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Research paper

# A preliminary investigation into the application of processing instruction as therapy for aphasia in Spanish speakers

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ABSTRACT

*Purpose:* This study was a preliminary investigation into the use of processing instruction (PI) to improve the use of the personal '**a**' to assign thematic roles in Spanish sentences for second language (L2) learners and persons with aphasia (PWA). Evidence suggests that PI is an effective teaching method for L2 learners with errant processing strategies. However its use with PWA with an acquired inability to process syntactic cues is unknown.
*Methods:* Thirty non-impaired Spanish as a second language learners and two Spanish-speaking PWA participated in this study. PI involved the use of explicit instruction and structured input activities with nouns and pronouns. Each participant's performance was assessed pre and post treatment. Two experimental and one control groups of L2 learners completed the PI activities over two days. PWA completed PI in individual sessions over four day and received additional cues.
*Conclusions:* L2 learners who received PI demonstrated significant improvement in the comprehension and production of '**a**'. However, the Spanish-speaking PWA demonstrated mixed results. Both of the PWA exhibited gains in the comprehension of '**a**' on referential tasks. One participant with aphasia demonstrated improved comprehension post-testing, and neither participant demonstrated gains on production post-testing. Results suggest that PI may be useful for increasing syntactic comprehension in people with aphasia. Findings from the current study are used to guide suggestions for further modification and use of PI as a treatment strategy for PWA.

**Learning outcomes**: Readers will be able to: (a) define processing instruction, (b) discuss the role of specific syntactic cues in Spanish comprehension, and (c) explain how PI might be modified for use with Spanish speakers with aphasia.



## 1. Introduction

Deficits in the production and comprehension of syntax are common in aphasia. Agrammatism is "generally defined as a disorder of sentence construction in aphasic language production" (De Bleser, Burchert, Holzinger, & Weidlich, 2012, p. 121). However, agrammatism presents different patterns based upon a speaker's language. For example, English speaking patients or persons with aphasia (PWA) tend to produce primarily content words and few bound or free grammatical morphemes (Paradis, 1988). However, in a cross-linguistic study of the discourse of individuals with agrammatism, Menn, O'Connor, Obler, and Holland (1995) found that most morphological errors could be described as incorrect choices among existing

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grammatical forms. Across languages, PWA rely on the simplest grammatical forms, substitute bound morphemes, substitute or omit free grammatical morphemes, and seek to avoid more complex syntactic structures.

Agrammatism also has been associated with deficits in syntactic comprehension. These deficits are most evident when patients must rely on syntactic cues to resolve meaning. Passive sentences, which invert the position of the subject and object, are more difficult for PWA to understand than active sentences (Beretta, Pinango, Patterson, & Harford, 1999). Additionally, PWA demonstrate greater difficulty with semantically reversible sentences than non-reversible sentences (Haendiges, Berndt, & Mitchum, 1996). In semantically reversible sentences, both the agent and the object are capable of performing the action (e.g., Mary calls Tom); therefore, the listener is dependent on the syntactic structure to identify thematic roles. In English, word order is a valid and reliable cue for thematic role assignment, but in languages with more flexible word order listeners rely on morphological cues such as verb inflection or prepositions to identify thematic roles (Hernandez, Bates, & Avila, 1996).

Researchers have found a strong relationship between the manifestation of syntactic deficits and the structural characteristics of the affected language. Specifically, framed within a Competition Model heuristic different sources of syntactic information compete or converge to determine what the listener understands (Bates, Devescovi, & D'Amico, 1999; MacWhinney, 1987). This model has important implications for the current study since Bates, Wulfeck, and MacWhinney (1991) argued that aphasia is associated with a selective vulnerability of morphology. Some aspects of morphology are more at risk while others are more protected depending on their importance in a given language relative to their processing cost. In richly inflected languages, morphological substitutions are commonly seen in PWA regardless of type of aphasia. The notion of competing resources can account for the universal and language specific nature of the syntactic comprehension deficits in aphasia.

Listeners rely on the most valid cues (in regards to availability and reliability) in their language as balanced against cue cost, or the processing effort demanded by the cue (Presson & MacWhinney, 2011). Syntactic or semantic feature(s) with the highest cue validity relative to cue cost will be given preference, particularly in the face of ambiguity. Researchers have studied a number of cues in a number of languages, including word order, subject–verb-agreement, and animacy (Hernandez et al., 1996). In the sentence *The tree blows the winds*, word order and subject–verb agreement favor *tree* as the actor while animacy favors *winds*. The cues, which will determine the interpretation, will depend on the language being tested. For example, interpretations by English speakers will favor word order, while interpretations by Spanish speakers will favor subject–verb agreement (Hernandez et al., 1996). Cue validity and cue cost are dependent on the structure of a given language.

Sentence comprehension deficits in a given language are a function of cue validity and cue cost. For example, Spanish, a pro-drop language with flexible word order, places increased demand on the syntactic cues used to identify thematic roles in sentences. As a result, Spanish speakers rely more heavily on verb inflection and functors to assign thematic roles (Hernandez et al., 1996; Ostrosky-Solis, Marcos-Ortega, Ardila, Roselli, & Palacios, 1999). As the Competition Model would suggest, Spanish speaking PWA demonstrate less difficulty with processing subject–verb agreement than English speakers with aphasia (Ardila, 2001). Ostrosky-Solis et al. (1999) found participants with aphasia primarily used free functors to disambiguate sentences, though with varying degrees of success. Additionally, Spanish speaking PWA demonstrate particular difficulty comprehending and producing prepositions low in semantic value and those which may have low value as syntactic cues (Reyes, 2007).

Concepts of cue validity and cue strength can be utilized to guide treatment for syntactic deficits by improving the ability of the PWA to assign thematic roles within a given language. Haendiges et al. (1996) constructed a series of sentence/picture matching tasks designed to facilitate the use of structural cues by PWA to assign thematic roles in reversible sentences. The participant demonstrated maintenance of the processing gains made for active sentences. However, improvement on the comprehension of passive sentences seemed to be based on the use of "by" to identify the agent and was not maintained. The treatment protocol and interpretation of their results were based on a mapping deficit hypothesis of agrammatism that proposes that PWA have lost the ability to map lexical information onto a syntactic form (Springer, Huber, Schlenck, & Schlenck, 2000). Viewed from the framework of the Competition Model, the treatment strengthened the participant's ability to use word order cues, the strongest English cue, to process active sentences. In the absence of word order cues, the participant defaulted to a prepositional cue ("by") with low cue validity. Syntactic processing in PWA could be improved with a treatment that specifically targets increasing individual awareness and processing of the cues critical to assigning thematic roles in a particular language.

The purpose of this study was to measure outcomes of a treatment protocol administered to non-impaired Spanish as a second language learners and two Spanish-speaking PWA. The protocol was designed to improve the use of the proposition personal '**a**' (to) needed to assign thematic roles in reversible sentences. Spanish syntactic comprehension requires a lower dependence on word order and a higher dependence on morphology (Hernandez et al., 1996), partly due to the frequency and saliency of morpho-syntactic cues in Spanish and the highly flexible word order (Ostrosky-Solis et al., 1999). '**A**' always precedes the object, signaling the accusative role: *María llama a él* [Maria calls him]. It is not always present before the object, but it is required before animate objects and is referred to as the personal '**a**' when used in this grammatical construction. A noun following '**a**' is always the object of the sentence regardless of word order.

The preposition '**a**' also is a marker of the infinitive tense (e.g., *voy a jugar* [I'm going to play]), a marker of the dative (e.g., *Pedro le da el regalo a Victoria* [Pedro gave the present to Victoria]), and can be used as a locative (e.g., *Pedro caminó a México* [Pedro walked to Mexico]; Kail & Charvillat, 1988). As a result, '**a**' has weak reliability and validity. However, '**a**' also has