Category specificity in normal episodic learning: Applications to object recognition and category-specific agnosia

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Abstract

Studies of patients with category-specific agnosia (CSA) have given rise to multiple theories of object recognition, most of which assume the existence of a stable, abstract semantic memory system. We applied an episodic view of memory to questions raised by CSA in a series of studies examining normal observers' recall of newly learned attributes of familiar objects. Subjects first learned to associate arbitrarily assigned colors or textures to objects in a training phase, and then attempted to report the newly learned attribute of each object in a recall task. Our subjects' pattern of recall errors was similar both quantitatively and qualitatively to the identification deficits among patients with CSA for biological objects. Furthermore, errors tended to reflect conceptually and structurally based confusions. We suggest that object identification involves recruitment and integration of information across distributed episodic memories and that this process is susceptible to interference from objects that are structurally similar and conceptually related.
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1. Introduction

The notion of a categorically organized semantic knowledge system is a fascinating topic of speculation and investigation, inspired in part by patterns of category-specific

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impairment in visual object recognition among patients with certain kinds of neurological damage. Beginning with a thought-provoking series of papers by Warrington and co-workers (McCarthy & Warrington, 1988; Warrington & McCarthy, 1987; Warrington & Shallice, 1979, 1984), a growing body of literature documents cases of category-specific agnosia (CSA). Patients with CSA have great difficulty identifying visually presented objects from certain categories, even though there is nothing wrong with their ability to derive a geometric structure from an image on the retina. This deficit affects performance in a variety of tasks that require retrieval of object knowledge, including object naming and retrieving particular semantic features. The overwhelming majority of cases show a disproportionate impairment of recognition and naming of visually presented biological objects (such as mammals, fruits, and vegetables), with relatively preserved performance on nonbiological categories such as clothing and furniture. The reverse pattern of CSA, in which it is primarily performance on nonbiological objects that is impaired, is very infrequent and (as further elaborated in a subsequent section) there are a number of alternative views on the question of how this pattern is related to CSA for biological objects.

Despite the potential interest of CSA, this phenomenon has had little impact on current theories of normal object identification developed outside the neuropsychological domain. We attribute this situation in part to the lack of a theoretical framework that would provide a clear analogue between the labeling errors of CSA patients and identification errors made by normal observers operating under processing constraints. An important goal of this article is to create such a bridging framework and to demonstrate that under certain conditions, the performance of normal subjects bears a clear similarity to that of patients with CSA of the biological type.

We begin by presenting a summary of data from published cases of CSA to identify the semantic categories that show the strongest pattern of dissociation. We then briefly review existing theories of CSA and we comment on the status of attempts to emulate category-specific effects in the identification performance of normal subjects. We argue that such attempts have not provided a convincing analogue of CSA, and we suggest that the principal reason behind this failure is a basic assumption common to all theories of CSA, that categorical knowledge is characterized in the form of stable semantic representations. We provide an alternative proposal in which semantic knowledge is the outcome of a collection of previously experienced episodes and is subject to continuous modification as new episodes accrue (Jacoby, Baker, & Brooks, 1989; Jacoby & Brooks, 1984; Kahneman & Miller, 1986). We introduce an experimental paradigm derived from this episodic framework that yields a pattern of performance in normal subjects strikingly congruent with the most common pattern of impairment seen in CSA.

1.1. Modal patterns of CSA

To characterize the nature of underlying differences in the representation of objects allowing for dissociations in CSA patients, we need to establish a consistent pattern of performance across a large number of categories. This task is difficult,