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When acquisition and aphasia converge: the case of copula omission

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This paper reports evidence for a convergence between child language acquisition and Broca's aphasia in the domain of copula omission. Our data shows that, in the spontaneous speech of people with Broca's aphasia (PWBA), copula omission is confined to aspectual predicates, replicating a finding previously reported by Becker (2002) for child English. This grammatical property is a much stronger predictor of copula omission than alternative, extra-grammatical factors, such as predicate length or utterance length. We argue that grammatical accounts which predict the fragility of Tense by virtue of its cartographic location, in terms of 'tree-pruning'/'growing trees', fare better than others in explaining similarities in patterns of omission in these two populations.

1 Introduction

Language acquisition and pathology offer a privileged standpoint to analyse patterns of strength and vulnerability in populations with limited processing abilities. In the domain of inflectional morphology, omission patterns are attested both in the grammar of young children and in the grammar of people with Broca's aphasia (PWBA). Research with both populations shows that these patterns are selective and do not imply the complete absence of inflectional layers: Aspect appears earlier than Tense in acquisition (Antinucci & Miller 1976) and when Agreement morphology is used errors are very rare (Hyams 1986; Guasti 1993/4, a.o.); similarly, Aspect and Agreement morphology in spontaneous speech is relatively spared, compared to Tense, in Broca's aphasia (Zhang & Hinzen 2022). One way to account for these patterns is by making reference to the cartographic location of these functional heads: high functional projections – those responsible for temporal anchoring in the high IP area and scope-discourse properties in the CP area – pose a higher burden on these populations, perhaps by virtue of requiring multiple applications of Merge (Friedmann et al. 2021). This idea has been incarnated in various 'truncation' or 'tree pruning' accounts, which were first proposed to explain the Root Infinitive stage in acquisition (Rizzi 1994; Haegeman 1996), then the vulnerability of C-T in Broca's Aphasia (Friedmann & Grodzinsky 1997), and more recently have been argued to be able to explain the acquisition path of the left periphery (Friedmann et al. 2021's 'growing trees').

In this paper we focus on copula production in the spontaneous speech of PWBA and provide evidence for a remarkable convergence of aphasia and acquisition data (Becker 2002). Copular predicates (*be tall, be tired*) offer an interesting angle to test what is vulnerable and what is spared in the domain of verbal inflection in Broca's aphasia in English. Since the dissociation of Tense and Agreement is difficult to observe in the morphologically weak inflectional paradigm of English lexical verbs, copular constructions offer an alternative angle to tease apart the role of Tense, Agreement and Aspect. Our findings confirm the same pattern of selective omissions that is attested in acquisition (Becker 2002). Namely, we find that copula omission is confined to aspectual predicates (those denoting temporary properties, e.g. *is on the tree*) and is virtually absent in non-aspectual predicates (those denoting permanent properties, e.g. *is a child*). An alternative, extra-grammatical account does not receive support in our data, since neither predicate length nor clause length alone affect the likelihood of copula drop. We interpret our findings as indicating that copula omission is a grammatical reflex not only in acquisition, but also in the speech of PWBA: the production of copular sentences is not characterised by indiscriminate omission to relieve processing effort but, rather, is sensitive to semantic properties of the predicate which correlate with syntactic properties of the clause. We argue that the convergence of data from these two populations should meaningfully illuminate the question of what drives omissions in the early grammatical system and in adult agrammatism.

2 Copulas and functional projections in acquisition

Copula omission is reported in the speech of young children in many languages, reaching its peak during the beginning of the second year and typically declining around 3 years:

(1) a. He on a horse (Nina 2;1, English, Brown 1973)
     b. Questo bianco (Raffaello 2;04, Italian, Cipriani et al. 1989)
        this   white
     c. Vomiko to vivlio (Elli 1;10, Greek, Tsimpli 2005)
        dirty the book

This phenomenon has been linked to the more general delay in the development of Tense. English finite *be* is traditionally analysed as an inflectional head, spelling out Tense features (Moro 1988; Lasnik 1999; Becker 2002, a.o). Child language provides empirical support for this analysis. For example, in the speech of English-speaking children, the finite copula never alternates with non-finite *be* (Schütze 2004): children's errors always result in omission but never in the production of the non-finite copula, which sets *be* apart from other lexical verbs where tense omission results in the production of root infinitive forms (*he ride on a horse*; **he be on a horse; he 0 on a horse*). Moreover, finite copulas interact with properties of subjects during children's Null Subjects stage. It has been noted that subject omissions are very rare in finite overt copula contexts (Sano & Hyams 1994; Hamann & Plunkett 1998), as they are in utterances with overt modals (Valian 1991) which are always finite. Instead, the vast majority of null subjects and non-nominative subjects occur in root infinitive contexts. Taken together, these facts suggest that finite *be* is a T head, not an inflected verbal head, and that utterances with null and overt copulas in child language are characterised by distinct clusters of structural properties related to the projection of the T node. The existence of these syntactic contingencies suggests that variability in the use of finite and non-finite forms is not random but reflects structural properties of the grammar.

Although tense features tend to appear around age 2 in the speech of young children, aspectual morphology appears in the earliest verbal forms and is mapped consistently to the inherent semantics of verbs (Shirai & Andersen 1995): for example, English progressive forms only appear on non-stative verbs and overgeneralisations are virtually non-existent (Brown 1973). Antinucci & Miller's (1976) analysis of Italian early past participles, which led to the 'aspect-before-tense' hypothesis, concluded that children use these forms to encode both stativity and perfectivity (end-states), and this has been confirmed in many more languages (see Tsimpli 1992/1996 for a review of child Greek, French, German, English, Irish and Spanish).

An interplay of Tense and Aspect during the Root Infinitive stage has been observed, although its interpretation is not completely clear. Hoekstra & Hyams (1998) noted that some languages (notably, languages where the infinitive is morphologically marked, such as French, Dutch, German and Russian) display a remarkable asymmetry between eventive (*go, eat, etc.*) and stative verbs (*have, love, etc.*). This association has been captured under the so-called 'Eventivity Constraint', according to which Root Infinitives are associated with eventive predicates. This constraint does not seem to hold in child English, where many stative verbs do appear uninflected (Ud Deen 1997); thus it is likely that cross-linguistic differences in the verbal domain need to be taken into account when analysing non-finite verbal forms.[1] However, it could be argued that non-verbal predicates in copular structures, by virtue of their more uniform syntax (under the hypothesis that the copula is a T head which is not derivationally related to the verbal stem of non-finite *be*), allow us to isolate the semantic contribution of Aspect from the more complex question of its morphological realisation in verbal stems.

The notion of Aspect which Becker (2002) explored in her analysis of English copula utterances relates to the semantics of their non-verbal complements. In the spontaneous production of 5 children selected from the CHILDES database (Nina, Peter, Naomi, Adam, Eve), Becker found that the magnitude of omissions was significantly higher with predicates denoting impermanent properties (2a) as opposed to predicates denoting inherent properties (2b):
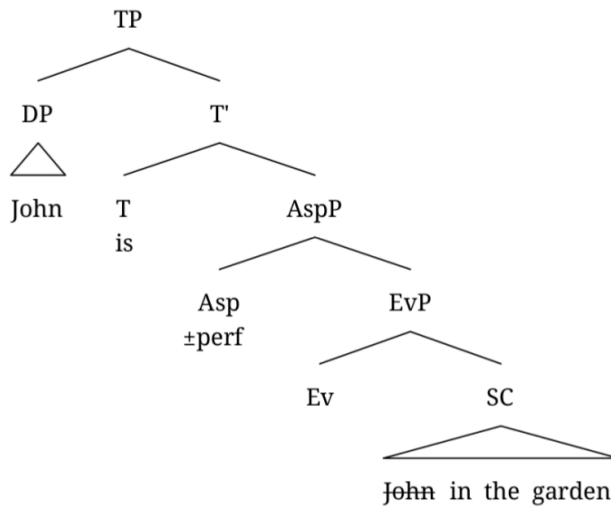
(2)   a.   Foot 0 in water (Nina, 2;0)
        b.   That's a funny fish (Naomi, 2;5)

The semantic difference between (2a–b) stems from Carlson's (1977) distinction between Individual Level (IL) and Stage-Level (SL) predicates. The former, in Carlson's analysis, combine directly with individuals, while the latter combine with temporal stages or 'slices' of individuals, yielding temporary properties. Thus nominal predicates (e.g. *be a man*) are typically classified as IL and locatives (PPs and adverbs, e.g. *be in the garden*) as SL. Adjectival copula predicates (*be tired, be clever*) can be SL or IL, although two diagnostics can be applied to distinguish the two interpretations: first, only a SL interpretation is compatible with temporal adjuncts (e.g. *John is tired/#clever in the evening*). Moreover, IL adjectives can be made SL by the addition of the so-called 'active be' (Bob is *being* silly), whereas this option is not felicitous when the predicate is already SL (*John is *being* tired).

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[1] Hoekstra & Hyams (1998) argued that English bare verbs are ambiguous between infinitive and unmarked forms, hence not 'true' Root Infinitives. They also noted semantic differences in their use: while English non-finite forms are typically associated with present interpretation, 'true' Root Infinitives tend to have modal/future interpretations in children's utterances. As will be discussed in the following section, a consistent cross-linguistic picture regarding the interplay of Tense and Aspect in the verbal domain is also lacking in aphasia.

Becker (2002) argued that the semantics of Stage Level predicates correlates, in the syntactic structure, with the inclusion of an aspectual layer. The structure of SL and IL predicates is assumed to be as in (3). The small clause (SC) containing the subject and the locative in the SL predicates projects a Davidsonian event argument (an extra argument position for *events* or *spatio-temporal locations*), which is selected by an aspectual phrase (AspP). This event argument ensures that a stage-level property is interpreted as a property of stages (spatio-temporal parts) of individuals. In contrast, the nominal small clause lacks an event argument and consequently does not project Asp.

(3)   a.   Stage-Level predicate

```
                    TP
                  /    \
              DP          T'
              /\         /  \
           John      T        AspP
                     is      /    \
                          Asp        EvP
                          ±perf     /   \
                                  Ev       SC
                                         /    \
                                    John  in  the  garden
```

       b.   Individual-Level predicate

```
                TP
              /    \
          DP          T'
          /\         /  \
       John      T        SC
                 is      /  \
                      John  a  man
```
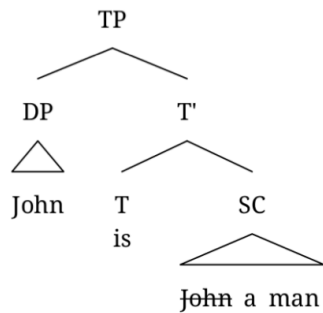
Assuming that Tense is responsible for the encoding of finiteness in the adult English grammar, the omission of the copula should result in an utterance lacking a deictic speech time reference point. One important question is, therefore, how tense omission in children's root clauses affects temporal anchoring. Becker's analysis maintained that Aspect could be recruited to carry out this function in null copula utterances. This is an option in languages with optional null copulas, notably Latin, Russian, Hebrew and African American English, though it isn't unconstrained. For

example, only present tense interpretation is allowed in main clause null copula constructions, suggesting that temporal anchoring must rely on a higher tense head for speech-time anchoring in past and future tense (Giorgi & Pianesi 1997). Assuming that temporal anchoring is realised via binding of a functional head by a temporal operator (Guéron & Hoekstra 1995), languages may employ two strategies: binding of T or binding of Asp. If the second strategy (Asp binding) is chosen, tense is not spelled out.[2]

The fact that copula omission in child English is overwhelmingly associated with SL predicates is linked, in Becker's analysis, to the availability of temporal anchoring via Aspect: if Tense is unavailable, temporal anchoring can be realised by a functional head in the low IP area associated with temporal information. This is not an option in IL predicates, and consequently copula omission is constrained in such contexts. Becker's findings, reported in **Table 1**, confirm this trend and support the conclusion that grammatical factors are at the heart of copula omission in child language.

Child	Individual-Level predicates				Stage-level predicates			
	Nominal		IL Adjective		Locative		SL Adjective	
	N	overt copulas	N	overt copulas	N	overt copulas	N	overt copulas
Nina	143	74%	24	63%	115	13%	39	44%
Peter	398	86%	28	57%	90	19%	86	51%
Naomi	122	90%	29	94%	30	33%	65	52%
Adam	302	52%	35	37%	26	8%	105	41%
Total		76%		63%		19%		47%

Table 1: Rate of overt copula production by complement type in Becker (2002).

An extra-syntactic account would claim that children omit copulas due to performance limitations. Within the debate on children's subject omission, proponents of this view (Bloom 1990; Valian 1991) capitalise on the observation that null subjects are more frequent in sentences with longer VPs. If children's copula omission is the result of processing limitations, it should be influenced by utterance length, such that longer utterances should increase the likelihood of copula drop. When taking utterance length into account, however, Becker (2004) did not

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[2] Becker (2002) argues that clauses which realise anchoring via Asp are non-finite, but leaves open the question of their temporal interpretation. Presumably, tense in these clauses is either absent or unspecified or 'default' (as in Russian present-tense predicative structures).

find a significant difference between overt and null copula utterances. In other words, children do not simply drop the copula in longer utterances. Similarly, in utterances of equal length, the asymmetry between SL and IL predicates remains. While Becker reports a small effect of utterance length in nominal and locative predicates, this was a much weaker predictor of copula omission than predicate type ($z = 2.11$, $p = .03$ vs $z = 7.01$, $p < .0001$).

Child English data, in sum, indicates that the developing grammar may be resorting to Aspect for temporal anchoring – an option which is available in other languages of the world. While this could be compatible with a parameter mis-setting account (assuming, for example, that children are adopting a Hebrew copula drop parameter), the optionality of omissions casts doubt on this hypothesis, since a parameter should be at work 100% of the time. Alternatively, Becker (2004) suggested that children may be transitioning between multiple grammars (Yang 2002) – one that allows temporal anchoring via Aspect and one that does not. Since Yang's 'variational' model assumes that the choice of a grammar is eventually determined by the evidence available to the learner in the input, it is more difficult to see how this account could be applied to omission phenomena in the contexts of acquired language disorders such as Broca's aphasia. On the other hand, a processing account might hold more explanatory power for this population, given the nature of their processing deficit. In this paper we reject the latter hypothesis and discuss more evidence for the role of grammatical constraints on copula omission in the speech of PWBA.

3 Copulas and functional projections in aphasia

Copula omission is attested also in Broca's aphasia as part of a generalised Tense deficit. Friedmann and Grodzinsky (1997) provided one of the first grammatical accounts of the deficit in aphasia drawing on arguments from linguistic theory which were being applied to acquisition around the same time (Rizzi's 1994 account of null subjects in child grammar). Their analysis of the tense deficit in the speech of a Hebrew aphasic patient provided new empirical support for the Split Inflection hypothesis (Pollock 1989) and highlighted ways in which Rizzi's truncation model could be extended from acquisition to aphasia.

Since Friedmann and Grodzinsky's seminal study on Hebrew, evidence for a selective impairment affecting Tense morphology has been reported in many other languages (Catalan (Martinez-Ferreiro 2003); Dutch (Kolk 2000; Bastiaanse 2008); German (Wenzlaff & Clahsen 2004), a.o.). Selective patterns of impairment are also attested in the CP domain: for example, while difficulties in the production of wh- questions are a prominent characteristic of the disorder, difficulties with yes/no questions appear to be subject to cross-linguistic variation (Friedmann 2002). Embedding is rare in the speech of PWBA but not entirely unavailable, as long as the structure is 'reduced'. In an analysis of a sample of English speaking fluent and non-fluent aphasic patients from the Aphasiabank Protocol Database, Llinàs-Grau & Martinez-Ferreiro (2014) report a small number of occurrences of *that*-clauses even in the speech of non-fluent (including Broca's) individuals. However, when these structures are produced they always appear

without the complementizer *that*, suggesting that reduced embedded structures may be available in the aphasic grammar (amounting to a truncated CP phase).[3] In another study of spontaneous speech by PBWA obtained from the Aphasiabank English Protocol database, Zhang & Hinzen (2022) report overuse of quotational embedding (direct speech) compared to controls, alongside underuse of reported speech embedding. This could be interpreted as an economy strategy, not only to avoid the complexity of projecting a full embedded CP complement (e.g. *he said that it was cold outside*) but arguably, also to circumvent the complexity of the embedded sequence-of-tense through the use of direct-speech present tense. Zhang & Hinzen's (2022) analysis also focused on so-called 'TAM markers' (Tense-Aspect-Mood) in the verbal domain confirming that, while Tense morphology is underproduced compared to healthy controls, Aspect morphology is not. In this domain, they note that use of temporal adverbs provides another compensatory strategy to establish a past time frame when grammatical tense marking (through auxiliaries and inflectional morphology) is impaired.

(4) a. That morning… Dad driving away and pants on the floor. (Zhang & Hinzen 2022: 15)
    b. Long time ago, a stroke, I guess Debbie is with me.

Zhang & Hinzen (2022) conclude from these patterns of spontaneous speech that not only are syntactic hierarchies intact in the grammar of PBWA, but also that sensitivity to temporal anchoring is somewhat preserved, as evidenced by the use of compensatory strategies to circumvent difficulties with inflectional morphology. Against a 'strong' categorical idea of pruning which would predict a global deficit affecting functional information associated with T and C, the evidence therefore suggests that PWBA can 'climb up the syntactic tree' (Friedmann 2005), with variation depending on individual differences and on the severity of the impairment. At the same time, the ability to activate functional information is constrained by the syntactic hierarchy of clause structure, with complexity increasing in the higher layers of the clause. In fact, longitudinal evidence also suggests that spontaneous recovery in agrammatism in the inflectional domain goes through a path predicted by the cartographic location of each functional head: in a patient tested by Friedmann (2005), recovery of some CP functions was visible months after tense inflection had been recovered, while Agreement inflections were the first to be regained.[4]

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[3] A phase (Chomsky 2008) is a syntactic unit corresponding to a cyclic domain. See Rizzi & Shlonsky (2007) and Sheehan & Hinzen (2011) for different analyses highlighting syntactic and semantic reflexes of *that*-omission in embedded complement clauses as evidence for their truncated nature.

[4] It should be noted that the preservation of Agreement morphology – and its early acquisition – have sometimes been cited as a counterargument against truncation accounts (e.g. Wexler 1998). Specifically, the general consensus (until early minimalism) that AgrS must be higher than T (Belletti 1990; Chomsky 1995) raised issues for the idea that the preservation of a node should entail preservation of all the nodes below it. In current minimalism, the structural notion of agreement as a specifier-head configuration has been abandoned and debates on whether the operation Agree takes place in narrow-syntax or rather at the PF interface (Bobaljik 2008) are ongoing. This makes Agreement

The interaction of Tense and Aspect has not been extensively studied in the spontaneous production of PWBA, but experimental evidence from production tasks (such as sentence completion tasks) paints a complex cross-linguistic picture. In particular, errors in aspectual marking have been reported in several studies of Greek PWBA in the production of both perfective and imperfective forms, thus refuting the prediction that Aspect should be more preserved than Tense (Stavrakaki & Kouvava 2003; Varlokosta et al. 2006; Fyndanis et al. 2012, a.o.). To date, however, only two studies have systematically tested the interplay of Tense and Aspect in relation to time reference, and the findings are enlightening. Dragoy and Bastiaanse (2013) found that Russian-speaking PWBA were less impaired in the production of past *perfective* forms compared to past *imperfective* forms, and exhibited the opposite pattern in non-past contexts (better performance with non-past imperfective as opposed to perfective forms). That is, aspectual semantics (completed vs ongoing) interacted with reference to time: according to the authors, prototypical associations between time and aspect (e.g., perfective as referring to the past, imperfective as referring to the present) boosted accuracy in the production of verbal morphology. Moreover, when participants made substitution errors for non-prototypical target forms, they typically adapted them according to Aspect rather than Tense (e.g., changing future perfective to past perfective, rather than to future imperfective). This can be taken as an indication that time reference is influenced by aspectual information, and that PWBA can use this information to scaffold temporal anchoring in order to compensate for the fragility of Tense. Although a recent study by Fyndanis & Temistocleous (2019) has failed to replicate the same pattern in a group of Greek-speaking aphasic individuals, the hypothesis entertained by Dragoy & Bastiaanse (2013) is consistent with evidence from child Russian (Gagarina 2000) supporting the 'aspect before tense' hypothesis in acquisition, and will require further cross-linguistic explorations in both acquisition and aphasia.

Dragoy & Bastiaanse's (2013) hypothesis is also close in spirit to Becker's (2002) hypothesis that Aspect plays a role in null copula structures. Specifically, following Becker's proposal for child language, it could be hypothesised that the grammar of PWBA optionally resorts to Aspect to realise temporal anchoring where Tense is too fragile to carry out this function. Under this logic, copula omission in aspectual (Stage-Level) predicates could be interpreted as an economy strategy, whereby Aspect is recruited to fulfil a function in place of the finite Tense node (fragile); at the same time, the absence of an aspectual layer in non-aspectual (Individual-Level) predicates would act as a constraint on copula omission 'forcing' the projection of Tense in order to realise temporal anchoring. This analysis provides an interesting way of predicting the optionality of omissions in the agrammatic population: where Tense is fragile, a grammatical property (the

a less than ideal candidate to test the preservation of syntactic hierarchies in the speech of PWBA. Arguably, the focus should be on C-T and Asp-vP as the heads satisfying UG requirements on the representation of the core semantic objects: *propositions* (CP phases) and *events* (vP phases).

availability of Aspect) may be able to predict where omissions will occur and where they will not. We report a first analysis confirming this prediction in Smith et al. (2023). In a sample of 195 utterances by English-speaking PWBA selected from the Aphasiabank Protocol database, we found a rate of 33% (39/120) copula omissions in SL predicates (locatives and SL adjectives) and only 5% (4/75) omissions in IL predicates (nominals and IL adjectives). We also identified a cluster of errors related to the T domain: first, non-nominative pronominal subjects only occurred in null copula contexts (5a), and so did null subjects (5b). Moreover, tense omission resulted in copula drop but never in non-finite *be* (a result that replicates the acquisition evidence). On the other hand, agreement errors in overt copula contexts were negligible (5c).

(5) a. [points: picture] and him home (Adler16a, 152)
     b. Now [points: self] home (BU07a, 38)
     c. Maybe the dresses [:dress] is here (Scale18a, 289)

Despite the existing evidence in favour of a grammatical account, indicating a convergence with the acquisition data, it is also conceivable that processing factors might affect copula drop differently in these two populations. In this paper we explore the relative weight of grammatical and processing factors as predictors of copula omission. Specifically, we test the role of constituent length (subject, predicate) and utterance length as measures of processing load. If copula drop is the result of a processing limitation over and beyond grammatical factors, it is conceivable that longer subjects may increase the likelihood of omission (along the lines of Bloom's (1990) proposal regarding the relation between subject overtness and VP length in child language). Alternatively, predicate length itself could be a stronger predictor of copula omission than semantics (Individual-Level vs Stage-Level). For example, since locatives are typically longer than nominals, length rather than semantics might turn out to be the relevant factor. Finally, copula drop could be the result of performance pressures at the clause level, as a strategy to alleviate processing load in longer utterances.

4 Methodology

4.1 Subjects

We analysed the production of copula sentences in the spontaneous speech of 24 English aphasic patients 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 (Elman 2009); Fridriksson (Fridriksson 2011); Kempler (Kempler 2008); Kurland (Kurland 2012); UMD (Faroqi-Shah 2018); MSU (Boyle 2014); Scale (McCall 2021); TAP (Silverman 2003); TCU (Muñoz 2015); Tucson (Hirsch Kruse 2015); UNH (Ramage 2019); Whiteside (Whiteside 2015); Wright (Wright 2008). Only transcripts of patients

diagnosed with Broca's aphasia were included. The sample included 10 females and 14 males (mean age 58, ranging from 39 to 76). All participants spoke English as their primary language; 22 were monolingual and two were childhood bilinguals (both languages acquired before age 6). Participants' average MLU was 3.99, ranging from 2.44 to 6.30. Individual background information is summarised in the Supplementary file.

4.2 Corpus analysis

The Aphasiabank English Protocol database includes four tasks: a free speech sample (describing speech, remembering stroke, describing an important event); picture descriptions (broken window, refused umbrella, cat rescue); story narrative (telling the story of Cinderella); procedural discourse (how to make a peanut butter and jelly sandwich). The same Protocol was followed in all the corpora analysed.

Our sample included 226 copula utterances[5] which were coded according to a number of grammar-related and processing-related dimensions. To test the role of grammatical factors, we coded each utterance according to predicate type (IL, SL) and according to the overtness of a CP layer (indicated by the presence of syntactic material in the left periphery). To test the role of processing/performance factors, we calculated subject length, predicate length and total utterance length (length of the non-verbal predicate or of the whole utterance in words, excluding the copula). Since omissions of other functional material (determiners, prepositions) could introduce a potential confound in analysing utterance length, the target utterance length (participants' intended utterance excluding any omissions) was also included in the analysis.

4.3 Results

To test the prediction that aspectual (stage-level) predicates are associated with higher rates of copula drop, we analysed the rate of overt copulas according to predicate type. Like Becker (2002) we found a striking asymmetry between IL and SL predicates, with 51 out of 56 omissions (91%) recorded in SL predicates (see **Table 2**).

There are some differences to note between our data and Becker's data, which afford us an opportunity to explore sentence complexity in addition to mere length. While children's MLU is around 3 (ranging between 2.84 and 3.38) and their overall rate of copula omissions around 50%, the average MLU of the participants analysed in our sample is higher (ranging between

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[5] For this analysis we excluded null subject utterances and utterances with contracted *it's* – this resulted in eliminating 33 utterances from the sample in Smith et al. (2023), to which we added 57 utterances from 8 more participants. The rationale for excluding contracted *it's* is that previous research suggests that this form is overused in aphasia (Korytkowska & Obler 2017), potentially as an unanalysed single form, which would create a potential confound when taking utterance length into consideration.

Predicate type	Complement	N omissions	% overt copulas	sd
IL	Adjective.IL	4	90.69% (39/43)	0.29
	Nominal	1	97.56% (40/41)	0.16
SL	Adjective.SL	34	59.52% (50/84)	0.49
	Locative	17	70.68% (41/58)	0.46

Table 2: Overt copula production in IL and SL predicates by complement type.

2.44 and 6.24, mean = 3.99) and omissions are at 25%. Moreover, while children in the Root Infinitive stage (at around 2 years) are on the cusp of recursive embedding, in our sample we find a non-negligible number of utterances which projected an overt CP layer (26/226, 11.5%). In these structures, only one omission occurred (6a). Other examples included left dislocation/hanging topic structures (8/26); questions (8/26) and complex structures including embedded clauses (10/26) (6b–d):

(6)   a.   where my phone? (Fridriksson 12a, 38)
        b.   my mother, she was good lady. (Scale31a, 134)
        c.   is that good? (Kurland24a, 7)
        d.   I already remember when we were hospital. (Whiteside15a, 23)

The effects of predicate type and the presence of an overt/activated CP layer were analysed in a mixed-effects logistic regression model in R (R core team 2018) using the *glmer* function from the *lmer* package. The model revealed a significant effect of both factors, with a larger effect of *predicate type* (for SL predicates: $z = –3.729$, $p = .0001$) and a mild effect of *CP* ($z = 2.265$, $p = .023$). Thus, the overt projection of a CP was a positive predictor of overt copula production. A truncation account, which predicts the projection of higher nodes to 'guarantee' the preservation of those below, fits directly with this finding.

    In contrast to grammatical accounts, which aim to elucidate a relation between omissions and syntactic properties of the clause (while taking into account general properties of the grammatical system, i.e., developmental immaturity or acquired grammatical deficit), an extra-grammatical account would contend that omissions simply stem from a processing overload and therefore occur under performance pressures. This would predict longer utterances to increase the likelihood of copula drop.

    The effect of length was first analysed at the predicate level. In principle, this factor could offer an alternative explanation for the asymmetry between omissions in locatives and nominals, since locative PPs typically contain an extra word compared to nominal complements. In our

sample, however, nominals and locatives did not differ in length; this was possibly due to the fact that many locatives occurred in a story-telling protocol in which patients told a story with the aid of picture props; half of locative predicates were adverbials (29 out of 58, e.g. 7a–b), often used deictically, while 12 PP locative predicates contained other omissions (of prepositions and/or determiners, e.g. 7c–d).

(7) a. [points: picture] the man inside (Kempler 03a, 152)
     b. A girl was there (Scale31a, 264)
     c. I was uh bedroom (UNH10a, 58)
     d. [points: picture] a man is a tree (Adler16a, 178)

Like Becker (2004), we failed to find a difference in mean predicate length between null copula utterances (M = 1.57, sd = 0.95) and overt copula utterances (M = 1.71, sd = 0.93); in fact, contrary to the prediction of a processing account, null copulas did not occur in utterances with longer predicates and this pattern was true for 3 out of 4 complement types (see **Table 3**).

Predicate type	Complement	Copula	N occurrences	mean length (words)	sd
Individual Level	Adjective.IL	null	4	1.25	0.5
		overt	39	1.51	0.82
	Nominal	null	1	2	*NA*
		overt	40	2.23	0.95
Stage Level	Adjective.SL	null	34	1.35	0.81
		overt	50	1.2	0.45
	Locative	null	17	2.06	1.14
		overt	41	2	1.12

Table 3: Mean predicate length in null and overt copula utterances.

We investigated possible effects of both subject length and predicate length on copula omission by fitting a mixed-effects logistic model including the following fixed effects: *predicate* (IL vs SL), *subject length* and *predicate length*. The model confirmed predicate type as a strong predictor (for SL: z = –3.81, p = .0001), while neither subject length (z = –.60, p = .55) nor predicate length (z = –.41, p = .68) were significant predictors of copula drop.

Next we investigated the relation between utterance length (as measured in number of non-copula words) and copula drop. If this factor alone could explain omissions, then one would expect no difference in rate of copula omission between IL and SL predicates in utterances of equal length. As shown in **Table 4**, this prediction is not supported.

Utterance length (non-copula words)	Individual-Level predicates				Stage-level predicates			
	Nominal Predicate		IL Adjective		Locative Predicate		SL Adjective	
	N	overt copulas	N	overt copulas	N	overt copulas	N	overt copulas
Two words	8	100%	10	100%	7	71.43%	31	48.39%
Three words	14	92.86%	15	80%	13	61.54%	27	66.67%
Four words	8	100%	15	93.33%	18	83.33%	12	66.67%
Five words	9	100%	2	100%	8	50%	5	60%
Six + words	2	100%	1	100%	14	78.58%	9	66.67%
Mean		97.56%		90.69%		70.68%		59.52%

Table 4: Rate of overt copula production by complement type and utterance length.

Contrary to the prediction of an extra-grammatical account, there is also no indication that copula omission increases in longer utterances, either in locative or SL adjectival predicates. While the rate of omissions fluctuates for locative predicates, in the case of adjectival SL predicates it stays constant in utterances of three words and above, with the highest rate of omissions concentrated in two-word utterances. This pattern is the opposite of the one reported by Becker (2004) for SL predicates in child language, where omissions in locatives appeared to be lowest in two-word utterances, increasing in utterances of three words and above. Examples of grammatical and ungrammatical two-to-five word utterances are given in (8–11):

(8)   Two words:
    a.   it was terrible (Elman06a, 45)
    b.   window broken (ACWT01a, 80) [target length: 3 words]

(9)   Three words:
    a.   Cinderella was very happy (MSU05a, 181)
    b.   she is the rain (Scale18a, 110) [target length: 4 words]

(10)   Four words:
     a.   Cinderella was a poor child (ACWT01a, 146)
     b.   the girl a tree (tcu03a, 205) [target length: 5 words]

(11)   Five words:
     a.   they were good to my parents (Scale31a, 190)
     b.   first I think it was ok (Elman06a, 84)
     c.   two sister ready the ball (Adler25a, 316) [target length: 7 words]

It can be seen that sentences of equal length sometimes differed both in complexity and grammaticality. For example, in the context of the Cinderella story, (11c) (intended: *the two sisters are ready for the ball*) the utterance includes two omissions in addition to the omission of the copula. For this reason, each utterance was coded for both *actual* length and *target* length.

Modelling actual utterance length alone, the effect was not significant (z = 0.98, p = .32); however, when controlling for target length, these factors became significant in opposite directions: while *actual* utterance length (z = 2.403, p = .016) was a mild positive predictor of copula production, the *target* utterance length was associated with an increase in the likelihood of copula drop (z = –2.227, p = .026). Including predicate type in the model, the *actual* utterance length remained significant (z = 2.103, p = .035) but *target* length no longer was (z = –1.831, p = .06), and the effect of *predicate* type was still larger (for SL predicates: z = –3.780, p = .0001).

Interestingly, however, the effect of utterance length (both actual and intended) remained significant in a model including a different grammatical factor, namely the presence of an overt CP. In this model *actual* utterance length (z = 2.308, p = .021) and *CP* (z = 2.381, p = .017) were both significant positive predictors of copula production, while *intended* utterance length (z = –2.307, p = .021) was a significant negative predictor.

To conclude, there is some indication that utterance length affects copula production, but such effect goes in a direction that would not be predicted by an extra-grammatical account, since both longer and linguistically more complex utterances positively predicted copula production rather than omission. Utterance length was not significant in isolation but only when controlling for the *intended* utterance length (thereby taking into account omission of other functional material, such as determiners or prepositions). We interpret this as a fluency effect, since utterances that had no other omissions were associated with fewer copula omissions overall (see **Table 5**).

In sum, our analysis confirms that a single grammatical property, i.e. the presence of an aspectual layer mapping onto the semantics of stage-level predicates, was the strongest predictor of copula omission in the speech of English PWBA. It also confirms a further prediction of a grammatical account: namely, that the overt projection of a CP layer was mildly associated with copula overtness, as predicted by a truncation account. Finally, effects of length (as a measure of processing load) were globally determined at the clause level and not at the level of single constituents, and interacted with measures of linguistic complexity.

Utterance length	Utterances with no other omissions		Utterances with other omissions	
	N	overt copulas	N	overt copulas
two words	47	72.34%	9	44.44%
three words	60	81.67%	10	30%
four words	37	89.19%	15	73.33%
Five words	19	78.95%	5	60%
six + words	20	80%	4	50%
Mean	183	80.33%	43	53.49%

Table 5: Rate of copula production in utterances with or without other omissions.

5 Discussion

In this paper we set out to test Becker's analysis of copula omission in child language in a sample of spontaneous utterances produced by English-speaking PWBA. Becker (2004) argued that children's null copulas are the reflex of an interaction between Tense and Aspect in child grammar, not the result of a processing bottleneck caused by extra-syntactic factors such as utterance length or predicate length. Overall, our results suggest that this analysis holds explanatory power in aphasia as well as acquisition. Copula omission occurred significantly more frequently in aspectual predicates (stage-level) but was constrained in non-aspectual predicates (individual-level), replicating the pattern reported in child English. In contrast, the length of single constituents did not have an effect on copula drop. In other words, neither the 'heaviness' of the subject node nor the length of the complement following the copula (nominal, locative or adjectival) influenced the likelihood of copula omission in our sample.

Two differences were also revealed between acquisition and aphasia data. First, the contrast between stage-level and individual-level predicates appeared to be more marked in our sample, to the extent that omissions were virtually non-existent in all individual-level predicates (both nominal and adjectival). This asymmetry was significant but less clear-cut in Becker's data, since children were still at a stage of large omissions. Our sample captures the fragility of the T node in a relatively fluent aphasic population, allowing us to observe the relative *strength* of T both in individual-level predicates and in structures including an overt CP layer (roughly 10% of all utterances), both of which, we argue, act as a grammatical constraint on copula omission. It is comparably harder to discern such a stage during language development since Root Infinitives and copula omission disappear very quickly as soon as complex syntax appears.

Regarding the effect of utterance length, Becker (2004) reported a small negative effect (an increase in copula omission in longer utterances) driven by the fact that omissions in locatives were most frequent in utterances of three words and above. We found utterance length to be a positive – not negative – predictor of copula overtness when controlling for target length. Assuming the preservation of syntactic hierarchies in the grammar of PWBA, this finding may not come as a surprise: for a processing system that has full competence but cannot (always) spell out a full tree structure (at the CP/TP and DP/NP levels), omissions may occur as an effect of planning and then 'pruning' high functional nodes. This might explain why *actual* utterance length and *intended* utterance length influenced copula drop together but in opposite directions. On the other hand, for a developing system in which structure is still 'growing' (Friedmann et al. 2021) one may not expect actual utterance length and target utterance length to diverge, since high functional nodes may be missing altogether until they become robustly available. While Becker's (2002) analysis did not take into account the target utterance length, the negative effect of utterance length on copula production in children's sample indirectly supports this explanation.

In this sense, it can be concluded that linguistic and performance factors do interact in the grammar of PWBA. This is not surprising, since it is well known that inflectional morphology can become hard (subject to optionality) even for healthy adult speakers under experimentally induced processing burden (McDonald 2008, a.o.).[6] For adult L2 learners, tense morphology can be subject to persistent optionality even at advanced stages of acquisition (Lardiere 1998),[7] a fact that has been linked to the processing difficulties that bilinguals face in controlling two language systems. Crucially, however, pruning accounts have been unsuccessful at explaining tense omissions in healthy bilinguals' spontaneous speech (Prévost & White 2000), since these do not come with the same cluster of properties that characterise the child's grammar at the Root Infinitive stage (nominative case errors, null subjects). For this reason we believe that the grammar of PBWA resembles child grammar in the sense that it isn't just the morphology that is hard to access (although this may well be an additional factor). Rather, commonalities between these two populations suggest that omissions are a reflex of a deep-rooted grammatical difficulty in accessing full phrase markers during language production (despite the fact that the abstract full clause syntactic hierarchy may never be lost, as Zhang & Hinzen 2022 suggest). Reducing overt projections at the root of the syntactic phrase marker is a processing strategy, but it comes with grammatical consequences at the structural level.

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[6] In McDonald (2008), adult participants who processed sentences under additional memory load (presented with strings of digits that they were asked to recall between trials) made more errors with tense regular morphology (especially past tense) and subject-verb agreement. We thank an anonymous reviewer for raising this point regarding the relation between linguistic complexity and other processing measures (such as working memory limitations).

[7] Although, crucially, the speaker in Lardiere's study had much more difficulty with affixal *-ed* and *-s* than with suppletive forms such as copulas.

Finally, in this article we contended with Becker (2004) that copula omission in stage-level predicates indirectly provides an argument for the preservation (or at least the relative strength) of Aspect. In other words, sensitivity to the aspectual semantics of this class of copular predicates was interpreted as the factor licensing a null copula, and we argued that this may be an economy strategy to realise deictic anchoring of the eventive predicate without resorting to T. Why should this be? As a reviewer points out, the opposite conclusion could in principle be compatible with the data, namely, that if this class of copula predicates is more complex (by virtue of containing an aspectual projection, which individual level predicates lack) the additive demands of Tense and Aspect might be the key factor driving omissions. If this was the case, there would be no evidence that Aspect is strong, but rather the opposite. There are some reasons why we don't believe that stage level predicates (e.g. locatives) are more complex than individual level predicates (e.g. nominals). From a theoretical point of view, Aspect in stage-level predicates is tied to the presence of a Davidsonian event argument, which is lexically motivated. There is no indication that stage-level predicates in our sample lacked a target-like aspectual meaning, since they were produced in appropriate contexts (e.g. to refer to impermanent properties in the picture-description tasks), although a systematic analysis of other linguistic features, such as co-occurrence with temporal adverbs (which can only modify stage-level properties), would be needed to confirm this analysis.

Future research should explore properties of null copula structures in languages where the distinction between IL and SL predicates is morphologically marked: for example in Russian, where null copular structures mark the aspectual distinction overtly in the complement by use of nominative (for IL) and instrumental (for SL) case, correct case marking in the speech of PWBA would provide evidence for preserved aspectual marking. In acquisition, the striking pattern of asymmetry in Tense omission correlating with properties of lexical Aspect (the stative-non-stative distinction in languages which obey the Eventivity Constraint, the SL-IL distinction in copular predicates) is typically taken as an indication of a very early sensitivity to Aspect, supported by the finding that children map lexical Aspect to perfective and gerundive forms consistently from their very earliest productions (Tsimpli 1992/1996; Shirai & Andersen 1995). This knowledge appears in place *before* the emergence of Tense (the so-called pre-functional stage), as well as during the Root-Infinitive stage, when Tense is subject to optionality and interactions can be observed between null Tense and Aspect. On the basis of these facts it has been proposed that children mark their first Tense distinctions using information about the intrinsic temporal semantics of verbs such as telicity (Antinucci & Miller 1976; Stoll 1998). If very early acquisition of a grammatical property predicts its preservation in language breakdown (Grodzinsky 1990; Avrutin 2000), it is possible that the preservation of time reference in aphasia must go through the route of lexical aspect.

6 Conclusion

This paper reported a remarkable convergence between aphasia and acquisition in patterns of copula omission in spontaneous speech. English-speaking PWBA displayed an asymmetry between Stage-Level and Individual-Level predicates which was previously reported in child English by Becker (2002): omissions were larger in aspectual (SL) copula predicates but very low in non-aspectual predicates. We interpreted this as an effect of the interaction between aspectual information and tense anchoring in the utterances of PWBA. We argued that null copulas amount to an economy strategy to realise temporal anchoring via a lower head in the verbal domain, namely Aspect. On the other hand, copula omission was constrained in copular utterances lacking an aspectual (eventive) semantics, and was virtually absent in more complex utterances (utterances projecting full CPs). Despite some effects of sentence length, a purely processing account does not find support in our analysis, suggesting that copula omission is a grammatical phenomenon both in acquisition and aphasia. In light of this convergence, we note that grammar-based accounts of tense/copula omission in child language which capitalise on parameter (mis)setting may have a hard time explaining why the same selective difficulty is exhibited by adult PWBA, who lose access to certain syntactic knowledge in adulthood as a result of impairment. A grammatical model of tense deficits in acquisition and aphasia must be able to account for the commonalities in omission patterns while at the same time considering the differences between these two populations.

Data availability statement

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Competing interests

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