

Neuropsychological Constraints on the Organization of Memory

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Neuropsychological investigation of patients with cognitive impairments following brain insult has long been directed at understanding the organization of mental processes at an anatomical level. Recently, however, considerable attention has been focused on the potential contributions of neuropsychological work to an understanding of organization at a functional or cognitive level. Damage to discrete regions of the brain can produce surprisingly circumscribed deficits that are specific to particular cognitive domains, and, indeed, specific to particular component processes or systems within a given cognitive domain. The selectivity of these deficits indicates constraints on cognitive organization imposed by the architecture of the brain. Identification and characterization of the nature of these selective cognitive deficits has permitted new, principled inferences to be drawn about the organization of normal cognitive systems, and it has provided confirmation of the biological validity of aspects of models derived from work with normal subjects or computer simulations.

This paper will focus on one example of the way in which cognitive neuropsychological research identifies important biological constraints on cognition. In brief, recent studies have revealed that amnesic patients with severe and pervasive disorders in learning and memory can nonetheless acquire new cognitive skills at a rate and in a manner comparable to normal control subjects. These subjects retain the capacity to acquire information that guides performance while at the same time showing a profound disability in acquiring memory traces accessible to verbal report or other explicit memory retrieval processes. For example, such patients can learn the optimal solution to the Tower of Hanoi problem, even though they may be incapable of remembering that they have done the problem before, or that they know how to solve it. They may also be incapable of explaining either the solutions they produce or the constraints they observe in producing a legal and optimal series of moves.

Future models of normal learning and memory must account for this striking dissociation. Such accounts may be built around the assumption that there are fundamental differences between the memory processes or systems mediating skilled performance and those mediating the remembering of facts and events.