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INTERSUBJECTIVITY THROUGH THE MASTERY OF SEMIOTIC MEANS IN TEACHER-STUDENT DISCOURSE

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Abstract

Vygotsky's ideas about the semiotic mediation of intermental and intramental functioning are harnessed to examine teacher-student interaction. In particular, the semiotic means for creating intersubjectivity are explored, with an emphasis on how it is possible for students to participate in classroom discourse without understanding the full meaning of what they are saying and doing. An example involving the use of graph paper to plot statistical evidence from a biology project is used to illustrate how material sign vehicles allow students to demonstrate "performance before competence" and how this can provide the means for them to appreciate statistical reasoning at increasingly higher levels.

Key Words: instructional interaction, Vygotsky, intersubjectivity, semiotic mediation

Throughout his writings Vygotsky emphasized that the dynamics of word meaning involve a struggle between thought and discourse, a struggle that he viewed as being at "the conceptual center of our investigation" (p. 245). This point was so central to his approach that he asserted, "The discovery that word meaning changes and develops is our new and fundamental contribution to the theory of thinking and speech" (1987, p. 245).

Vygotsky took this claim to apply to "microgenetic," as well as ontogenetic forms of development, asserting that word meaning "changes during the child's development and with different modes of functioning of thought" (1987, p. 249). Regardless of which "genetic domain" (Wertsch, 1985) is at issue, the general picture Vygotsky had was one in which thought is taken to be a relatively inchoate, "fused, unpartitioned whole" (1987, p. 251) that comes into contact with words, which involve generalization and discrete, sequential representation.

This dialectic between thought and word was at the heart of what had concerned Vygotsky for several years leading up to the formulation of the issue near the time of his death in 1934. In fact, it was part of discussions in which he had engaged since the time he had been a student in the seminars of Gustav Gustavovich Shpet (1879-1937). An intriguing figure in his own right, Shept was the focus of increasing repression in the 1930s and eventually was tortured and executed in the Siberian university town of Tomsk. Given his grisly fate and the direction in which the Soviet Union was moving in the early

1930s Vygotsky's failure to cite Shpet in his later writings is understandable. But the influence of this figure on many of Vygotsky's ideas, especially those developed in Chapter 7 of *Thinking and Speech* is clear.

If we trace this intellectual genealogy back yet further, we encounter the influence of two other major figures: Wilhelm von Humboldt and Edmund Husserl. Shpet's debt to the philological tradition of the former is evident in one of his most interesting and important works, *The Inner Form of the Word* (1927), which had the subtitle *Studies and Variations on a Humboldtian Theme*. And the influence of Husserl derived from some of the most formative influences on Shpet's intellectual life. As a young man he had traveled to Europe to apprentice with this great figure in phenomenology, and he maintained personal communication to the extent possible even into the early years of World War I. The influence of Husserl is manifest throughout Shpet's writings, and his first major work, *Appearance and Sense* (1991/1914) is generally viewed as the work that introduced Russian and Soviet scholars to phenomenology.

This digression in intellectual history is worth making because it provides some insight into Vygotsky's claim about how word meaning develops. Although chapter 7 of *Thinking and Speech* deals with several experiments and other empirical psychological studies, its main concern is a philosophical issue raised by Shpet, Husserl, and Humboldt. This intellectual heritage provides the context for understanding his claims about the dialectic between word and thought and the more general line of reasoning about the relationship between semiotic form and meaning.

From this perspective the dialectic involved is between a material sign form (what Charles Sanders Peirce called a "sign vehicle") and object-oriented intentions of speakers or listeners. It always involves an element of collision and conflict between a sign vehicle, whose meaning tends to abstract and generalize and belongs to an ongoing semiotic community, on the one hand, and the unique, spatiotemporally located intention of the individual, on the other.

This process has been described under the heading of "articulation" by Shpet. Semiotic action, including saying something in ordinary language, typically involves an element of articulating, or breaking up into a discrete, generalizing signs a thought or intention. In this view the thought or intention is something associated with an individual operating in a unique context and does not come in pre-segmented form. Instead, it is simultaneous and amorphous. The particular sign system (e.g., English, Russian, statistical notation) that we employ to articulate a thought imposes a particular organization on this thought, one that differs from other possible sign systems that could have been employed.

This view of the dialectic between thought and word, or more generally, intention and sign, has important implications for the analysis of socialization and instruction. These start with the underlying assumption that the outcome of instruction is "knowing how" rather than "knowing that" (Ryle, 1949; Bechtel & Abrahamsen, 1991). Specifically, it is knowing how to employ cultural tools such as language or mathematical techniques. This focus on the "mastery" of cultural tools (Wertsch, 1998) differs somewhat from our usual way of talking in which we speak of the need to understand or know concepts, and the different emphasis it brings has implications all the way down the line of reasoning

that follows.

The goal of instruction from this perspective is to help students become fluent users of a sign system. The outcome is a sort of “distributed cognition,” to use terminology from contemporary cognitive science. Namely, it involves distribution between cultural tools and the active agents employing them. From this perspective, instruction amounts to a sort of “taming” or “domestication” of novices’ interpretations of the world. This domestication has both benefits and costs because cultural tools inevitably bring with them “constraints” as well as “affordances” (Wertsch, 1998). For example, learning to deal with a set of data by employing a particular statistical technique provides insight into patterns that would otherwise remain undetected, but it also entails being less able to see other patterns that could be revealed by employing a different technique.

From a Vygotskian perspective, the process of mastering a semiotic tool is fundamentally social, though it of course has individual psychological moments and outcomes as well. In his “general genetic law of cultural development,” Vygotsky made this point by arguing that higher mental functioning appears first on the “intermental” and then on the “intramental” plane. When encountering a new cultural tool such as a statistical instrument, this means that the first stages of acquaintance typically involve social interaction and negotiation, between experts and novices as well as among groups of novices. It is precisely by means of participating in this social interaction that interpretations are first proposed and worked out and hence are available to be taken over by individuals.

One of the properties of the sign systems that are at the heart of instruction is that they are incredibly robust in that they can allow interpretation and understanding at many different levels yet still support the intermental functioning required to move learning and instruction along. It often seems to be possible to use these sign systems to communicate even with a very low level of shared understanding of their full implications. Indeed, most of us probably speak, calculate, and carry out other semiotic action most of the time without understanding the full power of the sign systems we are employing. In the famous image of Edward Sapir (1921), it is as if we are harnessing a dynamo capable of generating a huge amount of electricity just to power a doorbell.

An implication of this approach is that it is possible for students who are novices at using a particular sign system to begin to use sign vehicles without understanding all that much of their meaning, at least in the way it is understood by competent users. This appears to be counterintuitive when considered from the perspective we usually employ in Western social science. The reason for this is the implicit commitment to methodological individualism that underlies so much of what we do. From this perspective, it is impossible for a speaker to say something if she does not first have a relatively clear and articulate idea. From such a perspective, meaning and understanding are properties of the individual rather than of a dialectic between active agent and cultural tool.

The Vygotsky-Shpet perspective we are outlining suggests that something fundamentally different is often involved. Namely, the act of speaking often (perhaps always) involves employing a sign system that forces us to say more (as well as perhaps less) than what we understand or intend, more in the sense that interlocutors may understand us to be conveying a higher level message than our mastery of the sign system really justifies. This is so in everyday communication, even when we are speaking about topics

on which we have developed real expertise, but it has particularly important implications when it comes to how novices participate in intermental functioning in instructional settings.

The notion of “intersubjectivity” provides another useful part of a framework for dealing with these points. This is a notion that has been explored by figures such as Ragnar Rommetveit (1974, 1979) in connection with human communication in general and Barbara Rogoff (1990) in connection with human development and socialization in particular. Recently, Rommetveit has provided the following illustration of this phenomenon:

Imagine the following situation: A lady who is a very knowledgeable amateur auto mechanic discovers that there is something wrong with the carburettor of her car. Her husband, who is notoriously ignorant about car engines and does not even know what a carburettor looks like, offers to drive the car to a garage to have it repaired. He tells the car mechanic at the garage: “There is apparently something wrong with the carburettor.” This saves the latter considerable time in searching for the problem.

For Rommetveit, the point is that the husband in this case may have attained only a very minimal level of intersubjectivity with the mechanic when it comes to understanding the idea and function—and even the referent—of “carburettor.” However, he was still capable of passing along the message from his wife because he was harnessing a sign vehicle that did part of the work for him. As Rommetveit notes, instead of assuming that the husband possessed the understanding that could fully back up this utterance, he was involved in an episode of “ventriloquation” that allowed him to say more than he understood.

The point of Rommetveit’s example is not to encourage us to go about using expressions for which we have only a minimal understanding. Indeed, his example is clever precisely to the degree that it manages to do something unusual in this regard. In socialization, learning, and instruction, though, the point of many exercises may be to put us in a position not unlike that of the husband in this illustration. The standard situation in many instructional settings involves students’ saying and doing things that they only partially understand. This raises what might appear to some to be a paradox of how it is possible to say more than one understands, but it makes sense if one recognizes that the material form of sign vehicles allows us to function at a level that is “out ahead” of our current mastery.

But the point for instruction goes beyond this. Not only may it be possible, but it may be *desirable* for students to say and do things that seem to extend beyond their level of understanding. This is because such a possibility means they can enter into a basic form of intersubjectivity with more experienced teachers and experts and thereby leverage their way up through increasing levels of expertise. What might at first appear to be a failure to communicate is often the key to entering into a new area of instruction.

Methodological Challenges

The ideas of Vygotsky, Shpet, and others are often viewed as insightful and inter-

esting, but the implications of these ideas for empirical research are not always obvious. This should perhaps come as no surprise, given that Vygotsky was influenced by phenomenology, a school of thought that resists usual positivist analyses based on relationships between independent and dependent variables and so forth. Instead of trying to formulate things in such terms, it would seem that some sort of textual and discourse analysis would be appropriate as an approach to empirical research, and that is what we propose here. To be sure, this sort of approach can-and should-be complemented by others that involve controlled experimentation, large scale quantitative analyses and so forth.

The basic issue for empirical research in the Vygotsky-Shpet framework we have outlined is to determine how well subjects have mastered a word or other semiotic means. What sort of evidence can we muster to assess whether someone knows how to use words, statistical techniques, and so forth? How domesticated is their thinking and how fluent and appropriate is their mastery of these means? These are the kinds of questions that arise from such a perspective, and the answers would seem to be found in fine-grained analysis of the processes involved in intermental and intramental functioning. This means looking for evidence about whether a student is using a term or other semiotic means appropriately or responding in a way that suggests they understand the use of the term by another speaker.

The biggest problem that emerges in this regard is typically that investigators cannot be certain just how much students understand when they use, or respond to a term, even when that use or response seems to be appropriate. This follows from the robustness of these terms as outlined above. What makes methodological sense when using this perspective is to employ a conservative measure that gives credit to a speaker or listener for no more than the minimal understanding that is required to use or understand a term in the particular case. It is relatively easy to identify when students use or respond to a term *inappropriately*, and this certainly provides another major source of evidence. What is less clear and more difficult, however, is knowing when to credit someone with genuine mastery of a cultural tool.

Mastering Semiotic Tools in Instructional Discourse: An Illustration from Statistics

In an attempt to harness-as well as develop further-the ideas we have outlined so far, we turn to analyzing one segment of the interaction that occurred in a science classroom discussion. This discussion concerned how different levels of light affect the growth of plants. "Day 1" of the videotaped interaction started as follows:

MR: We're going to have you look at some data from your fast plants. It's data from day 19, and they're the plants in F6, and they're in high light. The reason we put those plants together is because there's no difference between the high light and F6. They're both under the same amount of light. We're gonna give you a sheet of graph paper, and I want you to organize the data in some way. We're gonna have you try to determine what's the typical fast plant at day 19.

RL: Another question we might ask is how spread out are the fast plants at day 19?

For the teacher or anyone else with any level of expertise in analyzing data of this sort, there are at least four obvious clues as to what is expected here. First, MR gives

the students graph paper. This paper qualifies as a cultural tool (specifically, a sign vehicle) that can be used to help individuals organize and summarize their data such that patterns become more obvious. This is a cultural tool that encourages individuals to take advantage of their powerful visual perceptual processing capabilities for understanding patterns in the world, but in order to afford this possibility, it must be used in an appropriate way.

Second, MR specifically mentions that he wants the students “to organize the data in some way.” He does not tell them which way, but he assumes that the graph paper affords certain possibilities of doing so that will help them see patterns. Third, MR mentions that he wants the students “try to determine what’s the typical fast plant at day 19.” In this context, the term “typical,” a term he repeats several times in what follows, has a special meaning. Namely, it points to a set of procedures for assessing the central tendency of a data set. And fourth, RL tells the students they should be asking about “how spread out” the data are. In this context, the notion of being spread out reflects a concern with what is called variation in the language of statistics.

In the discussion that follows, it becomes quite clear that, at least initially, the students’ understanding of how to use graph paper and how to organize the data, as well as their understanding of the terms “typical” and “spread out” have little overlap with that of the instructors. The group composed of Tanner, Kevin, Erica, and Jessica initially proposed to put one number from their data set in each square on the paper. This seems to have been their first attempt to respond to the directive to “organize the data.” To be sure, they were using the sign vehicle provided to them, but they clearly did not know how to use it as an expert would. Their performance was in some sense distributed between themselves and the cultural tool, but they were using this tool at a very low level of sophistication, one that might simply be termed inappropriate. In this sense, their use (misuse?) of the cultural tool bears a striking resemblance with young children’s use of cards as memory cues in Leont’ev’s “forbidden colors task” (Vygotsky, 1978).

In this context the group leader, Leona, notes, “It looks like the numbers will go from 30 to 255.” Jessica then says that the chart they are making could go from 1 to the biggest number, and Leona points out that they could not get this on the graph paper they have (presumably along the horizontal axis).

Up to this point the graph paper has served as a material sign vehicle that is interpreted at quite different levels by the participants in the conversation. The students are using it at a primitive level and see it as providing a set of blank spaces to be filled in with an ordered set of numbers. Why they are doing this is unclear-apparently to them as well as Leona or anyone else, but the graph paper does serve to impose some organization on the processes they are carrying out and hence is serving as a cultural tool that at least serves as a common material object of focus for the students and Leona.

Even at this primitive level of understanding and intersubjectivity, Leona was able to take advantage of the cultural tool to impose some order on the task by pointing out that the range of numbers in their data would not fit on the graph paper. Her move took advantage of this cultural tool to rein in the students’ seemingly aimless wandering and was an attempt to push their thinking to a higher level. An indication that they did

not really know what they were doing up to that point and realized this can be found in the fact that they immediately gave up on their first proposed use of the graph paper. This suggests that they were using the material form of this cultural tool but understanding very little in the way of how it could help organize their activity in a socioculturally appropriate way.

At this point, Leona posed the question, "If we want to show numbers from 30 to 255 on the range, what would we be thinking about? How many numbers do you have to cover from 30 to 255?" Jessica responded by pointing to the numbers recorded on the board and answering, "Sixty-three" (the number of data points on the board), indicating that the level of intersubjectivity between Leona and herself was still quite low. Again, however, it is worth pointing out that the relatively low level of intersubjectivity that had been attained at this point was possible because of the robustness of the semiotic means they were employing. Without attaining *some* level of intersubjectivity, there is little hope of leveraging it to a higher level in such cases.

At this point, Leona provides uptake to Jessica's response by using part of it as a "thinking device" (Lotman, 1988) and turning it into the next instructional question she poses, "What is our range of values? There are 63 numbers, but they go from 30 to 255. So, how much can they...?" And to this, Jessica responds, "Two hundred and twenty-five." This interchange takes the form of an I-R-E sequence, with all its pluses and minuses. On the one hand, this sequence served to give rise to an answer (one that is getting closer to an expert's understanding of the setting), but on the other hand, this answer was backed up with very little understanding of what function it served. Jessica could answer Leona's immediate question, but she demonstrated very little understanding of why Leona was asking the question and where she was going, providing additional indication of a low level of mastery of the cultural tools being employed.

The students' responses at this point indicate that she was continuing to focus on the number of points in the data, not the range of values in the data. This confusion, or misunderstanding of the proper use of the graph paper, continues into the next stage of interaction. There, Leona points out, "So, somehow we need to show 225 numbers on the paper," and in response Jessica, Erica, and Tanner start to calculate how many squares are on the graph paper, apparently in order to determine whether there were enough for their data. They continue to talk in terms of simply writing down numbers in the squares on the paper, whereas Leona is talking in terms of the range of values and how these values might usefully be divided into segments and displayed in the form of a histogram. When she realizes that they are calculating the number of squares on the graph paper, Leona finally asks them what they are doing and responds by noting, "Well, we don't want to know how many squares there is altogether, right?"

Realizing that the students still were not using the cultural tool they had been given in the appropriate way, Leona finally asks them to reflect on what they are doing, saying, "Let's think about what we want to know. So, we have these numbers from 30 to 255. What would be a good way of showing our data to make sense?" This increasingly direct form of "other-regulation" (Wertsch, 1985) still does not result in the redefinition of the students' use of the graph paper to represent data values rather than data points. One student makes this obvious by noting that they have more than enough squares on the

paper to show their data.

At this point, some twenty-four minutes into the session, Leona switches from using questions and other forms of indirect other-regulation to encourage the students to see her point to an explicit proposal for how the graph paper should be used. She explicitly and directly proposes (24.14), "It would be possible to group the numbers in one square, like from this to this, and then put an X there for each value in that range, like a frequency table or histogram," and this seems to generate a new insight in the students as to how the graph paper could be used as a cultural tool to get at the issues of central tendency and variation. Erica's "Oh!," followed by a pause, is suggestive in this regard.

Leona does not leave things at this, however. She moves on ahead with more concrete suggestions about grouping the data points together (e.g., 30-50) and marking the values in that range. Building on Leona's suggestions, the group initially discusses whether the range for each square should be 20 and then decides on 10. At this point, Erica says, "OK, we could do that. That's a good idea. It makes sense to me!" and Tanner responds, "Yeah, I get it. So you write 1 to 10 and put x for all the numbers from 1 to 10." In accordance with our comments about methodology, one cannot be certain how much the students really understand the setting and the use of cultural tools at this point, but they are clearly much closer to an expert's perspective than they had been earlier in the session.

Conclusions

The preliminary and partial analysis of classroom interaction that we have provided is intended to illustrate a few basic points about the Vygotsky-Shpet approach to instruction and learning. The first of these is that the goal of instruction from this perspective is to encourage students to master the use of cultural tools. Success is reflected in the ability to use these tools flexibly and fluently, and it involves a form of distributed cognition, one that involves active agents' use of semiotic means.

Given that the goal is to socialize students to use socioculturally provided and sanctioned semiotic means, the issue is how to engage them in a way that will lead to increasing levels of expertise. We have discussed this in terms of how it is possible to create initial levels of intersubjectivity when interlocutors have much different levels of understanding of what the task is and how to leverage that to higher levels of intersubjectivity and expertise.

In this particular instance, the cultural tool involves a complex mix of items. On the one hand, the students and Leona use the graph paper, which by itself imposes various degrees of organization on their activity. But there are many things one could use this graph paper to do, reminding us that another crucial part of the cultural tool has to do with histograms. These serve to organize data such that it is made available to powerful and efficient human visual processing capabilities, a technique that lies behind other strategies involved in calculation as well (Rumelhart, Smolensky, McClelland, & Hinton, 1986).

When using the graph paper in this context, two things become quite apparent. First, it is a cultural tool that allows novices and experts to enter into intermental functioning even when the two parties understand the task in very different ways. It is in

this sense that the graph paper is a very robust material sign vehicle. It allowed Leona and the students to begin a discussion of what to do with the 63 data points at a very low level of intersubjectivity. But it is precisely this that then made it possible to move on to increasing levels of shared understanding of the data and how they are to be analyzed.

In the terms we introduced earlier, by working with the graph paper as a sort of mediator between different levels of understanding of the task at hand, Leona was gradually able to domesticate the students' wide-ranging thoughts in this context. At one point she cleverly pointed to limitations that seem to exist in the graph paper itself, and this seems to have been sufficient to get the students to move away from one intention they seemed to have had. For the most part, however, she had to introduce increasingly direct forms of other-regulation to rein in the students' ideas, but she constantly negotiated this by harnessing the graph paper as a cultural tool.

On the one hand, this process could get off the ground only because the robust nature of this material sign vehicle offered possibilities for establishing intersubjectivity at very low levels. On the other hand, this sign vehicle provided the means for Leona to introduce increasingly complex notions of central tendency and variation that are evident upon visual inspection of the histogram, so the whole process was characterized by increasing levels of shared understanding of how to use a set of cultural tools.

An idea that has had a powerful impact on instruction in science and mathematics is constructivism, and it is worth ending with a few comments on how our analysis fits with this school of thought. In one sense, the Vygotsky-Shpet approach stands in opposition to constructivism because it focuses on the notion that human socialization involves mastering the cultural tools that are provided by a sociocultural setting. Becoming adult means being socialized into an existing social order, characterized by an existing set of cultural tools. From this perspective the essential point is that no amount of exploration on the part of novice students will yield the discovery of things like graph paper and histograms. These are historically evolved cultural tools, and the goal of instruction is for students to acquire mastery of them.

On the other hand, a great deal of the negotiation of meaning and intersubjectivity involved in our example looks like the kind of processes that are of interest to constructivists. Although the students did not discover graph paper or histograms, they did not simply have them passed on to them or somehow implanted in them in readymade form. Instead, they discovered a great deal of the meaning of these cultural tools through active exploration. In this sense, it seems to us that constructivism has a great deal to offer and indeed addresses a weak point in Vygotskian theory. The assumptions that seem to characterize some of Vygotsky's writings about standard, old style, didactic instruction may have had more to do with the setting in which he lived and worked than with any theoretical desiderata.

The resulting picture is one of *socioculturally situated constructivism*. In order for instruction to be maximally successful, there must be room for the active construction and negotiation of meaning on the part of students. But this construction is viewed as occurring within the confines established by a set of semiotic means that have emerged in a sociocultural setting. From this perspective, students are invited to discover the

meanings that can be worked out when using certain sign vehicles, but they are not invited to discover cultural tools themselves.

All this raises several basic issues of practice. What sign forms are most useful and appropriate for creating a baseline of intersubjectivity in instructional settings? How can we recognize the interpretations and misinterpretations of these sign forms that novices are likely to bring to the table? And what forms of intermental functioning are most likely to push novices to the next level of expertise? In many respects these are standard questions for anyone interested in instruction and its improvement, but the insight brought by the Vygotsky-Shpet perspective is that instruction may be possible precisely because we can say more than we realize in instructional settings.

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¹ While “thought” in this case is an appropriate translation of the Russian term “mysl’,” the other term in the opposition, “slovo,” can be translated as “discourse” as well as “word,” something that points to the active, processual nature of the semiotic phenomena Vygotsky had in mind.