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Journal of Memory and Language 54 (2006) 199–227
Journal of Memory and Language
www.elsevier.com/locate/jml

Semantic interference during blocked-cyclic naming: Evidence from aphasia ☆

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Received 31 May 2005; revision received 10 October 2005
Available online 15 December 2005

Abstract

Nonaphasic speakers are known to take longer to name pictures when they are blocked by semantic category and repeated multiple times. We replicated this "semantic blocking effect" in older controls and showed that in aphasia, the effect is manifested in increased error rates when naming semantically homogeneous, compared to mixed blocks. We further showed that semantic blocking affects Broca's aphasics more than a matched group of NonBrocas, and that the effect increases with repetition of the blocked sets. Error analysis undermines the inhibition-based account of the blocking effect by showing that errors arise from competition among increasingly activated items within the homogeneous set. The consequent slowing of naming latencies is due at least in part to the intervention of a controlled selection mechanism, and the disruption of this mechanism in anterior aphasia accounts for the increase in error vulnerability.

Keywords: Lexical selection; Production; Aphasia; Semantic interference

☆ This research was funded by grants from the National Institutes of Health: T-32 Training Fellowship HD007425; and R01 DC00191-22. Portions of this study were presented at the Academy of Aphasia, October, 2003 in Vienna, Austria (Hodgson, C., Schwartz, M. F., Brecher, A., & Rossi, N. Effects of relatedness, repetition and rate: Further investigations of context-sensitive naming, *Brain and Language*, *87*(1), 31–32), and at the Academy of Aphasia, October 2004 in Chicago, IL (Schnur, T. T., Brecher, A., Rossi, A., & Schwartz, M. F. Errors of lexical selection during high and low semantic competition, *Brain and Language*, *91*(1), 7–8). We gratefully acknowledge Nicholas Rossi's contribution to the collection and analysis of the data. We benefited from helpful discussions with Gary Dell, Sharon Thompson-Schill, and Nadine Martin and wise editorial suggestions from JML reviewers and editors. We also thank Esther Lee for her help in collecting the picture-similarity ratings and Branch Coslett for interpreting the lesion scans.
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0749-596X/$ - see front matter
doi:10.1016/j.jml.2005.10.002

Introduction

The task of naming pictures invokes semantically driven lexical retrieval, which, by most accounts, is a competitive process (Dell, 1986; Humphreys, Riddoch, & Quinlan, 1988; Levelt, 1989; Levelt, Roelofs, & Meyer, 1999; Roelofs, 1992; Stemberger, 1985; Wheeldon & Monsell, 1994). The occurrence of semantic errors in standard picture naming is prima facie evidence that retrieval is semantically based (e.g. Dell, Schwartz, Martin, Saffran, & Gagnon, 1997), while experimentally elicited interference effects attest to co-activation of a semantic cohort whose members compete for selection (e.g. Vitkovitch & Humphreys, 1991). Among the paradigms that elicit semantic interference in naming are the picture–word interference task (Glaser & Dungelhoff, 1984; Glaser & Glaser, 1989; Lupker, 1979), primed, speeded picture naming (Vitkovitch & Humphreys, 1991; Vitkovitch, Humphreys, & Lloyd-Jones, 1993, Experiment 2), alternating picture naming and naming to description (Moss et al., in press; Wheeldon & Monsell, 1994) and semantic blocked naming. This paper is concerned with the nature of the interference effect in semantic blocked naming (hereafter, blocked naming).

The blocked naming paradigm manipulates the context in which pictures to be named appear, with successive trials depicting items from the same or related semantic categories (homogeneous context: e.g., TRUCK, CAR, BIKE),[1] versus mixed-category items (mixed context: e.g., TRUCK, FOOT, DOG). The basic effect is that targets are named more slowly in the homogeneous context, when pictures are named once (Brown, 1981; Kroll & Stewart, 1994), or multiple times pseudorandomly (Damian, 2003, experiment 2; Damian, Vigliocco, & Levelt, 2001; Maess, Friederici, Damian, Meyer, & Levelt, 2002). In a variant of this paradigm, which we refer to as blocked-cyclic naming, sets of items (homogeneous or mixed) are named in succession multiple times, e.g., the animal set is presented once, then repeated again in a different order for some number of cycles (Belke, Meyer, & Damian, 2005; Hodgson, Schwartz, Brecher, & Rossi, 2003; Pickard, Brandon, Hodgson, Schwartz, & Thompson-Schill, 2003). This blocked-cyclic manipulation has the potential to elucidate how interference emerges across repetitions (e.g. Belke et al., 2005). We used it here to explore the build-up of blocking interference in persons with aphasia.

[1] We refer to both picture name responses and lexical representations with quotation marks (e.g., "dog"). Pictures and the concepts they represent are referred to with capitalization (e.g., DOG).

Semantic blocking in speakers with aphasia

Because blocked naming affords an opportunity to manipulate interference during word retrieval, variants of the paradigm have been used to investigate causes of word retrieval deficits in aphasia. Two patients have been reported who, when administered a version of semantic blocked-cyclic naming, produced significantly more errors on homogeneous compared to mixed blocks.

The first of these patients (FAS, reported in McCarthy & Kartsounis, 2000) exhibited nonfluent propositional speech with agrammatism, secondary to tumor. He also exhibited an unusually variable form of anomia, which proved to be sensitive to blocking context, cyclic repetition, and presentation rate. His naming accuracy was lowest for homogeneous blocks presented with a short response–stimulus interval (Rate 1 s vs. 10 s), and accuracy in this condition declined across cycles.

The second case, BM, was one of two reported by Wilshire and McCarthy (2002). BM exhibited nonfluent propositional speech without agrammatism, secondary to left cerebral vascular accident. BM was run on the blocked-cyclic naming task with 2 or 3 s to name each picture. At the faster rate, he made about 45% errors in the homogeneous condition, compared with 15% errors in mixed. At the slower rate, the difference between context conditions was not statistically reliable. Wilshire and McCarthy's second subject had anomia secondary to a posterior (left temporal) lesion. His naming was unaffected by the blocking manipulation or by the interaction of blocking with presentation rate or repetition cycle.

While these two studies suggest selective vulnerability to the blocking effect in patients with anterior forms of aphasia, the handful of other patient studies that utilized blocked naming have mostly produced negative effects for aphasics of both anterior and posterior types (Gotts, della Rocchetta, & Cipolotti, 2002; Hodgson et al., 2003; negative in one of two patients tested, Lambon Ralph, Sage, & Roberts, 2000; Schwartz & Hodgson, 2002; Williams & Wright, 1985). Thus, the literature raises questions about the generality of the findings from patients FAS and BM and the significance of the fact that their aphasias were of the anterior type (i.e., featuring nonfluent propositional speech with or without agrammatism). Our study explores these issues using a contrastive group study design.

Mechanisms of interference in semantic blocking

It is clear that the blocking effect hinges on semantic relatedness. First, the size of the effect tracks the degree of relatedness of items in the homogeneous blocks (Vigliocco, Vinson, Damian, & Levelt, 2002). Second, the effect can generalize to semantically related items that were not part of the response set (Belke et al., 2005). Third, the effect persists even when the visual similarity of homogeneous- and mixed-block pictures is equated, which