Concept Formation in the Wild

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INTRODUCTION

Concept Formation in the Wild

In traditional studies of concept formation and conceptual change, the focus is usually on well-defined and stable concepts of natural sciences and mathematics. This is the domain of “formal concepts,” as Greeno (this issue) calls them in his commentary. On the other hand, news media, political debates, and problem solving in work activities are saturated with different concepts. Again following Greeno (this issue), we may call them “functional concepts.” These concepts are inherently polyvalent, debated, incomplete, and often “loose” (Löwy, 1992). They commonly cut across disciplinary boundaries. Different stakeholders produce partial versions of such concepts. Thus, the formation and change of functional concepts involves confrontation and contestation as well as negotiation and blending. Functional concepts are loaded with affects, hopes, fears, values, and collective intentions.

Although useful, the distinction between functional and formal concepts is also risky. It may be misinterpreted as implying a hierarchy—formal concepts being somehow higher and more advanced than functional ones. This special issue builds on the understanding that no such simple hierarchy is valid. Formal concepts are functional for culturally and historically very specific practices and epistemologies. Functional concepts encompass a huge variety of practices and epistemologies. The challenge is to start digging into and making sense of this variety. It is too valuable to be neglected.

This special issue opens up complementary perspectives for a new field of inquiry, namely, the study of the formation of functional concepts embedded in various collaborative activities, organizations, and societal institutions. This field of inquiry cannot be built primarily on theories dominant in traditional studies of the formation and change of formal concepts.

Several theories offer promising foundational ideas for the study of the formation of functional concepts. In this issue, Ivana Marková’s article draws on the theory of social representations (Marková, 2003; Moscovici, 1984). The article by Nancy Nersessian, as well as the article by Rogers Hall and Ilana Horn, draw on Hutchins’s (1995) work on distributed cognition. The article by Charles Bazerman uses Vygotsky’s (1987, 1997) ideas of internalization and externalization as a key source. The article by Jaakko Virkkunen and Päivi Ristimäki, as well as the article by Yrjö Engeström, Jaana Nummijoki, and Annalisa Sannino, builds on Davydov’s (1990) theory of ascending from the abstract to the concrete. These theories share an emphasis on cultural mediation as a central feature of concept formation. On the other hand, they are significantly different and partially critical of one another in ways that provide a rich basis for comparison and synthesis.
In the following, we summarize some key points of these theories. To facilitate comparison, at the risk of oversimplification, we use triangular diagrams adapted from or constructed on the basis of the original texts.

In Moscovici’s theory of social representations, social knowledge is coconstructed by the knower and by the other (other individual, group, society, culture). Moscovici (1984) proposed the dynamic semiotic triangle Ego–Alter–Object as a core model of the theory of social knowledge (Figure 1). As Marková (2003, pp. 152–153) pointed out, the dyadic relation Ego–Alter presupposes not only asymmetry but, above all, the relation of tension. The moving force in this epistemology is tension between the subject and the other: “With tension we have a dialogical triad, the dynamic unit of the theory of social knowledge” (p. 153). Thus, social and semiotic mediation is central for the theory.

This approach assumes that concepts are not acquired as single entities from strictly discernible attributes but instead, they are generated in and through social experience and communication from semiotic networks of signs and symbols in their socio-cultural and historical contexts. Rather than referring to attainment of formation of concepts, this approach refers to social representing. (Marková, this issue)

In her interpretation of Moscovici’s triangle, Marková (2003, p. 152) defined the object as “social representation.” What is represented, as well as mediation by material artifacts, seem to disappear from the picture. On the other hand, the other four theories discussed next seem to disregard the social and dialogical nature of concept formation. Moscovici’s “alter” is not a key component in those theories.

In Hutchins’s (2005) theory, elements of structure are projected from the inputs to a blend (Figure 2). The emergent structure of the blend arises through composition, completion, and elaboration. The crucial stabilizing factor is the material anchor superimposed on the initial input object or phenomenon. For Hutchins, material anchors are more than just words or signs:

Thus, a word can be seen as a material anchor for a conceptual blend, but the contribution of the material medium to the blended space is minimal. In the framework developed here abstract symbols that have arbitrary relations to their referents will appear as the weakest type of material anchor. (Hutchins, 2005, p. 1572)

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**FIGURE 1** The Semiotic triangle of Moscovici (1984, p. 9).
INTRODUCTION

CONCEPT: BLEND

INPUT1: PHENOMENON, OBJECT

INPUT2: MATERIAL ANCHOR

FIGURE 2 Hutchins’s (2005, p. 1557) model of conceptual blending with material anchors.


In Nersessian’s (2008) theory, a challenging target problem is conceptualized with the help of construction and application of a conceptual model, drawing analogical resources from a source domain (Figure 3).

Model-based reasoning uses simulation as well as limiting-case abstraction, idealization, generalization, and generic abstraction. Conceptual models may be represented in the form of equations, texts, diagrams, pictures, maps, physical models, and kinesthetic and auditory experiences (Nersessian, 2008, p. 180). Notable in Nersessian’s theory is an emphasis on the multiple steps of model-based reasoning in conceptual innovation. The model and consequently also the concept evolve through several cycles of abstraction, simulation, mapping, and evaluation. Nersessian draws of the work of Hutchins, yet goes beyond it.

The studies that first led to the development of the notion of distributed cognition were of highly structured task environments (plane cockpit, naval ship) in which people created their cognitive powers by making use of existing representational artifacts (Hutchins, 1995). These are dynamic problem-solving environments, but the artifact components of the system are relatively stable. The research labs we have been studying are ill-structured, problem-solving environments in which people design and build representational artifacts that in turn serve to articulate the nature of the distributed cognitive system itself. The need to develop concepts for understanding novel phenomena drives practices
that create the problem-solving systems from which the concepts emerge and develop. The comparison is akin to that between flying a plane and building the plane while it is flying—and with only a vague idea of what a flying vehicle might look like. (Nersessian, this issue)

Vygotsky (1987) is known for his analysis of the interplay between everyday and scientific concepts and for his account of development from collections to complexes and eventually to formal concepts. However, with regard to the mechanism of concept formation, Vygotsky’s idea of double stimulation is of central importance. In the theory of double stimulation, the initial stimulus situation involves a conflict of motives. The conflict is resolved by invoking a neutral artifact as a second or auxiliary stimulus, which is turned into a mediating sign by investing it with meaning (Figure 4). “Man placed in the situation of Buridan’s donkey throws dice and in this way escapes the difficulty that confronts him” (Vygotsky, 1997, p. 209). This breaking away from the initial conflictual situation proceeds in two steps: first, selecting an artifact (e.g., dice) and investing it with meaning, and second, taking volitional action by means of the mediating sign. In such a process of double stimulation the formation of will and the formation of concept go literally hand in hand. It is essentially a process of reframing or recontextualizing a problem situation. Vygotsky also emphasized the temporal dimension of the process: “The conflict between motives frequently occurs a long time before the actual situation develops in which it becomes necessary to act” (Vygotsky, 1997, p. 215).

In Davydov’s (1990) theory, the initial problem situation or task represents a diffuse sensorial concreteness. It is manipulated and transformed to find its basic explanatory relationship or “germ cell,” which will be represented with the help of a model. These actions of transformation and modeling involve tracing the origin and genesis of the problem. The model itself is examined and used to generate and solve further problems. This enrichment and diversification of the abstract model leads to the ascending to the concrete, that is, to a conceptually mastered systemic concreteness that opens up possibilities of development and innovation (Figure 5).

All the five theories regard concept formation as crucially dependent on the cultural mediation. The theory of social representations focuses on social mediation by the “Alter”; the four other theories emphasize mediation by cultural artifacts, including signs. There are also other interesting differences between the theories. Hutchins regards words and signs as very weak material anchors, and also Davydov is critical of narrowly logocentric notions of concept formation. For

![FIGURE 4 Vygotsky’s (1987, 1997) theory of double stimulation.](https://example.com/figure4.jpg)
Vygotsky, words are the most important mediators: “Fundamental to the process of concept formation is the individual’s mastery of his own mental processes through the functional use of the word or sign” (Vygotsky, 1987, p. 132). On the other hand, Hutchins and Nersessian only hint at the motivational and volitional aspects of concept formation, whereas for Vygotsky motives and will are central in double stimulation. Moscovici, Nersessian, and Davydov emphasize the longitudinal and iterative character of concept formation, whereas Hutchins and Vygotsky are more focused on relatively short-term processes of concept formation.

The articles of this special issue deal with a wide range of practices and social institutions, ranging from the care of patients with haemophilia to research in bio-engineering laboratories, statistical consulting, teachers designing their instruction, writing in academic disciplines, managers shaping the strategy of their company, and home care of elderly patients. What makes these cases representatives of “the wild”?

In the introduction to his book *Cognition in the Wild*, Ed Hutchins (1995) explained the meaning of his title as follows.

The phrase “cognition in the wild” refers to human cognition in its natural habitat—that is, to naturally occurring culturally constituted human activity. I do not intend “cognition in the wild” to be read as similar to Lévi-Strauss’s “pensée sauvage,” nor do I intend it to contrast with Jack Goody’s (1977) notion of domesticated mind. Instead, I have in mind the distinction between the laboratory, where cognition is studied in captivity, and the everyday world, where human cognition adapts to its natural surroundings. I hope to evoke with this metaphor a sense of ecology of thinking in which human cognition interacts with an environment rich in organizing resources. (pp. xiii–xiv)

This special issue builds on the general direction of research Hutchins outlined (see also Hutchins’ commentary in this issue). However, an important extension is needed. Hutchins
pointed out that in the laboratory, cognition is studied in captivity. This may create the expectation that there is a wilderness out there in which human cognition is free. We don’t think so. Human beings live in various degrees of captivity, within institutions and organizations that have their own rules, boundaries, and limitations. So “in the wild” does not mean “free of constraints.”

For us, “in the wild” refers to the fact that the constraints are never complete. In other words, human cognition and action are never fully predictable or programmable. Donald Francis Roy (1959) showed in his classic paper “Banana Time” how workers break up highly constrained monotonous work activity by creating episodes of off-task camaraderie and playful interaction. In laboratory experiments, too, subjects engage in subtle diversions and digressions; each subject tries to make sense of and deal with the constrained situation in his or her own way. When these attempts are highlighted and contrasted with the experimenter’s official script, even the laboratory may begin to appear as just one, admittedly impoverished, variation of “the wild.”

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REFERENCES