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LECTURE OBLIGATOIRE N° 1

Beyond modularity (A. Karmiloff-Smith)

Is the initial architecture of the infant mind modular?

Fodor's 1983 book The Modularity of Mind (which I later criticize) made a significant impact on developmental theorizing by suggesting how the nativist thesis and the domain-specificity of cognition are relevant to constraints on the architecture of the human mind. For Fodor, the notion of 'architecture' refers to the organization of relatively fixed and highly constrained innate specifications: the invariant features of the human information-processing system. Unlike Bruner (1974-75) and Piaget (1952), who argue for domain-general development, Fodor holds that the mind is made up of genetically specified, independently functioning, special-purpose 'modules' or input systems. Like Fodor, I shall use the terms 'module' and 'input system' as synonyms. Each functionally distinct module has its own dedicated processes and proprietary inputs.

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Each module is like a special-purpose computer with a proprietary database. By 'proprietary' Fodor means that a module can process only certain types of data and that it automatically ignores other, potentially competing input. A module computes in a bottom-up fashion a constrained class of specific inputs; that is, it focuses on entities that are relevant to its particular processing capacities only. And it does so whenever relevant data present themselves -that is, an input system cannot refrain from processing. This enhances automaticity and speed of computation by ensuring that the organism is insensitive to many potential classes of information from other input systems and to top-down expectations from central processing.

Input systems, then, are the parts of the human mind that are inflexible and unintelligent. They are the stupidity in the machine -but they are just what a young organism might need to get initial cognition off the ground speedily and efficiently.

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Pre specified modules versus a process of modularization

Fodor' s detailed account of the encapsulation of modules focuses predominantly on their role in on-line processing. There is little discussion of ontogenetic [developmental] change, except to allow for the creation of new modules (such as a reading module). Fodor takes it as demonstrated that modules for spoken language and visual perception are innately specified. By contrast, I wish to draw a distinction between the notion of prespecified modules and that of a process of modularization (which, I speculate, occurs repeatedly as the product of development). Here I differ from Fodor's strict nativist conception. I hypothesize that if the human mind ends up with any modular structure, then, even in the case of language, the mind becomes modularized as development proceeds. My position takes account of the plasticity of early brain development (Neville, 1991; Johnson, 1993). It is plausible that a fairly limited amount of innately specified, domain-specific predispositions (which are not strictly modular) would be sufficient to constrain the classes of inputs that the infant mind computes. It can thus be hypothesized that, with time, brain circuits are progressively selected for different domain-specific computations; in certain cases, relatively encapsulated modules would be formed. Thus, when I use the term 'innately specified', I do not mean to imply anything like a genetic blueprint for prespecified modules, present at birth. Rather, ...I argue for innately specified predispositions that are more epigenetic than Fodor's nativism. The view that I adopt ...is that Nature specifies initial biases or predispositions that channel attention to relevant environmental inputs, which in turn affect subsequent brain development.

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Development from a domain-general perspective

Fodor's nativist thesis is in sharp contrast with domain-general theories of learning, such as Piaget's constructivist epistemology, which were once popular in the development literature. Piagetian theory argues that neither processing nor storage is domain specific. Of course, implicitly at least, a Piagetian must acknowledge that there are different sensory transducers for vision, audition, touch, and so forth. They do not accept, however, that the transducers transform data into innately specified, domain-specific formats for modular processing. For Piagetians, development involves the construction of domain-general changes in representational structures operating over ail aspects of the cognitive system in a similar way.

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Neither the Piagetian nor the behaviourist theory grants the infant any innate structures or domain-specific knowledge. Each grants only some domain-genera1, biologically specified processes: for the Piagetians, a set of sensory reflexes and three functional processes (assimilation, accommodation, and equilibration); for the behaviourists, inherited physiological sensory systems and a complex set of laws of association. These domain-general learning processes are held to apply across all areas of linguistic and nonlinguistic cognition. Piaget and the behaviorists thus concur on a number of conceptions about the initial state of the infant mind. The behaviorists saw the infant as a tabula rasa with no built-in knowledge (Skinner, 1953); Piaget's view of the young infant as assailed by 'undifferentiated and chaotic' inputs (Piaget, 1955) is substantially the same.

Needless to say, there are fundamental differences between these two schools. Piagetians view the child as an active information constructor, behaviourists as a passive information storer. Piagetians conceive of development as involving fundamental stage-like changes in logical structure, whereas behaviorists invoke a progressive accumulation of knowledge. However, in the light of the present state of the art in developing theorizing, Piagetians and behaviourists have much in common in their view of the neonate's 'knowledge-empty' mind and their claims that domain-general learning explains subsequent development across all aspects of language and cognition.

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Development from a domain-specific perspective

The nativist / modularity thesis projects a very different picture of the young infant. Rather than being assailed by incomprehensible, chaotic data from many competing sources, the neonate is seen as preprogrammed to make sense of specific information sources. Contrary to the Piagetian or the behaviourist infant, the nativist infant is off to a very good start. This doesn’t, of course, mean that nothing changes during infancy and beyond; the infant has much to learn. But the nativist/ modularity stance posits that subsequent learning is guided by innately specified, domain-specific principles, and that these principles determine the entities on which subsequent learning takes place (Gelman, 1990; Spelke, 1991).

The domain specificity of cognitive systems is also suggested by developmental neuropsychology and by the existence of children in whom one or more domains are spared or impaired. For example, autism may involve a single deficit in reasoning about mental states (theory of mind), with the rest of cognition relatively unimpaired. Williams Syndrome, by contrast, presents a very uneven cognitive profile in which language, face recognition, and theory of mind seem relatively spared, whereas number and spatial cognition are severely retarded. And there are numerous cases of idiots-savants in whom only one domain (such as drawing or calendrical calculation) functions at a high level, while capacities are very low over the rest of the cognitive system. By contrast, Down Syndrome is suggestive of a more across-the-board, domain-general deficit in cognitive processing.

Adult brain damage points to domain specificity, also. It is remarkably difficult to find convincing examples in the neuropsychological literature of an across-the-board, domain-general disorder (Marshall, 1984), although a case might be made for an overall deficit in planning in patients with prefrontal damage {Shallice, 1988). But in many instances, disorders of higher cognitive functions consequent upon brain damage are typically domain specific -that is, they affect only face recognition, number, language, or some other facility, leaving the other systems relatively intact. .

So, if adults manifest domain-specific damage, and if it can be shown that infants come into the world with some domain-specific predispositions, doesn’t that mean that the nativists have won the debate over the developmentalists still ensconced on the theoretical shores of Lake Geneva (Piaget's former bastion of anti-nativism and anti-modularity)? Not necessarily, because it is important to bear in mind that the greater the amount of domain-specific properties of the infant mind, the less creative and flexible the subsequent system win be (Chomsky, 1988). Whereas the fixed constraints provide an initial adaptive advantage, there is a tradeoff between the efficiency and automaticity of the infant's input systems, on the one hand, and their relative inflexibility, on the other. This leads me to a crucial point: *The more complex the picture we ultimately build of the innate capacities of the infant mind, the more important it becomes for us to ex plain the flexibility of subsequent cognitive development*. It is toward such an end -exploring the flexibility and creativity of the human mind beyond the initial state -that my work in language acquisition and cognitive development has been concentrated, in an attempt to determine both the domain-specific and the domain-general contributions to development. It is implausible that development will turn out to be entirely domain specific or domain general. And although I will need to invoke some built-in constraints, development clearly involves a more dynamic process of interaction between mind and environment than the strict nativist stance presupposes.

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Source: Karmiloff-Smith, A. (1992). *Beyond Modularity: a developmental perspective on cognitive science*. Cambridge (Mass.), MIT Press.