



## Research report

# Preservation of passive constructions in a patient with primary progressive aphasia

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## ABSTRACT

Research into agrammatic comprehension in English has described a pattern of impaired understanding of passives and retained ability on active constructions. Some accounts of this dissociation predict that patients who are unable to comprehend actives will also be impaired in the comprehension of passives. We report the case of a man with primary progressive aphasia (PPA) (WR), whose comprehension was at chance on active sentences, but at ceiling on passives. In a series of reversible sentence comprehension tests WR displayed difficulties with active transitives and truncated actives with an auxiliary. In passive sentences, he displayed sensitivity to the agent marker *by*, as well as the passive morphology of the verb. This pattern of dissociation challenges current theories of agrammatic comprehension. We explore explanations based on the distinction between morphological and configurational cues, as well as on the semantic and discourse related differences between active and passive constructions.

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## 1. Introduction

One of the signs of aphasic impairment can be agrammatic comprehension, i.e., a difficulty in deriving information from sentence structures as opposed to single words in both spoken and written language. Agrammatic comprehension manifests most clearly in the interpretation of semantically reversible sentences such as *The man pushes the elephant* or

*The elephant pushes the man* where both *man* and *elephant* are possible agents on the basis of lexical-semantic information. Successful interpretation rests on sensitivity to syntactic structures in order to identify thematic relations and determine “who did what to whom”. Agrammatic performance on sentence–picture matching tasks can be at or below chance when sentences are semantically reversible (Ansell & Flowers, 1982; Berndt, Mitchum, & Haendiges, 1996;

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Caramazza & Zurif, 1976; Schwartz, Saffran, & Marin, 1980). Syntactic comprehension impairment can be present in people with different neurological profiles, including patients with vascular aphasia and those with primary progressive aphasia (PPA) due to fronto-temporal degeneration (Gorno-Tempini et al., 2011; Hanne, Sekerina, Vasishth, Burchert, & De Bleser, 2011; Martin, 2006; Thompson et al., 2013; Wilson, Galantucci, Tartaglia, & Gorno-Tempini, 2012).

Investigations of syntactically impaired comprehension explore processing of different sentence types. The dominant profile that is reported is of less difficulty with transitive active constructions (*The man pushes the elephant*) than with passive constructions (*The elephant is pushed by the man*). This profile is strongly associated with cases of “agrammatism”, characterized by non-fluent, agrammatic production and comprehension resulting from damage to the left inferior frontal gyrus, and Broca’s area in particular. It has been proposed that processing of passives (and other non-canonical sentences) demands additional cognitive resources, and that people with agrammatic comprehension either lack these resources or have difficulties using them (e.g., Menn, 2000). A range of models has been proposed to describe the cognitive underpinnings of agrammatic comprehension, and to account for this “typical profile”.

First accounts suggested a loss of sensitivity to syntactic information and subsequent dependence on lexical and heuristic strategies in guiding interpretation (Caramazza & Zurif, 1976). The first psycholinguistic investigations of agrammatism were published at a time when generativist theories were becoming the dominant conceptualization of syntactic processing, and generativist models of agrammatism quickly emerged. The Trace-Deletion-Hypothesis (TDH) in particular has been prominent (Grodzinsky, 1984, 1995, 2000) and is based on the hypothesis that passives result from a transformational movement rule which changes the canonical constituent order. In English, where the canonical word order is agent-verb-patient, the patient NP moves from its canonical postverbal position at the level of “deep” or underlying structure to the preverbal position in surface structure. It leaves behind a trace which is needed for interpretation (*The elephant<sub>i</sub> was pushed t<sub>i</sub> by the man*). According to the TDH, the agrammatic comprehension observed in typical Broca’s aphasia can be the result of the trace being deleted, making the interpretation of English passives (and also object relatives and object clefts) difficult. The Double-Dependency Hypothesis (Beretta & Campbell, 2001; Mauner, Fromkin, & Cornell, 1993) similarly relies on the processing of traces. In more recent generativist theories traces appear in active constructions as well, which makes it harder for solely trace-based approaches to explain the dissociation in the typical profile (Grodzinsky, 2000). More recent accounts of agrammatic comprehension focus on deviation from canonical order and put less emphasis on traces (Bastiaanse & Edwards, 2004; Bastiaanse & van Zonneveld, 2006; Draï & Grodzinsky, 2006).

Other explanations for syntactic comprehension impairments concern working memory capacity (Just & Carpenter, 1992). Compared to actives, passive constructions require the additional morphology of the passive auxiliary, the past participle inflection on the verb (-ed/-en), and, in the full passive, the agentive marker *by*. One proposal is that impairment

in verbal or syntactic memory systems, resulting in slowed activation, manipulation or retention of information (Caplan & Waters, 1999; Haarmann, Just, & Carpenter, 1997; Haarmann & Kolk, 1991; Swinney & Zurif, 1995), might affect the processing of passives more than actives. There are other reasons why passives may pose higher cognitive demands than actives and even healthy adults process them more slowly and less accurately (Baddeley, 1968; Ferreira, 2003; Street & Dąbrowska, 2010, 2013). Actives are acquired earlier by children (Baldie, 1976; Brooks & Tomasello, 1999; Horgan, 1978; Maratsos, Fox, Becker, & Chalkley, 1985; Maratsos, Kuczaj, Fox, & Chalkley, 1979; de Villiers & de Villiers, 1985). They are also considerably more frequent in language use: only 3% of all spoken and 9.23% of all written verb phrases in the British National Corpus (BNC) are in the passive voice (Roland, Dick, & Elman, 2007). This may result in actives being more ‘entrenched’. Lexical integration and bias has also been suggested to be a factor in the processing of passives (Menn, 2000; Street & Dąbrowska, 2013). Passives may be harder because most verbs appear more frequently in active constructions. Gahl et al. (2003) reported that while aphasic participants generally found passives harder to comprehend than actives, passives were less difficult when the main verb was more likely to appear in passive structures (e.g., *injure*) than when the verb had an active bias.

However, it has been argued that the “typical” profile of superior performance on actives over passives may misrepresent the population of people suffering from sentence comprehension impairments. Systematic investigation of individual patients reveals a wider range of comprehension profiles (Berndt & Caramazza, 1999; Berndt et al., 1996; Burchert, De Bleser, & Sonntag, 2003; Caramazza, Capasso, Capitani, & Miceli, 2005; Caramazza, Capitani, Rey, & Berndt, 2001; Kolk & van Grunsven, 1985; Luzzatti et al., 2001). For example, Caramazza et al. (2005) tested the comprehension of reversible sentences by 38 aphasic speakers of Italian with non-fluent agrammatic speech and lesions to Broca’s area. Only 15% of the participants performed at chance on passives and above chance on actives. The majority showed equal performance on both sentence types. The dominance of a typical profile in the literature may be the result of over-reliance on group averages, or even a selection bias favoring publication of cases that fit common models of agrammatism (Druks & Marshall, 1996).

We explore a particular profile of syntactic comprehension impairment: people with aphasia who perform well on comprehension of passives, but display chance performance on actives. Druks and Marshall (1995) describe the case of BM, a 68-year-old man with a left fronto-temporal lesion due to stroke. According to the Boston Diagnostic Aphasia Examination (Goodglass & Kaplan, 1972), his clinical profile was best described as that of Broca’s aphasia, although his phrase length was better than the upper limit for Broca’s aphasia. BM was tested on comprehension of spoken reversible sentences with different syntactic structures. He performed at chance on reversible active sentences (including declaratives, questions and existentials), but above chance on the corresponding passives. These observations present a challenge to theories which focus on the passive as transformed from canonical word order. It is difficult to explain how

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