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Phonological Input or Output? A Case of Phonological Input Deficits in Logopenic Primary Progressive Aphasia

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Introduction

Logopenic variant PPA (lvPPA) is characterized by sentence repetition deficits (Gorno-Tempini et al., 2011). Repetition errors in lvPPA are often attributed to phonological working memory (P-WM) deficits, but there has been little research localizing impairments to input or output phonological processes. We present evidence from CLR1796, an individual with lvPPA, who showed selective disruption to phonological input processes with relatively intact phonological output.

Case History

CLR1796 was 72 years old with 12 years of education. He was 1.5 years post-symptom onset, prior to which he had no history of other neurologic impairments or learning disabilities. The Mini-Mental State Exam (Folstein et al., 1975) indicated a mild cognitive impairment and the MRI showed diffuse atrophy. He did not have apraxia.

Results

Evidence for input-specific phonological impairments

Please see Table 1 for specific performance results on each test. CLR1796 had nearly perfect oral reading but impaired repetition of sentences, words, and nonwords, including phonological and semantic errors in repetition. The presence of semantic errors in repetition (e.g., jab - stick) supports disruption affecting the lexical level. His few reading errors were almost exclusively regularizations of irregular words (e.g., pronouncing “sew” as “sue”). This dissociation between repetition and reading points to a spoken input as opposed to output deficit.

Disruption to multiple phonological input processes

We further investigated phonological input at the levels of phonetic processing, P-WM, and the phonological input lexicon. Phonetic processing was assessed using the first subtest of the PALPA (Kay et al., 1996). CLR1796 showed impairments on PALPA 1 nonword minimal pairs (69.4%). When given a modified version of PALPA 1 with reduced P-WM demand ("different" trials presented visually; CLR1796 was asked to identify a spoken target by pointing to one of two written nonwords) several weeks after the original PALPA 1 administration, he scored 91.7%. His relatively high score on this task suggests P-WM impairments may have contributed to seemingly poor phonetic processing on the original PALPA 1. His poor performance on the rhyme probe task from the Temple Assessment of Language and Short-Term Memory in Aphasia (TALSA) (Martin et al., 2018) is also indicative of a P-WM impairment. Phonological input lexicon tested via PALPA 5 Auditory Lexical Decision revealed particularly poor performance on low frequency and low imageability items.

Modality specificity of Working Memory (WM) impairment

To determine whether CLR1796 has a domain-general WM deficit or a specific P-WM deficit, we assessed WM performance in the visuospatial domain. Visuospatial WM was measured with computerized Corsi blocks (Mueller et al., 2014), and his forward span was 4, which is within normal limits.

Conclusions & Future Directions

CLR1796 has an input-specific phonological impairment affecting multiple input components including P-WM and the phonological input lexicon. Orthographic and visuospatial processing were relatively intact compared to phonological operations. An ongoing case series investigation explores how commonly input-specific vs. output-specific phonological impairments are observed in lvPPA. Gaining a better understanding of the underlying impairment in lvPPA may lead to the development of more beneficial and targeted treatments as well as diagnostic tools.

References

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Table 1. Psycholinguistic Test Results

Assessment	CLR1796 - Mean	Controls - Mean (SD)	N of Controls
Mini Mental State Exam (MMSE) (/30)	18	27 (1.6)	550
Sentence Reading (# of correct words) (%)	98.4%	99.8% (0.6%)	7
Sentence Repetition (# of correct words) (%)	23.8%	98.2% (2.3%)	7
Word Reading (respond after word disappears)			
One-syllable (%)	100.0	100.0% (0.0%)	5
Two-syllable (%)	100.0	100.0% (0.0%)	5
Three-syllable (%)	100.0	100.0% (0.0%)	5
Word Repetition			
One-syllable (%)	60.0%	100.0% (0.0%)	25
Two-syllable (%)	20.0%	100.0% (0.0%)	25
Three-syllable (%)	20.0%	100.0% (0.0%)	25
PALPA 1 Minimal Pairs - Same Trials (%)	91.7%	99.2% (1.6%)	23
PALPA 1 Minimal Pairs - Different Trials (%)	47.2%	97.5% (6.5%)	23
Modified PALPA 1	91.7%	96.8% (2.4%)	7
PALPA 5 - Auditory Lexical Decision			
Overall Accuracy (%)	58.8%		
High Imageability - High Frequency (%)	90.0%	99.3% (2.4%)	21
High Imageability - Low Frequency (%)	80.0%	100.0% (0%)	21
Low Imageability - High Frequency (%)	70.0%	99.8% (1.1%)	21
Low Imageability - Low Frequency (%)	60.0%	98.1% (3.4%)	21
Nonwords (%)	42.5%	95.0% (0.1%)	21
PALPA 25 - Visual Lexical Decision			
High Imageability - High Frequency (%)	100.0%	98.6% (3.4%)	26
High Imageability - Low Frequency (%)	100.0%	97.2% (3.9%)	26
Low Imageability - High Frequency (%)	100.0%	99.5% (2.7%)	26

Low Imageability - Low Frequency (%)	85.0%	98.1% (5.0%)	26
Nonwords (%)	76.3%	99.8% (0.8%)	26
WORKING MEMORY TESTS			
TALSA Rhyme Probe (span)	1.67	6.70 (0.84)	16
Visuospatial WM - Corsi block (span)	4	6.4 (1.5)	40