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# The Effects of Working Memory and Attention Impairments on Language Symptoms in Aphasia

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## Abstract:

A growing body of evidence has corroborated the notion that aphasia is not a pure linguistic disturbance, but is one that is exacerbated or perhaps generated by underlying cognitive weaknesses. Varying degrees of dysexecutive syndrome, attention deficit, and working memory impairment are thought to interfere with semantic, syntactic, and phonological processing. As a result, symptoms of aphasia may be intensified. This thesis reviews evidence for the existence of a modular cognitive-linguistic system in terms of Baddeley and Hitch's (1974) single resource model, and outlines how this interplay is manifest in persons with aphasia (PWA). An instantiation of two reciprocally interactive components implicating long-term linguistic representations and the mobilization of cognitive resources for linguistic processing is proposed in order to condense relevant literature on the matter, and to support McNeil and Pratt's (2001) proposition for an operational definition of aphasia that universally includes a cognitive element. Due to persistent ambiguity surrounding the nature and separation of working memory, attention, and the central executive in PWA, the ability to draw clinical conclusions on the precise characterization of neuropsychological deficits manifest in various aphasia severities remains to be poorly defined, particularly in the acute and early subacute stages of aphasia recovery. This is due to the fact that authors tend to exclude participants with severe aphasia syndromes who are in the rapidly changing acute and early subacute stages of functional recovery. Consequently, the current study originally aimed to elucidate the roles of multiple cognitive facets across the severity continuum in persons within the acute and early subacute stages of aphasia recovery using procedures designed to bypass verbal responses. Specifically, this study explored the nature and exclusivity of verbal and nonverbal working memory subdivisions, as well as the influence of attentional control, for the purpose of elucidating certain cognitive-linguistic syndromes in persons with severe aphasia. A comprehensive cognitive battery was assembled to include the following: two n-back programs, one tapping phonological working memory, the other tapping semantic working memory (entitled "phonoback" and "semback," respectively, both administered at the 1-back and 2-back levels), forward and backward block tapping tasks, and a nonverbal numeric Stroop task with measures of both inhibition and facilitation. The effect of response modality on simple and complex digit spans was also explored to elucidate the effect of verbal responses on certain cognitive tasks in PWA.

Consequential to unexpected recruitment difficulties, persons in the acute and early subacute stages of aphasia recovery could not be included; therefore, findings apply to those with

chronic aphasia. While participants presented with a range of severities, only 1 group could be formed, precluding *a priori* sample divisions. Results of this study alluded to the presence of processing deficits in all participants, although effects of inhibition and facilitation could not be precisely determined. All participants presented with phonological working memory deficits as measured by complex digit span, which was not influenced by response modality. Results on a measure of visuospatial working memory were mixed, but found to be inversely associated with aphasia severity. The role of semantic working memory in aphasia severity could not be determined; however, a relationship between visuospatial working memory and the semantic n-back was identified, suggesting intrusion of visual working memory that was, perhaps, compensatory in nature. This study also identified that pronounced cognitive deficits can exist in both younger and older adults with aphasia, thus diminishing the putative influence of natural cognitive decline on aphasia symptoms.

While quantitatively limiting, this study was able to corroborate many research claims for the presence of distinct linguistic processing deficits in PWA, as well as the possibility of nonlinguistic processing deficits, through qualitative means. Results ultimately supported a need to further elucidate the nature of cognitive impairment in PWA across time, severity, and syndrome in order to derive standard therapeutic interventions that sufficiently remediate both cognitive and linguistic aspects of aphasia. Specifically, it is suggested that future studies explore whether or not working memory, attention, and executive control are relatively separable constructs in PWA, and whether cognitive processing deficits can be (a) localized within Baddeley's and Hitch's (1974) framework and (b) reduced to phonological, semantic, or syntactic domains.

**Keywords:** Aphasia, Executive Control, Interference, Language, Response Modality, Selective Attention, Single Resource Model, Working Memory