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Proceedings of the Annual Meeting of the Cognitive Science Society

Title

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Permalink

<https://escholarship.org/uc/item/8s675661>

Journal

Proceedings of the Annual Meeting of the Cognitive Science Society, 29(29)

ISSN

1069-7977

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Publication Date

2007

Peer reviewed

Recovery from Brain Damage: The Role of Exemplar Typicality within Categories

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Keywords: Typicality; aphasia; recovery; generalization

Introduction

Aphasia is a language disorder that results from damage (such as stroke or head trauma) usually to the left hemisphere of the brain. Naming difficulty is the most common form of language deficit noted in individuals with aphasia. Consistent with the level of naming impairment, therapy tasks have either focused on facilitating access at the phonological or at the semantic level. As a novel approach to treatment for naming deficits in aphasia, we have manipulated exemplar typicality within categories in order to facilitate improvements in naming abilities.

Numerous studies on normal individuals have found typical examples of a category to be accessed faster and more accurately than atypical examples (Rips, Shoben, & Smith, 1973; Rosch, 1975). Evidence for the typicality effect exists through typicality ratings (Rosch, 1975), response times on category verification tasks (Kiran & Thompson, 2003a; Larochelle & Pineu, 1994), and category production frequency (Rosch, 1975). The applicability of exemplar typicality as a treatment variable was initially put forth by Plaut (1996) in a connectionist simulation examining relearning following damage within a computer network. Plaut found that the retraining atypical examples resulted in improvements on typical items as well whereas training typical items, however, only improved the performance of those items. Since then, we have demonstrated the same effect in individuals with aphasia across four studies examining living, nonliving, well defined and ad hoc categories (Kiran & Thompson, 2003b; Kiran, Ntourou, Eubank & Shamapant, 2005; Kiran, Shamapant, & DeLyria, & DeLyria, & 2006).

Methods

All participants (N = 13) in these studies suffered a stroke to the left hemisphere at least 7 months prior to the initiation of the experiment. Further, all presented with severe naming deficits and concurrent semantic impairments as measured by standardized language assessments. Stimuli in treatment consisted of 10- 15 typical examples (e.g., *bird: robin*) and 10-15 atypical examples (e.g., *bird: ostrich*) within a specific category. Examples were matched for frequency, familiarity, and number of syllables. A single subject experimental design with multiple baselines across behaviors and participants (Connell & Thompson, 1986) was employed. In such an experimental design, effects of treatment are assessed at regular intervals for each patient separately. As treatment is extended to atypical or typical members of a superordinate category, generalization to remaining examples is examined. The emergent naming

patterns provided information regarding the re-organization and representation of semantic categories.

Results

Results across the four studies and 13 patients have revealed that training atypical examples results in improvements to untrained typical examples in patients with aphasia. In contrast, training typical examples does not result in generalization to untrained atypical examples. We hypothesize that because atypical examples are dissimilar to one another and to the category prototype, they collectively convey more information in terms of semantic features about the variation that can occur within the category than do typical examples. These results, although counter-intuitive to traditional treatment approaches, suggest that training naming of atypical examples is a more efficient method of improving naming items within a category than training typical items (Kiran, in press). In keeping with the theme of this conference (“Cogsci in the real world”), these results illustrate the applicability of the basic principles of conceptual structure in understanding the mechanisms of relearning of category structure and corresponding phonological representations in patients with brain damage.

Acknowledgments

The work reported here was supported by a grant from NIDCD R03 DC6359 awarded to the author.

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