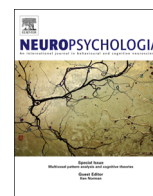




ELSEVIER

Contents lists available at ScienceDirect

## Neuropsychologia

journal homepage: [www.elsevier.com/locate/neuropsychologia](http://www.elsevier.com/locate/neuropsychologia)

# Effects of phonological and semantic deficits on facilitative and inhibitory consequences of item repetition in spoken word comprehension

Daniel Mirman<sup>\*</sup>, Allison E. Britt, Qi Chen

Moss Rehabilitation Research Institute, 50 Township Line Rd., Elkins Park, PA 19027, USA



## ARTICLE INFO

## Article history:

Received 3 January 2013

Received in revised form

31 May 2013

Accepted 6 June 2013

Available online 14 June 2013

## Keywords:

Repetition

Perseveration

Access deficit

Aphasia

Spoken word comprehension

## ABSTRACT

Repeating a word can have both facilitative and inhibitory effects on subsequent processing. The present study investigated these dynamics by examining the facilitative and inhibitory consequences of different kinds of item repetition in two individuals with aphasia and a group of neurologically intact control participants. The two individuals with aphasia were matched on overall aphasia severity, but had deficits at different levels of processing: one with a phonological deficit and spared semantic processing, the other with a semantic deficit and spared phonological processing. Participants completed a spoken word-to-picture matching task in which they had to pick which of four object images matched the spoken word. The trials were grouped into pairs such that exactly two objects from the first trial in a pair were present on screen during the second trial in the pair. When the second trial's target was the same as the first trial's target, compared to control participants, both participants with aphasia exhibited equally larger repetition priming effects. When the second trial's target was one of the new items, the participant with a phonological deficit exhibited a significantly more negative effect (i.e., second trial response slower than first trial response) than the control participants and the participant with a semantic deficit. Simulations of a computational model confirmed that this pattern of results could arise from (1) normal residual activation being functionally more significant when overall lexical processing is slower and (2) residual phonological activation of the previous trial's target having a particularly strong inhibitory effect specifically when phonological processing is impaired because the task was phonologically-driven (the spoken input specified the target). These results provide new insights into perseveration errors and lexical access deficits in aphasia.

© 2013 Elsevier Ltd. All rights reserved.

## 1. Introduction

Understanding the facilitative and inhibitory dynamics among partially active representations is a major theme across studies of memory, language, and cognitive control. In each of these domains, partially active representations have been shown to facilitate performance in some contexts and inhibit or compete in other contexts. For example, in the domain of lexical processing, *lexical neighbors* – words that are similar in spelling, sound, or meaning, and are thus partially activated during processing – have been shown to exert both inhibitory and facilitative effects on target word processing (for a comprehensive review see Chen & Mirman, 2012). Chen and Mirman used computational model simulations to demonstrate that the complex pattern of facilitative and inhibitory effects could be captured by a simple computational

principle: strongly active neighbors exert a net inhibitory effect and weakly active neighbors exert a net facilitative effect.

Item repetition also has both facilitative and inhibitory consequences. Perhaps the most robust example of facilitation is *repetition priming*: processing is faster and more accurate on the second presentation of an item than on the first (e.g., Cave & Squire, 1992; Goldinger, 1998; Ratcliff & McKoon, 1988; Scarborough, Cortese, & Scarborough, 1977; Van Petten, Kutas, Kluender, Mitchiner, & McIsaac, 1991). The flip side of repetition priming is *perseveration errors*: unintentional and erroneous repetition of a previously produced response (e.g., Martin & Dell, 2007; Fischer-Baum, & Rapp, 2012). Perseveration errors in aphasia have been studied for over 100 years (Stark, 2007) with a central debate between two broad types of mechanisms: perseverations arise because the new input is not sufficiently activated (“failure to activate”) or because the previous target is not sufficiently inhibited (“failure to inhibit”).

Negative serial position effects are another example of inhibitory effect of item repetition: performance progressively deteriorates across repetitions of an item. Such effects have become a

<sup>\*</sup> Corresponding author. Tel.: +1 215 663 6433; fax: +1 215 663 6783.  
E-mail address: [dan@danmirman.org](mailto:dan@danmirman.org) (D. Mirman).

**Table 1**  
Background test performance for the two participants with aphasia.

	MR1626	MR2374	Control norms*
Abhasia Subtype	Broca's	Transcortical motor	–
WAB Aphasia Quotient	67.8	75.5	–
Auditory lexical decision (PALPA, <i>d'</i> )	2.28	2.55	–
Words (% correct)	93	84	–
Nonwords (% correct)	79	94	–
Picture naming (PNT, % correct)	51	59	97.2 (2.7)
% Semantic errors	2.3	9.7	–
% Mixed errors	1.1	8.6	–
% Nonword errors	22.3	4	–
% Formal errors	12.0	4	–
Primary perseverations	0.6	1.1	–
Word repetition (PRT, % correct)	68	96	–
Nonword repetition (% correct)	8	70	82.6 (10.5)
Phoneme discrimination			
No delay (% correct)	80	90	97.45 (3.0)
Delay (% correct)	78	93	95.55 (3.7)
Short-term memory			
Immediate serial recall (Words) Span	1.4	4.8	4.8 (0.3)
Semantic STM Span	1.67	0.5	5.39 (1.3)
Phonological STM Span	1.29	6.27	6.45 (1.6)
Spatial STM Span	5.0	5.3	5.31 (1.5)
Semantic processing			
Pyramids and Palms (% Correct)	96	85	–
Camels and cactus (% Correct)	81	31	89.8 (5.6)
Synonymy Triplets (% Correct)	90	67	97.4 (5.4)
Peabody picture vocabulary test (Standard score)	90	46	100 (15)
Picture name verification test (PNT, % Correct)	97	95	98.6 (0.9)
Lesion volume (cm <sup>3</sup> )	77.3	88.8	–

\* Note: Mean (SD) control norms were collected from various sources and are presented here for general information only; the neurologically intact control group from the present study did not complete this test battery.

hallmark of “refractory/access” deficits in aphasia (Warrington & McCarthy, 1983, 1987; McNeil, Ciolotti, & Warrington, 1994; Forde & Humphreys, 1995; Warrington & Ciolotti, 1996; McCarthy & Kartsounis, 2000; Crutch & Warrington, 2008).

In the present study we aimed to shed new light on these dynamics by examining the facilitative and inhibitory consequences of different kinds of item repetition in two individuals with aphasia. Critically, the two individuals had deficits at different levels of processing: one with a phonological deficit and spared semantic processing, the other with a semantic deficit and spared phonological processing. We chose a simple spoken word-to-picture matching task because this task has minimal working memory and cognitive control demands and we manipulated whether the repeated item was the target or a distractor in order to assess both the facilitative and inhibitory effects of item repetition. The results indicated that inhibitory effects emerge specifically when a level-specific deficit weakens processing of critical input. This account was implemented in a simple computational model and tested with concrete simulations that provide an existence proof that the proposed principles are sufficient to account for the observed data. We conclude with discussion of how these results inform theories of typical and impaired word comprehension.

## 2. Experiment

### 2.1. Methods

#### 2.1.1. Participants

Sixteen (10 female, 6 male) neurologically intact adults from the greater Philadelphia area completed the study. Their ages ranged from 35 to 78, with a mean age of 59. All participants were native English speakers who reported having normal or corrected-to-normal vision and hearing. They had no history of

neurological events or conditions, and all scored 27 or above on the Mini Mental State Examination (Folstein, Folstein, & McHugh, 1975).

Two individuals with aphasia (MR1626 and MR2374) were selected from the Moss Neurocognitive Rehabilitation Research Registry (Schwartz, Brecher, Whyte, & Klein, 2005) based on their differing patterns of performance on background psycholinguistic testing (Table 1). Background test scores were obtained through the Moss Psycholinguistics Project Database ([www.mappd.org](http://www.mappd.org); Mirman et al., 2010). These two participants were approximately matched on overall aphasia severity (Western Aphasia Battery [Kertesz, 1982] Aphasia Quotient), lexical processing (Philadelphia Picture Naming Test [Roach, Schwartz, Martin, Grewal, & Brecher, 1996] and PALPA auditory lexical decision [Kay, Lesser, & Coltheart, 1992]), and lesion size. In addition, because the left inferior frontal gyrus (LIFG) has been hypothesized to be involved in resolving the competition produced by item repetition (e.g., Schnur et al., 2009), the participants were matched with respect to the lesion status of LIFG: for both participants the left inferior and middle frontal gyri were substantially lesioned (see Fig. 1; lesion location was defined by an experienced neurologist). Both participants with aphasia also performed very well on word-to-picture matching using familiar words/concepts (Picture name verification test), indicating that they would be unlikely to exhibit substantive differences in accuracy in our study.

MR1626 was a 74-year-old right-handed male with 11 years of education. In 2007 he suffered a left middle cerebral artery ischemic stroke involving primarily the left frontal lobe, including the inferior frontal gyrus and the motor strip, and extending along the interior of the Sylvian fissure. A phonological deficit was apparent in the preponderance of formal and nonword errors in picture naming, impaired word repetition and severely impaired nonword repetition, and modest impairment of speech perception (syllable discrimination). He performed normally on a test of non-verbal spatial short-term memory (a computerized version of the Corsi blocks task), suggesting that his poor performance on tests of verbal short-term memory also reflected a phonological deficit.<sup>1</sup> High performance on tests of semantic association and low rates of semantic naming errors revealed largely intact semantic knowledge.

MR2374 was a 54-year-old right-handed male with a college education. He suffered a left middle cerebral artery ischemic stroke in 2010 resulting in a large inferior frontal gyrus lesion with smaller extension into the middle frontal gyrus.

<sup>1</sup> This participant appeared to have both phonological input and output deficits, either because the impairment affected a shared phonological processing level, or happened to affect both independently. In either case, for this participant, the distinction between phonological input and output deficits is not relevant.

Download English Version:

<https://daneshyari.com/en/article/10464778>

Download Persian Version:

<https://daneshyari.com/article/10464778>

[Daneshyari.com](https://daneshyari.com)