

Vygotsky and Cognitive Science: Language and the Unification of the Social and Computational Mind

William Frawley

(University of Delaware)

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William Frawley's original and wide-ranging new book embraces linguistics, artificial intelligence, philosophy, and psychology in seeking a reconciliation between contemporary cognitive science and Vygotskian psychology.

Lev Semenovich Vygotsky (1896–1934) was a Russian psychologist who founded the sociocultural school of psychology, which is based upon the *general law of cultural development*. This states that "Every function in the child's cultural development appears twice: first on the social level, and later, on the individual level: first, between people (interpsychological), and then inside the child (intrapsychological)" (Vygotsky 1978, p. 57). The proposed link between the external, *interpsychological* activity and the *intrapsychological* processes within the mind allows the internalization of the higher mental processes from their social origins. This process of internalization is central to Vygotsky's work and is focused upon within Frawley's book. Internalization is not a simple "transfer" or "copying" process; the structure and functions of the process change during its internalization and lead to the formation of an "internal plane of consciousness" (Leont'ev 1979). The individual's psychological functioning that emerges from this process reflects the nature of the culture from which he or she was derived (Rogoff and Wertsch 1984). The processes of social interaction that are the point of contact between the intra- and the interpsychological activity are mediated by sign systems such as language. Vygotsky places particular emphasis upon "inner speech," which is described as "thinking in pure meanings" (Vygotsky 1986), as opposed to the embodiment of external speech in words. He describes it as a "distinct plane of verbal thought," the "next plane" being thought itself (Vygotsky 1986). This process of inner speech is also of central importance to the arguments presented in Frawley's work.

In order to understand the direction of Vygotsky's approach, it is also important to recognize that sociocultural psychology is developmental. Children interact with adults in a society within which a sign system is available and it is through this mediated social interaction that internalization takes place. The emphasis upon the internalization of culture via semiotic mediation suggests that the nature of the relationship between learning and development is particularly interesting. Vygotsky introduced his own approach to this relationship in the shape of the **zone of proximal development**. This represents the crystallization of the internalization process, with particular reference to the school-aged child, and describes the most fertile interactions that occur between members of an educational culture and a learner. In addition to its influence upon sociocultural psychology, Vygotsky's work is also at the heart of the theoretical framework that has been built around the concept of **activity** in Soviet psychology. This concept has subsequently been clarified and expanded by Leont'ev (in

Leont'ev [1978, 1979], for example). This approach views human activity as oriented towards the satisfaction of an objective through goal-directed actions. Both the developmental approach of Vygotsky and his importance to activity theory are recognized within Frawley's book, but neither form the central point of focus, which is reserved for the process of internalization.

The emphasis that Vygotskians place upon the influence of external culture and social interactivity to the nature of an individual's mental processes creates a tension with the internalist accounts of mind that dominate contemporary cognitive science. It is this tension that Frawley aims to diffuse in *Vygotsky and Cognitive Science*. The process of internalization that is at the heart of the Vygotskian tradition is used to focus attention on the role played by language at the boundary of mind and world. This provides a common point of interest between Vygotskians and cognitive scientists. *Vygotsky and Cognitive Science* is divided into two parts. In Part 1, the author presents the foundations of his framework for a Vygotskian cognitive science, or **sociocomputationalism** as it is later renamed. Part 2 presents an explicit integration of the views of Vygotskians and cognitive scientists that is based upon this framework and is focused upon subjectivity, control, and control disorders.

In Chapter 1, "Internalism and the ideology of cognitive science," Frawley looks at the internal-external clash over the direction of explanation in cognitive science. He provides a sketch of the current state of play in the study of mind and suggests that the internalist-externalist dichotomy currently driving cognitive science falsely pits computationalism against socioculturalism. He suggests that a proper reading of Vygotsky reveals discussions of the internalization process and control that are consistent with both psychologists and computationalists.

Chapter 2, "From Plato's problem to Wittgenstein's problem," offers a framework for integrating externalism and internalism. Plato's problem, how do we know so much from so little? is supplanted by Wittgenstein's problem, how do we manage both the internal virtual machine and the external real machine? Plato's problem is central to the study of the mind. In his answer, Plato suggests that exposure to the world of ideal forms equips us with an inner system of universal truths. This is an internalist view that doesn't fit well into a Vygotskian perspective. Wittgenstein's problem explores units of mind that are neither wholly internal nor wholly external, and in this way Wittgenstein addresses the process of internalization. Vygotsky is therefore presented by Frawley as providing the empirical research program that Wittgenstein lacked, and a social psychology of action becomes Vygotsky's answer. The application of this answer can be seen in the ways that cognitive scientists and Vygotskians use language to access the connections between the internal architecture of the mind and the external context in which the mind operates. Thus Chapter 2 explores a framework, in the form of Wittgenstein's problem, that deals with the clash of Chapter 1 as it forces cooperation between computation and culture.

Chapter 3, "Architectures and contexts: Unifying computational and cultural psycholinguistics," argues for unity in terms of the relationship between context, which is defined as "the setting for thought" (p. 108), and architecture, defined as the "inner computational code" of the mind (p. 5). The study of these relationships in terms of the way that language mediates between mind and world and, through the process of internalization, leads to individual development allows Wittgenstein's problem to be translated into the empirical arguments of social and computational accounts of mind. This all sets the stage for a Vygotskian cognitive science focused upon three aspects of mind: **subjectivity**, **real-time operation** (also referred to as implementation or control), and **breakdown** or "control disorders."

Chapter 4, "Subjectivity: Consciousness and metaconsciousness," opens the second part of the book. Consciousness is explored by computationalists and was also the central issue for Vygotsky. This chapter is a good survey of the state of play with regard to consciousness, its proponents and doubters. Both computational and social approaches accept that there must be continuity of structure between lower mind and consciousness. Subjectivity is presented as having three modes:

1. nonconscious processing (also referred to as nonconscious information processing);
2. consciousness (also referred to as conscious awareness); and
3. metaconsciousness (also referred to as deliberate meta-thinking).

These three modes are characterized by an assembly of overlapping properties categorized under the headings of *structure*, *function*, *context*, *universality*, and *speed*. This chapter also contains three examples of cognitive science reinterpreted through a Vygotskian perspective: external representations and distributed cognition, nonlogical effects in inferencing and domain-specific thinking, and learning and teaching. These examples are also used to emphasize Frawley's suggestion that a Vygotskian cognitive science requires two mental languages: a language *of* thought and a language *for* thought (speech for self-conscious thinking).

Chapter 5, "Control and the language for thought," addresses the questions left unanswered in Chapter 4: where in a computational mind is sociocultural subjectivity? and how is metaconsciousness implemented? The language for thought is defined as "falsely dialogic signing for position that mediates thinking" (p. 178). Each of the units in this definition is explored in turn. *False dialogue* is used to convey the view that the language for thought involves the merging of speaker and listener. *Signing* is used to indicate that speech is not the only sign system of the language for thought and *for position* to emphasize the association between the individual self and linguistic viewpoint. *Mediates thinking* emphasizes the instrumental nature of the language for thought, which is not a further representational system at a higher level than the language of thought. Current private-speech research is criticized as being too narrow, as Frawley returns to the promotion of a context-and-architecture view of the language for thought. He uses various different language dialogue examples to argue that a reflexive language will mediate context and code, meaning that a context-and-architecture view will turn on the relative contextualization of self-referentiality. The linguistic structure of the language for thought is considered from the perspective of the meaning, form, and function of six linguistic phenomena: prediction, focus, evidentiality, person, discourse markers, and metalinguistic markers. Their cross-cultural differences, their early use by children, and their role in private speech are explored.

Chapter 6, "Control disorders: Splitting the computational from the social," spells out the principal lesson of the book so far: that the linguistic integration of computational and social mind depends upon the form and operation of the mind's control language. A catalogue of control disorders is explored: Williams syndrome, Turner syndrome, spina bifida with hydrocephalus, and autism. The linguistic deficits associated with these syndromes are presented as being disorders of knowledge as opposed to deficits in resources. The latter might be compensated for by increasing the resources available, but the disorders discussed in this chapter do not allow such a bypass. Frawley suggests that a useful computational perspective on these disorders represents them as interface management problems.

The Epilogue tries to address some of the questions that might come to mind after reading the book. The defining feature of cognitive science is presented as the pursuit of mind, requiring a "design-limitation account of computable representations" (p. 261). This leads to the suggestion that a Vygotskian cognitive science (sociocomputationalism) is an explanation of the "design of higher thought compatible with both sociocultural knowledge and external to mind and internally computed representations" (p. 262). It is described as a claim about how the world is in the mind by means of certain features of language and an account of computationally effective sociocultural information.

Vygotsky and Cognitive Science is an interesting and somewhat unexpected exploration into the power that can be gained when one steps back and reviews apparently conflicting theories to note that there are points of contact that can provide a much stronger approach to the same set of problems and issues being considered by each school of thought in isolation. It is certainly different from the other texts that use Vygotsky (Newman and Holzman [1993], Wertsch [1985a, 1985b], for example); nevertheless, it tackles difficult subject matter in a clear and concise manner. By trying to provide an implementable sociocognitive account of metaconsciousness, Frawley bites the bullet and attempts a difficult maneuver in which all hand-waving vagueness is out of bounds. Frawley observes that cognitive science and the Vygotskian approach each have something that the other lacks, and each can be read in terms of the other. The important cover terms *Vygotsky*, *computational*, *internalism*, and *externalism* are all defined very broadly, which results in wide-ranging discussions. However, there is differentiation within this breadth. Vygotskian accounts of the mind in context that do not provide a theory of the inside (Lave and Wenger [1991], for example) are not encompassed by Frawley's definition of *Vygotskian*; they are missing the opportunity to explore an implementable theory of mind: this is the computationalist's strength.

The book's discussion is presented clearly, and is written with authority and with relevant connections to the surrounding arguments and narrative. A diverse range of examples is frequently used for support. This includes puzzles such as Missionaries and Cannibals and Tower of Hanoi, dialogue analysis, programming in C and Pascal, and clinical defectology, to cite but a few. The overview flavor of the framework outlined in Part 1 is complemented by the concentration upon three points of focus—subjectivity, control, and breakdown—which provides an opportunity for more-detailed explorations in Part 2.

Frawley admits at the outset that his interest in Vygotsky's work is restricted to the internalization process as opposed to the theory of development. This selective treatment makes it difficult to judge who might find the book appropriate or useful. It certainly is not a detailed account of Vygotsky's work in relation to theory of mind or computational linguistics. It is an exploration into the energizing counterpoint that can result when apparently inconsistent approaches are viewed in a conciliatory way. It argues for the mediation of internal and external worlds using thought through language.

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