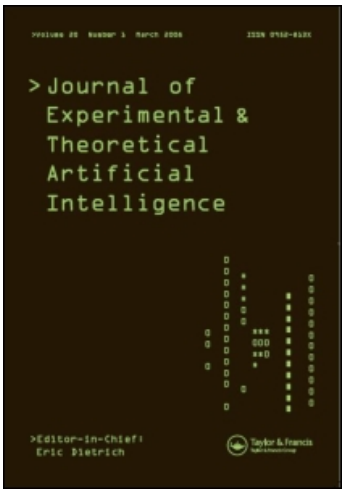

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Pluralism, relativism and the proper use of theories

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COMMENTARY

Pluralism, relativism and the proper use of theories

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Dale argues strongly for pluralism in Cognitive Science. As an advocate for representational pluralism in my own work, I certainly applaud this stance (e.g. Markman 1999; Markman and Dietrich 2000). Indeed, I largely agree with Dale that there are a few key reasons to want to adopt a pluralistic stance. For one, different theoretical approaches have different strengths and weaknesses, and it is often easier to envision a complete architecture for cognition emerging from the merger of approaches rather than by one approach overcoming its weaknesses to explain all of the phenomena that are within the bailiwick of the second. For another, the kinds of questions that are asked naturally given one theoretical approach are often quite different from those asked given a second seemingly incompatible approach. An important component of the evaluation of any theory is the extent to which it causes us to ask new questions. Consequently, pluralism is clearly crucial to current progress in Cognitive Science.

The difficulty with any pluralist stance is that there is a tendency for detractors to argue that pluralism leads to relativism and a proliferation of theories. That is, if we accept that there are likely to be many possible explanations of cognitive processes that work in concert and drive different aspects of the field, then there is little utility to trying to adjudicate between theories. The strong form of the logic of experimentation is that data that are inconsistent with a theory falsify that theory (Platt 1964). From a relativistic view, data that are inconsistent with a particular theory limit the scope of that theory, but they do not falsify it. That is, a given theory does not hold in cases for which there are data that are inconsistent with a theory. Taken to the extreme, relativism can lead to a large number of micro-theories each of which holds in a particular narrow domain.

So, it is incumbent on anyone who adopts a pluralistic stance to outline criteria for deciding which theories are good candidates to remain part of a pluralistic cognitive science, and which approaches should be abandoned.

Obviously, a complete discussion of principles for adjudicating among theories is beyond the scope of a brief commentary like this. However, there are a few different issues that these principles must address. First, general principles of coherence like the ones in ECHO (Thagard 1989, 2000) are useful for deciding among theories that are aimed at explaining some of the same phenomena. For example, theories that cover a broader range of data are to be preferred to those that cover a narrower range of data.

One observation about many paradigm debates within Cognitive Science is that they tend to resolve into dilemmas. Typically, there are two opposing approaches, each of

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which is applied most straightforwardly to a particular class of phenomena, but does less well at explaining phenomena for which the opposite approach is applied. For example, the contrast between symbolic computation and continuous dynamical systems discussed in the articles by Dale and Edelman (see also Dietrich and Markman 2003) rests on the observation that dynamical systems are excellent descriptions of many low-level perceptual and motor phenomena (e.g. Kelso 1995). More complex models have been built from this base, leading to the suggestion that dynamical systems may be a better explanatory framework for cognitive science than more traditional symbolic modelling (Spivey 2007). At the same time, dynamical systems are less successful at accounting for phenomena for which symbolic models were developed. A pluralist view would adopt both of these theories and focus their application on the phenomena for which they are best-suited.

There will be more than two active frameworks within a pluralist Cognitive Science, however. In particular, there are a number of dimensions along which theories may differ, and there are often pairs of opposing theories along each of those dimensions. For example, a second pair of opposing theories involves the distinction between embodied representations and amodal representations (see e.g., Glenberg 1997; Barsalou 1999; Markman and Dietrich 2000). The embodied view assumes that all representations are rooted in perceptual and motor routines. In contrast, the amodal view assumes that there are representations that are not tied directly to perceptual and motor states. These opposing views do not require a stance on the dynamical systems/symbolic computation debate discussed above. Thus, a pluralist Cognitive Science will likely include both of these pairs of oppositions (or others that aim to explain the same classes of phenomena).

Once core dilemmas have been identified, research must examine ways to make the seemingly incompatible approaches work together. That is, to the extent that there are seemingly contradictory mechanisms that are part of the cognitive architecture, these elements must ultimately be brought together.

The typical mode for resolving these contradictions is to argue in favor of one or the other pole of the dimension. An appealing alternative, however, is to create a hybrid system that contains elements of both of the putatively oppositional approaches. This approach is sometimes suggested to be less desirable than selecting one or the other original approach (Spivey 2007). The real limitation with this approach, however, is in making a system that successfully bridges the gap between approaches. A strength of the Jilks et al. paper is that it is an attempt to combine a traditional symbolic architecture with a more continuous neural network. This type of approach is a promising view for how research of this type should be carried out. The authors of this paper have done an impressive job of reconciling two frameworks that are typically placed in opposition. This paper provides an excellent road map for other researchers who want to bring together approaches that are typically thought to be incompatible.

It is reasonable to ask why it would be better to resolve the dilemmas that arise from a pluralistic approach to cognitive science in favor of a merger of approaches rather than in favor of selecting one horn of the dilemma or the other. I would argue that assuming the cognitive architecture reflects a myriad of seemingly incompatible mechanisms is a broader reflection of biological systems that they are typically a kluge. Biological systems add mechanisms through processes of genetic mutation, combination, and drift. The ones that increase the fitness of the system survive. Thus, if two seemingly incompatible mechanisms will be useful to solve a key biological problem, then if those mechanisms both end up in a

single organism through some genetic accident, they will tend to confer survival benefits on the organisms that have them.

That is, theoretical elegance is not a desideratum for biological systems. I believe that selecting one horn of a dilemma is a theoretically elegant solution to a problem. Given nature's propensity to create (spectacularly successful) hacks, however, I suspect that when we fully understand the set of mechanisms that make up the cognitive architecture we will be surprised mostly that a system with that many different mechanisms could function at all.

For those who are not convinced by any of these arguments, I would also add that I agree with Dale that the utility of any theory is largely practical. There are, of course, many dimensions of practicality. From a scientific standpoint, a theory is primarily of use if it leads researchers to ask questions that they have not addressed in the past. For example, the rise of dynamical systems approaches in cognitive science has led to a number of new observations about the moment-by-moment evolution of cognitive processing using techniques such as eye tracking (see Spivey 2007 for a review). Similarly, theories of embodied cognition and perceptual symbol systems have led to a number of important demonstrations about how bodily states influence cognitive processes that would not have been addressed without these theories (Glenberg 1997; Barsalou 1999; Wilson 2002; Markman and Brendl 2005). For any science, and particularly for one as young as cognitive science, the suggestion of new places to search for data is invaluable.

In summary, then, the most difficult question for the pluralist to answer is how to avoid slipping from pluralism to relativism. Every theory is not as good as every other. Thus, the pluralist must be clear about what criteria are to be used to determine which theories deserve further scrutiny, and which do not. I suggest three criteria that can be used to evaluate theories. First, general principles of theory evaluation like coherence and coverage must play a role in evaluating theories. Indeed, the only general evaluation criterion from classical philosophy of science that is called into question by a pluralist is parsimony. Second, the pluralist should take the many dichotomies that have been posited within the field and seek to resolve them by finding mechanisms that allow them to work together rather than finding a way to eliminate one or the other horn of a dilemma. Third, the pluralist should seek theories that lead to new questions. New and surprising data are the lifeblood of cognitive science, and a good theory is one that helps supply these data.

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