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CONCEPTS IN THE POTBOILER — THE FINAL DEBATE*

The domain of concepts is like a potboiler, as Fodor (1994) said. That's good news for us — the students of concept representation. We needn't worry about the job: there is still more and more to work on. And the aim of our workshop wasn't to give definite answers to the questions about concepts, but to keep them still open, while enriched, and to start some new inquiries. In the introductory part I enumerated the most frequent issues in our studies. This closing chapter is intended to deal with the most intriguing and even mysterious ones. Some of them match the list in the introduction, some others are restated here.

Concepts and words

The relation between words and concepts has always been in the focus of interests for epistemologists, linguists, and psychologists. For years, however, no one questioned that the relation is very close: words and concepts were treated as two sides of the same coin[1]. Concepts were formed to understand word meanings, words were to denote concepts (see e.g. Vygotsky, 1962, original edition 1934). The Chomskyan revolution in (psycho-) linguistics partly broke the obligatory character of that assumption. Lexical representations were placed in the modular linguistic system, organized mostly around formal-syntactic rules, and thus got partial independence of the conceptual system. However, close word-to-concept relations were quickly re-created in the generative semantics theories (e.g. Jackendoff, 1983). And, still more important, close word-to-concept links were never abandoned in the studies on concepts; moreover, most of the research on concepts were also claimed to be research on semantics (Keil, 1979, 1989, Carey, 1985, Markman, 1988, are only a few examples). With the possible exception of the studies on the classification

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* This section was intended to be open for every participant of the workshop, or to include the transcripts of the workshop debates. Unfortunately, most of the workshop debates were too technical for the purposes of this paper. I have also failed in my attempts to encourage the participants to write brief texts discussing selected critical aspects of the theories of concepts. As a result this section expresses only my personal view, and also my subjective interpretation of other participants' research. I am, however, indebted to all workshop participants whose papers and debates inspired me to write this text.

[1] What was however often questioned was the ontological and epistemological status of concepts, see e.g. Lyons, 1976.

of relatively simple visual patterns, technics used to investigate conceptual systems were, at least partly, verbal.

Nick Braisby and Bradley Franks re-opened the debate in their paper, and proposed an intermediate mental construct: perspective, which fixes conceptual content for word use. There are many open questions concerning perspectives: what is the mechanism for generating perspectives? What kind of rules do they apply? To what kind of inputs are they sensitive? And finally, how do they develop? Braisby and Franks locate perspectives at the pragmatic level, and the standard input to the perspective generating mechanism as pragmatic-situational. However, perspectives are claimed to be a very powerful mechanism to manipulate conceptual theory-like structures. Although perspectives cannot change the (relatively) stable theories, they can impose highly specific pragmatic constraints (or filters) onto conceptual knowledge processing. The question arises if, and how, it is possible to make this claim congruent with the modular (and so not transparent for other modules) character of conceptual domains, discussed later in this chapter. Also, to assign psychological reality to any mental construct it is necessary to demonstrate its developmental reality. The perspective generating mechanism (like other processes involving pragmatics) has to integrate knowledge from different sources: "theory of mind", social routines, physical reality, metalinguistic knowledge, and the most mysterious one: the "metaconceptual" knowledge which should allow the manipulation of conceptual content. How does the process of integration of these sources of knowledge develop? We would gladly offer some space in this journal to anyone who can develop that issue.

Another aspect, and another list of methodological problems in words-concepts-reality relations, were discussed by Tiia Tulviste. Both words and concepts (or words-via-concepts) refer to real objects. Any manipulation of concepts and words as mental objects requires understanding their representational, and, at least in the case of words, arbitrary character. The studies of the development of metasemantic awareness are part of that inquiry. However, Tulviste's critique of the state-of-the-art provides an excellent illustration for the applied part of Braisby and Franks' paper: standard measures of metasemantic awareness failed to activate appropriate perspectives in subjects, and thus did not access their actual knowledge. Tulviste, in Vygotskian tradition, links metasemantic awareness with reflectivity in thinking. However, thinking reflectivity itself requires appropriate conceptual tools. The necessary, but not sufficient one, is metarepresentation in either Leslie's (1994) or Perner's (1992) sense. The research on this, and the search for other necessary conceptual constructions, have to be done to answer both questions posed by Tulviste (which I restate here in my own words): (1) at what point in development does metasemantic awareness emerge (what are conceptual pre-requisites for it, which cognitive and communicational functions depend on it later in development), and (2) how does metasemantic awareness function, what kind of rules and conceptual tools does the subject apply to separate, and appropriately link, concepts, words and reality?

Shape bias

Studying the word-concept-reality link evokes another, relatively narrow, but intriguing problem: the shape bias in concept and word learning. Landau, Smith and Jones (1988, Jones, Smith and Landau, 1991), and more recently Imai, Gentner and Uchida (1994), have demonstrated that young children, asked to extend word meaning, extensively use object shape (but not size or texture) even if shape conflicts with category. However, if the task was purely conceptual and didn't contain the naming component, children chose

thematic or category rather than shape alternatives. The shape effect was one of the main topics in the discussion after Dedre Gentner's talk at our workshop. The most obvious interpretation of the results, shared by students of this effect, is that shape bias is a specific rule applied to concrete noun learning. However, this interpretation is baffling: how could shape (or any other perceptual information) be used to extend word meaning aside from conceptual representation of the word extension? Acknowledgment of this hypothesis requires loosening the direct word-to-concept relation. The word-learning mechanism should be then thought of as a relatively smart device taking as an input, as well as generating hypotheses and making decisions on the basis of, three independent sources of information: perceptual, conceptual, and linguistic (syntactic). Since not only Gentner, but also her opponents (Tardif and Gopnik) seriously consider at least bi-directional relations between word and concept learning[2], the idea of any (even partial) arbitrariness of word meaning in relation to concepts , and the direct access of the lexical system to any other "real world" (perceptual) information seems to be a hard challenge for theories of semantic and conceptual development.

A lot of new studies were run to show some limitations of the shape bias. Some of them are reported in Gelman's paper (this issue). In my lab we have replicated and extended Imai, Gentner and Uchida's (1994) procedure. The results (Haman, 1997) indicate that shape bias is sensitive to some changes in procedure, and to conceptual domain. In the most salient experimental condition shape bias was much stronger for animate natural kinds (especially for plants) than for inanimate nature, but there was a "texture bias" in the case of inanimate natural kinds. This result fits well those of our study of *ad hoc* categorization in adults (see Haman's chapter in this issue). The real role of shape and other perceptual properties in categorization and naming remains then an intriguing but open question. We are going on with our project, especially in attempts to identify the area of domain-specificity.

The problem of domain specificity is hovever broader. At least two of its components are of special interest here. These are: (1) the issue of the balance between domain boundaries ("within domain chauvinism") and cross-domain combination, both in actual thinking and developmental perspective, and (2) the issue of "special domains" - domains which take a privileged position on "the map of the mind". The first issue was widely discussed in my paper, so here I will focus on the second one. One of the approaches to domain-specificity[3] defines domains as cognitive modules in the narrow, close to Fodorian (Fodor, 1983), meaning of the term *module*. Thus, the domain could be identified as a hardwired encapsulated cognitive mechanism, designed to detect and process specific scope of inputs. This view is represented, for example, by Leslie (1994) who suggested two such modules: ToMM and ToBy, responsible for (respectively) "theory of mind" and "naive mechanics". There are also other areas of cognition suggested and broadly accepted to play the role of domain-

[2] The idea of linguistic constraints on concept formation is not new but was re-formulated recently, and forms an interesting problem in itself. Tardif's and Gopnik's cross-cultural studies demonstrate that the structure of language acquired by the child could direct early hypotheses about word meanings, and even the concepts. Other examples of new research on that problem are Soja, Carey, and Spelke (1992) or Imai and Gentner (1994). The restricted space available for this paper does not allow me to deal with this aspect of concept -word relation in detail.

[3] See Hirshfeld and Gelman (1994) for review.

specific modules: e.g. the domain of number (and, of course, different mechanisms of perceptual and linguistic processing). However the list of the area of conceptual knowledge which could be sensibly considered as innate modules is highly restricted[4].

Domain-specificity is also proposed as a solution for the frame problem. That leads to an approach opposite to modular. Domain could be identified with any area of conceptual expertise, even very narrow, artificial, culture-dependent, and so learned, rather than innate.

Has the concept of domain any real status then? Does it denote any particular mental structures, clearly and consistently distinguishable from others? Or is it merely a useful "shortcut" to very different representations and processes?

Hard modularity

Modules belong to that level of cognitive architecture which could be identified by both its neural bases (even if very complex) and functional properties (both semantic and syntactic in "the language of thought"). Modules are equipped with perceptual "filters" which allow them to pick up relevant information from other input systems. Papers by Baillargeon, Kotovsky and Needham (1995) and Spelke, Phillips and Woodwards (1995) represent two views of the bases for "naive mechanics". Papers by Leslie (1994, 1995), or Premack (1990, Premack and Premack, 1995) suggest early mechanisms for the formation of "theory of mind" or metarepresentation. A similar (or competitive) function could be served by the rationality perception mechanism presented at our workshop by György Gergely (see Biró et al., this issue). Some of such (probably innate) mechanisms very probably play an important role in the process of the development of conceptual knowledge of objects, intentions, and perhaps also biological life. However, it is far from clear whether mature "naive psychology", biology", or "mechanics" still rely on these hardwired (?) modules, or whether they form independent structures based on their specific, but constructed in development, or even domain-general rules. Leslie's arguments showing the persistence of perceptual illusions in motion perception in adults are enough only to show the developmental stability of the module for movement interpretation. They do not suffice, however, to support the claim that these mechanisms still play a central role in the adult's mechanical thinking. On the other hand, first investigations of the neural bases for the "theory of mind" in adults (Fletcher, Happe, Frith, Baker, Dolan, Frackowiak, and Frith, 1995) partly support the idea of "hardwired" domain-specificity, but say nothing about its precursors and development[5].

Soft modularity

Naive theories of physical objects and motion, naive psychology (and biology?) have some innate precursors, although the link between them is far from clear. Domain(s) related to other natural kinds like rocks, rivers, rain, clouds, sun, and stars, and the more reason to artifacts, and at least some nominal kinds, very implausibly have such precur-

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[4] For example Leslie (personal communication) accepts only "naive biology" aside from ToMM i ToBy as rather implausible candidates to that role.

[5] There are however some intriguing data that could validate the role of innate perception of causality module(s) in adult conceptual reasoning. Nowak, Kofta & Sędek in their unpublished study used Michotte's (1963) procedure (adapted also in Leslie's studies) to study the adult's concept of freedom. Subjects easily attributed freedom to a ball which started to move not launched by another ball.

sors. Could these domains be specific in the weaker sense of modularity? Is that kind of specificity functionally equivalent to hardwired modularity? Some data validate that claim: even relatively young children consistently classify non-living natural kinds, moreover the course of learning astronomical concepts is partly culture-independent (Vosniadou, 1994, however she reports also some cultural differences in these processes) and, as Eve Kikas (this issue) showed, presuppositions on which naive astronomy is based are extremely persistent and hard to change (at least by formal instruction).

There is another dimension that could be mapped (at least partly) onto the hard/soft module distinction, i.e. first-person experience. Self-propulsion versus external force initiated movements, rational action, mental states, and internal biological processes all are directly, in first-person manner, experienced by humans. Rules and laws governing the behavior of stars, clouds, vacuum-cleaners, computers, plants and even some sociocultural events are external — we couldn't experience their effects directly, but we have to infer them in a complex process, taking perceptions as inputs.

The question (open of course!) is then as follows: are there any privileged conceptual domains, and, if the answer is "yes", what makes these domains privileged: hard-wireness or first-person experience?

Kinds and essences

Aside from the question formulated above, the problem of domains without modules (let us name them "external domains") is still alive. The most prominent solution for it was the "essentialist assumption" articulated, for example, by Gelman, Coley and Gottfried (1994), or in another form by Keil (1989). Assuming the inner nature of things, and collecting things with similar inner mechanisms into larger sets (or the reverse: extending by analogy inferences about mechanisms underlying well-known objects onto less familiar ones) could delimit the borders for "external" conceptual domains. However Susan Gelman in her paper questioned the psychological reality of the essentialist assumption at the early stage of conceptual development. As she and her colleagues recently demonstrated, three-year-olds do not make relatively simple inferences about familiar natural kinds, and rely rather on superficial information (see Gelman's paper, this issue, for details). Gelman suggests that it is rather the notion of kind that structuralizes children's early ontology. There is converging evidence from other research for kind based reasoning without knowledge of internal mechanisms. However, what seems to be partly ignored in those studies are informational inputs in "external domains" which are perceptual, and so focused on superficial properties of objects. To what extent do essences have to be deep, invisible, and nonobvious? Or, if the child first of all sees tiger's stripes, could he/she assume that the essence of the tiger is somewhere in those stripes, and first of all in their specific origin (but not in the functions of invisible bones, spleen, brain, or genes)? If it were true, this would not be a problem of late adoption of the essentialist assumption, but rather of theory change which moves the kind specific essence more and more inside, as a child meets counterevidence for "surface essence", and at the same time learns more about nonobvious properties of the kind and its relations to other kinds (see also Simons and Keil, 1995). And, finally, do "true" (in the literate adult sense) essences of simple, inanimate natural kinds, like rocks or wind, lie somewhere very deep?

Whatever answer we may find for these questions would not enable us to explain in depth the problem of persistence of early core assumptions in "external domains". The

research by Eve Kikas and Katarzyna Stemplewska-Żakowicz showed resistance to change of the knowledge of natural kinds learned in natural ways (contrary to school-based). Both studies were concentrated on "external domains". Even if the instruction had some direct impact on a subject's beliefs, the change was only temporary. Is that simply proof of lack of effectiveness of the contemporary schooling system, or rather manifestation of a deep property of the human conceptual system, e.g. its quasi-modular, systematicity or coherence oriented, and so relatively stable character? There has been a lot of work done recently on cognitive constraints on learning sciences, but how to teach concepts is still a problem to be solved, and this is a problem of great importance. And it is this part of our research which we could offer to our societies.

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