenon that can appropriately by classified as zone of proximal development, then it emerges from their mutual engagement that provides for a space that allows Jeanne to come closer to her goal of helping Mario. Jeanne's collaboration and the ensuing emergence of her are a refracted form of the activity's object/motive. Equally, Jeanne's collaboration is a prerequisite for Mario's refracted form of the object/motive to emerge. It is not clear beforehand whether they will be successful, but both exhibit to one another the willingness to engage the other. This is the kind of trust that we pointed to in a previous chapter and that relates to the ethical commitment Mario and Jeanne make. Their mutual orientation and participation exhibits a willingness to continue even when their overall assessment of the situation, as exhibited in the affective dimensions of their verbal, prosodic, and bodily productions.

At which point, we may ask, does the room for maneuver comes to be enlarged for Mario? At which point is he, by the *sym*practical activity, enabled to do more than he has done just prior to the interactions with the teacher? It is not during the first two fragments of their interaction, but emerges in Fragment 2.3 at line 189 when Mario asks where to write the '12'. Jeanne responds, 'You are not writing it'. Here we are at the exact dividing line between arithmetic and algebraic thinking. To focus on totals is to see the actions from an arithmetic viewpoint. To see the actions as actions *per se*, as actions that do not need to be carried out, is to see them from an algebraic viewpoint. Looking back, we can see that Mario has been focusing on the total sum of the money in the piggybank (chips in the goblets), and here he asks precisely the question to which Jeanne responds that it is not the '12', the sum, that comes to be noted; 'you are finished', she says, moving on to the next cell. Her question about the composition ('composed', turn 162, 'comprises', turn 166) has not had the effect to make Mario attend to writing down a representation of the process. Rather, he asks where to note the result – whereto he is to transfer the number of chips in the goblets. Jeanne then does what she has done before, but, using her pointing gestures, she continues with the third week, this time asking, 'how many three dollars do you have' (turn 193). And it is here that Mario responds 'three'. Now comes the crucial question: 'What do you write here?', she says while pointing to the corresponding cell (turn 200). And the tentative first part of the new action, 'Three?' to which Mario adds, following Jeanne's movement of the finger to the neighboring cell, 'plus three? plus three?' The utterance that follows – the 'social evaluation' of the preceding one (Bakhtine [Volochinov] 1977) – not merely affirms, but does so with an emotionally positively charged intonation. Mario has completed, for the first time, together with the teacher's pointing to a representation of the previous action, the action required to fill the cell. For the next cell, the action still emerges, tentatively, but less so than in the previous case, from the *sym*practical activity. It is at this point, then, that Jeanne notes that she thinks he understands. Mario indeed fills the next cell on his own, verifies what he has done by looking at Thérèse's worksheet, then finishes, whereupon he states aloud and firmly that he now understands. It is not the correct action itself that achieves the object/motive, but rather the fact of having objectified the object/motive, that is, the *becoming conscious* of the relevance of the goal-directed action with respect to the motive-directed activity as a whole.

In this situation, the zone of proximal activity does not come about mysteriously when the teacher sits down next to Mario. It does not exist initially, when she interacts with him and he with her. The zone of proximal development, that is, the point when Mario's action possibilities expand, when he produces new actions, is already under way for a while. It emerged in their sympractical activity, and from it, as the result of the sympractical activity. This means that Mario was as much responsible for its emergence as Jeanne. Both made it possible. Both have to subscribe to the same goal of making it possible. In fact, it is Mario who marks the need for the zone of proximal development repeatedly, in stating that he does not understand. He states the need for a structure that would allow him to do what he cannot do at the time.

Here we might say, in adapting Holzkamp (1993) to our context, that the emergence of the object/motive (see also chapter 6) and the control over what is to be learned (because of the creation of new action possibilities) in the process of overcoming the initially existing precariousness and frustration are but two different manifestations of the same process: sympractical activity. The object/motive and transformation and expansion of action possibility emerge together and, with them, the sense of precariousness and frustration subside and positive valuation becomes possible. The negative emotional tonality at the end of chapter 2 and during the initial two parts of their subsequent interaction is a reflection of the object/motive, here, a reflection of the experienced distance between the current situation and the only vaguely available object/motive to be revealed in and as result of activity.

The first two fragments, in fact, constitute a search for actions that would make the emergence of Mario's zone of proximal development possible. Jeanne does not produce the required actions, and her search requires Mario's participation. It is in the sympractical activity that Jeanne can find the actions required for Mario's room to expand the repertoire of his actions. When Jeanne attends to other students, gets up and leaves the group, she thereby provides a sign that her task has been completed, and simultaneously, Mario's action possibilities have expanded, that he has developed. In itself, her departure could also mean that she has abandoned him and now attends to other students' needs. But she explicitly provides an evaluation of her pedagogical activity: 'I think you understand now'.

At this point, also, Jeanne produces a sign that constitutes the affirmation of a connection between the societal, collective practice and the individual action. Mario has concretely brought about an action that is consistent with the object/motive of the collective activity. The accompanying psychic reflection is a realization of collective consciousness marking the coincidence of individual sense and objective, collective signification. This coincidence is in fact the concrete realization of the latter in the former mediated by the signs in which cultural significance is congealed. Algebra has been reproduced. It is this possibility of algebra to emerge from individual, subjective, corporeal human praxis that is reproduced; because anyone potentially can reproduce it in this way, the objective nature of algebra is also reproduced in and through subjective, living and lived labor. There is a tight interconnection between culture and the individual, a connection that is not achieved in theories where students and teachers produce 'taken-as-shared' actions and sense. The objectivity of mathematics, Husserl's (1939) geometry, our algebra, and in fact any cultural product (Merleau-Ponty 1960), requires more than taken-as-shared conventions. It requires the identity of object/motive, the cultural objectivity of the activity itself, which leads to the objective nature of the subject matter. What has to reveal itself to Mario is the fact that his personal sense of the activity is a concrete realization of collectively available significations. Like in the case of Mozart (Elias 1993), it is precisely when Mario's personal sense is expressible in and by means of collective significations that we have a reproduction of mathematics within the limits of its culturally objective nature (Radford 2006). It is precisely when his experience realizes collectively possible experiences, an

understanding mediated by the collective nature of language and signs, that the object/motive of the learning activity has revealed itself to Mario.

The zone of proximal development does not just emerge. The possibility of its emergence depends on whether the learner really is willing or in the position to take up the yet to be disclosed object/motive, and consequently the opportunity of expansive learning. To learn what the curriculum intends, the student actually has to take up and pursue the intended object/motive. Students may realize a task without taking up the object/motive, in which case they do not expand their action possibilities in the intended way, and do not learn what they are invited to learn. We see this clearly in the contrast between Aurélie and Mario. The former comes to complete the table of values, but her outer expressions continue to be frustrations, hitting (pounding) the desk surface, and verbal articulation of not comprehending. She does complete the task, but she does not engage in a way that allows the intended object/motive to emerge, whereas it does so from Mario's activity. Both have the table of values filled in the same way, both at least partially with the 'help' from another person. But whereas Aurélie copies what Thérèse has in her table, Mario produces the entries in and through his individual actions the cultural-historical appropriateness Jeanne has ratified in and through her evaluative contributions. In his case, the emerging object/motive does have 'sense-producing function', whereas in her case, the activity realizes a different object/motive, filling the table, and it does not have, in Leont'ev's terminology, 'sense-producing function'. These actions come to make sense when the sense of these actions emerges, when Mario becomes conscious of the fact that he is to note in each cell not the total sum of money in the piggybank but that he is to represent the repeated addition itself. Such a divergence as observable in the object/motive for Mario and Aurélie has been theorized in terms of the notions of *expansive* (transformative) and *defensive learning* (Holzkamp 1993). Expansive learning activity increases the action potential of the subject, whereas defensive learning only leads to the avoidance of negative repercussions (grades, punishment). Both expansive and defensive learning might lead to task completion and examination success. Copying, like cheating, is a practice that arises from and leads to defensive learning; it produces material outcomes (e.g., filled worksheets, correct exam responses) but does not lead to the intended learning outcomes that the curriculum specified.

Re/Thinking ZPD (Symmetrically)

> *The success of common developmental interests of parents and children, which is grounded in general interests, is an absolutely necessary condition* for the adequate *development of the child's individual subjectivity*. (Holzkamp 1979: 45, original emphasis)

In this quote, the development of the child is intimately tied to the developmental interests of the collective, including parents and children alike. Individual devel-

opment is realized in the pursuit of common interests. This orients us toward a more symmetric treatment of the zone of proximal development in which the developmental interests of all parties are involved and satisfied.

The notion of zone of proximal development has come to be used widely to theorize learning and learning opportunities. Unfortunately, following a simplified reading of its original definition and primary sense in the quotation that opens this chapter, the concept tends to be thought of in terms of the *opposition* of individuals. One of these individuals, a teacher or peer, is more capable than another individual, the learner. Somehow they engage in an 'inter-mental' or 'inter-psychological' plane, where the learner constructs knowledge from himself or herself on an 'intra-mental' or 'intra-psychological' plane. Vygotsky, following Marx/Engels[3], does not think of the higher psychological function as appearing *in* the societal relation – rather, the societal relation *is* the function. This view is at odds with the oppositional conceptualizations, which convey a substantialist approach that thinks of learning as knowledge assimilation and collectivity in terms of ensembles of individual actors interacting in self-interest. Their interaction is thematized through the dubious prism of the differences of what happens within the individual consciousness and what happens in collective consciousness – as if they could exist separately. Speaking is reduced to the individual, subjective intention of the speaker, who, in speaking, is considered to externalize ideas that have previously formed on the inside. The approach is substantialist in that it takes some prior situation, including the institutional positions of the participants in an interaction (i.e., teacher, student), and uses it to make causal attribution about the events that ensue. But such approaches are unsatisfactory given that there is insufficient attention to the co-constitutive nature of subjective consciousness and collective consciousness. The two forms of consciousness are co-constitutive because subjective consciousness always already realizes a form of collective consciousness; but collective consciousness exists in and as a possibility of subjective consciousness. More so, individualist and oppositional approaches convey notions of verbal expressions that are 'radically false' (Bakhtine [Volochinov] 1977: 122). Do we have to think of the zone of proximal development in terms of knowledge transmission and the underpinning opposition of a more and a less capable individual? Is it possible to think of this concept in terms of the unicity of interactional processes in which any moments (individual subjects) are *constitutive*, that is, cannot be thought of independently? In this chapter, we propose a different way to think about the zone of the proximal development in which asymmetries are possible because of the existing intercomprehension of interacting participants who become each other's teachers and students.

In the work of Vygotsky, who created the concept, we do find starting points for thinking about the zone of proximal development from a *symmetric* perspective. There is a real societal relation (Fig. 5.1), and it, as with all societal relations, en-

[3] 'Consciousness never can be something other than conscious being, and the being of humans *is* their real *life process*' (Marx/Engels 1956: 26). Here, Marx/Engels make the connection from consciousness as a form of being and being as a life process. Consciousness, therefore, is nothing other than the ideal reflection of real life process.

Fig. 5.1. There is a real social relation in real concrete activity. The ideal reflection of this concretely situated and anchored social relation *is* the first appearance of the higher function that emerges.

compasses more than one person. It is irreducible to the individual and constitutes a societal phenomenon sui generis. The symmetric perspective is grounded in a common world of historical significations and ways of life that we come to share since our birth and that form the basis of common implicit or explicit reference, common knowledge, assumptions, and so on. It is also grounded on the sharing of language. Thus, in a conversation – a word whose sense derives from the Latin *conversare* in the middle voice, that is, with active and passive aspects – speakers use words. But, any word spoken for the purpose of understanding is symmetrical, belonging to both speaker and listener. Thus, '[t]he word is a thing in our consciousness, as Ludwig Feuerbach put it, that is absolutely impossible for one person, but that becomes a reality for two' (Vygotsky 1986: 256). A conversation is a *con*versation only when the word is a reality for two – when 'each word has two sides. It is determined equally by the fact that it comes *from* someone as by the fact that it is directed *toward* someone. It constitutes precisely *the product of the interaction of speaker and listener*' (Bakhtine [Volochinov] 1977: 123, original emphasis). When we take a conversation as the unit, in which each word has two sides, any asymmetry within the unit, or between moments of the unit, has to be thought of differently. How, then, within this context, can we think about obuchenie (teaching/learning) situations differently than from the asymmetry of institutional positions of teachers and students? In the following, we develop our reflections concretely using an instant from our mathematics classroom, an excerpt from Fragment 4.2b.

The excerpted instant begins when Jeanne moves from the second to the third week of the saving process to be modeled in algebraic terms. She names the week to be considered and then offers up a question (turn 191).

Fragment 5.1 (excerpted from Fragment 4.2b)

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  191  J:  third week; how mANY threes are you going to add in
           your:: (1.03) piggybank?
→ 192      (0.96) ((questioning look on Mario's face))
  193      how mANY three dOLLars are you going to have.
  194      (2.08)
→ 195  M:  how much money are you going to have?
  196  J:  how many thrEE dollars are you going to have?
  197      (1.47)
  198  J:  three dOLLars, three dOLL[ars  ], three dOLLars (0.23)
           ((points to the 2 '3's in week 2 and simultaneously
           points with left hand to the first, second, and third
           goblet))
  199  M:                          [three]
  200  J:  what are you going to write here?
  201  M:  three?
  202      (2.59) ((Jeanne moves finger to the cell on his left))
  203  M:  <<p>plus three? plus three? >
  204  J:  yES:: ((he writes))
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We might gloss this excerpt in a traditional way saying that the teacher Jeanne attempts to allow Mario to 'construct' the idealization of what he has done earlier, the repeated additions of $3 to the existing amounts in the piggybank, to the additive and multiplicative structures. Some readers might think that she provides a sort of 'scaffold' that allows Mario to do what he eventually does. But in reading this transcript in this manner we would neglect the active part that Mario plays in this event. He not only responds, does what one might attribute to Jeanne as wanting him to do, but in fact contributes to bringing about the particular teaching moves. Thus, for example, in turn 193, Jeanne repeats what she has said before. We ask, why might she be doing so? In fact, it is itself a response to something that is not said but nevertheless present as a signifier in the situation. As indicated in the transcript (turn 192), Mario produces a questioning look, which we might gloss as 'what are you saying?' (the signified). She responds to this question by repeating what she has said. Now she no longer intonates it as a question but as a constative. She articulates again *precisely* what she had said, and now is saying again. There is a long pause and then Mario offers what he has heard Jeanne to say: 'how much money are you going to have?' (turn 196). The intonation is a questioning one (pitch moves upward). He offers a hearing, and, in intonating the offer as a question, simultaneously asks whether *this* is what he was asked, 'how much money?'. Something is unclear, and he provides Jeanne with the resource that might assist in helping her understand *his* problem.[4]

[4] We may actually hear this sequence as part of a conversational *repair*, in which the interaction participants have to clarify what is being asked before the response becomes possible. This repair itself is produced as part of the ongoing activity and therefore is as much an integral part of it as the production of the answer itself. Moreover, the entire situation is discursively produced so that the talk is not just about the contents of question and answer but also about the making of this situation: Mario is an integral and constitutive moment rather than an auxiliary and incidental vessel to be filled with existing cultural knowledge.

When we take an approach to the analysis in which each word uttered in the transcript is a thing in the consciousness of both, then the analytic situation changes. In fact, we may say that not only does Jeanne guide Mario to the point of naming what goes into the cell, but Mario also guides Jeanne towards what she needs to do to assist him. Mario does exhibit considerable cultural competence, which allows the conversation to unfold in the manner we observe. For example, we can see from the unfolding episode that he knows that Jeanne is asking a question. What is problematic is the content of this question. That it is problematic, Mario exhibits at least twice, once with his questioning look (turn 192) and another time when he offers a possible hearing (turn 195). The *question* of what she wants is problematic, rather than the fact that she wants something from him. He allows her to know more than that he has simply not understood. His lack of understanding may have arisen from not listening or not hearing what she has said. But in such a situation he might have asked, 'What did you say?', thereby indicating that the problem is a failure to hear rather than a failure to comprehend. Symmetrically, in producing at least the first part of what comes to be the sought-for response (i.e., 'three plus three plus three'), Mario lets Jeanne know that she now has asked the appropriate question. His appropriate response constitutes the evaluation of the appropriateness of her question. That is, Mario is a teacher allowing Jeanne to find an appropriate manner to phrase her question at the very instant that she is attempting to allow him to articulate a proper response. In other words, Jeanne and Mario are each other's teacher and student; and they are so simultaneously.

Up to now, we have focused on Jeanne and Mario. But the words that they have oriented toward each other also have been produced for everyone else present. The arrangement has the organization of a theater in which the audience is allowed to follow and understand. In this theater, each word exists not only is for the benefit of the two main protagonists but also for the benefit of the generalized other, the other children constituting this group, the researchers present, and all those who will vicariously come to know about the event through the researchers' writings. The active participation of the audience is exhibited in the orientation that Jeanne exhibits to the two girls and the camera.

Our analysis shows that far from exhibiting an asymmetry, the zone of proximal development is an interactional achievement that allows all participants to become teachers and learners. In our analysis, each utterance has come to be paired with an evaluation. Not only does the participant with an institutional position of teacher evaluate, but so do the participants with the designated institutional positions of student (learner). Each word is the product of the relation – an objective social fact sui generis (Durkheim 1919) – which makes the turn pair the minimal unit of analysis. Each word (locution) is paired with a 'social evaluation'; and it is the 'social evaluation' that 'defines all aspects of the utterance, totally permeates it, but finds its most pure and typical expression in expressive intonation' (Bakhtin [Medvedev] 1978: 122). It is precisely because of the evaluative role of each utterance that the teacher can know that the student has or has not understood, and the student can know that he has or has not provided the appropriate response. In other words, it is the unfolding and unpredictable *connectivity* that is allowed by the so-

cial evaluation of utterances and intentions that ties together, in a reciprocal manner, the participants in a symmetric space of *inter*-action.

Asymmetries are possible because the symmetry constitutes a basis (ground) for asymmetrical teaching and learning roles to emerge, roles that reflect a division of labor in collective obuchenie activity. This approach is based on the idea that a word never belongs to the speaker only because it 'addresses itself to an interlocutor; it is a function of the person of this interlocutor' (Bakhtine [Volochinov] 1977: 123). The utterance, therefore, 'absolutely cannot be considered as individual in the narrow sense of the term; it cannot be explained in reference to the psychophysiological conditions of the speaking subject' (ibid.: 119). The utterance *is* shared by speaker and listener rather than 'taken-as-shared' by their separate minds; it reflects *inter*-comprehension rather than separate comprehension. The advantage of the symmetric approach to the zone of proximal development that we propose here is that it allows the question of the more capable subjectivity to emerge from the interaction, appropriate especially when the question of who is in the know cannot be established on the basis of the institutional positions that the individuals otherwise take. Both Jeanne and Mario take the role of teacher; and both take the role of learner. Who is in the know and who learns is a product interactionally and contingently achieved as participants engage with each other. That is, it is appropriate to think of the institutionally sanctified 'teacher' to be a 'learner' and of the institutionally designated 'student' to be the 'teacher'. This approach allows us to understand why and how teachers learn during the course of their professional experience: In each interaction, teachers can find out whether something they have done or said was or was not successful, and also whether their subsequent attempts in changing their actions/utterances bring about the appropriate response. To them, the institutional relation is one that they can 'objectify', in other words, that they will exhibit or offer up in subsequent situations with other students. This case is in fact very common in classrooms. In our classroom research we have often followed some teacher with a camera around the classroom, recording his/her interactions and observing how refined the teacher's actions and discourse become as the teacher goes from one group of students to another (e.g., Roth 1998a). Far from constituting a sole opportunity for the student to learn (e.g., subject matter), the zone of proximal development constitutes an opportunity for the teacher to learn too (e.g., subject matter pedagogy).

The reconceptualization of the zone of proximal development that we are suggesting rests hence in a form of intersubjectivity that is grounded in a common world of cultural-historical significations and ways of life that we come to share with others since our birth. As noted previously, this common world forms the basis of common implicit or explicit reference, common knowledge, assumptions, and so on. It is this common world of reference that makes intelligible for the teachers and the students the game of 'finding the contents of the piggybank' and all that this game entails. Intersubjectivity is grounded in this common subbasement. But there is more: Our shared complex language, with its intricate forms of reference, auto-reference, and expression, accounts for the symmetrical role that participants come necessarily to play in conversations. Yet all this is not enough

for learning to occur. What is still missing is what we observe in the episode: the willingness to tune ourselves to others, to commit to a common cause, and to engage in a manner that is other-oriented. Thus, in the conversation with Jeanne, Mario could have given up the discussion. Jeanne could have too. She could have called on another student. But she did not. She kept adjusting to Mario, as Mario kept adjusting to Jeanne, both oriented towards the respective other.

Of course, it would be a mistake to think that we enter in interaction with others as *tabulae rasae*. The teacher knew beforehand the multiplicative-additive formula '$3n + 6$.' It is part of the cultural and historical knowledge that the teacher ubiquitously and continuously draws on to organize her experience of the world. She may not be aware of the fact that pattern generalization was an intense area of research in Pythagoras' brotherhood, or in Diophantus' Alexandria, or the Renaissance. Yet this cultural knowledge of pattern generalization endows the teacher with a particular asymmetrical role in the fourth-grade interaction. It is this asymmetrical element to which Vygotsky refers in his definition of the zone of proximal development. But this asymmetry in itself is not sufficient to understand learning. The teacher cannot make the object of knowledge merely appear in the students' consciousness. As Vygotsky points out in *Educational Psychology* (a text written during the years when he taught in his hometown Gomel, Belarus), 'strictly speaking . . . [i]t is impossible to exert a direct influence on, to produce changes in, another individual' (Vygotsky 1997: 47). In the same text he complains that 'the old pedagogics . . . treated the student like a sponge which absorbs new knowledge' (ibid.: 48). The primary asymmetry that results from the societal distribution of cultural knowledge is drowned in a symmetrical space where the participants' consciousnesses connect. Such a connection requires the appearance of a form of intersubjectivity where the participants de-center themselves. Their respective consciousness seeks the respective other through words and corporeal actions and reactions, such as grasping, touching, and pointing. And it is only when the object of knowledge appears simultaneously in Jeanne's and Mario's consciousness that learning occurs.

Naturally, the semantic density of knowledge (the as additive-multiplicative algebraic structure as a theoretical construct) is not the same in each one of the participants. For the teacher, the conceptual object of the multiplicative pattern – i.e., n x 3 + 6) – may relate to many theoretical aspects (first degree polynomials, theorems, abstract definitions, etc.) that are not part of the discussion. Yet, as our episode suggests, a common conceptual ground is reached. The appearance of the object of knowledge in Mario's consciousness, that is to say, its objectification, is a gradual and lengthy process in the course of which the various conceptual layers of the object are disclosed – e.g., that instead of totals, we can also think in terms of repeated actions, like in '6 + 3+ 3' or as '6 + 2 x 3' or even more theoretically, as '$6 + 3n$' or '$a + bx$'.

To sum up, conceptualizing the zone of proximal development in the manner we suggest here rests on a non-transmissive and non-authoritarian form of knowing and on a non-individualistic conception of the participants. As to the former, knowing is not theorized as the reception of already-made pieces of cultural-

historical knowledge. Knowing refers rather to the possibilities that become available to the participants for thinking, reflecting, arguing, and acting in a certain historically contingent cultural practice – here the practice of algebra. As to the latter, instead of conceiving of participants as self-contained agents having already preformed intentions and ideas, or as solipsistic actors that merely take knowledge and intentions as shared illusions of interaction, participants are considered as actively involved in the *co*-formation of an emerging intersubjective attunement that is made possible by language, forms of perception, and more generally, our biological, historical, and cultural heritage. The emerging intersubjective attunement is certainly beyond a 'pure' cognitive realm. As our classroom episode illustrates, it entails a tremendous load of mutual emotions and continuously adjusted corporeal positions in the space of discourse and inter-action.

There are various theoretical and practical implications here. From a theoretical viewpoint, the role of participants in a zone of proximal development entails a better understanding of language and interaction. The perspective articulated here resorts to a conception of language and interaction that is at odds with classical ideas of information processing approaches and individualistic psychologies. Our notion of zone of proximal development draws on a conception of language, corporeality, and other semiotic resources that recognize the multiple perspectives of participants while they are at the same time seen to offer a constitutive background for intersubjectivity and the attunement of the participants. Within this context, we need to better understand how participants draw from those resources to position themselves in zones of proximal development and to tune to others in conceptual and affective layers to collectively reach interactional achievement. We also need to better understand how participants deal with the various political forms of asymmetries (e.g., knowledge distribution, genre, and ethnicity) to orient to others in the symmetrical space of language and intentions. Language, we note above, ties us together. A word always exists for more than one consciousness. But at the same time, a word is *ideological*; that is, a word always belongs to a system of ideas: '*The word is the ideological phenomenon par excellence*' (Bakhtine [Volochinov] 1977: 31). A word hence reflects the social, political, and theoretical position of the person uttering it. What this means is that in the encounter of consciousness that the zone of proximal development brings together, there is also an encounter of ideologies and perspectives and potentials for their transformations. This is why the idea of learning as transmission is terribly misleading. As we suggest above, both Jeanne and Mario learned from each other. However, the most important aspect of the zone of proximal development is not the mutual benefits that participants obtain in achieved interaction. To think along those lines is still to remain in the waters of individualism, one that justifies interaction in terms of the profits that each one of the participants collects (Radford and Roth 2010). The most important aspect of the zone of proximal development is the emergence of a new form of collective consciousness, something that cannot be achieved if we act in solitary fashion.

From a practical viewpoint, we need to investigate the discursive, corporeal, and other actions that encourage participants to attend to others in a responsible and

committed way, and to understand how new knowledge, subjectivity, and new forms of collective consciousness become variously produced. More efforts have to be deployed to understand – through empirical examples – zones of proximal development not only as zones of agreements but also of tensions, disagreements, misunderstandings, conflict, and subversion.

The Subject's Perspective on Learning

Cultural-historical activity theory in the Leont'ev–Holzkamp lineage orients us to take into account the subject's perspective on the activity, in other words, what is and can be apparent in the consciousness of the subject. When we consider Mario's perspective, it is quite evident that the learning object, the algebraic modeling of a practical saving situation, cannot be apparent in his consciousness. This is what the learning activity is to produce as its outcome. What then, we have to ask, is it that is and can be apparent to the subject? In the present instance, Mario is confronted with an empty table of values, the description of a life-like situation, and some questions. The latter ask him to fill the table of value. However, as we follow him along, we recognize that at one point Mario realizes that his currently available action possibilities are insufficient to fill in the table. He even asks what to write while interacting with Jeanne. What will allow him to complete the task is an expansion of his action possibilities. But which actions will do the trick? He cannot know, for if he knew, he would be able to apply them. The *learning* problematic therefore will be one of expanding the action possibilities such that the task can be completed. Simply telling (ordering, instructing) Mario to do this or that (e.g., 'put "3 + 3 + 3" into the cell of week 3') will not allow him to understand the sense, for he still does not know the object/motive of the activity, which, as developed in chapter 6, determines the sense of the action. The action acquires its sense as Mario makes sense of the action. This 'acquisition of sense' or, rather, the attribution of sense, occurs through the other in sympractical activity – as in Vygotsky's (1989) example of the child who may make a hand movement but who learns the social signification of the movement as a gesture only through the relation to its parents. With the recognition that the currently available actions are insufficient to complete the task also comes the experience of being at the mercy of the situation, subject to the conditions, and frustration as its emotional reflection. To overcome being at the mercy and subject to the conditions requires an expansion of control over the condition and, with it, of the experienced quality of life. A learning theory that improves upon all other existing learning theories has to be able to articulate what it means to learn from the perspective of the learner and eliminate the going conflation of teaching action with learning action. As we have seen, activity itself *may* transform the level of control over the situation and therefore the quality of life, which Mario expresses at the end in the utterance 'Me, I now understand'. By means of his intonation, the utterance comes to be replete with satisfaction at being able not only to fill the table but to understand what is required to do so.

Learning situations tend to be theorized from a third-person perspective making the researcher describe the mental structures or practices that students enact. The question never is one from the students' perspectives, who participate in the classroom interactions as conscious beings. In flesh and blood, students are not abstractions, are not cognitive frameworks or abstract practices in action. They do what they do based on life as it is available to them in their consciousness. As sensual living beings, students engage in real relations with the material and social reality *as these present themselves in* their *consciousness* (rather than that of the researcher). Mario and Jeanne are not abstract beings, not computers placed into human bodies, but concrete persons caught up in classroom life. As real human beings, individuals act in the manner that is sensible and intelligible to them, which reflects previous interactions that they have had with others in equally concrete situations. It is precisely for this reason that Mario *can* understand an offering as a question and that Jeanne may offer up an utterance as a question rather than as a constative. It has been noted that Vygotsky's theory, as generally used, with its focus on the differential distribution of knowledge in a teaching/learning situation is not suited to characterize learning more generally, especially adult learning and its generally often autarkic nature (Holzkamp 1993). Our reframing of the zone of proximal development shows that learning is not limited to one party in the relation but is open to all participants. What this requires, too, is a better understanding of learning from the position of the subject in activity – which forces us to consider and take into account the consciousness of the acting subject. It has reasons for doing what it does, and these reasons determine actions rather than some mental frameworks not only hidden from researchers but also, and more important so, hidden from the acting subject him/herself. The nature of these reasons, because they can be articulated when necessary, is inherently cultural-historical.

In cultural-historical activity theory, the concrete subject is understood not as a constant moment of the activity but as a moment in continual flux, in which changes reflect the changes within the material-practical activity as a whole. This outer context arises from the conditions in which the activity is embedded and the changes that the subjects brings about. The changes are continuous, expressing themselves more or less predominantly in all aspects of the situation of which the acting subject is conscious. Thus, we can see Mario first engage intensively and, in and through his activity, then become more and more disaffected to the point where he manifestly expresses extreme frustration. Interestingly, it is in and through the same activity that the frustration subsides, leading to the emotionally positively charged statement, 'I understand' at the end of the episode. It is not the teacher who brings about this change: It is the engagement itself, the sensuous *sym*practical activity that enables and promotes the change.

The question we face is how to conceptualize and theorize the work that the subject accomplishes in articulating the object of learning – based on its own perspective. Learning is not just a mechanism that somehow unfolds. Rather, learners do what they do for *their* personal reasons that are nevertheless intelligible *generally*. Some students may be interested in learning because they experience it as an expansion of their control over life conditions and action possibilities – expansive

learning leading to more adequate forms of thought and reflections of reality (Il'enkov 1994). Other students do engage in learning activities to avoid negative consequences – defensive learning. Still others engage in learning activities to try to do something with others, to confront the unknown and the challenge, even if the object/motive and the risks are unclear and remain so for a considerable time. We cannot understand what the reasoning subject does in the learning activity – which is based on what is given to its consciousness – unless we begin with the grounds that found its actions. This, in turn, requires that the difference between the learning demands posed from the outside, by the teacher, and the learner's own subjective learning interests are articulated (Holzkamp 1993). This is so because the student does not *have to* respond to the learning demand so that the motive of his/her activity may actually be different than the one that the teacher wants to initiate.

Fundamental to the question about learning is how learners can *intend* what there is to learn and how to learn it, because that which is to be learned is precisely unknowable. If they already knew what they had to learn, then students did not have to engage in learning it. This is important to the question of directing and controlling one's activity, for if learners do not and cannot know the object/motive beforehand, they also cannot aim at it – an activity-theoretic articulation of the learning paradox (Bereiter 1985). This is also why 'a specific learning object, precisely as *learning* object, that is, in the context of a problematic of learning, is articulated necessarily in the beginning only in a reduced way – incompletely, superficially, in undifferentiated manner, and so on' (Holzkamp 1993: 212). In the emergence of the learning object/motive, learners will become conscious of the problematic nature of the access to the learning object. It is only in the initial actions that the learning problem – accessing and realizing the object/motive of the learning activity – can become concrete in and to consciousness. The initial actions only open the problem superficially, and the learner needs to continue in the pursuit of the object/motive so that it can become available to his/her consciousness in its entirety. For the learner to engage with the learning object in a conscious and directed way, the discrepancy between his/her current knowledge and the learning object/motive needs to become available in his/her experience. The individual needs to be able to experience that there is more to learn than what is available to them on the basis of their current knowledge and understanding. In other words, they have to experience the dialectical contradictions that are situated at the epistemological level of classroom activity.

In this sense, the cultural-historical activity theoretic approach that we are describing here comes close to other theories in mathematics teaching and learning. In particular, it comes close to Brousseau's theory of didactic situations. However it departs from it in the manner in which the resolution of the dialectical contradiction is conceptualized. In Brousseau's theory, the student interacts with a 'milieu' that has to provide him/her with the appropriate feedback to realize the contradiction and to overcome it. Although part of the milieu, the teacher has to recede into the background to let the student engage with the problem in a phase that Brousseau calls a-didactic. The a-didactic situation rests on the idea that knowledge has

to come from the student him/herself. The teacher cannot show it. For 'if [the student] accepts that . . . the teacher teaches her the result, she [the student] does not establish it herself and therefore does not learn mathematics; she does not make it her own' (Brousseau 1997: 41–42). His is a very different view of what we have been saying about the manner in which the student-teacher relationship is conceptualized in activity theory.

Let us note, nevertheless, that the epistemic claim made by the theory of didactic situations is very much consistent with the constructivist one. However, the theory of didactic situations takes a different route vis-à-vis its concept of knowledge (hence an ontological claim). Indeed, as it is well known, the knowledge that the student produces is merely *viable* for constructivism. There is not even the slimmest possibility to correlate it to a common cultural knowledge, for all knowledge, by being constructed in a strict manner by the individual itself, remains personal (von Glasersfeld 1989a). At the inter-personal or social level, the individual's knowledge appears only as a working hypothesis, the illusion of something taken-as-shared. This, of course, is the well-known problem of solipsism. In the theory of didactic situations, in contrast, students are supposed to generate by themselves something common, more specifically a knowledge (savoir) that can be related to cultural knowledge. And the epistemological dialectical contradiction is overcome by assuming that the situation (e.g., a well engineered mathematical problem) will necessarily make recourse to the target knowledge (Radford 2009b).[5]

From a subject-oriented approach to cultural-historical activity theory, the perspective of the learner as the conscious subject in the learning process becomes of primary importance. In this approach, traditional conceptions of the teaching-learning situation, which emphasize either the agency of the student (e.g., constructivism) or the agency of the teacher (e.g., traditional teaching), have to be rethought. The subject of the activity needs to reflect on its own acts, as reflected in consciousness, which tends to occur when a contradiction is sensed in the activity. The essential psychological role of reflection resides in the emergence of the object/motive of activity, which the subject, in successful instances of learning activity, discovers in its own acts. Thus, 'the development of mathematical cognitive acts has a distinctly developmental aspect. It bears not only on the origins of particular acts but also on the genesis of thought in general, which functions as an "ideal component of real activity of social man"' (Davydov and Andronov 1981: 24). The purpose of teaching is to allow the emergence of a relation between personal sense and collective signification, and this relation cannot be transferred or given. It cannot be intended, as the student is supposed to learn the object/motive of activity in and through his/her participation in it. The object/motive of activity, therefore, can only be disclosed/discovered from the concrete circumstances in which it is realized and materially embedded.

Some of the pedagogical work grounded in cultural-historical activity theory has been critiqued because it focuses too much on the agency of the teacher and

[5] 'Each item of knowledge can be characterized by a (or some) adidactical situation(s) which preserve(s) meaning; we shall call this a fundamental situation' (Brousseau, 1987: 30).

too little on the creative agency and subjectivity of the learner. Learning is equated with teaching and the knowable teacher is juxtaposed with the deficient student. Typical of this kind of research are learning sequences realized and analyzed in terms of the *zone of proximal development*. Thus, 'in the current exclusively "educational" reception of the concept . . . an interpretation is suggested, according to which substantial learning progress of the child over and above its current state is possible only via the support of the teacher, who is the real subject of the child's learning' (Holzkamp 1993: 418). The teaching/learning relation that we circumscribe by the term *obuchenie* comes to be shorted to *teaching*. However, our work presented here suggests that the form of teacher-student interactions in the zone of proximal development does not have to be conceptualized asymmetrically and that in fact an interaction ritual requires a fundamental symmetry for teaching/learning to occur. Our foregoing description and analysis exhibits the active participation of Mario in the societal relation – the one that subsequently exhibits itself as higher function. He not only tries to tune in to what Jeanne says, but also is an important subject who actively contributes to the interaction ritual. As a result of this active participation, the child comes to discover the object/motive of activity, which the teacher cannot transmit by telling. In fact, to be a learning activity, the student must engage so that the object/motive of the activity, embodied in the concrete materials and concretely enacted social relations, discloses itself to him in and through his activity. This is so because the object/motive of the learning activity is the personal sense, that is, the relation between individual actions and collective activity.

A focus on consciousness as the organizing concept of the learning process allows us to integrate two heretofore separately theorized phenomena: cognition and emotion, the latter having orienting and valuation function in the learning process. Consciousness is the 'medium of the intersubjective relation to the world' (Holzkamp 1991: 89). The problem that current research has not yet answered is this fundamental contradiction: to be a self-directed subject, the learner needs to compare the learning object with his/her current knowledge, yet is inherently not in the position to know what s/he *is supposed to learn*. In this situation, the independent learner needs to be able to articulate the learning object sufficiently so that the learning process can be planned, organized, started, and self-regulated. The presence of the knowledgeable teacher, however, changes this equation, for the teacher can assume these functions in the activity where the object is initially unknown to the student but progressively discloses itself to him in and through his own engagement.