The risks of rationalizing cognitive-development

de Gelder, B.

Published in:
Behavioral and Brain Sciences

Publication date:
1994

Citation for published version (APA):
de Gelder, B. (1994). The risks of rationalizing cognitive-development. *Behavioral and Brain Sciences*, *17*(4), 713-714.

development of writing, grammar, and linguistic theory. Because we have a written culture, we think of a natural language as a set of sentences built out of a set of words, which are built out of a set of letters. A lot of linguistic theory takes this further and characterises natural languages as formal systems in which sets of sentences are generated out of a finite set of elements by a finite number of rules (see especially, Chomsky 1957).

These are theories that we have brought to linguistic behaviour. They give us an excessively abstract conception of language and direct our attention away from what we need to explain: *linguistic behaviour.* Rather than looking at writing and formal systems, we should look at speech or Sign. (For an excellent introduction to Sign, see Sacks 1989). It is not really paradoxical to say that language is the idealisation, the theoretical redescription, of linguistic behaviour. In modelling the emergence of language we need to model the way we have progressively modelled our own behaviour.

I provide this as an accessible, though very recent, example of the way we have idealised our behaviour. At a deeper level we have idealised the concept of thought itself. Philosophical analysis can unravel this redescription to give us a leaner, behaviourally oriented set of concepts. I believe I can show, for instance, that propositional attitude talk is a convenient but, in principle, dispensible way of talking about *ability.* In light of these leaner concepts we can see RR as a process that has evolved by constructing implicit theories about our behaviour.

The evolutionary story that falls out of this account is that individuals born with an ability to modify their behaviour have a better chance of survival, so that the ability to redescribe becomes an inherited characteristic. Modelling the evolved mechanism in the individual is likely to be too difficult, but it might be feasible to discover the kind of mechanism that evolves when we select from individuals born with an ability to modify their behaviour. This relates research in developmental psychology to attempts to model the origins of language and cognition in the species (e.g., Edelman 1992; Edelman et al. 1992; Reeke et al. 1990a; 1990b). We should take not just a developmental but an evolutionary approach to the emergence of mind.

Such an approach throws light on the vexing question of language. Karmiloff-Smith argues that RR precedes language learning in the individual. Others (e.g., Dennett in press) argue for the importance of language in understanding RR. An evolutionary approach resolves this conflict. We can conjecture that the development and exploitation of what we might loosely call "interactive behaviour" in the species played a vital role in evolving innate redescriptive abilities in the individual. Thus, at the level of individual development Karmiloff-Smith is right: there is an innate redescriptive ability that precedes language learning and to a large extent makes it possible. Interactive, "protolinguistic," behaviour got its finger into the pie early on though. Individuals born with a capacity to modify their behaviour, especially their *interactive* behaviour, had a better chance of survival, and RR became an inherited characteristic. It started with very basic abilities. But you gotta start somewhere.

The risks of rationalising cognitive development

Beatrice de Gelder
Department of Psychology, Tilburg University, 5000 LE Tilburg, The Netherlands, and Laboratoire de Psychology Expérimentale, Université Libre de Bruxelles, Belgium. **b.degelder@kub.nl**

Abstract: The notion that cognitive development might be a redescriptive and demodularising process raises two issues: (1) the apparent symmetry between initial state and adult state modularity, and (2) the continuity and temporal logic assumed to link implicit and explicit representations.

Beyond modularity (henceforth, *Modularity*) presents a post-modular picture of mental representations, arguing that modular initial state representations implicit in behavioral mastery and in domain-specific processing undergo successive phases of recasting. This process ultimately brings about the uniquely mensch-like achievement of explicit representation in symbolic thought.

1. *Development as demodularisation.* At first blush, the claim that the notion of a modular mind is not useful for understanding cognitive development is difficult to integrate with a host of neuropsychological observations over the last two decades that seem to fit the modularity thesis. Modules whose candidacy appears best supported by the facts from adult neuropsychology are also those for which there is currently the best evidence in early infancy. As a matter of fact, the chapter titles of *Modularity* which detail the demodularisation process (e.g., the development of linguistic, physical, mathematical, psychological knowledge), read like a list of the major cognitive domains for which adult disorders have been documented. If initial-state modularity is minimal and quickly superseded, how is one to explain these striking continuities in functional architecture between the infant and the adult brain? The continuity becomes even more puzzling when *Modularity* also claims that the modularity of adult cognitive architecture is a developmental product and results from representational redescription (RR).

2. *Does explicit representation result upward mobility of implicit representations?* The RR approach incorporates a temporal logic where explicit representation depends on upward mobility of implicit representation. Alternatives to such a continuity view could be that implicit and explicit representations exist independently, operate in interaction or in parallel, and if so, that they belong to representational systems that may dissociate, with one possibly present without the other. There is ample empirical evidence of this alternative and much more complex relationship between implicit and explicit processes and representations in adult studies – normal as well as neuropsychological – perhaps most clearly in the study of memory (Weiskrantz 1987). In the area of developmental phenomena, a critical observation would be one showing that knowledge as inferred from conscious report and knowledge as inferred from implicit performance may dissociate.

The initial state competence for speech processing is in place in early infancy. Moreover, as reported in *Modularity,* explicit and conscious knowledge about language seems to arise very early on. Four-year-olds show explicit phonological knowledge in word games, rhyming, and so forth, and a couple of years later, they easily segment words into phonemes. Where does this explicit knowledge come from? A resoundingly popular answer in the early seventies was enshrined in expressions like "the child as a young grammarian," admitting simply that over time infants came to have access to their implicit phonemic representations. Since those days, the list of problems with this view of explicit as access to implicit has grown longer and longer.

To begin with, it can no longer be assumed that speech perception consists of a simple mapping from the signal to linearly ordered phoneme-like segments. Second, it turns out that achieving explicit representation generally requires tuition (de Gelder et al. 1993; Read et al. 1987). Third, modularity may be far more solidly entrenched in the functional architecture of the modular initial state than even Fodor suggests, a possibility suggested by cross-modal interactions in the language module that cut across the sensory systems. Representational systems are thus likely to be abstract from the beginning and to remain so all along. Fourth, the assumption of implicit phonemes was challenged by connectionist models, with the very same implications for the link between implicit and explicit representations, and with extra uncertainty about the nature of the implicit representations that may (or may not) underlie a given explicit manifestation. For example, with backpropagation models of word recognition, there is no control over the kinds of implicit representations the network will develop. If phonemic representations are developed in the hidden units, this still will not provide a basis for explicit phoneme representations, unless another representational system takes the network as its object and projects an interpretation for it in a metalanguage, equating patterns of activation with phonemes (Norris 1992).

What, then, are the constraints on such metaprocesses? Are they still domain-specific or will any kind of instructional environment promote metarepresentation? Evidence about specific phonological deficits in developmental dyslexias suggests the former. There may then be a trade-off which is problematic for any RR kind of view: the less domain-specific the input to the development of metarepresentation, the looser the connection becomes between implicit and explicit representation. This opens the gates for dissociations between implicit and explicit representations. It is generally observed that young, poor readers lack explicit segmental representations of spoken words. Is this a delay in an RR-like process? Do adult poor readers catch up and have explicit representation in adulthood? As a matter of fact, there is evidence that they do (de Gelder & Vroomen 1991); but do these explicit representations result from a process of bringing implicit representations out? Not only do reading skills of this group remain very poor, but there are indications that implicit representations of speech are anomalous. If so, we would have a case of explicit phonemic representations without implicit ones. A model of adult language processing where implicit processes are first and fastest and explicit ones come last and take longest, would hardly be acceptable. Likewise, one seriously hesitates to consider that in development implicit representations simply precede explicit ones. It would seem that neither chronometry not chronology offers a unique cue to implicit versus explicit processes and representations.

One might view *Modularity* as a developmental theory of the central processor, noting that it was Piaget who imposed such philosophical a prioris on development psychology, leaving it with the mission of providing an empirical solution to the epistemological question of the possibility of objective knowledge (subject-object interactions grounded in sensorimotor behaviour with representational systems growing out of it through gradually incorporating the external object of knowledge into the cognitive structures of subject). Philosophical credos make heavy saddles for empirical theories. Of course, we are attached to the thought of the human mind as an integrated whole, but that is quite a mouthful for a scientific program. Many current approaches to adult cognitive architecture portray this as a federation of autonomous and interactive systems, with distribution of processes over separate subprocessors, multiple systems underlying what appears superficially as the same behaviour and modular processes across vastly different sensorial systems. For the time being, understanding development may be better served with the same working hypothesis.

Representation: Ontogenesis and phylogenesis

Merlin Donald

Department of Psychology, Queen's University, Kingston, Ontario K7L 3N6, Canada. **donaldm@qucdn.queensu.ca**

This is one of the more enjoyable books I have read in some time; it is clear, provocative, and positive. Many of the ideas presented need further testing, but this is precisely the point of constructing an integrative hypothesis – to provoke empirical tests of the hypothesis. RR theory addresses two structural issues central to human cognitive ontogenesis: (1) how memory representations become explicit, and (2) how the modular structure of mind can be affected by ontogenetic factors. I have argued elsewhere (Donald 1991; 1993a; 1993b) that both of these structural issues are also central to human cognitive phylogenesis. I wish to explore very briefly some of the parallels and differences between the ontogenetic and phylogenetic approaches.

1. The accessibility/retrievability issue. The crucial memory event in human cognitive evolution, as in development, was gaining explicit access to memory. Our closest relatives, the apes, have very poor explicit memory retrieval, whereas humans voluntarily call up items from their own memory banks, reflect on them, alter them, and store the products of their own reflection. The only apes showing a more advanced capacity for explicit retrieval are those raised in human culture, and even under these circumstances, where symbols and languages are provided, there are severe limitations to what they can achieve. In this aspect of their cognition, apes seem more like other mammals than like humans; they seem to lack the kinds of accessible representations needed for explicit memory retrieval. In contrast, all neurologically normal humans are capable of performing explicit memory tasks. It follows that hominids must have passed through a series of cognitive adaptations that eventually gave modern humans the powerful retrieval devices that support explicit memory. This places the question of explicit access to memory at the center of human cognitive evolution.

Converging evidence from several disciplines suggests that early hominids evolved at least two different ways to construct *autocuable*, that is, self-triggerable, memory representations; these consisted of a nonverbal, or mimetic route, and a verbal, or linguistic route (Donald 1991; 1993a; 1993b). These retrieval capacities were probably not acquired as adaptations in their own right; they were byproducts of a more general change in representational capacity, driven primarily by sociocultural selection pressures. Accordingly, there are a number of possible ways – both verbal and nonverbal – to gain explicit access to representations in adult humans. In this respect, I agree fully with Karmiloff-Smith, at least in principle.

2. Modularity. The modularity issue is just as central to evolution as it is to development. Did human cognitive evolution always occur within specified domains, or was it domain-general? I have argued that so-called nonmodular or domain-general adaptations, those that Fodor places in the "central processor" are in fact quasimodular in humans. Retrievable representations are superordinate models that serve to describe knowledge encoded in traditional mammalian systems, such as the perceptual systems. They are thus scaffolded on top of a more fundamental, episodic level of representation, which itself remains implicit.

Explicit access to episodic memories is a uniquely human skill; in animals, episodic memories are implicit (Donald 1993b). In effect, to retrieve a given memory, the latter must be recoded in accessible form using either of the two autocuable paths acquired by humans in evolution. Karmiloff-Smith's RR theory seems quite compatible with this way of thinking, at least on first view; her proposed process of redescription even has a nonverbal dimension that seems to correspond to what I call the "mimetic mode," as shown in her E2 phase, where the child has conscious access to representations but cannot yet speak about them. What is impressive about this convergence of views is that her database, terminology, and theoretical starting points were so different from my own.

Another feature of the RR model that appeals to me is that it has room to accommodate the impact of literacy training on ontogenesis. I have proposed that one of the seminal developments in recent human cognitive evolution has been the externalization of memory. Since the emergence of external symbolic storage in the Upper Paleolithic, the human representational universe has not only been expanded greatly, but it has also undergone a basic structural change. The thousands of hours devoted to acquiring symbolic literacy skills must have a tre-