

Word-finding pauses in primary progressive aphasia (PPA): Effects of lexical category

Abstract

Word-finding pauses are common in logopenic primary progressive aphasia (PPA-L). However, no previous research investigated the distribution of word-finding pauses in PPA or their specificity to PPA-L. We coded pauses preceding nouns and verbs in narrative speech samples from participants with PPA-L, agrammatic (PPA-G) and semantic PPA (PPA-S), and controls, hypothesizing that frequent word-finding pauses, if present, should match previously-observed lexical category deficits (noun deficits in PPA-L and PPA-S; verb deficits in PPA-G). The PPA-L group paused more frequently before nouns than verbs, whereas no other group exhibited lexical category effects, suggesting that frequent word-finding pauses are specific to PPA-L.

Introduction

The three subtypes of primary progressive aphasia, agrammatic (PPA-G), semantic (PPA-S), and logopenic (PPA-L), have distinct linguistic profiles and patterns of cortical atrophy (Gorno-Tempini et al., 2004, 2011; Mesulam et al., 2009, Mesulam, Wieneke, Thompson, Rogalski, & Weintraub, 2012). PPA-G is characterized by agrammatism and motor speech deficits, whereas PPA-S is associated with impaired semantic representations leading to word comprehension deficits. In PPA-L, these features are relatively preserved. The current consensus criteria for a diagnosis of PPA-L (Gorno-Tempini et al., 2011) include word-retrieval difficulty in spontaneous speech and naming as well as impaired phrase and sentence repetition, neither of which is specific to PPA-L (Mesulam et al., 2012).

Word-finding pauses are a prominent feature of connected speech in PPA-L and have been repeatedly observed qualitatively (e.g., Gorno-Tempini et al., 2004, 2008; Mesulam et al., 2012). However, no previous research has attempted to quantify the distribution of word-finding pauses across the subtypes of PPA or to evaluate their specificity to PPA-L. Rohrer, Rossor and Warren (2010) measured overall mean pause length in connected speech samples from participants with nonfluent PPA, including those with PPA-G and PPA-L, classified according to the presence/absence of apraxia and agrammatism. Participants with PPA-L (no apraxia/no agrammatism) paused more frequently than unimpaired controls, but not more than other individuals with nonfluent PPA. However, Rohrer et al. (2010) did not address the distribution of pauses, which is critical for determining whether frequent pausing is due to word-finding difficulty and/or other causes (e.g., motor planning).

Previous research has shown that retrieval of nouns and verbs is differentially impaired across the three subtypes of PPA. In picture naming tasks, participants with PPA-G exhibit greater difficulty with verb retrieval, whereas PPA-S is associated with greater noun retrieval deficits (Hillis et al., 2006; Hillis, Oh, & Ken, 2004; Thompson et al., 2012b); in contrast, participants with PPA-L do not exhibit lexical category effects (Thompson et al., 2012b). A different pattern emerges in narrative speech, in which patterns of lexical production (e.g., N:V ratios) have revealed impaired noun production in PPA-S and trends toward impaired noun production in PPA-L and verb production in PPA-G (Thompson et al., 2012a; Wilson et al., 2010).

In the present study, we investigated the distribution of pauses in narrative speech in the three subtypes of PPA and age-matched controls. We hypothesized that word-finding pauses, if present, would follow the same pattern as that observed for lexical production deficits in narrative speech (verb deficits in PPA-G; noun deficits in PPA-S and PPA-L), whereas pauses due to other sources (e.g., motor planning) would be equally distributed across lexical categories. Thus, if PPA-L alone is characterized by frequent word-finding pauses, then lexical category effects in the distribution of pauses (i.e., more pauses before nouns) should be evident only for PPA-L.

Methods

We collected and analyzed narrative speech samples (the Cinderella story) from 33 participants with PPA (12 with PPA-G, 9 with PPA-L, and 12 with PPA-S) and 12 age- and education-matched controls. Classification of PPA participants followed the criteria detailed by Mesulam et al., 2009 (cf. Mesulam et al., 2012). Participants with PPA-G exhibited impaired production of non-canonical sentences, assessed with the Northwestern Anagram Test (Thompson, Weintraub, & Mesulam, 2012) and the Northwestern Assessment of Verbs and Sentences (Thompson, 2011), but intact word comprehension, assessed with a subset of the Peabody Picture Vocabulary Test (Dunn & Dunn, 2006); some also exhibited motor speech deficits. Participants with PPA-S exhibited impaired word comprehension but intact complex sentence production, whereas participants with PPA-L exhibited preserved word comprehension and complex sentence production, but deficits in phrase- and sentence-level repetition, assessed using a subset of the Repetition subtest from the Western Aphasia Battery (Kertesz, 1982).

We transcribed and coded each speech sample using the methods described in Thompson et al. (2012a). We then coded the presence or absence of pauses for each noun and verb in the speech sample. There were three subcategories of pauses: *unfilled pauses* of 300 ms or greater, *filled pauses* (e.g., *um*, *er*), and *lengthening* of the previous word, which can signal disfluency (Shriberg, 2001). To examine the distribution of pauses across lexical categories, we collapsed across the three pause types, and calculated the percentage of nouns and verbs that were preceded by pauses (of any sort).

Results

Figure 1 illustrates the percentage of nouns and verbs preceded by pauses in each of the four participant groups. A two-way ANOVA (group x lexical category) revealed a main effect of group ($F(3, 41) = 17.289$, $p < .001$) and an interaction between group and lexical category ($F(3, 41) = 3.891$, $p < .05$). Follow-up paired comparisons between groups revealed that the PPA-G group paused more overall than all other groups (p 's $< .001$), whereas the PPA-L group paused more than the PPA-S participants and controls (p 's $< .05$); overall pause rate did not differ between the PPA-S and control groups. To examine the source of the group x lexical category interaction, we performed paired t-tests for each group on the percentage of pauses for nouns vs. verbs. The PPA-L group paused more frequently before nouns than verbs ($p < .05$), but no other groups exhibited lexical category effects.

Discussion

The present study investigated the distribution of word-finding pauses across lexical categories in the three subtypes of PPA and unimpaired controls, in order to test whether word-finding pauses are specific to PPA-L. The results demonstrated that the distribution of pauses corresponded to previously-reported lexical category deficits (e.g., Thompson et al., 2012a; Wilson et al., 2010) only in participants with PPA-L, who paused more frequently before nouns than verbs. This finding supports previous qualitative observations that word-finding pauses are prominent in the connected speech of people with PPA-L (Gorno-Tempini et al., 2008; Mesulam et al., 2012), but less prominent in PPA-G and PPA-S. The results further suggest that in the process of making a diagnosis of PPA-L in a clinical setting, it may be useful to supplement qualitative observations with quantitative analysis of the distribution of pauses. Frequent word-finding pauses in PPA-L may be due to deficits in phonological working memory (Gorno-Tempini et al., 2004, 2008) and/or phonological word-form retrieval (Mack et al., submitted), both of which have been associated with the temporo-parietal junction, one of the typical regions of atrophy in PPA-L (Gorno-Tempini et al., 2004, 2008, 2011; Mesulam et al., 2009, 2012).

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Figure 1. Percent of nouns and verbs preceded by pauses in PPA-G, PPA-L, PPA-S, and controls.

