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Children's Learning in the "Zone of Proximal Development"

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zation into the culture they are learning. These aspects of social guidance of learning are what we believe may be responsible, on a day-to-day basis, for the rapid progress of children in becoming socialized participants in the intellectual and social aspects of their society.

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This chapter presents a more general view of the zone of proximal development than ordinarily encountered in the American psychological literature. It refers to Soviet influence on Vygotsky and presents examples from work, play, and educational activities involving elementary-school-age American children.

Current Activity for the Future: The Zo-ped

Peg Griffin
Michael Cole

Translation from one conceptual system to another is always a risky business When the translation crosses cultural boundaries, the risks are even greater In this chapter, we examine Lev Vygotsky's concept of the zone of proxima development (*zona blizhaishego razvitiya*) for aspects that have been underplaye or overlooked in most English-language discussions. It is our impression tha English-speaking scholars interpret the concept more narrowly than Vygotsk intended, robbing it of some of its potential for enabling us to understand th social genesis of human cognitive processes and the process of teaching an learning in particular. The standard source for discussion of the zone of prox imal development (Zo-ped) is Vygotsky's monograph *Language and Though* published posthumously in 1934 and translated into English in 1962. A pointed out by Graham (1971) and Kozulin (in press), the translators omitte material that they considered irrelevant, so that the English-language versio contains only 153 pages, while the Russian original had 318 pages. Additiona

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discussions are contained in Vygotsky (1978) and other sources, but these, too, represent compilations from the original.

Vygotsky defined the Zo-ped as the difference between a child's "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" (1978, p. 86). At the time when this definition was offered—the early 1930s—Vygotsky was director of the Institute of Pedology, whose mission was a little like one of the National Institute of Education's centers, since it was charged with translating basic research into pedagogical practice. IQ tests imported from Western Europe were being widely applied in the U.S.S.R., and Vygotsky was attacking the manner of their use, arguing that standardized tests give a picture only of completed development, information of little use in the all-important task of instruction. It was the duty of the school system, he believed, to bring out the full potential of every child. This task could not be accomplished by assuming that completed development fully specifies a trajectory for the future. The standardized assessment strategy leads to a false understanding of the relation between development and instruction, which converts the school system into a vast selection machine. Many nineteenth-century Russian thinkers, including Tolstoy, argued that education should be a transforming experience. Their arguments had a great deal in common with the educational philosophy that came to be championed by John Dewey in the early decades of this century in the United States. From this perspective, "Instruction is good only when it proceeds ahead of development, when it awakens and rouses to life those functions which are in the process of maturing or in the zone of proximal development. It is in this way that instruction plays an extremely important role in development" (Vygotsky, 1956, p. 278).

American Analogies to the Zo-ped

In recent years, a variety of concepts have been introduced into the American developmental literature that are easily interpreted as alternative formulations of the Zo-ped concept.

Next-Step Versions of the Zo-ped. During the 1960s, several American theorists advanced the notion that children's development could be enhanced if their environments provided just the right amount of discrepancy between their prior achievements and present demands (Hunt, 1961). Very similar ideas have been put forth more recently by Turiel (1972) and others. For instance, Siegler (1981; Siegler and Richards, 1981) provides an analysis of the sequential steps involved in understanding classic time-distance-rate problems. Effective training, which focuses on the next step, contrasts with ineffective training, which goes too far beyond the child's current ability.

An important way in which the idea of Zo-ped differs from the next-step formulations is that Zo-peds are expected to embody several levels of the

task at once, both next steps and previous steps. Real-life settings, unlike the laboratory tasks that are used for analytic clarity, seem better served by the notion that the child is in an apprenticeship situation where adults create and support several levels of participation. In such situations, development is more appropriately viewed as changes in responsibility for certain steps than as their presence or absence (Kaye, 1982; Laboratory of Comparative Human Cognition, 1981; Lave, 1983). Next-step versions of the Zo-ped also have a built-in limitation for those investigating the possibility of social origins of mental functions. A stepwise progression where the environment serves only as a "trigger" (Fodor, 1983) for the maturing child and a stepwise progression where an adult "scaffolds" next steps are difficult to differentiate on empirical grounds.

Scaffolding. A widely used notion that appears to bear a strong resemblence to the Zo-ped concept is the notion of scaffolding, introduced a decade ago by Bruner and Wood and applied by several researchers who were interested in the way in which the environment helps to arrange for next stages of development. The basic notion is that "adult tutorial interventions should be inversely related to the child's level of task competence—so, for example, the more difficulty the child had in achieving a goal, the more directive the interventions of the mother should be" (Wood, 1980, p. 284).

A good many authors use the notion of scaffolding as if it were synonymous with the idea of a Zo-ped. For many purposes, it may be. Certainly, when the task is to build a tower of blocks, the notion of scaffolding comes easily to mind as a metaphor. But, scaffolding—bolted together tiers of boards upon which human workers stand to construct a building—admits for more easily of variation in amount than in kind. Yet, the changes in adult support ordinarily reported in scaffolding research point to qualitatively distinct kinds of support: Sometimes, the adult directs attention. At other times, the adult holds important information in memory. At still other times, the adult offers simple encouragement. The metaphor becomes more problematic when we focus not on the execution of a specific task but on the changes in the child. A central notion shared by Vygotsky, Dewey, and theorists who use the scaffolding notion is that the discovery of new goals is central to the process of development. To capture the important way in which adult understanding of goals structures the sequence of activities, we would need to add architects and foremen to the building process that scaffolding indexes. Building would have to begin with all the scaffolding in place, and it would have to admit of work starting with the uppermost reaches of the roof as well as the basement.

The scaffold metaphor leaves open questions of the child's creativity. If the adult support bears an inverse relation to the child's competence, then there is a strong sense of teleology—children's development is circumscribed by the adults' achieved wisdom. Any next-step version of the Zo-ped can be of similar concern, including work that we have done.

With these concerns about limitations on Vygotsky's expression of his

concept and limitations in current American work related to it, our work has taken two turns: First, we have taken an interest in literature related to the Zo-ped that allows us to escape the largely spatial metaphor, in which the temporal aspect of the construction of the whole remains as a residual, unanalyzed aspect of the living process. Second, we have taken an interest in less well-sequenced tasks and in activities in which adults have more ambiguous roles and abilities.

Some Russian Concepts Related to Zo-ped

As we have become exposed to the broad range of Russian scholarship during the 1920s and 1930s, we have become better able to appreciate the close connection between the development of Vygotsky's sociohistorical approach to psychology and developments in other fields of Soviet science and the arts. Two connections that have been made explicit in the work of Alexander Luria, Vygotsky's student and colleague, were the importance of the theory of motor control being developed by Nicholas Bernstein (1966) and the concept of a functional system developed by Peter Anokhin (1969). (As Luria (1978) explains in his autobiography, Vygotsky and Luria were initiating experiments in neuropsychology as early as 1928.)

Nicholas Bernstein was a physiologist who became famous in the Soviet Union for his studies of the organization of movement and for his insistence on the centrality of feedback. One of Bernstein's most important principles was that the movements of living organisms are organized in time as well as in space: "The fact that they [movements] do not exist completely at any given moment but unfold in time, the fact that they include in their existence the time coordinate in a somewhat different fashion than, for example, anatomical organs and tissues by no means removes them from the ranks of objects studied morphologically. On the contrary, the idea that movement is, in many respects, like an organ (existing, as do anatomical organs, in a coordinate system of x, y, z, t) is extremely fruitful" (Bernstein, 1966, p. 178).

Living organisms are active creatures that find themselves in objective situations of enormous complexity. Since no two situations and no two movements ever repeat themselves precisely, Bernstein maintained that living movement is always created anew at each new moment in time and controlled by feedback. The existence of feedback in turn implies the existence of some "model of the future" that can "feed back" to the present. Bernstein spoke of the concurrent necessity of two forms of models: models of the past and models of the future. Living movement is a process of resolving the information from these two sources. At this point, space comes back into the picture, because the living organism that does the resolving must engage in activity in space in order to resolve the contradictions between what it remembers and what it expects.

Including Bernstein in the discussion, we see that the Zo-ped includes

models of a future, models of a past, and activities that resolve contradictions between them. Furthermore, we see a way to make theoretical sense of variations along the temporal coordinate. That is, next steps can be varied for theoretical and practical, educational profit. Creativity is an obvious property of the system from Bernstein's perspective, and convergence is the relatively unexpected outcome which must be explained.

A second concept, implied by Bernstein's work but elaborated by the psychologist-physiologist P. K. Anokhin (1969), is that of the functional system. This concept was used heavily by Alexander Luria, who pointed out that the term *function* is often used to refer to a particular tissue. For example, production of insulin is the function of the pancreas, planning is the function of the frontal cortex, and so forth. Luria repeatedly warned against such simple analogies. Using an example from Anokhin, Luria (1978) pointed out that the "function of respiration" cannot refer to a particular tissue because the whole process of respiration is carried out by a functional system consisting of several elements, including motor, sensory, and automatic nervous systems, the circulatory system, and so on. Functional systems are distinguished not only by the complexity of their structure but also by the flexibility of the roles played by the constituents. So, for example, in cases of injury to the diaphragm, which ordinarily makes possible the intake and expulsion of air, intercostal muscles in the chest can take over and ensure the essential goal of the system—the intake of oxygen and the expulsion of carbon dioxide.

We can see this idea working strongly in Vygotsky when he says, "I have attempted to demonstrate that the course of child development is characterized by a radical alteration in the very structure of behavior; at each stage, the child changes not only her response but carries out that response in new ways, drawing on new instruments of behavior and replacing one psychological function by another" (1978, p. 72–73). From Anokhin and Luria, we can see that the constituents of a Zo-ped, as aspects of a functional system, will have flexible roles. The material, the task, the adults, the children, the models of the future, the models of the past, and the temporal arrangements all function together, as the needs and opportunities arise, to perform the function of development. The reorganization that Vygotsky posits on the internal plane and on the ontogenetic level can be seen operating on the interpsychological plane and microgenetically.

Finally, we also need to introduce the idea of leading activity. A. N. Leont'ev (1981), who worked closely with Luria and Vygotsky in the development of the sociohistorical school, is especially important in this regard. His starting point was Marx's notion that a science of humankind must begin from an analysis of the concrete activities that are the immediate conditions for the development of consciousness. He put the matter as follows: "In studying development of the child psyche, we must therefore start by analyzing the development of the child's activity, as this activity is built up in the concrete conditions of its life. . . . Life or activity as a whole is not built up mechani-

cally, however, from separate types of activity. Some types of activity are the leading ones at a given stage and are of greatest significance for the individual's subsequent development, and others are less important. Some play the main role in development and others a subsidiary one. We can say, accordingly, that each stage of psychic development is characterized by a definite relation of the child to reality that is the leading one at that stage and by a definite, leading type of activity" (1981, p. 395).

Important to Leont'ev's concept is the notion of the parallellogram of development. Figure 1 sketches this construct. The lower two sides of the parallelogram in Figure 1a (solid lines) indicate performance under everyday circumstances; the upper two sides (dotted lines) characterize performance when the subject is acting within the current leading activity. The point of greatest divergence between the two lines is where the subject for whom this activity is a leading activity reorganizes his or her prior functioning. Subjects for whom this is not a leading activity have either incorporated it into their everyday functioning and therefore are already acting in the reorganized way, or they are impervious to the sort of opportunity that this activity Zo-ped offers. Figure 1a shows a parallelogram plotted against age and performance coordinates. Figure 1b shows the sequence of parallelograms and the sequence of transformations of the everyday that Leont'ev and his co-workers have proposed.

Figure 1a. A Parallelogram of Development: Dotted Line Indicates Leading Activity. Mid Age Group in Zo-ped

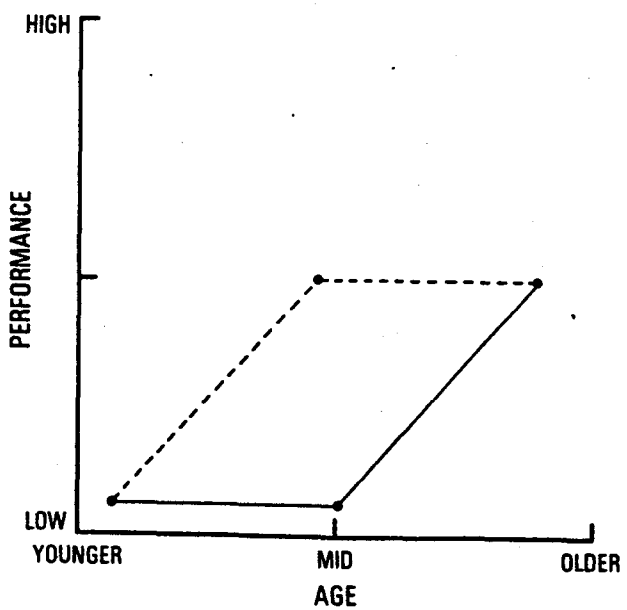
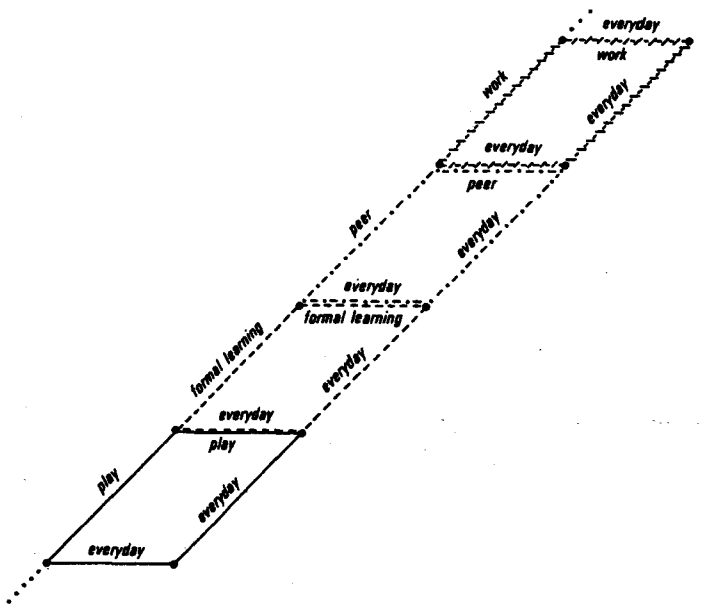


Figure 1b. Successive Leading Activity; Reorganization of Everyday Functioning



Recent publications (Wertsch, 1981) provide detailed information on the Soviet theory of activity. Our interest highlights three points: First, as an alternative to internal, individual stage approaches to the study of development, leading activities provide for a notion of societally provided progressions, the sort of context-selection mechanisms that we have considered important for understanding development (Laboratory of Comparative Human Cognition, 1981). Second, the "leading" notion provides a framework for uniting several important aspects of development: Variations in the frequency of experiences can be related to changes in kind of psychological activity. Changes in leading activities can be related to the reorganization of constituent actions and operations internally and interpsychologically. The appearance of new leading activities provides for the emergence of new functional systems. As a new leading activity appears, it provides for the reorganization and internalization of prior stages by transforming them into the everyday, in contrast to the new leading activity. Third, just as a fuller notion of the Zo-ped allows one to experiment with the reordering of steps for theoretical and practical gain, so it allows one to experiment with the reordering of the cardinal progressions between the parallelograms of development provided by leading activities. In the sections that follow, we will give several examples of research on teaching, learning, and development using the notion of Zo-ped

combined with the idea of functional systems operating over time and the acceptance of leading activity as an important grounding for the study of the process of development.

The Zo-ped in Educational Activity

Within the domain of reading, several decades of research have resulted in a refined notion of the sequence of pedagogical steps that can be arranged to help novices master the mature act of reading with comprehension. Reading is introduced by teaching children to recognize and reproduce letters of the alphabet and to decode words through a phonics-based procedure or through mastery of a sign vocabulary, after which they are introduced to sentences, segments of text, and finally whole texts.

In their research on the teaching of reading in bilingual contexts, Moll and Diaz (1983) found that Spanish-dominant children undergoing instruction in English were introduced to reading in precisely this sequence. Performance among these students was generally below the grade level for English-dominant children within the school district, and both the children and their teacher viewed the process as a struggle. The only remarkable thing about this situation was that, when some of the same students were observed in a Spanish-language environment, they manifested a reading ability several grade levels above the level at which they were working in the English classroom. Instead of spending their hours of reading instruction working on phonics and word decoding, these children were doing rather complicated comprehension exercises, including the writing of book reports on materials at the fourth-grade level. Moll and Diaz were struck by the incongruity of children who were simultaneously too illiterate to read in a language that they could speak (English) and literate in another language, so they decided to test the notion that the children's reading level in Spanish was a reasonable estimate of their independent reading ability. That is, their reading level was the top of a Zo-ped that could not be sustained in an English-language setting because the criterion for next steps in reading presupposed correct phonetic renditions of individual words. In their terminology, the demand to create correct oral renditions of English words pushed the children to the bottom of the Zo-ped for reading as comprehending, which gave a false impression of their ability to interpret the English text and which created a very difficult environment for further instruction.

The intervention designed by Moll and Diaz applied the notion that support with a Zo-ped need not follow a strict task analysis of levels of difficulty. Assuming that the children could read at the fourth-grade level, they used a fourth-grade reader. Children read the material in English, but they were not restricted to English in their discussion of the text, since Moll and Diaz, highly Spanish-English bilinguals, were the teachers. They mixed Spanish and English oral language freely so long as the topic remained the meaning

of the English text. Currently, Moll and Diaz are working with teachers and school system officials to reorganize instruction for these students to accelerate their acquisition of reading in both Spanish and English. When the burden of constructing phonetically and grammatically correct oral versions of a response was removed from the children, they exhibited a very clear ability to engage successfully in the task of comprehending the English text.

In Soviet developmental psychology, education (formal learning) becomes the dominant activity, following play and preceding peer activity or work. The principle of functional reorganization with Zo-peds can also be applied to the functional reorganization of activity systems. In the examples that follow, play, work, and peer activities become contexts that reorganize performance in domains usually found in schools.

Play Activity

New microcomputer technology has a potential to contribute to systems of play activity. With it, we can make little fantasy worlds in which children can assume powerful positions as they encounter interesting dilemmas. The television screen, the keyboard, the game paddles, the children, and the adults are recruited into the microworld and transformed, courtesy of a nicely designed program and material social supports in the environment. As in the work by Istomina (1975) and Manuilenko (1975), the most interesting transformation results in the child's becoming able to perform better than he does under other circumstances. Their experiments demonstrated the role of play activity in increasing the child's memory capabilities. Our experiments investigate the role of play activity in children's learning of school tasks, particularly of their learning to estimate along a number line.

In the following paragraphs, we show some of the details of one such activity. At the beginning of the incident reported, Kalani has no visible access to the properties of a number line or to the skill of estimating that a number line can support. His responses are not controlled by arithmetic concepts. The play activity with a peer and an adult brings him to a superior level of performance and to a position where he can independently both rely on properties of the number line and engage in estimation to respond to the task. Like many of the children with whom we work, Kalani often finds it difficult to coordinate with adults in outright educational activities. In a play setting, he can initiate and regulate the adult help that he needs to regulate and stimulate his own mental activity and development.

The Setting. We are in The Fifth Dimension, a world ruled over by the Wizard. (We invented The Fifth Dimension as a device to organize the children's activities with microcomputers without imposing a schoollike control structure. See Laboratory of Comparative Human Cognition, 1982, for a description of its genesis.) Children and little figurines that are their personas are allowed to enter this world, which consists of twenty-one rooms, each a

trap or an opportunity, depending on the Wizard's disposition and the child's performance. Kalani is a citizen of The Fifth Dimension. His co-participants, Mr. C and a peer, John, cannot act alone in The Fifth Dimension; they do not even exist there without Kalani's intervention. Kalani and his figurine survive and get transformed by passing from room to room until they reach a room that has a door to the outside. Kalani can reenter with a transformed figurine and try to survive in each and every room. In each room, there is something different to do. Most of these things involve microcomputers, but some require physical games or trips to other places. The activities range from arcadelike games to word processing and mathematical calculations. Each activity has tasks at three levels. If Kalani chooses a high level and accomplishes the task, then he and his figurine have more control over their future: Kalani can choose which of several doors to leave the room by, and he can even get some free passes to bypass some rooms on his way.

The Play Activity Within the Play Activity. Kalani is in a room in The Fifth Dimension. It is another play activity, a microworld, where Kalani is on the ocean in danger of being attacked by a shark. He can use sonar or radar or a harpoon to meet the challenge. Whichever he chooses, the program designers—Jim Levin and his colleagues at the Laboratory of Comparative Human Cognition (LCHC)—have arranged it so that Kalani is faced with estimation tasks on two number lines, where only the end points have number values that appear on the computer's screen initially. One line is vertical, and one is horizontal. One line is called Aim in the game world, and the other line is called Distance. The shark is located at the intersection of these lines, and Kalani must find it by using his knowledge of the number line and by using his estimation skills.

As a Fifth Dimension host, Kalani is obligated to engage his young friend John in the activity. He takes the first turn, estimating where the shark is in terms of the Aim coordinate. John is given the Distance coordinate. John, as a visitor, is unfamiliar with the game and the equipment; Kalani and Mr. C help him out. When the children's estimate is registered, it is quite far off. The children are a bit dejected when they see that they have missed the shark, but they quickly set up to try again. Again and again, they try with little success.

Mr. C (and the researchers viewing the computer and video data later) notice something more. While Kalani takes his turns quickly and easily, neither child appears to have access to a strong representation of the number line or strong estimation skills. Occasionally, with luck or skillful intervention by Mr. C, they get a shark and start out on another hunt, but they show no reliance on well-developed arithmetic concepts and skills. It appears that Kalani has good access to the game world (the goal of the task, the sequence of events, and the equipment). He, as the person in charge, contradicts Mr. C and rejects advice about these matters. John, however, is clearly uncertain about what is going on. The children maintain a high level of interest and use words that suggest that they are "in the game"—they talk of the shark and of firing, not about the computer or school arithmetic.

Mr. C's hints augment the hints provided in the program that appear on the screen. As he talks to the boys, he also interprets the feedback provided for successful and unsuccessful trials in more depth. In both modes, Mr. C uses an estimation procedure that relies on bisection of the number line and landmark estimates. He does not refer to a counting strategy although the "hops" of the lines during the children's turn can be counted. (There are numbers on the screen that mark particular points on each number line—the end points and the points of the child's past incorrect guesses—and these numbers can be used to count up or down from.) Nevertheless, in spite of Mr. C's interventions, Kalani has trouble. He moves the wrong way: Trying to find a smaller number than his last shot, he goes toward a bigger number, but the Zo-ped emerges:

Kalani: (The Aim line endpoints are twenty-three and forty-two in this game, at Kalani's choice.)
Mr. C: Kalani was too high. I'd say Kalani needs to be about...
Kalani: (moving and firing before Mr. C finishes)
Mr. C: Oh, I betcha that's wrong!
Kalani: How do you know? (shouted and sarcastic)
Mr. C: 'Cause I understand the number line.
Kalani: Uhhh. Huh. (It is John's turn, and Mr. C helps. They miss the shark.)
Kalani: I need to make a bigger number, don't I? (Kalani has always talked about a number target, not whether it was bigger or smaller than the last try.)
Mr. C: No, you need to make a smaller number, Kalani. You're shooting way up here on Aim, almost up to forty.
Kalani: Twenty-three?
Mr. C: Why don't you try... Well, here's twenty-three down here.
Kalani: (laughing softly) No, no, not twenty-three!
(Mr. C suggests thirty, and Kalani moves his line in the proper direction. After a lot of help with John's turn, they find they have still missed. During John's turn, Kalani agrees with Mr. C about which way is the right direction, disagreeing only in the estimation of how much smaller it has to be. In a collegial manner, Kalani and Mr. C consult.)
Mr. C: Just a little higher than thirty, Kalani.
Kalani: Thirty-two. (said slowly, with slow movements)
Mr. C: Or thirty-three, maybe. (as a comment, not an imperative)
(Another session of John's turn with help from both Kalani and Mr. C. This time, however, Mr. C starts to count the hops that the lines make as John moves from his previous guess. Then, Kala

takes his turn without help or commentary, getting appropriately a little higher. And so on, until finally they hit the shark. All three shout in jubilation.)

Kalani: (reading the feedback on the screen) Yeah, but look at the number of misses—Six! (They try another game, where Kalani says) We'd better get hints! (Kalani takes his turns confidently, using the properties of the number line and estimation skills and takes over much of the coaching of John. Mr. C continues counting out loud as the screen position changes. Kalani never does.)

Subsequently, Mr. C leaves to attend to another child. Kalani changes the game a bit, taking advantage of the variation in the program, and continues to succeed. But, along the way and without Mr. C's presence, he starts to count out loud. At first, he counts always from the lines' end points, not from the last guess as Mr. C had done. Then, Ms. G passes by and comments, "Ohh, you're going way back there to the end to count?" Pointing to a midpoint that had marked his prior guess and that was much closer to his counting goal, she asks "What about this?" Kalani, now playing alone, even without John, changes his counting strategy to use the closest numbered point as a starting point on the very next move. He achieves success at the highest-level task, and leaves the room with the most possible control over what room he will enter next in The Fifth Dimension.

The Play Zo-ped. Kalani's improvement has several facets. He learned to insert an estimated judgment of bigger or smaller into his procedure of searching for the proper number. He became 100 percent reliable at recognizing and acting on information about bigger and smaller numbers and number line landmarks. (At first he looked for thirty-eight between seventeen and six.) He moved from being able to perform a task with help, to being able to perform the task alone, to being able to help a peer. He moved from rejecting adult help to initiating requests for it and even to accepting it nonchalantly. At the time that his behavior could be said to be random or at least not controlled by arithmetic concepts, he was also quite fidgety and paid attention to whatever else was going on in the room. He even left the scene from time to time. When he was succeeding, he stayed on task and had to be reminded when it was time to leave. Playing in The Fifth Dimension and playing in the microcomputer shark game provided a Zo-ped for Kalani to go beyond himself. These play activities have also provided a place for us in the children's future, as the children find it plausible and fruitful to coordinate with adults who are interested in engaging them in educational activity.

Work Activity

In the spring of 1982, we developed a plan for a summer program of research involving a group of children with whom we had been working since the preceding fall. The children, ranging from third- to seventh-graders, had

one thing in common—they experienced difficulty in school (Laboratory of Comparative Human Cognition, 1982). Our experience suggested that the children had a very sketchy and limited view of what their lives might be like as adults. But a view of one's future as a productive and effective member of society can motivate and constrain the day-to-day actions in which one gets involved as a student in school. If we could provide grown-up work experiences for the children in a special summer program, we believed, they might discover the goal of their future work activity as a framework for organizing their academic behavior. We had significant assistance from colleagues in this endeavor. Beyond our fellow members of LCHC (notably H. Mehan and M. Riel), we had assistance from A. Brown and J. and R. Campione, from Illinois, and V. Koltsova, from Moscow.

We arranged for three different sorts of work activities. One involved making television shows, news shows, and documentaries. The functional reorganization described in the paragraphs that follow occurred as the children prepared for and taped the documentary.

Ben, Rex, and Ms. G. As Davydov and Markova (1983) note with respect to educational activity, there is no guarantee that an individual will enter fully into an activity. Consequently, the structure of the activity cannot be claimed to be the sole determinant of mental development. Effective activity may be a necessary condition to create a Zo-ped, but it is not sufficient. In many different activity structures throughout our work with him, Rex, a fourth-grader, proved this point. He was particularly likely to wreck educational activity structures, sometimes only for himself but sometimes for everyone concerned. Ben, a sixth-grader, was often much easier to coordinate with. He entered fully into many activities that we planned. On the occasion described here, however, the emergence of the activity was fraught with difficulty for all concerned. When it did appear, however, the children went beyond themselves in their performance. A Zo-ped had been created, they organized themselves, and they even took on the responsibility of organizing help from the adult.

The observation started thirty minutes before the boys were to be on camera for the work of making a documentary film about the camp. The three participants were gathered in an office at the university's media center, just down the hall from the impromptu recording studio. It was midmorning on the last day of camp. We provided a tape recorder, a typewriter, materials on which to write a script and cue cards, and materials to assist in planning the presentations—memory prompts about the camp's various activities and possible categories for evaluation of them.

At first, only Ms. G showed any positive engagement with the work activity. Ben had a very heavy cashbox—he had been the manager of one of the other work activities, a lunch restaurant, and the children had not yet negotiated the dispersal of their profits. So, of course, Ben and Rex counted money and discussed the decision. They played with the typewriter. They did

anything but prepare for the documentary. Their first engagement with the work was to reject the activity. Ms. G brought up their obligations to do the work, the opportunities that it afforded, the audience projected for it, and the potential content for their contribution. Rex and Ben countered her every move. They provided intricate rationales for not doing the preparation or the taping. The materials that could help them to develop a script or practice their delivery were spurned.

There is a five-minute segment where the children are unable to understand Ms. G and unable to remember anything about an event that had happened two weeks before, a camp-out sleep-over. Ms. G runs through a dozen different types of memory prompt to no avail. She had not been there, but people had been full of stories about the event for days. Listening to the tape of the documentary preparations suggests that it was not that the children would not say what they remembered but that they really did not remember. Finally, Ms. G exclaims, "Well, I guess your part isn't going to be a documentary about our camp; it's going to be an expose! All the children were supposed to go to the cookout and sleep-over, but it seems like you two were left out!"

This went on for ten minutes. The resource available to the adult was the work and its conditions. At a precise time, the children would have to enter the recording studio and do their jobs. There was no out; only the children could do the work, and it had to be done. It was the children's story of what had happened during the camp and what they thought had been good and bad about it. Everybody had to meet the time deadlines because of the scarcity of equipment and time. Finally, with just twenty minutes left, the children turned to the work:

Ben: I'll write the sleep-over, okay? You write the first week.
Rex: Okay.
(Later)
Ben: I'm making a mess here. I need a big blank sheet of paper.
Ms. G: Okay. (gets him one)
(Later)
Rex: (Trying to read one of the planning prompts, a typewritten sheet with questions and lines for written answers) What does this mean? (pointing to a line of text)
Ben: (Looking where Rex points) It has to mean *of* the first week, because the sleep-over didn't last a week. (This statement may appear obscure, but it correctly interprets the meaning of the text.)
(Later)
Rex: Do we have to do the whole page?
Ms. G: No, just as much as you want.
Rex: We'll do two more.
Ben: No, we have to be sure to do The Fifth Dimension.

They devised an outline for their presentation and a means to use notes to replicate it on camera. Each child demanded Ms. G's help with remembering, evaluating, ways of expressing, spelling, and writing notes and reading them. She was taxed to the limit of her abilities as the children took on the work. So were they: They knew what they wanted to do and what it took to do it, and they would not settle for anything but the best from themselves.

When they got to the planning prompts that asked the children to look to the future, to say what they thought about how their summer experience related to school and even real life in the future, Rex had difficulty again. He returned to claiming that the audience was not worth making a documentary for. He wanted to talk about hitting home runs in baseball, which had not been one of the summer experiences at the camp:

Rex: I want to say... (He is cut off.)
Ben: You mean like what we'd do next year?
Ms. G: Yeah, or even later.
Rex: (Cutting in, laughing) You know what we should say... (He is cut off.)
Ben: Like in college?
Ms. G: Umm...
Rex: (Cutting in, talking to himself) ... About pitching no-hitters.
Ben: (Also talking to himself) Responsibility.
Rex: What should I put down, man? (plaintively)

Soon, time was up. The two, who earlier had been full scofflaws about the whole enterprise, rushed down the hall to record, one worrying about a frog in his throat, the other about butterflies in his stomach. Only Ms. G got off task, with a comment about bodies turning into zoos.

In the studio, Ben and Rex continued to organize Ms. G to give them help—about personal appearance, style, and basic reading. They asked for repeated practice on their short presentation. They invented a way to mark the script to indicate who the speaker should be. And, Ben continued to organize Rex, to the degree that anyone could. Their final presentation was quite smooth, both children reading not like they usually did, stumbling and using a special "reading intonation," but instead quite like television announcers. The one problem came at the end, as Rex was talking about the future:

Rex: We study ba... (cutting himself off). Wait a minute. In school, we study baseball to go to college. Uhh.

A zone had been created: the work activity structure, the children entering into it, the adult help, and some changes in each child's literacy performance. What the children could not do currently under the conditions of the school, they could do under these other conditions.

Microgenesis of Leading Activities

The examples that we have given so far concentrate on a single leading activity in conjunction with school tasks. However, we also believe that it is possible to show changes in leading activities that follow development sequences within a single setting. In the course of work investigating the role of social organization in cognitive change (Newman and others, in press), we instituted "child only" or peer activities among fourth-graders. In order to do so, we constructed a sequence of leading activities. At one point, we were trying to get the children to engage in a combinatorial logic problem and concretely to make as many pairs as they could from a set of four chemicals. The sessions started out as play, moved into peer activity, and culminated in educational activity.

A Playful Start. Costumes and props identify play in many societies and in many age groups. We provided the children with costumes: small-sized, white, button-down-the-front lab coats. They were still too big for many of the children, but the children, with clumsily rolled up sleeves and coat hems touching their shoe tops, did look like scientists or, rather, like youngsters playing at being scientists. We provided test tubes, test-tube racks, beakers, squeeze-top droppers, and glass rods for mixing, and we arranged them on a table with a cabinet base, like those seen in many movies about laboratories. We also provided the children with a chart for recording experimental results.

The children responded in play. As they were putting on their coats, they started to characterize the activity. They referred to themselves as doctors or as Frankenstein. They made jokes as if they were in medical settings or in a mad scientist's lab. For some groups, the joking continued, although a little sub rosa, as the teacher told them about the task and showed them the equipment. When the teacher told them about being careful of their clothes and about washing their hands in case the chemicals bothered them, the joking surfaced again, a little nervously. We arranged for the teacher to be busy with something else, so she left the children alone. The joking stopped as the children began to organize to do the task without the teacher as a resource.

The Peer Activity. There were two or three children in each of the dozen groups that we arranged. When two fourth-grade girls and one fourth-grade boy work together, one level of the division of the work is easy to predict: The girls do one part, and the boy does another. Other hallmarks of peer organization of this age group also emerge. Friends bend over backwards to give and take a fair share, to have equitable turns. Those who are not as friendly have tussles about the materials and equipment.

Although the teacher's instructions specified what the task was—to make all the possible pairs with no duplicates—the children did not start out doing that task. They showed no orientation to an epistemic solution—no evidence that anyone could know ahead of time how many and which pairs there should be. Instead, they made pair after pair, enjoying the interesting

effects produced by their combining actions. They did not plan what to do next on the basis of some "next" combination's being the logical one to do. More practically, the next pair was chosen on the basis of what a child could find or could talk or wrestle a peer into giving up.

For many groups, however, the task emerged from the peer organization. A question would arise about whether one child could have another turn or not, a question that could be resolved by figuring out whether there was another pair left to be made or whether all the pairs had been done. Or, a question would arise about whether a particular chemical had to be given up by a child so that it could be combined with a chemical that another child had possession of, again occasioning a transformation of the task to see whether that pair had already been made or whether some other pairs were left to be made before possession had to be relinquished. It should be noted that the children were not necessarily being selfish. Sometimes, the fairness issue was raised by a child who would not personally profit. But, under such circumstances the task could emerge. Some children turned to an epistemically well-organized procedure for getting all the pairs that were possible from the set of four chemicals.

The Educational End. For some groups of children, the task did not emerge during the peer activity. However, the teacher returned and helped them to answer her questions about whether they were finished and about how they knew that they had made all the pairs that they should have. Even the children who had not discovered the task in the peer activity engaged in it with their teacher's help.

For the children who had discovered and accomplished the task in the peer activity, it became different in the educational activity: The focus was on how the children knew that they had made all the pairs, not whether there was one concrete pair left. The children reported their results in a more orderly fashion, from which an abstract structure could be more easily discerned. The children did not identify their individual contribution to the effort as a way of reminding themselves of the particular event of mixing a pair. Rather, they relied on a logical procedure to organize the mentioning of the pairs and to account for their certainty that no pairs had been left out of the collective effort.

Sequences of Activities. When ontogenesis is considered, the sequence of these three sorts of activities is play, followed by education, followed by peer activity. When this age group is considered, its members can be seen to be on the brink between education and peer activity as leading activities. It is clear that the peer activity provided a Zo-ped in which some of the children could engage in the formal operational task in a way that is not common for fourth-graders. But, it is also clear that the educational activity provided a Zo-ped for other children and for a different sort of analysis for those who could go beyond themselves in the peer activity.

In the analysis, Newman and others (in press) point out that the peer

activity is valuable for child, teacher, and researcher because it is an occasion where children can discover the task. In many activities in classrooms, we can only observe children working within prepared goal structures provided for them by the teacher or experimenter. The task is the question, and the environment is managed so that most of the interactions involve answering it. There is little chance for children to find questions that adults are not actively asking (and that they already know the answers to), and there is little chance for researchers or teachers to monitor or promote the children's development in this regard. It appears that play activity is an available mediating device. The role playing invited the children into an interaction with materials and with each other from which the adult's planned task might emerge. The children stopped playing when the costumes and equipment lost their novelty and when the children lost their teacher. They gave up the peer activity when it had done its work—provided them with the occasion to discover, with certainty, a solution to their task.

The Zo-ped Expanded

LCHC has a long-standing concern about the methodology and theory that is required to conduct a serious examination of cognition outside laboratories and schools and to see the variations in thinking with which humans provide themselves as a hedge against unknown ecological presses. Our interest in human diversity is not a commitment to variety as the spice of life but rather to variety as the source of the future. Supported by an examination of the broader context of Vygotsky's work, we are looking beyond the understanding of the Zo-ped as a reaction to inappropriate standardized assessment measures for a variety of next steps.

We have expanded our ability to see gaps—divergences in which development occurs in a variety of leading activities. The adult role in the functional system differs from activity to activity. It does not always provide support for a stepwise progression, and it does not always assume the executive or higher-order functions. We see the diffculties in getting subjects to discover tasks in different activity settings, even in getting them to engage in the activity at all, but exactly these difficulties are the occasions for us to see the movements, the new creations of a developing organism. Adult wisdom does not provide a teleology for child development, Social organization and leading activities provide a gap within which the child can develop novel creative analyses. As Emerson (1983) puts it, a Zo-ped is a dialogue between the child and his future; it is not a dialogue between the child and an adult's past.

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This chapter integrates Vygotsky's concept of the zone of proximal development into a field-theoretical conceptual framework based on the axioms of the theory of open systems.

Construction of the Zone of Proximal Development in Adult-Child Joint Action: The Socialization of Meals

Jaan Valsiner

Following the methodological ideals of the hard science of classical mechanics, psychology at large, including developmental psychology, has developed its conceptualizations of psychological phenomena on the basis of the axioms of closed, rather than open, systems (Bertalanffy, 1981). Thus, the developing child is usually construed by psychologists as an individual person in himself or herself, the importance of whose relationships with the environment is at best mentioned but very rarely studied. This rarity of attempts to study children's development within environments follows logically from the definition of psychology as a science dealing with psychological phenomena abstracted from their contextual embeddedness (Super and Harkness, 1981).

In contrast, the complex structured phenomena of biological and social realities are more adequately handled on the basis of the theory of open systems. The subject matter of research on child development is the interdepen-

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