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'To be' or not 'to be': an analysis of copula production and omission in people with non-fluent aphasia

Giuditta Smith [a,b], Charlotte Kershaw [c], Valentina Brunetto [c] and Maria Garraffa [a]

[a]School of Health Sciences, University of East Anglia, Norwich, UK; [b]CISCL, Università degli studi di Siena, Siena, Italy; [c]School of Arts, Cultures and Societies, University of Leeds, Leeds, UK

ABSTRACT

Background: Agrammatic aphasia has been widely associated with impairments with functional words and complex sentences. Speech errors of people with aphasia (PWA) have been reported to be selective, with patterns of omissions in functional words, most notably in the domain of tense inflection on verbs compared to agreement in morphologically rich languages.

Aims: In languages like English, where tense and agreement are hard to disentangle in their inflectional paradigms, investigations of the inflectional domain in PWA are rare. In this study, we introduce a novel approach that allows the disentangling of inflectional errors in English through the patterns of copula omission of the verb *to be*. The inflectional system of the functional verb to be is richer, and its distribution in the sentence is based on the semantics of its predicate (stage-level vs. individual-level).

Methods and procedures: Spontaneous productions of 16 PWA collated from AphasiaBank transcripts were analysed for violations of tense alongside other patterns of error that could suggest an impairment in the inflectional domain.

Outcomes and results: Copula deletion was found to be modulated by the semantics of the predicate, showing a selective pattern of omission in stage-level predicates. Incorrect case assignment (accusative in place of nominative) was also observed as an indicator of impaired tense.

Conclusions: The results confirm the effectiveness of copula to be to investigate the English inflectional system and substantiate previous studies on selective errors in the verbal domain in PWA in English.

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1. Introduction

In the last decades, cross-linguistic research in people with aphasia (PWA) has greatly contributed to the specification of the grammatical deficit, with important advancements both in the clinical description of agrammatic aphasia and in the theoretical investigations derived from agrammatism (Druks 2017; Garraffa & Fyndanis, 2020).

CONTACT Maria Garraffa m.garraffa@uea.ac.uk Queen Building, Faculty of Medicine and Health Sciences, University of East Anglia, Norwich Research Park, NR4 7TJ, Norwich UK

A robust result has been reported in the domain of verbal inflection starting from Friedmann and Grodzinsky's (1997) seminal work discussing the existence of a selective difficulty in tense morphology (tense, *The boy lov-ed*) and not agreement (agreement, *The boy$_{sg}$ love-s$_{sg}$*). This finding has since received great cross-linguistic validation (see 2.1 below for an extensive discussion).

The exploration of tense impairment in English-speaking PWA remains scarce, mainly due to the low levels of inflectional morphology of this language. To investigate verb marking in English PWA, this study proposes an innovative approach, analysing different manifestations of the verb *to be*. Copula contexts in PWA were collated from the transcript database AphasiaBank (MacWhinney et al., 2011) and were inspected for violations of tense through copula deletion. The tense/agreement asymmetry was also explored, as violations of agreement between person and number of the subject and copula were investigated.

Associating tense impairment to copula deletion draws from Becker's (2002; 2004) analysis of the copula in early child English and her discovery of an asymmetry in patterns of omissions as captured by a semantic distinction between stage-level predicates and individual-level predicates. Stage-level predicates (SLs) (e.g., *be tired*) denote impermanent properties and thus incorporate both aspectual and temporal information related to a state or event. Individual-level predicates (ILs) (e.g., *be tall*) are not aspectual, as they denote permanent characteristics. As we will discuss in further detail in 2.2, Becker (2002) argued that the larger rate of copula omissions in SL predicates in early child grammar is a by-product of the fragility of tense. Aspectual (SL) predicates allow temporal anchoring even in the absence of the copula, therefore offering a more economical strategy to tense agreement operations; this strategy is not possible in non-aspectual (IL) predicates where temporal anchoring can only be achieved by tense, which is encoded on the overt copula. Extending this analysis to the speech of PWA, we predict tense deficits to be detected in the form of selective omissions of the copula in SL predicates. Following Baker (2013), we predicted that an impairment in tense -if present- would also inhibit nominative case assignment. For this reason, we included an investigation of subject-verb agreement.

The paper is organised as follows. Section 2 introduces the literature framework on the evaluation of the verbal inflection in PWA. It further posits the copula *to be* as a suitable basis for this study through discussion of previous findings of copula as well as aspect usage by PWA. Section 3 presents the methodology used to approach the research questions, the collation of data, choice of participants and coding of materials. Section 4 displays the results of this study while Section 5 reviews the results considering the research questions and the literature. Lastly, Section 6 summarises the findings of this study indicating its implications for aphasiology research as well as its theoretical implications.

2. Characterising the deficit in the verbal domain

2.1. Tense and aspect impairments in agrammatism

Impairments in the verbal domain have been extensively reported as a key feature of agrammatism (Faroqi-Shah & Thompson, 2004; Rochon et al., 2000; Saffran et al., 1989; see Faroqi-Shah & Friedman, 2015 for a review), and overwhelming cross-linguistic

results support the idea of a selective impairment of tense over agreement morphology (e.g., Gavarró & Martínez- Ferreiro, 2007 for Ibero-Romance; Wenzlaff & Clahsen, 2004 for German; Garraffa, 2009 for Italian). According to these results, inflectional morphology containing information of tense (i.e., +/- PAST) is generally more impaired than the agreement operation between the subject and the verb (i.e., +/- PLURAL). Given the nature of the asymmetry, numerous proposals have been put forward to integrate the impairments of PWA in the verbal domain within linguistic theory (Clahsen & Ali, 2009; Druks, 2017; Garraffa & Fyndanis, 2020). Most notably, a representational account of the grammatical deficit is based on the position of the two nodes (Tense Phrase and Agreement Phrase) in the verbal inflection domain, hypothesising a reduction of the syntactic tree in Broca's aphasia (Tree-Pruning Hypothesis (TPH)) as proposed by Grodzinsky (2000) and Friedmann and Grodzinsky (1997). The TPH model elegantly explains other observed phenomena including poor mastery of operations taking place within the CP layer (such as WH-questions and embedded clauses, Menn et al., 1990), but proves problematic for the integration of situations (as noted in Clahsen and Ali 2009) in which tense is impaired but higher nodes are not (e.g., embedded clause production in English, Lee et al., 2008), and of situations (as noted in Druks & Carroll, 2005) where the asymmetry between tense and agreement is exhibited even if agreement is claimed to precede tense (e.g., Moroccan Arabic, Diouny, 2007). In opposing analyses, tense deficit is understood as independent and unconnected to other functional elements (including agreement and CP), and consequently the result of processing rather than representational issues. These may be triggered by so-called uninterpretable features which are harder to process than interpretable features (Impaired Interpretable Feature Hypothesis (IIFH), Nanousi et al., 2006), or by underspecified features, such as +/- PAST (Tense-Underspecification Hypothesis (TUH; Wenzlaff & Clahsen, 2004, 2005). The deficit may therefore be attributable to a more general impairment in discourse linking -as suggested considering findings from languages where tense is not grammaticalized on the verb and no impairment is found (Bastiaanse, 2013, elaborating on Avrutin, 2006)-, or on a syntactic computation -as suggested considering agreement errors in more complex agreement configurations (i.e., post verbal subjects in Italian PWA, Garraffa, 2009, 2011).

In languages that mark it morphologically on the verb, aspect marking was also found to be impaired in PWA (e.g., Nanousi et al., 2006; Varlokosta et al., 2006; Fyndanis et al., 2013 in Greek; Novaes & Braga, 2005 in Portuguese; Dragoy & Bastiaanse, 2013 in Russian). Aspect reflects the denotation of whether the event is finished (perfective) or ongoing (imperfective). Typically, impairments in aspect are identified as incorrect tense assignment in sentences where the temporal status of the event is given, for example through temporal adverbs indicating the duration of the event (*Tomorrow, for an hour, he (*will) be in a meeting*). As a consequence, in languages where aspect is marked it is closely linked to tense, and some authors propose a hierarchy of complexity where past and perfective are the most problematic forms (as in the case of the Past Perfective) over present/future and perfective and imperfective (Nanousi et al., 2006; Stavrakaki & Kouvava, 2003), and, in a similar vein, others postulate a direct interaction between time reference and aspect, proposing an association between past and perspectives on the one hand, and present/future and imperfectives on the other (Dragoy & Bastiaanse, 2013).

2.2. Copula Use in Agrammatism

Studies testing tense in English agrammatism are uncommon due to the nature of the English inflectional system. Arabatzi and Edwards' (2002) study of English agrammatic PWA illustrated both the replacement and omission of verbal inflections through task-elicited and spontaneous language. Similar results were found in Bastiaanse (2013). Coherently with what was discussed until now, minimal agreement errors were observed, with most PWA forming none.

Friedmann and Grodzinsky's (1997) seminal paper further reports a dissociation between tense and agreement in copula production, which mirrors that of inflected verbs. At the same time, errors in copula use appear unique in that they comprise both incorrect tense replacements and entire deletions. Across non-fluent PWA, copula omission appears like a prevalent phenomenon (Nadeau & Rothi, 1992 for English). While several studies on verbal deficits in agrammatism include analyses of copula production alongside production of lexical verbs, there are no comprehensive investigations of copula *to be* in aphasiology studies to date. Although Clahsen and Ali's (2009) experiments tested inflectional features (tense, agreement and mood) in copula production in English PWA, by asking participants to choose a form to fill a sentence gap, the tasks mask authentic use by not allowing for omission errors. In fact, the contexts associated with copula omission in PWA are rarely addressed or prove inconclusive. The third person copula *is* has been reported in spontaneous speech to be prominently deleted due to being a semantically empty dummy form (Menn et al., 1990), while de Roo (2003) observes overuse of *is* in Dutch possibly as a strategy to lessen processing pressures.

2.3. The Syntax and Semantics of Copula Structures

A grammatical account of copula omission was proposed by Becker (2002). Analysing early child language omissions, Becker proposes that it is the predicate-dependent inclusion of an Aspect Phrase (AspP) projection which correlates with copula deletion in language acquisition. Following Carlson (1977), copula predicates can vary between: (i) individual-level (IL), which denote fundamental, integral features and (ii) stage-level (SL), which denote temporal or geographical impermanence. This semantic contrast tends to be mapped onto nominal and locative predicates respectively (1 a-b), whereas adjectival predicates (1 c-d) may belong to either category. This distinction is illustrated in the examples in 1.

(1)

(a) Bob is a frog	(c) Bob is wise
(b) Bob is in the castle	(d) Bob is sleepy

In (1a) and (1c) the copula combines with IL predicates: the features 'to be a frog' and 'to be wise' are fundamental and integral to the individual (Carlson, 1977). In contrast, (1b) and (1d) illustrate SL predicates as the locative indicates an impermanent state (one is not perpetually 'sleepy'). Becker (2002) proposes different syntactic compositions for the two types of predicates, where SL predicates, but not IL predicates, project an Aspect Phrase (AspP). The presence of an AspP layer in SL predicates can be observed cross-linguistically and this semantic contrast is lexicalized in some languages. For example, Portuguese and Spanish

select different copulas, namely *ser* for predicates highlighting integral features of an individual whereas *estar* is appropriate in the expression of impermanence (Camacho, 2012).

To justify her finding that SL predicates are the primary site for copula omission in early child language, Becker (2002; 2004) proposed that the presence of AspP in the syntactic representation of the sentence allows children to disregard overt copula production. In her analysis, a contrast between the Temporal Anchoring process in children and adults is considered. In line with Guéron and Hoekstra (1995), Temporal Anchoring refers to a binding mechanism between a temporal, functional head in the inflectional domain, and a tense Operator in the CP domain. Temporal Anchoring must be fulfilled (Enç, 1987), yet it is only achieved through binding to either tense or aspect, since these are the only inflectional heads with temporal properties. The chosen head for binding is language-dependent, but differences may arise between adult and child grammar: inspired by the idea that cross-linguistic parametric options may be active within a monolingual child's grammar (Hyams & Wexler, 1993), the deletion of the copula in the context of SL predicates, which is ungrammatical in adult English but possible in other languages of the world (e.g., Russian, Hebrew, African American English), may be licit in (English) child grammar under AspP-binding as an alternative strategy to realise temporal anchoring; however, this is not an option in IL predicates because deletion of the copula would result in an utterance lacking a licit mechanism for temporal anchoring. Children's syntactic representation of IL and SL predicates is displayed in Figure 1.

3. Research Questions and Hypotheses

Children's adoption of non-target aspect binding in English reviewed in 2.3 would be a consequence of a developmental stage where tense is fragile. If aspect is authorised to execute a function ordinarily carried out by tense, it seems plausible to suggest that, in the presence of an impairment in tense, a similar strategy might become available. Consequently, the present study proposes to adopt copula production as an approach to investigate tense impairment in PWA. Our analysis focuses in particular on a semantic feature within the inflectional domain which has not previously received attention in the aphasiology literature, namely the distinction between aspectual (Stage-Level) and non-aspectual (Individual-Level) copula constructions. The goal of this approach is to overcome several limitations to explore verbal deficits in the grammar of English PWA: first, given that copula verbs differ in whether they incorporate an aspectual layer in their inflectional domain, they provide a novel angle from which to test the interaction between different inflectional features (tense and aspect). Moreover, as noted in Clahsen and Ali (2009), copula verbs offer a way of teasing apart the role of tense and agreement since they conjugate on person and number, unlike regular verbs (see Table 1).

Consequently, the main research question of this study will examine tense by examining whether copula production/omission patterns are modulated by the type of predicate expressed by the copula construction (IL, SL) (RQ1). Tense marking will be tested on overt/null copulas, and not on grammatical/ungrammatical temporal marking. This is in line with our predictions that null copulas are linked to an impairment in tense and avoids the problem of determining the grammaticality of tense marking in spontaneous speech (Friedmann & Grodzinsky, 1997). Our hypothesis to be verified is that overt copulas occur

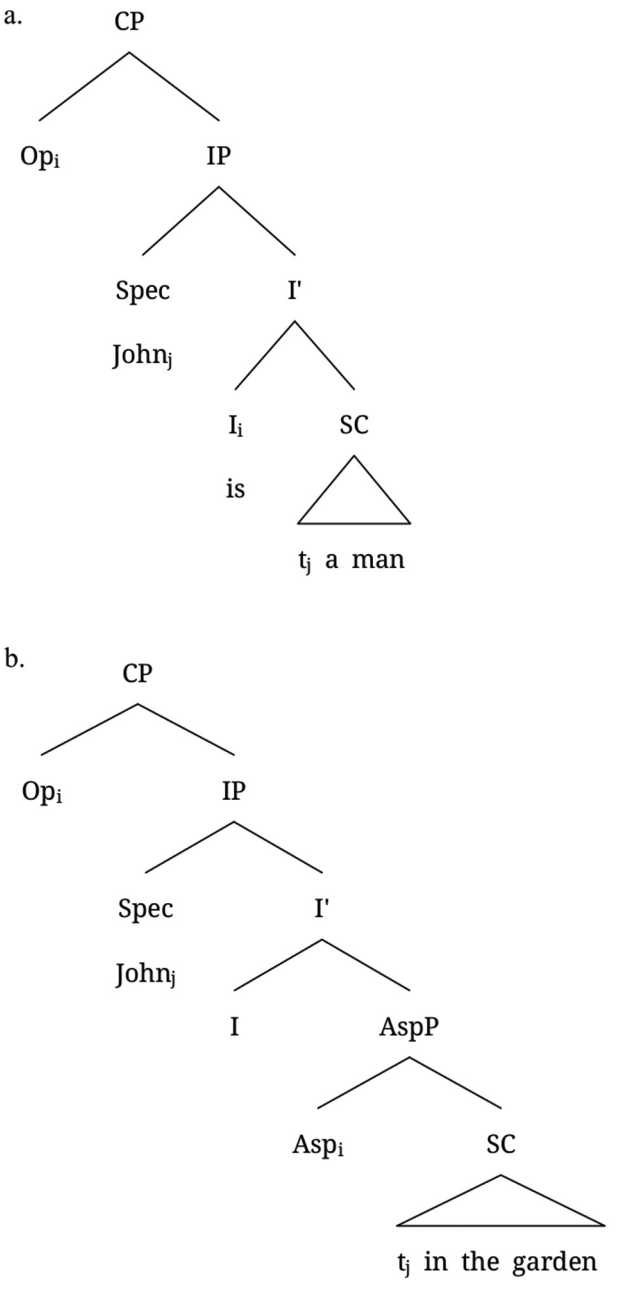

Figure 1. Syntactic representations of (a) Individual-level predicates inflectional specification and (b) Stage-level predicates aspectual specification (Becker, 2002).

Table 1. Irregular conjugation of copula to be in present and past tense.

Person	Subject Pronoun	Present	Past
1sg	I	am	was
2sg	you	are	were
3sg	he/ she/ it	is	was
1pl	we	are	were
2pl	you (lot)	are	were
3pl	they	are	were

more often within individual-level predicates and omitted copulas within stage-level predicates as a result of a tense deficit.

As copulas, unlike regular verbs in English, also undergo agreement, the status of agreement will also be checked (RQ2) by examining whether agreement features are preserved on the copula. Given the tense-agreement asymmetry reported cross-linguistically (see 2.1), ungrammatical subject-copula agreement is anticipated to be non-existent to minimal.

It should be noted that in English, nominative case is assigned to subjects when the inflection is finite (*he is/*him is*); thus, a deficit in tense also predicts that errors in nominative case assignment should occur when a pronominal subject occurs with a null copula. For this reason, the type of subject used was also recorded (whether a full DP, a pronoun, or a null subject), and case assignment on pronominal subjects was checked. We did not expect the type of subject to be dependent on the choice of copula, as the use of subjects in PWA is known to show great variability, and to often favour overextension of subject pronouns (Chapman & Ulatowska, 1989; Martínez-Ferreiro et al., 2019).

4. Methods

Language data were obtained from ten corpora within the AphasiaBank Protocol database (MacWhinney et al., 2011)[1] The Protocol database on AphasiaBank contains scaffolded interviews where clinicians followed a question script. Each interview incorporates: a stroke story, an important event, four picture descriptions, a Cinderella narrative and a procedural discourse of sandwich making. The rationale for using the Protocol database is that the PWA receive similar language input in those sessions, therefore the linguistic environment remains similar. This is fundamental as participants' spontaneous production of copula contexts elicited in this setting can be shared across the cohort permitting the formulation of generalisations.

In total, 195 copula contexts were analysed. All collated data was coded for copula overtness, predicate type, and subject type. Grammatical agreement was coded through the matching of subject number and copula number. It should be noted that agreement was only tested on the 152 utterances where the subject and the

[1]The following corpora were used: ACWT Corpus (Binek and Shelley); Adler Corpus (Szabo); Boston University Corpus (Hoover); Elman Corpus (Elman); Fridriksson Corpus (Fridriksson); Kempler Corpus (Kempler); Kurland Corpus (Kurland); Montclair State University Corpus (Boyle); SCALE Corpus (McCall) and Whiteside Corpus (Whiteside)..

copula were overt. Subject DPs were also classified for case. (See Appendix for further details of coding).

The following *to be* contexts were disregarded from this analysis as they were not complementary of this study.

(a) Auxiliary *to be* constructions [the dog is barkin' (Kempler03a, 205)].
(b) Quotative use of the copula [I was like (Fridriksson12a, 34)].
(c) Expletive subjects *it* and *there* within copula predicates [it's raining (Scale18a, 101)].
(d) Fillers, repetitions and [+ exc] marked interjections in the transcript [that's all (Kempler04a, 134)].
(e) Ambiguous copula contexts including those missing a complement [she was so thing (Scale31a, 488)].

(a) and (b) exhibit non-copula functions of *to be*; in (a) *to be* operates as an auxiliary and the fixed phrase in (b) encodes a quotative role (Tagliamonte & Hudson, 1999). Copula predicates with subject 'it' were only included where the pronoun was referential, thus (c) was not counted as it contains a dummy subject with the purpose of maintaining syntactic structure (Patten, 2012); similarly, existential sentences with 'there' were excluded because their syntax is different from that of predicative constructions. Utterances in (d) were excluded as these retained set phrases are constructed and perceived differently by PWA to other instances of the copula; their inclusion may misrepresent true use of the copula. Those in (e) were problematic for interpretation due to their semantically opaque nature (ambiguous copula) or syntactic incompleteness (omitted complement).

4.1. Participants

Sixteen English speaking participants (6 females) were selected from the AphasiaBank Protocol database (MacWhinney et al., 2011). Transcripts were selected from the following corpora: ACWT (Binek & Shelley 2012); Adler (Szabo 2008); BU (Hoover 2012); Elman

Table 2. Number of words, mean length of utterance in morphemes (MLU) and number of copula contexts for each subject.

	Subject	MLUm (sd)	N Words	N Utterances	N Copula Contexts
1	ACWT01a	3.82 (2.51)	267	81	7
2	Adler16a	4.86 (3.37)	508	113	6
3	Adler25a	3.26 (2.42)	536	192	12
4	BU07a	4.17 (2.82)	715	190	14
5	Elman06a	4.02 (2.96)	652	181	18
6	Fridriksson12a	4.32 (2.48)	1079	288	13
7	Kempler03a	4.39 (2.77)	691	183	22
8	Kempler04a	3.63 (2.53)	545	182	9
9	Kurland13a	3.53 (2.42)	321	105	11
10	Kurland24a	6.29 (4.20)	379	73	5
11	Kurland29b	3.87 (3.01)	408	130	5
12	MSU05a	6.19 (4.08)	520	94	5
13	Scale01a	4.70 (3.16)	765	187	12
14	Scale18a	4.69 (3.02)	402	98	11
15	Scale31a	5.69 (3.92)	950	206	29
16	Whiteside15a	5.11 (1.84)	1061	239	16

(Elman 2009); Fridriksson (Fridriksson 2011); Kempler (Kempler 2008); Kurland (Kurland 2012); MSU (Boyle 2014); Scale (McCall 2021); Whiteside (Whiteside 2015).

Participants had a mean age of 61.5 ($\sigma = 9.87$) and a mean level of education of 15 years ($\sigma = 2.21$). Each selected participant has been medically diagnosed with non-fluent aphasia with the Western Aphasia Battery (WAB-R, Kertész, 2007), with three of them being classified with the Boston classification system for subtype of aphasia (BDAE, Goodglass et al., 2001). All participants had acquired aphasia after stroke, and the lesion was localised in the left hemisphere for all participants except one.

The criteria for inclusion were mean length of utterance in morphemes (MLUm) and native proficiency in English. As a quantitative measure of connected speech, MLU is claimed to be an effective indication of linguistic abilities in language impairment (Dalton & Richardson, 2015; Fromm et al., 2017; Marini et al., 2011) and MLUm to be correlated with morphosyntactic skills (in children, Brown, 1973; de Villiers & de Villiers, 1973). MLUm was calculated using the Computerized Language Analysis Software (CLAN; MacWhinney, 2000) (Table 2). As analysis was sentence-level and required the formation at least of a small clause, only participants with a calculated MLUm of 3 and over were included, with a range from 3.26 to 8.57. Furthermore, the selected subjects had to be native speakers of English. This led to the exclusion of two persons from the original selection (Scale25a (McCall, 2011) and TCU-bi02b (Muñoz, 2011)) as they were non-native English speakers. Where participants engaged in multiple interviews, the transcript which displayed the greatest MLU was selected to prevent participant duplication.

4.2. Coding

Copula contexts: each copula context was coded for the inclusion of an overt or zero-copula. Overt copulas were either contracted (*it's*) or full (*is*). Absent copula contexts were detected through examining the linguistic environments aided by the set Protocol structure (MacWhinney et al., 2011). For example, copula productions were particularly induced in the picture tasks and Cinderella narrative as the participants were required to form descriptive constructions. Therefore, two adjacent DPs- or one DP and AP- which formed an ungrammatical utterance alone were analysed as null copula contexts if this interpretation was supported by the context.

Subjects: All subjects of the copula predicates were categorised as full DPs ([the stepmother was bad (Elman06a, 268)]), pronouns ([I was asleep (Fridrikkson 12a, 106)]), or null (*but <> more fluent* [but I am more fluent] (BU07a, 80)), and coded for person and number. Utterances with a null subject were interpreted by examining participants' gestural behaviour using the interview videos provided within AphasiaBank and the transcript codes (MacWhinney et al., 2011).

Table 3. Examples for predicates in different grammatical categories.

Individual-Level Predicate	Stage-Level Predicate
Nominal complement	Locative complement
Adjectival complement: encoding inherent, physical features	Adjectival complement: encoding impermanent, accidental features

Agreement: copula contexts including an overt subject and an overt copula ([Cinderella was a poor child (ACWT01a, 146)] (152 out of 195) were coded for agreement. agreement was coded as correct if the person and number features on the subject matched those on the copula ([The man and the woman is married (Kempler03a, 312)]).

Predicates: all copula contexts were classified as Stage-level (SL) or Individual-Level (IL). The criteria for predicate classification according to copula complement are shown in Table 3.

In some instances, these criteria were adjusted on the basis of contextual considerations. For example, *the man is a tree* (Adler16a, 178), which superficially looks like a nominal predicate, was coded as a stage-level predicate since it was most likely a locative construction lacking a preposition. This was made clear as it was constructed during the Protocol cat rescue task (MacWhinney et al., 2011), where one image displayed a man on a tree. Instances where linguistic criteria were overridden by context were scarce; only 3% of all copula contexts were specifically categorised dependent on the situation they encoded.

4.3. Statistical analysis

A two-way ANOVA was run to investigate whether copula production (overt/omitted) was predicted by predicate type (stage-level vs individual-level), subject type (DP, pronoun, null), and their interaction. Analyses were run on Rstudio (Rstudio Team, 2020).

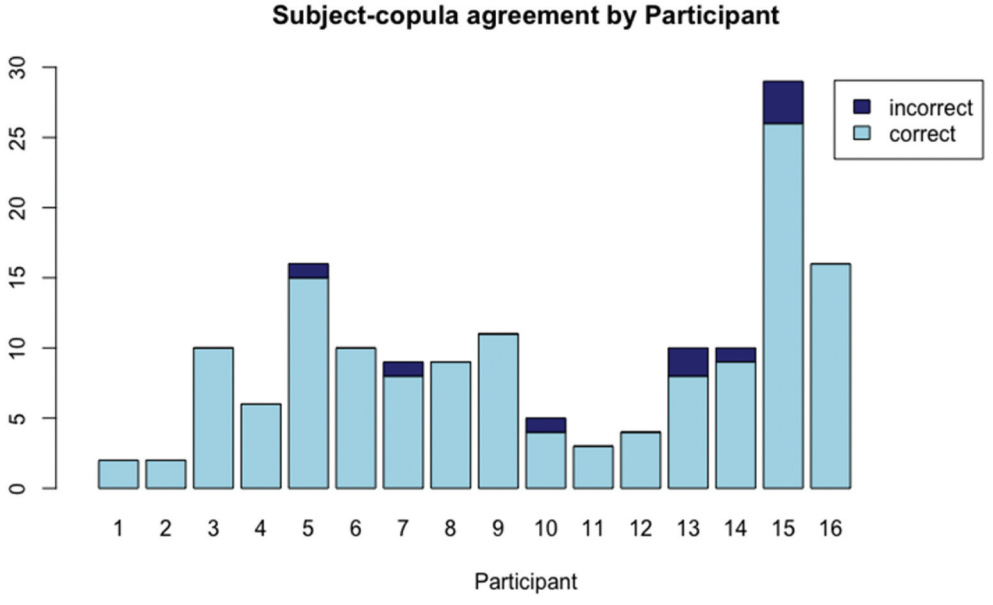

Figure 2. Correct and incorrect production of subject-copula agreement by each participant.

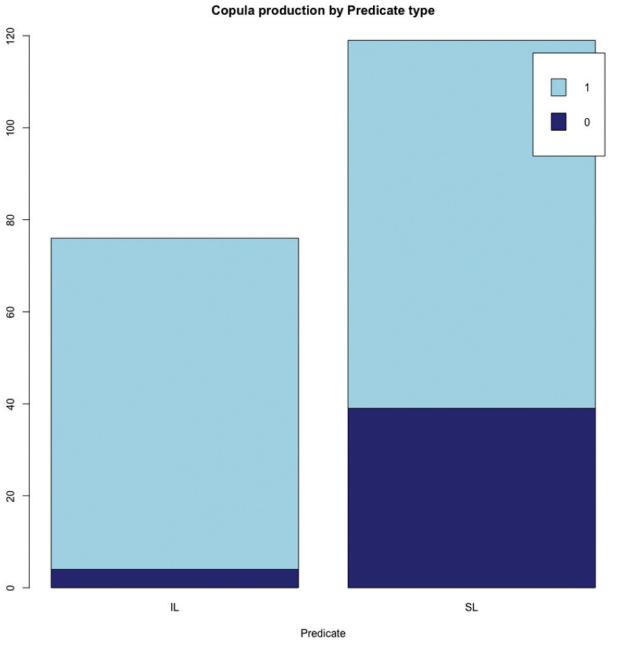

Figure 3. Number of overt copula (1) and omitted copula (0) productions for each predicate type.

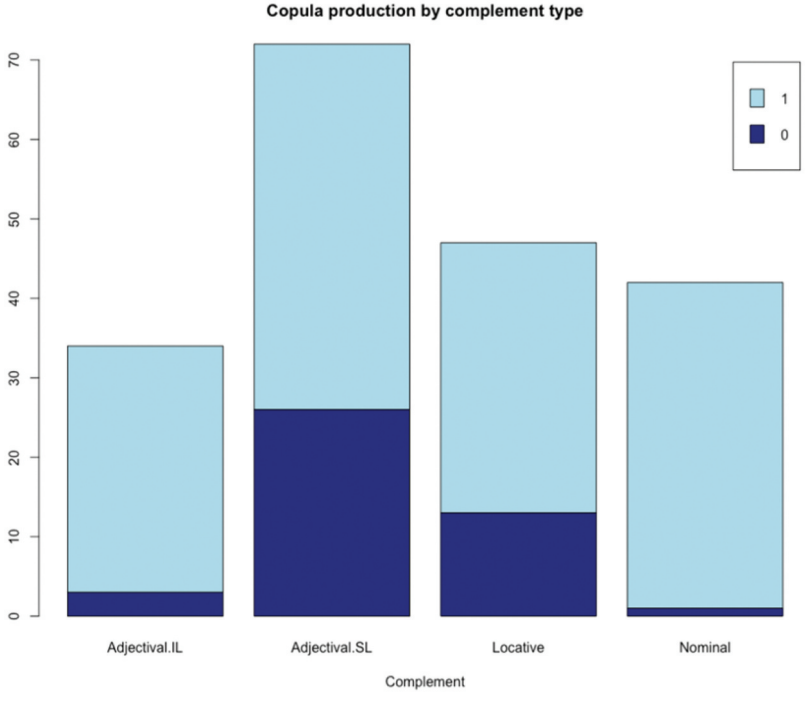

Figure 4. Number of copula omissions (0) and overt copula (1) productions in each complement type.

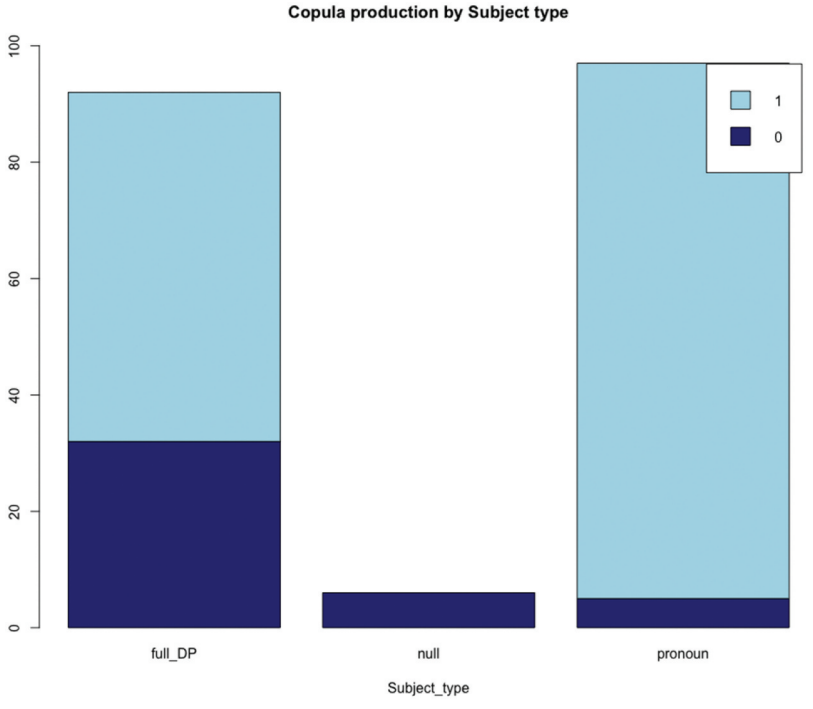

Figure 5. Proportion of copula omissions (0) and overt copula (1) production for each subject type.

5. Results

5.1. Subject-verb agreement

Agreement was analysed in contexts where an overt subject and an overt copula were present (152/195). Figure 2 presents the total subject-verb agreement productions by participant. Overall, only 9 agreement violations were observed (5.9%). Ten of the 16 participants were 100% accurate in their use of subject-verb agreement.

5.2. Copula Omission Across Predicate Types

A 22% copula omission rate was found across the total 195 *to be* contexts. Copula omission was greatest with SL predicates, with 33% of omissions (39/120) compared to 5% with individual-level predicates (4/75) (Figure 3). Results are also visualised by complement type (IL: nominal, adjective; SL: locative, adjective) in Figure 4, which shows that the copula was deleted more frequently when the complement was an adjective in both IL and SL readings.

As for subject type, the copula omission was most frequent where the subject was a full DP: 34.8% (32/92) of full DP constructions contained a null copula (Figure 5). Pronominal subjects were the most frequent subject type but occurred almost exclusively with overt copulas (both in the contracted form, which almost always appeared with a pronominal subject (48/56), and in the full form, which appeared both with pronominal subjects (44/97) and with full DPs (53/

97)), and only 5.2% of the time they occurred in null copula contexts (5/97). On the other hand, the 6 only null subjects found in the corpora co-occurred with null copulas (6/6).

A two-way ANOVA with predicate type (SL, IL) and complement type (adjectival, locative, nominal) as factors revealed a significant main effect of predicate type, $F(1)=22.50$, $p<.001$, and at trend for complement type, $F(7)=2.03$, $p=0.05$. The interaction between predicate type and complement type was not significant, $F(3)=0.558$, $p=0.64$, showing that utterances containing IL predicates displayed very low rates of copula omission irrespective of the type of selected complement.

Next, a two-way ANOVA with predicate type (SL, IL) and subject type (null, pronoun, full DP) as factors was run, revealing a significant main effect of both predicate type, $F(1)=26.41$, $p<.001$,and subject type, $F(2)=21.32$, $p<.001$. The interaction between predicate type and subject type was not significant, $F(1)=0.836$, $p=0.36$, showing that utterances containing IL predicates displayed very low rates of copula omission irrespective of their subject.

Post-hoc analyses for subject type showed that there were significantly fewer copulas (none) where the subject was null (t-value = -3.92) compared to full DPs and pronouns.

6. Discussion

The purpose of this study was to provide a novel framework to investigate the presumed tense impairment in PWA in a language, like English, where tense morphology does not allow for a fine-grained analysis of the impairment. In this approach, tense deficits were assumed to be visible on copula deletion.

The main research question was to investigate whether an asymmetry was found within copula deletion patterns as determined by the type of predicate (SL or IL). Copula omissions were expected to occur as a result of a tense deficit; in particular, a higher magnitude of omissions was predicted in SL predicates assuming that the presence of an Aspect layer would allow temporal anchoring via AspP-binding discarding the more costly operation of tense-binding (Becker, 2002). Tangentially, copula omission, when present, was also expected to affect properties of the subject, given that nominative case is assigned to subjects when the inflection is finite. Copula omission was therefore expected to result in case errors or subject omissions.

A second research question pertains to (S-V) agreement, which is active on copulas in English. Given the known tense-agreement asymmetry of the impairment in the verbal domain in PWA, subject-copula agreement errors were expected to be rare.

These predictions were largely confirmed by the data: participants displayed a very low rate of agreement errors in copula production, and SL predicates were the primary site of *to be* omission with a slight prevalence in adjectival contexts; moreover, a relationship with subject type was confirmed, and particularly null subjects were accompanied by a zero-copula. In the discussion that follows we turn to each of these findings considering the reviewed literature and consider their potential implications.

Firstly, the very low rate (6%, 9/152) of agreement violations, which were present in only 6 out of 16 participants in the sample, suggests that the subjects' ability to construct agreement inflection between subject and copula is generally preserved in English-

speaking PWA. This finding replicates the results of previous research with English PWA (Arabatzi & Edwards, 2002; Clahsen & Ali, 2009) and is consistent with cross-linguistic results on the preservation of agreement (Druks & Carrol, 2005).

Regarding whether predicate type influences copula production in English PWA, the rate of omissions in IL predicates was very low in our data, suggesting that there is a correlation between Aspect and copula omission in PWA, which, according to the framework adopted here (Becker 2002; 2004) and given the convergence with child grammar, may be the result ungrammatical Temporal Anchoring. Tangentially, this result is further consistent with accounts suggesting aspectual features to increase complexity (Dragoy & Bastiaanse, 2013; Fyndanis et al., 2013; Nanousi et al., 2006), as the aspectual predicate type (SL) was the one with the highest number of omissions. In this sense, the present findings are compatible with a grammatical account of the impairment of tense. It should be noted, however, that the observed patterns were not entirely predicate-dependent; there were deletions in IL predicates and copula productions in SL predicates. This appears problematic under a strict positional account (Grodzinsky, 2000), and variation should be expected.

Regarding the relationship between the subject category and copula omission, it was hypothesised that copula deletion, resulting in a lack of finiteness, would pose an issue for nominative case assignment on the subjects. This prediction was largely substantiated in our data, where all null subjects occurred alongside a zero-copula. Half (3/6) of the null subjects were interpreted as the non-overt first-person pronoun *I*, and half as the third person inanimate pronoun *it*. Contexts with overt pronominal subjects displayed a very low rate of copula omissions (5/97), and crucially 60% (3/5) of these instances demonstrated incorrect Case assignment as shown in (2):

(2) him home (Adler16a, 152).

Importantly, the effect of predicate type on copula production was not modulated by either the type of subject produced or the type of complement of the copula, as shown by the lack of interaction reported between predicate type and both measures. This further confirms that the effect of SL is independent of other potential co-occurring factors.

Thus, it can be presumed that these English participants present an impairment in tense, observed as complete copula omission and consequent complications in the grammar of subjects. It must be mentioned that arbitrary subject deletions and subsequent production simplification have been interpreted because of a higher processing cost of DPs such as *the kitchen* over pronouns (De Roo, 2003). However, as full DPs may also consist of one noun, for instance *Bobby* (Kempler03a, 96), it can be assumed that the same results would emerge in that there was little to no divergence of utterance length. Further analysis of a relation between subject length and copula omission is needed to shed light on this question (Brunetto et al., 2023).

On the other hand, agreement and Aspect are both preserved, as confirmed by the very low rate of subject-copula agreement errors and by the asymmetry between SL and IL predicates which, in our analysis, was due to a grammatical strategy involving Aspect to carry out temporal anchoring in the presence of fragile tense computations.

7. Conclusions

The aim of this paper was to provide a fine-grained analysis of tense impairment in English PWA using the copula *to be*. This study was carried out by exploring tense impairments and agreement inflectional analysis through investigating the proposed selective nature of copula deletion based on predicate type and examining implications of deficient tense on subject category.

The results supported an impairment of tense as well as a dissociation between tense and agreement; incorrect agreement was scarce across all participants while impaired tense was observed both through copula deletions and flawed subject Case assignment. This pattern is convergent with that of the adopted framework (Becker, 2002; 2004), therefore providing further support with data from aphasia that a fragile tense results in a selective vulnerability of copulas of SL predicates. The resulting convergence of child language and aphasia is discussed in Brunetto et al. (2023), and has been reported in several areas of language (use of ungrammatical non-finite clauses, Kolk, 2001; Grodzinsky et al., 2018; pronoun interpretation, Grodzinsky et al., 1993; Ruigendijk et al., 2011).

This is the first time that a fine-grained investigation of tense impairments in PWA is proposed for English, and the outcomes suggest that the proposed analysis is efficient in detecting specific vulnerabilities in tense (and not agreement) in English speakers and should therefore be pursued in future studies. One direction may be theoretical, in that the distinction at predicate level, here discussed under a structural account, may also lead to subtle differences in processing operations that would further motivate the selective vulnerability found in PWA. Another direction may be clinical, as this framework may be utilised to develop a treatment focused on rehabilitation of tense morphology for English that do not focus on irregular verb morphology (Valinejad et al., 2022).

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ORCID

Giuditta Smith http://orcid.org/0000-0002-9358-5700
Valentina Brunetto http://orcid.org/0000-0003-0942-8815
Maria Garraffa http://orcid.org/0000-0003-1767-424X

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