

**Adaptive Evolution Applied to Cognition  
and the Concept of Accessibility**

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Cognitive processes, like other biological phenomena, are subject to adaptive and evolutionary explanations as well as to explanation in terms of mechanisms. In addition to providing a different type of explanation, adaptive (functional) and evolutionary explanations can enlighten the search for mechanism in a number of ways. For example, principles of behavior or cognition can be arrived at by a study of function (e.g., optimization). In addition, functional considerations may provide clues to mechanism and focus research on phenomena with ecological validity.

The adaptive and evolutionary approach emphasizes diversity, both within the organism and across species. Some processes -- and certainly, some processing principles -- may be domain general. But most cognitive and behavioral adaptations are seen as solutions to specific problems and hence are expected to show specific adaptation to the peculiar properties of these problems. Adaptive specializations of this sort are illustrated by highly sophisticated perceptual and navigational abilities in some species. These specializations are available only to a restricted set of inputs and outputs, and are therefore described as inaccessible.

It is proposed that cognitive capacities can be arrayed on a dimension of accessibility. At one extreme these capacities are inaccessible or domain limited. At the other extreme they are utilized in many systems and perhaps available to consciousness. Part of the evolution of intelligence might involve increasing accessibility of originally tightly wired or inaccessible programs. Thus, while Pavlovian Conditioning may have originally appeared in a very specific context, through evolution it becomes a generally accessible system. The major evolutionary mechanism responsible for this is probably preadaptation, in which a structure originally evolved for one purpose is used for another. This can happen in two ways: By sharing of the actual circuitry or by reduplication of the circuitry through use of genetic blueprints.

Accessibility also describes some basic features of development. Piagetian decollages are examples of increasing accessibility in which the same program becomes operative in wider and wider domains. Similarly, some aspects of education involve getting access to what one already knows. Thus, in learning alphabets the critical insight has to do with phonemic segmentation. This is carried out by a specialized part of the brain involved in speech perception and tied into the ear-mouth input output system. But in learning to read, one must access this system through a new route, the visual system. On the other hand, many aspects of neuropsychology can be described as loss of access. This is essentially what Geschwind describes as a disconnection syndrome.

In general, the concept of accessibility allows for different degrees of domain specificity and for systematic changes usually in the direction of greater accessibility in evolution and development, and in the direction of decreased accessibility in aging and neuropathology.