Verbal Perseveration in Aphasia during Word-String Repetition: Effects of a Filled versus Silent Interstimulus Interval

Introduction

Verbal perseveration is experienced to varying degrees by many individuals with aphasia. Perseveration is defined as an inappropriate recurrence or repetition of a previously produced response in place of the target item. Despite numerous studies of factors influencing the occurrence of perseverations and several prominent accounts of their occurrence in aphasia (Cohen & Dehaene, 1998; Martin & Dell, 2004; 2007) there are only a few studies that address the treatment of perseveration in aphasia. The theoretical framework of the present study is Dell, Burger & Švec's (1997) account of perseverations: Perseverations are more likely to occur when activation of the target word is weak (reduced connection strength) and residual activation of a retrieved lexical representation is strong enough to be selected in error.

Treatment studies of naming whose methods are consistent with this model use a two-pronged approach to the reduction of perseverations: (1) impose an interval between items to be named to allow for residual activation of past responses to decay sufficiently and (2) combine this with an additional task designed to improve retrieval, by strengthening the weak activation of the current intended utterance. Stark (2011) included the technique of "taking a deep breath" paired with a word-finding therapy for verbs using a natural sentential context. Helms-Estabrook, Emery, & Albert, (1987) used a time-interval strategy paired with cueing hierarchies to facilitate word retrieval. Muñoz (2011) combined semantic feature analysis with an interstimulus interval to address the two conditions that lead to perseveration. Her results were highly effective in reducing the perseveration but there was minimal improvement in naming. She surmised that the interstimulus interval alone might have been sufficient to reduce the perseveration. None of these studies investigates the effect of imposing only the interstimulus interval without accompanying language therapy although it is consistently acknowledged that the time interval is essential component to the reduction of perseverative responses.

Intervals can be filled or unfilled with different potential effects on rates of perseveration. An unfilled interval would allow more time for the representation of a previously produced word to decay, thereby reducing the probability of perseveration. A filled interval between stimulus and response could interfere with activation of the target word, weakening its activation and creating an environment for a previously retrieved word to be selected for production. This would result in more perseverations. In this study, we examine this possibility.

Aims of the study

Whereas most theoretical and treatment studies of perseveration focus on naming, this study examines perseveration in the context of repetition. Specifically, we examined the effects of

interference on the occurrence of perseverations in repetition of word pairs and word triplets by comparing a 5-second filled with a 5-second unfilled interval condition. The verbal interference generated in the 5-second filled interval condition should interfere with efficient activation of the target word, allowing more opportunity for perseverative errors to occur. Thus, our hypothesis is that individuals with aphasia will demonstrate more perseverative errors during the 5-second filled interval condition than during the 5-second unfilled interval condition.

Method

Participants. Fourteen participants with varying types of aphasia and degrees of severity participated in this study.

Procedure. Two different word repetition tasks were administered using both a filled and unfilled interval condition. In Task 1, there were 30 2-word strings, for a total of 60 words. In Task 2, there were 30 3-word strings, for a total of 90 words. In the unfilled condition, a 5-second silent interval was imposed between stimulus and response; in the 5-second filled condition (the interfering condition) the interval was 'filled' with the participant counting aloud numbers presented on a screen in unison with the clinician. Order of presentation was counterbalanced across participants. Word strings were presented in a randomized order for each participant during both interval conditions.

Scoring. Word errors were counted as perseverations if the response was a whole-word repetition of a previously produced word that appeared in one of the earlier word strings. The dependent variable was the number of perseverated whole words in each condition.

Results

A paired sample t-test was used to compare rates of perseveration on the 5-second unfilled interval and 5-second filled interval condition in both the 2-word string task and the 3-word string task.

There were significantly more whole-word perseverations in the filled compared to the unfilled interval conditions in both the 2-word string task ($t(13) = -2.494$, $p = .027$) and the 3-word string task ($t\ (13) = -2.675$, $p = .019$). The mean proportion of perseverations for the 14 participants for the 2-word string task was .064 for the 5-second unfilled interval condition compared to a mean of .12 for the 5-second filled interval condition. Similarly, the mean proportion of perseverations in the 3-word string task was .07 for the 5-second unfilled condition and .11 for the 5-second filled condition.

Among the 14 participants, 11 showed more perseveration in the filled than the unfilled condition. The three participants who did not show a difference demonstrated either equal perseverative responses on both conditions or differences of less than .02 from the unfilled to the

filled condition. These three participants tended to be more characteristic of nonfluent aphasia than most of the other participants.

Discussion

There are three aspects of this study worth noting. First, the results provide additional support to the hypothesis that the presence of a silent interstimulus interval reduces perseveration (in this study, relative to an interval that includes verbal competition). As has been proposed, the interval may provide more time for the current target word's representation to become activated and the residual activation of representations of previously uttered words to decay.

Second, the filled interval condition provides evidence that verbal competition during a language task leads to an *increase* in verbal perseverations. The verbal competition may interfere with activation of the current target word, decay of residual activation of prior utterances or both. Further investigation is needed to determine what mechanism is affected by the interference of the filled condition.

A third aspect of this study worth mentioning is that we examined perseveration in the context of a repetition task. Perseverations occur in all modalities of language, but are most often studied in the context of naming. We have recently used the technique of imposing a silent delay in the context of a sentence repetition task (Kohen, Benetello & Martin, in preparation) in order to reduce high rates of perseverative intrusions. Thus, the use of a silent interval to reduce perseverations may have many applications in diagnostic and treatment protocols and warrants further investigation.

In future studies, we plan to conduct these same analyses on additional participants who are currently completing this study and examine the patterns of performance in relation to profiles of language and cognitive abilities of each participant, Although we expect an overall trend of more perseverations when verbal interference is imposed prior to a response, we also expect that some individuals with aphasia will be more prone to this pattern than others, depending on their language and cognitive abilities. Finally, we plan to investigate the hypothesis that in repetition, a silent interval may allow for increased self-monitoring, especially for individuals with more fluent aphasia.

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