

Commentary for:

Coordinating Perceptually Grounded Categories through Language. A Case Study for Colour

by Luc Steels and Tony Belpaeme

Word count:

Abstract: 60 Text: 905 References: 81 Total: 1046

A Synthesis of Many Levels of Constraints as a Modern View of Development

Derek Harter

Computer Science and Information Systems (Journalism 208)

Texas A&M University – Commerce

P.O. Box 3011

Commerce, TX 75429

Tel: (903) 886-5402 / Fax: (903) 886-5404

Email: Derek_Harter@tamu-commerce.edu

URL: <http://faculty.tamu-commerce.edu/dharter/>

Shulan Lu

Department of Psychology (Henderson 218)

Texas A&M University – Commerce

P.O. Box 3011

Commerce, TX 75429

Tel: (903) 468-8628 / Fax: (903) 886-5404

Email: Shulan_Lu@tamu-commerce.edu

Abstract: The debate of nativism vs. empiricism is over the relative importance of evolutionary vs. ontogenetic mechanisms. This is mostly seen today as a false dichotomy. The synthesis of these positions provides a modern viewpoint of grounded category formation. This combined view places equal importance on feedback between these levels in guiding development, and is more appropriately compared to culturalist positions.

Much of the debate between nativism and empiricism seems to us to echo similar debates that have been prevalent in developmental psychology and biology on the questions of nature vs. nurture. That is to say how much of a role does genetic evolution play in the development of behavior in humans and animals? How much can be attributed to ontogenetic learning by the individual? Is either factor predominant and if not are there some areas of behavior and learning where one or the other is the main contributing factor? These debates seem, however, to have reached somewhat of a preliminary consensus that it is neither and both at the same time (see for example Oyama, 1985). The basic idea being that both complex adaptive systems (evolution and ontogenetic development) are at the same time separate but also are tightly coupled with each other in mutual feedback relations. The complex and constant feedback between these levels are what define and shape the attractors that such systems constantly seek out to survive and reproduce in their environments (Thelen, Schoner, Scheier & Smith, 2001; Thelen & Smith, 1994).

So from this we believe it may be a bit of a straw-man to compare a culturalist position to simple nativist and empiricist positions as separate from one another. A more modern viewpoint (Oyama, 1985; Lewontin, Rose, & Kamin, 1984) would need to view nativism and empiricism in a synthesized manner and conclude that the complex mutual feedback between the evolutionary and ontogenetic processes is what coordinates the development of categories. Therefore, the culturalist position is mainly innovative in that it posits a new complex adaptive system, that of language and culture use, as a third factor that plays a role in the feedback among levels to coordinate the development categories.

The authors describe the culturalist position as “viewing language ... as a complex adaptive system that is constantly coordinated by its users.” However, they go on to indicate that they believe that a consensus needs to be reached on which approach, nativist, empiricist or culturalist, is most appropriate in explaining the grounded development of categories and therefore most useful for an engineer in developing a mechanism to implement robust category development in an artificial system. Even if language use and social interaction are shown to be another type of system that play an important role in the development of categories, does this really mean that genetic evolution and/or individualistic learning would be shown to play lesser roles? No we believe, and possibly the authors would agree. All three are involved, and understanding the development of categories necessitates understanding all three systems as well as how they interact with and feedback upon one another. As the authors say, the question is

really one of levels of freedom, and which levels of adaptive systems are most involved in constraining which levels of freedom.

The authors maintain neutrality on the question of nativism, empiricism and culturalism as to which, if any, theory best explains observations and data on human performance. However, they do state a position, saying that multiple sources of constraints are present in the formation of shared categories. They list three constraints: those coming from embodiment, those from the environment and those from culture; and they generally identify nativists as emphasizing the first category, empiricists the second and culturalists as throwing cultural constraints into the mix. It would seem that the true position they favor, and one we would very much agree with, is that all of these sources of constraints play important roles. Emphasizing one over the others always misses an important point, that it is the interaction between these constraints at different levels that is the key component of development. This article provides important results that will help us to tease apart the contributions of these various influences, using simplified models of developmental processes. However, we feel that the authors don't go far enough in pushing a synthesized view. Some people may still be stuck in a viewpoint maintaining the primacy of one type of constraint in the developmental process, but at least in terms of genetic and environmental constraints it is clear to many that both play important roles, interact with each other, and the interactions between the mechanisms must be studied as well as the mechanisms themselves.

Language and social interaction as complex adaptive systems would seem to occupy an intermediate level, in terms of time scale, between the relatively slow processes of evolutionary development, and the quick processes of ontogenetic learning. Therefore might they represent a kind of bridging level between the long-range and short-range processes? What level of social interaction is necessary such that a population will develop a shared set of grounded categories? The experiments in this article are a type of communication, but a very simple one at that. Is it really necessary to have a human-like language, or is some much more simple type of social interaction capable of developing shared categories? For example, is simply the fact of animals being social, where they have to act together and coordinate behavior, enough to provide some type of simple semiotic symbols that would allow for the development of coordinated categories? If any type of social interaction is capable of producing shared categories, does a more full-blown human language accomplish something even more in constraining levels of freedom? What extra mileage might a human-like natural language add into the development of shared categories?

References:

Lewontin, R.C., Rose, S., & Kamin, L.J. (1984). *Not in Our Genes*. New York: Pantheon.

Oyama, S. (1985). *The Ontogeny of Information: Developmental Systems and Evolution*. Cambridge, MA: Cambridge University Press.

Thelen, E. Schoner, G. Scheier, C. and Smith L.B. (2001). The Dynamics of Embodiment: A Field Theory of Infant Perseverative Reaching. *Behavioral and Brain Sciences*, 24, 1-45.

Thelen E. & Smith L.B. (1994). *A Dynamic Systems Approach to the Development of Cognition and Action*. Cambridge, MA: The MIT Press.