

## Cognitive Science in the 21<sup>st</sup> Century: Body, Society, and Culture<sup>1</sup>

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*In Memoriam: V.V. Petukhov*

The second half of the XX century has become an epoch of the explosive development of cognitive psychology and cognitive science, now a mighty interdisciplinary scientific domain with a great many of research centers and university programs all over the world. The information processing language has become a sort of *lingua universalis* for cognitive science as a new discipline, not just a conglomerate of sciences, with computer modeling a method acknowledged by all constituting disciplines. Hence, during the first decades of its triumphant development, cognitive science aimed at the elaboration of human information processing models. Such models could be limited to one or another cognitive process (e.g. memory or attention) or could rather represent a “cognitive architecture” implementing certain principles of information processing system structure as a whole. But anyway they were based on the metaphor of cognition as an information processing system, i.e. a technical device, thus most of the models have been limited to the processes with an obvious technical counterpart. In establishing the foundations of the new research domain, the human subject was reduced to a computer implicitly taking over all mental functions studied in psychology before.

However, from the very beginning of its development, the main lines of the cognitive science criticism, both from outside and from inside (see Gardner, 1987), have sprung. First cognitive studies have been criticized for neglecting consciousness as a prerequisite of cognition, for disregarding motivational and emotional regulation of cognition, for bypassing social nature of human cognition, as well as its aspects related to the structure and metrics human body and human actions both developmentally and functionally. Finally, the very idea of the brain as a computer has been called in question. In other words, the essence of all the claims has been that it is a human subject as a biological organism and a member of a certain society and culture (rather than an “information processing system”) which thinks, perceives, recalls, imagines, pays attention and makes decisions. The further development of cognitive science has demonstrated that these lapses and gaps would become the cognitive science growth zones in the 21st century.

Since then, the development of cognitive science could be described as facing the reality, giving birth to a number of trends which could be summarized as 3E+D, including

- Embodied Cognition, or, restating one of the cognitive science gurus, “cognition in the flesh”
- Embedded Cognition, or situated cognition, which means cognition within the context of activity
- Emotional Cognition
- Distributed/Social Cognition

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It should be noted that first two elements of the 3E+D formula are sometimes used as synonyms, or organized hierarchically, or even merged in the EEC (Embodied Embedded Cognition) concept. However, it seems important to distinguish them, as they reflect two different aspects of the rootedness of cognition: on the one hand, its relatedness to the body of the cognitive subject, either human or animal (body structure, its metric features, etc.), and on the other hand, with the environment in which our cognition operates and which becomes its integral part with a number of functions.

One way or another, but over the last years cognitive science has been developing in a more cultural-historical direction. As the “information processing system” gets back its flesh together with the ability to move and to feel, as it finds itself in a social environment and cultural context, and, last but not least, as it experiences inner dialogue as an intrinsic aspect of human consciousness in Vygotsky's interpretation, this inevitably leads to the revision of theories and models proposed to explain human cognition during half a century of cognitive science advancement.

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