Models and Modularity in Language Processing

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Ten years ago, everyone in cognitive science had an opinion on modularity. This was particularly true for those working on language, where what Boland and Cutler (1996) call the "Great Divide" in psycholinguistic theory separated autonomous from interactive models. I am sure that most participants in this symposium will agree that this Divide is not as forbidding as it was in the pioneer days of cognitive science. Indeed, many of us now have no idea what side of the debate we are on.

The evolution from a Great Divide to a friendly panel discussion at the Cognitive Science Society Meeting is due, in large part, to the development of explicit models. These models--and here I have particularly in mind connectionist models of word and sentence comprehension and production--have stripped away the rhetoric and allowed us to see the actual operations of "modular" and "interactive" accounts. Sometimes we find out that the differences between such accounts are quite subtle, for example, whether or not there is a hypothesized set of excitatory connections from a word layer to a phoneme layer.

The kinds of models that I have found most useful have the characteristics of being globally modular and locally interactive. There are processing levels, for example, words are associated with a semantics and with phonological forms. Often, there is the need for a processing level simply because of the nature of the required mapping. For example, because the mapping between the semantic representation of a word and its phonological form is not linearly separable, an intermediate "word" level between meaning and form is needed. Processing is interactive in the sense that adjacent levels influence one another through feedback and feedforward. However, this interaction is limited. Only a few levels will participate in an attractor state, the active levels being determined by the task being performed. For example, when we are just about to say a particular word, only levels related to its form are active; there is no interactive influence from meaning at this late stage in processing.

One final point: It isn't too difficult to talk about modularity-related issues in language processing when dealing with lexical processing--word recognition and word production. Sentence processing is another story. It has been my experience as a consumer (and some-time producer) of empirical findings in sentence comprehension that it is hard to get any results that are recognized as definitive. The problem is simply that we don't have sentence processing models that are as explicit as the lexical models. Until we do, we will continue to have trouble relating data to theory.

References

Boland, J. & Cutler, A. (1996). Interaction with autonomy: Multiple output models and the inadequacy of the Great Divide. *Cognition, 58*, 309-320.