

# Aphasia

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## A Study of Agrammatic Agreement and Syntax in English and German

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## **Abstract**

The present study examines fourteen transcripts of agrammatic speakers of English and German in an attempt to investigate possible impairment level differences in syntax and subject-verb agreement. The paper will draw from Friedmann and Grodzinsky's (1997) Tree-Pruning Hypothesis and the Competition Model developed by MacWhinney and Bates (1987; 1989). A contextualisation of relevant differences between English and German grammar is also given, along with basic theory on language processing and psycholinguistics. Following from the analysis, it is concluded that German speakers were significantly less impaired in terms of syntax and subject-verb agreement, but inverted set word order more frequently. Substitution of finite verbs for non-finite forms occurred almost five times as much in English as in German. Speakers of German produced marginally more subject pronouns and significantly more verbs than English speakers. The findings, therefore, support the Competition Model's hypothesis that heavily-inflected languages are less susceptible to morphological and syntactical impairment than less-inflected languages; having said that, the limitations of this study are also acknowledged.

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# 1. Introduction

Nearly two million people in the world suffer from a type of language impairment known as aphasia, a condition which belongs to the rare class of cognitive deficits which affect only language rather than a variety of brain functions. The study of aphasia is rooted in medical science and psychology, but has attracted attention from linguists in the last few decades. Language-based descriptions of aphasia symptoms became common, and linguistic theories of what exactly happens to language when it is impaired by aphasia were formulated.

Scientists still hold wildly varying ideas about the exact features impaired by this deficit, and whether different language systems are more difficult for patients to recover. For example, Friedmann and Grodzinsky (1997) studied Hebrew aphasia and concluded there must be underlying universal rules governing impairment. This notion has been challenged by, among others, Ruigendijk (2010), who concluded there were varying levels of incorrectness between English, Dutch, and German speakers. Many questions remain about whether impairment is dependent on, or influenced by, issues such as grammatical case and gender, morphosyntax, transitivity, and agreement. All of these grammar topics can differ substantially from language to language.

## 1.1 Aims and Objectives

The present study examines German and English data collected from several Broca's agrammatic aphasia patients. In doing so, this research will make an attempt to answer the following research questions from a linguistic viewpoint:

- 1) What syntactic and grammatical features do English and German speaking agrammatic aphasia patients use and which are problematic?

- 2) How does English and German impaired speech compare in terms of verb conjugation, word order, and morphology?

The study will focus on subject-verb agreement and clause syntax, as these features have been shown in previous studies (e.g. Bates et al., 1991: 127; Ferreiro, 2003: 51) to be highly impaired in agrammatism. Moreover, verb grammar and clause syntax are significantly different in English as opposed to German, and as such some notable differences in impairment levels could exist in agrammatic speakers of each language.

## **1.2 Rationale**

Cross-linguistic aphasia research is of particular importance as examining impaired data can improve patient care and offer new models in speech and language therapy specific to individual languages. In German, for instance, inflections may take a more salient place in therapeutic sessions due to findings by psycholinguists that morphology is a particularly problematic area. Moreover, aphasiology forms a practical rather than theoretical angle of inquiry in linguistics. For example, Hatchard (2018) showed how aspects of universal grammar could be disproved by examining the retention of specific phrases in aphasia patients. Although this study certainly does not aim for levels of complexity as high as Hatchard's, it does seek to be placed in the same field, attempting to offer insights into the grammatical structure of English and German through the study of agrammatic speech.

These differences in structure between English and German will be discussed first in a brief contextualisation of this study, along with general literature concerning aphasia. Two aphasiology frameworks, the Tree-Pruning Hypothesis and the Competition Model, will then be provided, along with the data and methods this report uses in its analysis.

## 2. Contextualisation

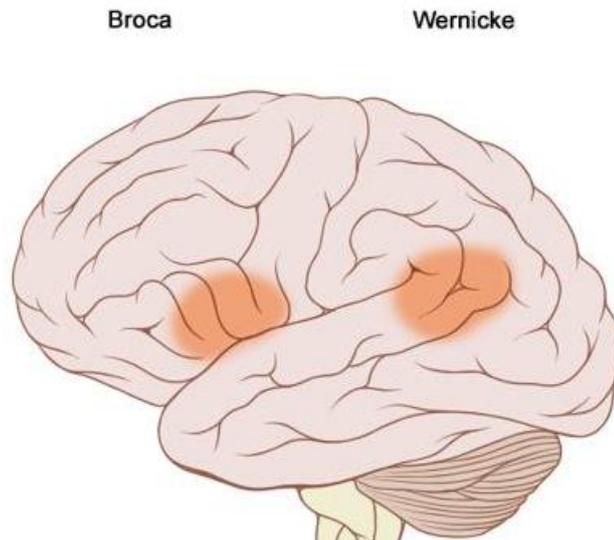
### 2.1 Aphasia

Examinations of the relationship between the brain and language were begun in the late 19<sup>th</sup> century by Paul Broca and Carl Wernicke, who each discovered language-specific areas in the brain which they rightly considered responsible for language-related tasks (Broca, 1861; Eggert, 1977). Subsequently, it was recognised that lesions to either Broca's or Wernicke's areas (see figure 1) cause different linguistic effects. Broca's area appeared predominantly important for production of language and grammar, while Wernicke's was identified to be essential to receptive language skills (Friederici, 2011: 1360). This appears to be linked to the latter's proximity to the primary and secondary auditory cortices.

The localisation of human language ability to these two areas has been backed up by open-brain surgery, in which stimuli were administered to Broca's and Wernicke's areas while the patient retained consciousness (Van Boxtel, 2018). However, some studies have suggested that language faculties are not solely limited to these areas. Indeed, researching language impairments has shed new light on language processing in the brain: for instance, a study by Marien et al. (2017) showed cerebellar lesions can also cause loss of speech, or even the eradication of several languages selectively in polyglots.

Aphasia, therefore, is defined as a non-developmental language impairment caused by lesions in specific areas of the brain, usually as a result of strokes, tumours, or infarctions (LantÉri-Laura, 2005: 106-7). Aphasia can have widespread consequences for patients' ability to communicate, and can be permanent if symptoms do not fade within three months of onset. Hijdra et al. (2016) summarise that there are four main types of aphasia. However, this study will focus on Broca's (or the expressive) type, which is caused by a lesion to the frontal lobe of the dominant hemisphere.

*Figure 1: lateral view of the left hemisphere, detailing Broca's and Wernicke's areas;*  
*adapted from Gaillard (2008)*



Broca's aphasia involves agrammatism, which means that there is relatively much production, but ungrammatical speech. This study is concerned with grammar as it is not only foundational to the way we speak, it is also the basis of most theories of developmental linguistics, such as Universal Grammar, Construction Grammar, and many others. Moreover, grammar offers a way of finding tangible differences in impairment cross-linguistically, as structural rules often differ significantly between languages.

To illustrate the above theoretical framework, a salient example of agrammatism is given below, taken from the AphasiaBank database. (Note: phrases after &= denote actions rather than language; [/] or / indicate pauses; and phrases in [: ] explain intended meanings.)

well ‡ &um Wall\_Street\_Journal. &=laughs not so good. &=ges:up\_and\_down  
ups and downs . &uh &um maybe <this many the group> [//] &uh many &r this  
one [/] one two three four fi(ve) and here and here and here &=ges:levels yeah.

This speaker is a relatively fluent agrammatism patient. He was asked by the researcher to describe an event that happened in his life that made an impact on him. In the resulting speech, it is evident that few verbs are produced at all. Moreover, the use of gestures is frequent and more involved than in normal speakers. In fact, many agrammatic patients examined in this study frequently attempted to ‘write’ words they cannot say on the table they were sitting at. Also, clause structure is visibly impaired: very few full SVO or SV structures are formed at all.

I sad. &um &uh I wanna talk. &um &um sad &uh angry.  
&=head:nod yes. sad and hætid@u [: angry] &=head:nod. hm.

This speaker is significantly less fluent when asked the same question. The only verb produced is ‘wanna’, and only two subject pronouns are given. Mainly, the speaker uses simple, mono- or bisyllabic adjectives and does not produce any concrete SVO clauses or complex verb phrases. General use of pronouns, whether personal or deictic, is severely impaired.

## **2.2 German and English – An Overview**

The differences between English and German delineated below illustrate how inversions of standard word order, verb conjugation, and production levels of subject pronouns, could vary in English and German agrammatic patients due to the contrastive nature of these issues in the two languages.

### **2.2.1 Syntax**

German, as opposed to English, theoretically has a free-standing word order. This is a result of grammatical case in German, which, unlike English, allows for the morphological

labelling of subjects and objects without requiring them to occupy specific slots in word order. Although natural Subject-Verb-Object order occurs by convention in German, variation is frequent and stretches well beyond poetic or lyric word order deviation in English. An example includes the following sentence (subject marked in red, object in blue, lexical case in bold):

The dog bites the man

<b>Der Hund</b> beißt <b>den Mann</b>	<b>Den Mann</b> beißt <b>der Hund</b>
---------------------------------------	---------------------------------------

Despite *der Hund* being positioned at the start of the sentence in the first example, but at the end in the second, the meaning of both sentences is kept the same by the accusative article *den*, which indicates the man is the object of the biting being done. Another, more famous, example of case use is found on the frontage of the German parliament:

<b>Dem</b> deutschen Volke
----------------------------

The dative article ‘dem’ denotes a direct object relationship. Therefore, the correct English translation of this phrase would require a pronoun: *to the German people*.

As this type of structure is unheard of in English, it may be easier for German agrammatics to express coherent sentences if word order is not as crucial to comprehensibility as it is in English. Alternatively, noun case could either make it easier or more difficult (as will be discussed in Section 3.2) to formulate sentences altogether, due to the lexical access that is involved in retrieving case inflections.

## 2.2.2 Verbal and Pronoun Inflections

A similar issue occurs with verb conjugation. Listed below are the different types of German verbal inflections with their English counterparts (variable inflections marked in bold and underlined).

Ich laufe <u>e</u>	I walk
Du läuf <u>st</u>	You walk
Er läuf <u>t</u>	He/she/it walk <u>s</u>
Wir lauf <u>en</u>	We walk
Ihn lauf <u>t</u>	You walk
Sie/sie lauf <u>en</u>	They walk

As is evident from the above, English verbs are normally conjugated with only one inflection, [s], while German uses four: [e], [st], [t], and [en]. This relatively complex inflectional patterning in German as opposed to English creates a potential for more, or perhaps less, severe impairment. Alternatively, if the data this study examines is in line with one of the frameworks discussed below, the Tree-Pruning Hypothesis, agreement could be almost completely unaffected across both languages.

The same inflectional principles do not, however, apply to pronouns. English uses three main types of personal pronoun (i.e. *I*, *me*, *myself*) and German works more or less the same way (*Ich*, *mich*, *mir*). Two slight differences are found in the fact that German does not have a reflexive pronoun, but instead adds the word 'selbst' to denote reflexivity, and that the uses of *mich* and *mir* are encapsulated in the English *me*. From a functional viewpoint, however, these variations do not contrast remotely as much as word order or verb conjugation. Therefore, one

would expect that pronoun grammar is impaired in roughly the same way in agrammatic speakers.

### 2.2.3 Non-finite Substitution

Non-finite verbs are extremely common in English speech, occurring in multiple tenses, aspects, and sentence moods. English uses present and past participles to indicate progressive or perfect aspect, infinitives with various uses such as a complement to verbs, as adverbial modifier, or predicative expressions, and gerunds as subjects of predicative expressions and complements to prepositions (Börjars & Burridge, 2010: 146). Examples of this are listed below.

I was <b>running</b> (Pres. Part)
I had <b>run</b> (Past. Part)
I had <b>to run</b> / <b>To run</b> is hard (Inf.)
<b>Running</b> is hard / I thought of <b>running</b> (Ger.)

Contrary to that, German only uses a past participle for the perfect aspect, with progressive aspect not being expressed in verbal inflections. German’s present participle is only used when describing nouns and therefore occupies a completely different functional category, that of noun modifiers. German does make frequent use of the infinitive. Combinations of auxiliaries, modals, and main verbs, are highly common:

<b>fließender</b> Verkehr (Pres. Part)
Flowing traffic (Pres. Part)
Das <b>hätten</b> sie <b>machen sollen</b> (Subjunctive + Inf. + Modal)
They should have done so (Modal + Aux. + Past. Par.)

In the second example, the modal *sollen* occupies exactly the same functional category as the normal main verb, *machen*. It even goes with the same infinitive inflection. Agrammatic speakers are highly unlikely to realise that one verb is a modal and another is not. Therefore, it is safe to consider both as regular infinitives for the purpose of this study. The subjunctive used in this example, *hätten*, is no longer extensively found in English, nor is it frequent in German agrammatic speech.

As non-finite substitution is a well-described phenomenon in English aphasia (Ferreiro, 2003: 51) it is possible German agrammatic speakers perform similarly. In this case, one would expect finites to be substituted by infinitives rather than present participles. Examples of non-finite substitution in both languages are given below.

und das Mädchen Eis **essen**

um **catching** [//] **hitting** [//]  
**kicking** the ball

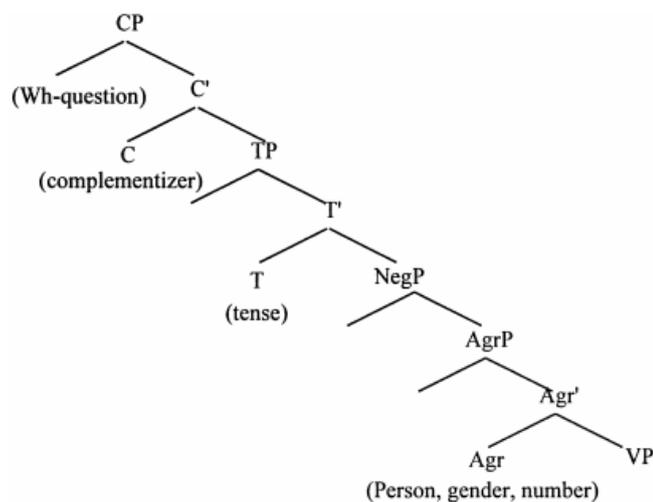
As can be seen from these excerpts, the German third person singular *isst* is replaced by the infinitive *essen*. Contrary to that, the English speaker prefers using present participles.

### 3. Literature Review

#### 3.1 Tree-Pruning Hypothesis (TPH)

An influential study aiming to explain impairment patterns in agrammatic aphasia was conducted by Friedmann and Grodzinsky (1997) in a Hebrew case study. They formulated the tree-pruning hypothesis (hereafter TPH), which adheres to Noam Chomsky’s (1957) theory of generative grammar. Chomsky’s model uses phrase marker trees to distinguish between agreement markers (AgrP) and tense markers (TP) and postulates that, in the syntactic tree underlying every language, agreement is located below tense (Tissen, 2006: 1). This is illustrated in figure 2.

Figure 2: inflection represented in Friedmann and Grodzinsky’s (1997: 412) marker tree



According to Friedmann and Grodzinsky (1997: 415), this syntactic tree is ‘pruned’, or separated, between tense and agreement, causing the level of tense and everything above to be impaired, while agreement remains relatively intact. The evidence Friedmann and Grodzinsky provide is based on a case study of a Hebrew-speaking agrammatic patient, whose tense and agreement patterns match the TPH perfectly. An example of this is given below (*idem*, p.416).

axshav ata holex. etmol ata telex.

Now you (2sg-M) go (2sg-M-pr.). Yesterday you will-go (2sg-M-fut.)

In this sentence, tense is impaired: despite the deictic marker *yesterday*, the future tense is used. However, agreement remains intact, as the second person singular is produced correctly on two occasions.

Moreover, wh-questions and complementisers (i.e. ‘that’ in *John thinks that he will fail*), are also theorised to be impaired, while agreement and negative sentences should be largely intact (*idem*, p.397). This is hypothesised to function the same across languages – in line with Chomsky’s universal grammar. A further example of this study includes:

Siparti la Nir xayal. Lo hevina oti.

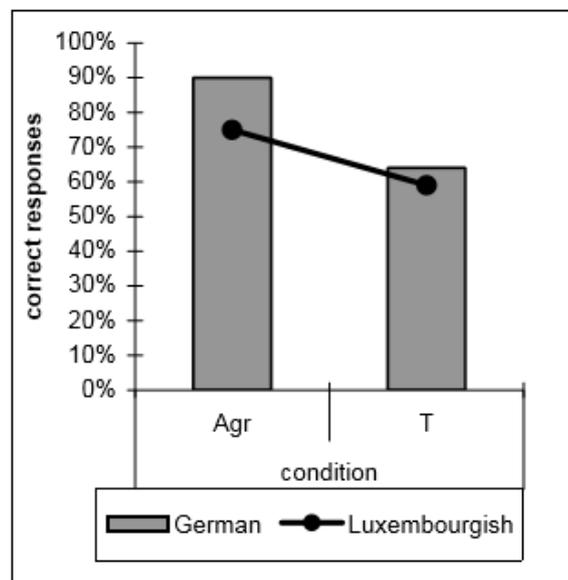
(I)-Told her [**that**] Nir a-soldier. [she] didn’t understand me.

In this clause, the complementiser *that* is omitted, leading Friedmann and Grodzinsky (1997: 409) to claim their patient either omits part of embedded clauses, omits complementisers, or avoids using embedded clauses altogether. As is visible from Figure 2, this evidence fits with a consistent impairment location between TP and AgrP.

The TPH’s support includes a study by Tissen (2006), who examined German and Luxembourgish speakers and found tense was significantly more impaired than agreement in both languages, as detailed below in Figure 3. Tissen’s study is based around sentence completion tasks, in which participants are asked to fill in the correct verb forms in sentences. For instance: “*Yesterday I told you my telephone number. Today I \_\_\_\_ you the number again*” (Tissen, 2006: 2). This study concluded tense was significantly impaired in both German and Luxembourgish, while agreement was far less of a problem. Thus, a cross-

linguistic study was used to give credence to a linguistic model. Another study aiming to support the TPH will be discussed in Section 3.3, and will show how the TPH can be used in an applied, functional setting.

Figure 3: Tense and Agreement impairment levels in German and Luxembourgish, from Tissen (2006: 2)



### 3.1.1 Criticism

However, the TPH contradicts a common phenomenon in agrammatism, the substitution of finite verbs for non-finites, as this type of verb shows tense but not agreement. For instance, patients may produce *he running* more easily than *he runs*. This construction is described in Section 2.2.3.

Another criticism can be made about the fact that Friedmann and Grodzinsky's evidence is based around a case study rather than a quantitative approach. Several researchers have since offered evidence rebuking the TPH by studying cross-linguistic aphasia quantitatively. For instance, Wenzlaff and Clahsen's (2002: 20) findings are not at all in line with the TPH:

they studied German agrammatism and found similar levels of impairment in agreement and tense in their sample. The TPH remains, then, a contested theory.

### 3.2 The Competition Model (CM)

Originally developed as a theory of language processing and acquisition, the Competition Model, developed by MacWhinney and Bates (1987; 1989), has found effective application to language impairments. The model takes a functional view of language processing, and splits language into ‘cues’, parts of speech that possess or indicate a specific role (e.g. time marking). It then assigns a weight to these cues, based on *cue validity*, a combination of how often a cue is used and how reliable the information contained therein is, and *cue cost*, the amount and type of processing involved in producing a given cue. For instance, to produce an article in German one requires advance knowledge of the grammatical case the article must be produced in, leading to higher cue cost. This is exemplified thus:

die Krone <b>des Reiches</b> the crown <b>of the empire</b>
--

The genitive article *des* is used to form a possessive construction, which evidences how articles in German carry more grammatical functions than in English, where articles only denote specificity and definiteness.

Cue validity and cost be effectively applied to agrammatic aphasia: Bates et al. (1991: 3-4) postulate that cues with higher cue cost will be more moderately impaired in aphasia. *Des Reiches* would, following the CM, be easier to produce than *the empire*. In general, because cues with high information loads are more salient, their impairment will be less severe, since agrammatic patients’ processing capacities are able to access multiple different parts of the information needed.

### 3.2.1 Criticism

The basic principle of the Competition Model, the higher the information load of a given cue the less impaired said cue will be, has been challenged by some recent evidence. For instance, Ruigendijk (2010: 456) investigated German, English, and Dutch determiner usage in agrammatic speakers (Dutch determiners are only slightly more complex than in English). She found German determiners to be far more impaired, and concluded the Competition Model was not supported by the evidence she presented (Ruigendijk 2010: 457). This led her to postulate that determiners are impaired because they are at the head of the determiner phrase and therefore depend on grammatical case. Since English and Dutch do not assign case to determiners, and case assignment is severely impaired in Ruigendijk's data, this would cause German determiners to be more deficient. This is, furthermore, a clear instance of how a cross-linguistic examination has contributed to aphasia research, and an example to the present study.

That said, the notion of impaired case assignment is not universally accepted. Indeed, this study's research has not found cases to be impaired significantly at all. One of only few clear examples of impaired case assignment is given below:

Der Junge hat <b>ein Hund</b> im Arm
--------------------------------------

The accusative indefinite article *einen* would have been appropriate in this sentence. However, comprehensibility is unhindered by the omission of *-en*, and, more to the point, in three of sixteen possible inflections, *ein* would have been correct. It is only for the masculine accusative and plural dative that *-en* is used (Goossen, 2018). Moreover, the native German pronunciation of *einen* is often only very slightly distinguishable from *ein*.

### 3.3 Applied Linguistic Aphasiology

This section explores two aphasiology articles and evaluates their research objectives and results, as well as their data samples and methods, to exemplify how aphasia research generally takes place.

Benedet et al. (1998) chose to focus on Spanish agrammatism, and viewed this phenomenon in light of the CM. They posit that Spanish inflectional morphemes are mostly very high in cue reliability and cue availability (which, following the CM, together constitute cue validity), but claim that agrammatic patients may be more susceptible to the effects of cue cost (a combination of the perceptual saliency and the amount of information required in a speaker's memory in order to use a particular construction) than unimpaired speakers.

Therefore, the CM would logically imply Spanish morphology would be less impaired than English inflections. To test this hypothesis, the authors examined six Spanish patients, using grammaticality judgement and filling-in tasks (as exemplified by Tissen (2006) in Section 3.1); and auditory comprehension tests, where the patient was presented with two slightly different picture scenarios and a description of one picture was read out, prompting the patient to identify which. The data used for a comparative analysis with English was taken from an earlier article.

From their cross-linguistic analysis, it was concluded that Spanish speakers appeared significantly better at producing correct subject-verb agreement (Benedet et al., 1998: 325), but that English-speaking patients performed slightly better at comprehension tasks (*idem*, p.327-8). They therefore maintain that the CM cannot be enough to explain both production and reception patterns in agrammatism.

The data sample of this study is small, including only six speakers. Moreover, English data had to be taken from another study, which causes disparities in terms of elicitation

methods (this will be further explored in Section 5). It may further be argued that grammaticality judgement and sentence completion tasks do not elicit natural, spontaneous speech, and that performance may therefore be generally better than if research had been conducted in interview format. However, due to the sensitive nature of aphasia as a condition it can sometimes be difficult to find consenting patients, which is a broader methodological problem in aphasiology.

The second article this study will discuss is Friedmann's (2002) examination of syntax in agrammatism. The author builds on her and Grodzinsky's TPH by examining 13 Hebrew, 2 Arabic, and 1 English speaker (Friedmann, 2002: 160), focusing on the formation of questions. Hebrew, Arabic, and English, use different methods of forming questions: while English often uses auxiliaries (e.g. *do you like cheese?*), Hebrew does not (e.g. *you like cheese?*). The research objectives driving this article were primarily to illustrate and maintain the TPH, of which Friedmann is a supporter.

Friedmann (2002: 166-8) used spontaneous interviews to elicit yes/no questions as well as wh- phrases, before moving on to question production tasks. Additionally, the patients performed repetition tasks, in which a question is read aloud by the interviewer and then repeated by the patient.

The findings suggest wh- questions are impaired across the three languages. However, in Arabic and Hebrew, yes/no questions were less impaired than wh- questions, whereas in English both interrogative types are equally problematic. This is theorised to be in line with the TPH, which claims every grammatical aspect above Tense in the syntactic tree is impaired, including wh- questions (*idem*, p.177). The use of spontaneous interviews is an especially strong point in this article: in grammaticality judgements or completion tasks

aphasia patients may find it easier to produce the correct forms of verbs and syntax, while spontaneous speech is often much more difficult and natural.

Some methodological issues can be said to limit the study's results, however. First of all, there is no mention of the one English speaker also performing sentence repetition tasks, which causes a methodological difference between the three language groups. Moreover, the use of repetition tasks in general is anything but spontaneous and the reliability of this task may be questionable, as it relies on short-term memory as well as language processing (Ostrin & Schwartz, 1986). Furthermore, the disparity between sample sizes (the Hebrew sample being seven times as big as the Arabic group and sixteen times as big as the English sample) may have caused data discrepancies.

These two studies are salient examples of how aphasia is usually researched. The present study aims to follow a similar quantitative path, and is further informed by both theories the two aforementioned articles were based on.

## 4. Data

AphasiaBank is an online database providing free-of-charge access to transcripts, videos, and audio recordings of interviews with aphasic patients (MacWhinney et al., 2011). However, most of its contents are focused on English, with relatively few recordings of German agrammatism. In fact, only seven transcripts were found which were in German and concerned Broca's agrammatic aphasia. Thus, this selection limited the analysis that could be made.

A major advantage of using AphasiaBank is in the principle of research ethics. AphasiaBank's protocol (MacWhinney et al., 2014b) adheres to various psychological and medical codes of conduct. All data are freely available for use in education and participants have signed informed consent forms allowing recordings of themselves to be put on the AphasiaBank database. Where language impairments disallowed the comprehension of consent forms, documents which detailed research consent in pictures were used. Thus, participants still knowingly agreed for their data to be put online. The database is accessible only to registered institutions and is password-protected, as well as anonymised as far as possible.

Seven English transcripts were chosen to match the German data. Although this results in a relatively small sample size ( $N = 14$ ), which is somewhat disadvantageous, this was judged to be more academically robust than taking a large English sample resulting in a numerical imbalance. The selected English interviews were all conducted by the same researcher from the Snyder Centre for Aphasia Life Enhancement (or SCALE), in order to limit differences in elicitation methods. Depending on the prompting by interviewers, participants may be encouraged to use more language or different tenses. Eliminating this possible way of data manipulation enhanced the homogeneity of the English data.

After some preliminary analysis one speaker was deselected and another put in their place. This was due to the original speaker's African-American dialect, which often inflects possessives and third person verbs differently in unimpaired grammar; it would therefore have been difficult to measure impairment levels of inflections in this person's speech.

The German interviews consisted only of picture-naming sets, so the English analysis was also limited to this exercise. Picture-naming is designed to elicit intransitive, dative, and locative structures, using a wide range of situations and pragmatic awareness the patient may have access to (Bates et al, 1991: 127). Participants are given a set of images which describe a narrative, often a relatively simple story. The interviewer then asks the participants to tell them the events described in the pictures, with a beginning, a middle, and an end. Appendix A includes the picture sets used in the English interviews – the German images were unavailable. It is unfortunate that different pictures were used with German participants, however, the elicited language was grammatically similar enough for this to be a hugely objectionable problem.

Because picture-naming sets primarily elicit present-tense verbs, testing the TPH (as described in Section 3.1) was more difficult as tenses were fairly uniform. The TPH posits that tense is impaired in agrammatism while agreement remains intact. Therefore, only the latter part of the hypothesis could be reliably examined. As for the CM, this framework was not limited by the data: the principle of cue cost applies to verbs, articles, prepositions, and cases, all of which were abundantly present in the data.

## 5. Methods

First of all, it must be noted that performance varied wildly across selected speakers. A key tenet of aphasia is that it is not a uniform condition and there are many different ways and degrees in which a speaker may be impaired. For instance, the first English speaker this report analyses produced a multitude of different verbs and various expressions, while the second speaker only mentioned four verbs altogether. The same tended to happen in German, with some speakers using relatively complex verb tenses while others produced very few verbs all in the same tense and person. However, for the purposes of this study, these differences are not hugely problematic, as data are not compared on a personal or individual level, but rather examined together.

Some examples illustrating performance differences are given below. As is evident from them, some participants were vastly more fluent than others. This is a methodological issue as it means dispersion in correctness and production scores will vary.

Das das Mädchen nee hat schon abgebissen  
und jetzt (.) kann ich nicht anders sagen hat  
auch wieder einen Apfel bei der Hand und isst

Katze und auf einen Tisch +... / Katze Bett  
+... / Katze auf einen Stuhl +...

tweet [/] tweet nothing do with it I don't know  
but something like do

PAR: <much better> [/] much better  
INV: much better?  
PAR: yep

Section 2.2 explained the rationale behind examining subject-verb agreement, syntax, and production of subject pronouns and verbs. In short, agreement was judged for grammaticality, as well as substitution of finites for non-finites (Ferreiro, 2003: 51), while syntax was examined for grammaticality and inversion of SVO order. The analysis was thus

split into two main parts: one concerning Agreement, the other concerning Syntax. A complete list of analysed features is given below:

<b>AGREEMENT</b>	<b>SYNTAX</b>
Total verbs (TV)	Total clauses (TC)
Correctness (C)	Correctness (C)
Substitution (S)	Inverted clause (IV)
Other error (OE)	Subject produced (SP)
	Verb Produced (VP)

*Table I: overview of analysed variables*

The variables were then counted up, which enabled a detailed quantitative comparison between speakers. Such measures included calculating means ( $\mu$ ), average dispersion ( $\sigma$ ), and the ranges of each dataset. Sections 6.1 and 6.2 detail the findings resulting from this manner of analysis. A quantitative path was chosen as this is the primary way of discovering patterns in errors and speech, despite the relatively small data sample available.

Examples of all variables are given below.

**Correct agreement:**

and then &uh cat the [/] &m the &m girl was	Der Junge hat ein'n Skier
---	---------------------------

**Substitution:**

no it's [/] it's &uh &uh me &uh &uh running uh mow the grass	und das Mädchen Eis essen
---	---------------------------

**Incorrect syntax:**

but the man [/] &mi &uh gimme [/] gimme something to do with it	Der Hund sitzt im Auto nee nee der dat Auto im Dach der Hund
--	---

### Inversion:

window &u:m broke	der Stuhl die Katze der Stuhl sitzt auf eine Katze
-------------------	--

### Subject pronoun not produced:

&w &uh &we &uh rainin(g) oops	äh skien Winter skien ja
-------------------------------	--------------------------

### Verb not produced:

&uh rai(n) &um umbrella	Das Mädchen (.) Pfirsich (.) Birne ?
-------------------------	--------------------------------------

However, sometimes judging instances of the variables above for correctness was less straightforward than anticipated. In terms of non-finite substitution, for example, there were a number of cases in English speech where it was unclear whether the progressive aspect was intended and the auxiliary verb omitted, or whether the intended finite verb was substituted with its non-finite form. An example of this includes:

well ‡ &th this [//] &uh the man [: boy] [/] the the &m &um gir(1) [: boy] &um &um <kicking the ball> [/] <b>kicking</b> the ball .
---

The use of *kicking* could be interpreted as resulting from non-finite substitution of *kicks* in the target phrase *the boy kicks the ball*, but an equally valid case could be made for the target phrase being *the boy is kicking the ball*, in which case the non-finite inflection has been realised correctly, but the auxiliary has been omitted. Ambiguous cases such as this were not marked as substitution due to the uncertainty surrounding them.

Moreover, aphasic patients have the tendency to repeat a specific phrase which they have retained. Instances of these cases were clearly marked in AphasiaBank transcripts, and

included clusters such as *I don't know*, *Something to do with it*, and *I don't understand*. The AphasiaBank definition of what constituted a phrase like this was followed, as marked in the transcripts. If counted every time, these phrases could have skewed the results of the analysis, and therefore they were only included in the count once. This is justifiable, as it is evident from their use, and reported in aphasia literature, that these clusters do not constitute meaningful instances of verb use in the context of this study (e.g. Varley, 1993: 23).

## 6. Analysis

As explained in Section 5, the analysis was divided into two parts: Agreement on the one hand, and Syntax on the other. Data are presented in table format as well as in graphs.

### 6.1 Agreement

The methodology section explained the rationale behind studying correctness and non-finite substitution. Table 2 details the results of analysing agreement in the fourteen datasets, focusing on correctness (C), substitution (S), and other errors (OE).

SPEAKER	C	S	OE	SPEAKER	C	S	OE
E1	55.5	33.3	11.1	G1	73.0	13.5	5.4
E2	100	0	0	G2	52.2	19.6	17.4
E3	56.3	40.6	3.1	G3	94.4	0	5.6
E4	12.5	75.0	12.5	G4	78.6	3.6	17.9
E5	69.4	5.5	25.0	G5	71.0	0	29.0
E6	40.4	30.3	30.3	G6	70.0	10.0	20.0
E7	50	50	0	G7	88.2	5.9	5.9
	$\mu=54.9$	$\mu=33.5$	$\mu=11.7$		$\mu=75.3$	$\mu=6.7$	$\mu=14.5$
	[12,100]	[0,75]	[0,30]		[52,94]	[0,19]	[5,29]
	$\sigma=8.46$	$\sigma=3.99$	$\sigma=2.91$		$\sigma=8.24$	$\sigma=3.16$	$\sigma=4.24$

*Table 3: individual agreement scores (%)*

As is evident from the table above, correctness (C) in agreement was significantly higher in German than in English ( $\mu=75.3\%$  against  $54.9\%$ ). Ranges were far wider for English [12,100] than for German [52,94] while dispersion was roughly the same at  $\sigma=8.24$  and  $8.46$  for German and English, respectively. A visualisation of these statistics is given below.

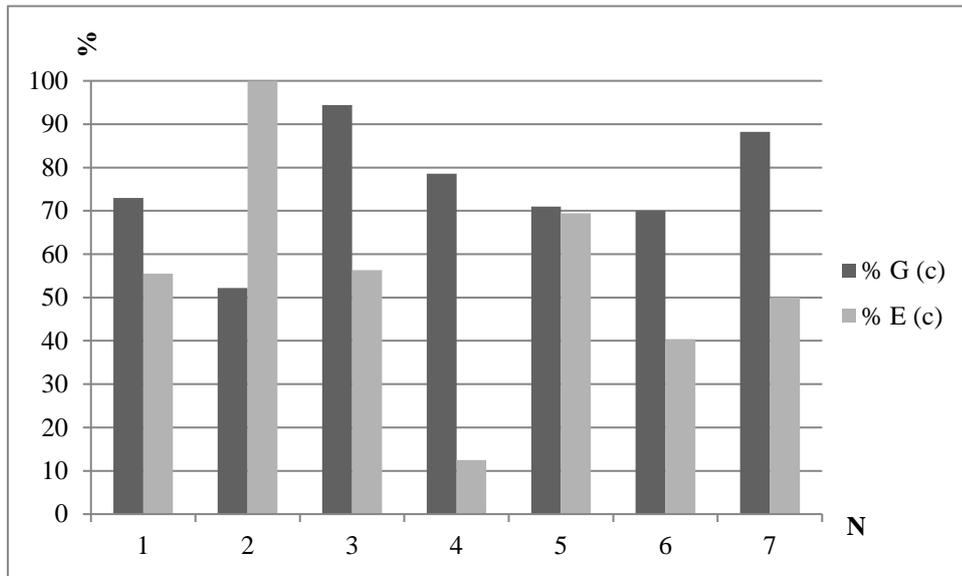


Figure 3: correctness patterns in agreement

On the contrary, substitution (S) occurred more in English than German:  $\mu=33.5\%$  against  $6.7\%$  with ranges  $[0,75]$  and  $[0,19]$  and  $\sigma=3.99$  against  $3.16$ . This results in English substituting  $27\%$  more verbs than German, although one English speaker, E2, did not substitute any verbs at all. Remaining errors (OE) occurred nearly equally:  $\mu=14.5\%$  for German and  $11.7\%$  in English ( $\sigma=4.24$  and  $2.91$  respectively). Substitution figures are collated in the graph below.

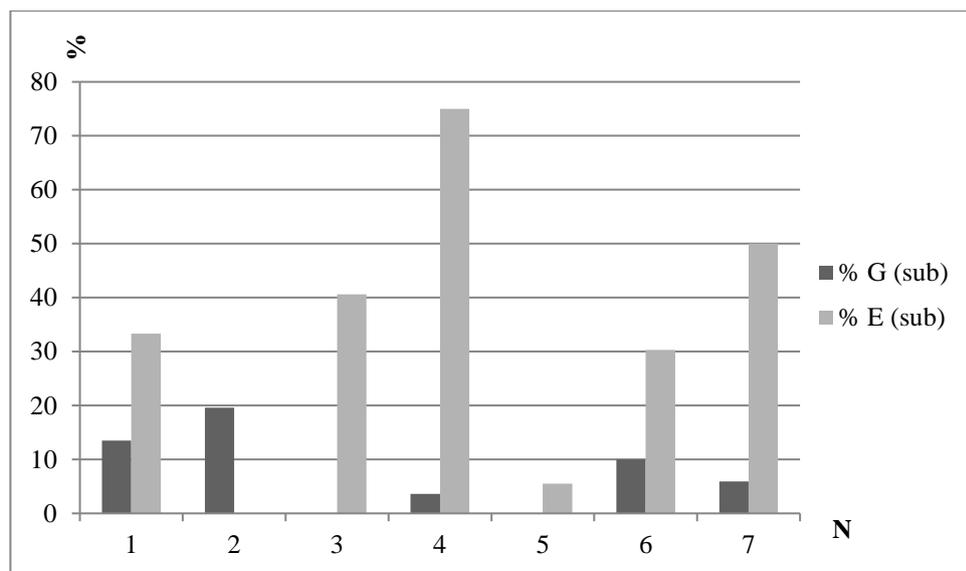


Figure 4: Substitution patterns in agreement

## 6.2 Syntax

Table 3 lists total syntax results, focusing on correctness (C), inversion (IV), production of subject pronouns (SP), and production of verbs (VP).

SPEAKER	C	IV	SP	VP	SPEAKER	C	IV	SP	VP
E1	33.5	0	64.7	76.5	G1	48.3	24.1	89.6	93.1
E2	20	0	100	30	G2	36.7	26.7	86.7	100
E3	34.4	12.5	78.1	68.8	G3	96.9	0	100	90.6
E4	0	14.3	71.4	57.1	G4	65.5	10.3	93.1	96.6
E5	75	9.4	100	96.9	G5	68.6	0	100	72.4
E6	17.4	0	82.6	47.8	G6	32	12	100	96
E7	6.7	13.3	80	26.7	G7	35.7	17.9	96.7	60.7
	$\mu=26.7$	$\mu=7.1$	$\mu=82.4$	$\mu=57.7$		$\mu=54.8$	$\mu=13$	$\mu=95.1$	$\mu=87.1$
	[0,34]	[0,34]	[65,100]	[27,97]		[32,97]	[32,97]	[87,100]	[73,100]
	$\sigma=7.85$	$\sigma=1.49$	$\sigma=8.04$	$\sigma=9.37$		$\sigma=7.2$	$\sigma=2.91$	$\sigma=2.19$	$\sigma=4.39$

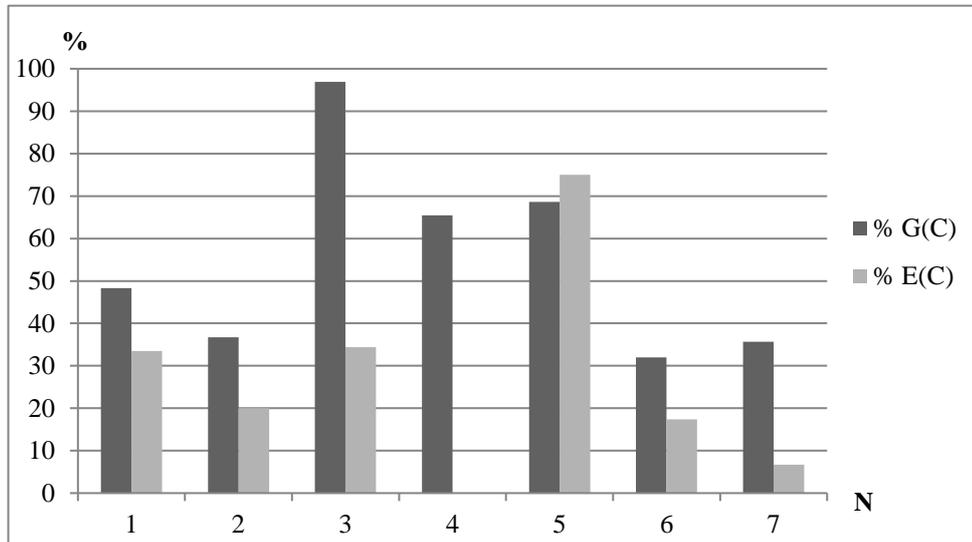
Table 3: individual syntax scores (%)

Some of the extreme results in this analysis were a result of several speakers' highly impaired production: speakers E3 and E5, for instance, only produced 10 and 14 clauses, against an English average of 20.4. However, despite this, the results are telling. German correctness averaged 54.8% against English 26.7% ( $\sigma=7.2$  and 7.85 respectively). Ranges reflect this difference: [32,97] for German against [0,34] for English. Thus, German speakers performed notably better in terms of sentence arrangement than English speakers.

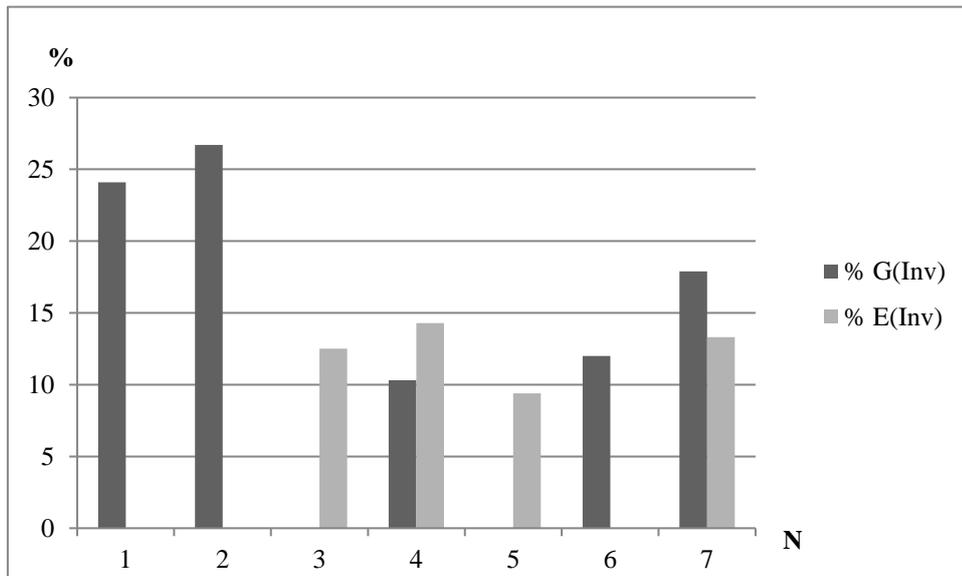
Results for inversion are less decisive:  $\mu=13\%$  for German against 7.1% for English ( $\sigma=2.91$  and 1.49 respectively), ranges [0,27] and [0,14]. Although there is a difference in inversion levels (German speakers inverted almost twice as much as English speakers), 13% of clauses is not a high level and there were several speakers (G3, G5, E1, E2, and E6) who did not invert any clauses at all.

Visualised in graphs, clause structure scores look like this:

*Figure 5: correctness patterns in syntax*



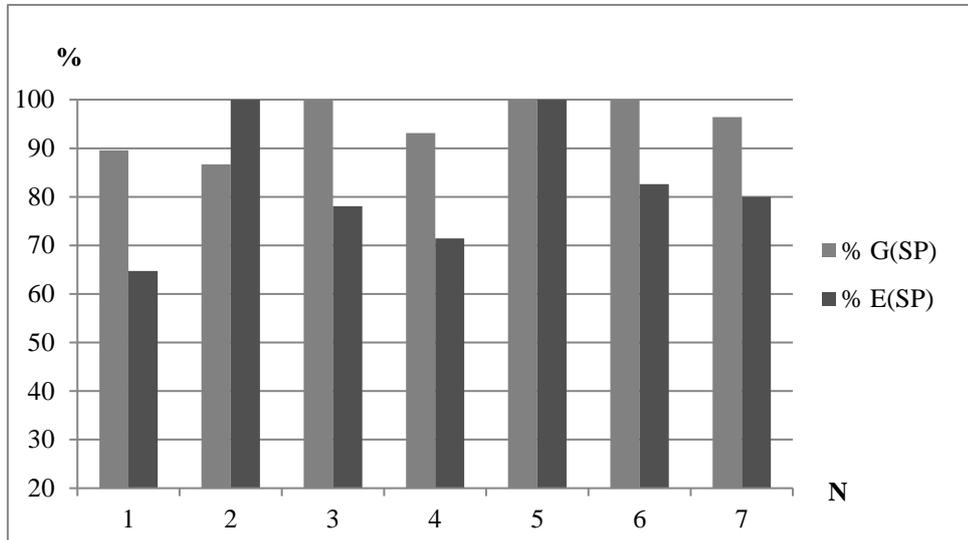
*Figure 6: inversion patterns in syntax*



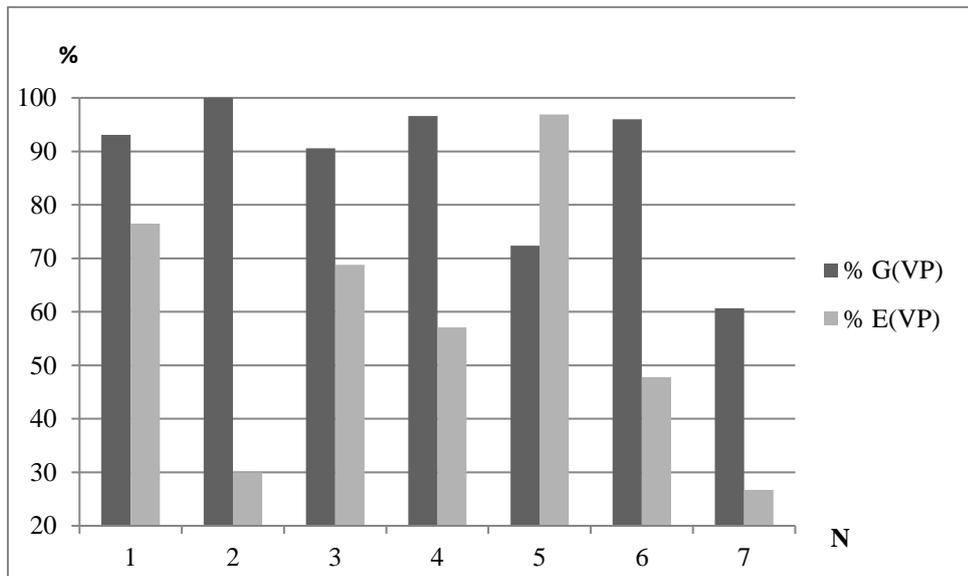
Production levels for subjects and objects show Germans produced more on both variables than English speakers. SP for German averaged 95.1% against 82.4% for English ( $\sigma=2.19$  and 8.04), with VP levels of  $\mu=87.1\%$  for German and 57.7% for English ( $\sigma=4.39$  and 9.37, respectively). Ranges reflect the wider dispersion in English: for SP, German scores

ranged [86,100] against [65,100] for English, and for VP, [61,100] against [30,97]. Below are visualisations of these patterns.

*Figure 7: subject production patterns*



*Figure 8: verb production patterns*



These figures are in line with Theobald-Ellner's (2008: 32) research which also found that German speakers produced higher levels of subject pronouns. Apart from this reference, production levels of pronouns have been relatively unexplored territory, although Friedmann and Grodzinsky (1997: 410) do mention the speaker in their case study omitted 36% of

subject pronouns. As discussed in Section 2.2.2, pronoun production was theorised to be impaired roughly similarly, and although the difference is not extremely significant, further research may be needed into this phenomenon to explain why German speakers, despite the similarity in grammar between English and German in this area, produce more pronouns.

## 7. Discussion

### 7.1 Agreement

It is evident from the data delineated above that English agreement scores were notably lower than in German ( $\mu=54.9$  against 75.3% respectively), and that consequently, it can be deduced English speakers produce fewer correct morphological inflections than their German counterparts. Two examples of incorrect agreement are given below.

he **need** the umbrella to go to school

ah das Mädchen **isst waschen** äh  
Schwamm

In the English example, the third person singular inflection has been omitted, whereas in the German excerpt the auxiliary *isst* is combined with an infinitive, which is impossible in present-tense German. However, on a comprehensibility level, the English mistake does not appear as fundamental as the German one – indeed, many American English dialects regularly omit third person inflections as a norm.

The TPH makes the case for relatively intact agreement, as outlined in Section 3.1, a claim that seems to have been positively disproven by the data this study puts forward. Although the majority of verbs were produced correctly in both languages, comprehensibility of speech is sometimes severely hampered by the absence or incorrect realisation of verbs, and thus the TPH cannot be justified by these data in either language. The examples given above and further in this Section illustrate this point.

To the contrary, the Competition Model appears to be able to explain these patterns more accurately: because German verbs carry more information, their cue cost is higher than English verbs, and thus German verbs are impaired less. Although, some cases of incorrect

English verb use, such as the example above, were not detrimental to the comprehensibility of phrases. Though this study did not set out to prove or disprove either the TPH or the CM, its findings seem to largely support the latter.

One German speaker's use of noun cases shows that noun inflections are essential in German for expressing coherent sentences. This speaker used the wrong case marker, as outlined below, but then corrected themselves and used the right inflection, visibly aware of the grammatical significance of the article.

Der Junge trägt (.) der Junge trägt (.) der Hund nee der Junge  
trägt der Hund **nee Verkehrt der Junge trägt den Hund ja ja**

As for substitution, this was abundantly present in English data, although dispersion was high with a range of [0,75]. An example includes the following:

no it's [/] it's &uh &uh me &uh &uh **running** uh **mow** the grass

This excerpt also offers an exception to the predicted norm of English non-finite substitution: in one sentence, both a present participle (*running*) and an infinitive (*mow*) are used instead of inflected or pronoun-marked forms. In German, the infinitive was almost always used, although substitution did not occur even remotely as often in German as it did in English (6.6% against 33.5%). Although there are no clear grounds for German substitution being significantly lower than in English, it could be argued that nouns are semantically and grammatically stronger than verbs in German, and that therefore German speakers rely more on nouns and pronouns to express meaning than English speakers.

## 7.2 Syntax

For syntax, too, English correctness was lower than German (26.7% against 54.8% on average). A thorough analysis of case markers would be required to conclusively prove the CM's theory that German syntax is less impaired due to the presence of these markers and freer word order. However, as mentioned previously, case marking in these data was largely unimpaired and sometimes even self-corrected. Despite this, correct syntax was sometimes produced in English, as the example below illustrates.

he's scared but he is getting the stairs

This speaker not only realises syntax correctly, but also uses the conjunction *but*, which is rare in agrammatic patients, and correctly produces auxiliary verbs and non-finite inflections.

As for inversion, this did not occur often in the data at all (7.1% for English and 13% for German), and therefore this study has not been able to prove conclusively that impairment by inversion occurs significantly more in one language than another. Inversion types seemed relatively similar, with object slots usually being inverted, as per the examples below. Often, however, self-correction resulted in inverted SVO order, and it is dubious whether inversion should have been counted in those cases.

\*PAR: he [/] he [//] &um and **the window he crash**

This example illustrates how word order seems to have been elicited by the picture-naming sets. The participant may have looked at the broken window (see Appendix A) before realising the subject of the sentence they were expressing, and consequently subject-object

inversion took place. Moreover, the verb *crash* does not usually go with a person in this case, rather with an object which crashes through something.

Der Stuhl sitzt der Stuhl der Stuhl die Katze  
**der Stuhl sitzt auf eine Katze**

Subject and object are clearly confused in this German excerpt. The resulting phrase is literally translated as *the chair sits on a cat*, rather than the other way around. Interestingly, noun case is impaired in this example, as well: the preposition *auf* goes with the dative when indicating location, which should result in *einer Katze*, but instead the accusative or nominative appears to have been used. As this is case marking by preposition rather than syntax, however, it does not occupy a specific lexical function and semantic meaning does not change depending on the case used.

As with agreement and syntax, production of verbs and subject pronouns seems to be justified by the Competition Model, as well. Although both language groups produced the majority of their verbs and subjects (96.1% and 82.4% for SP, 87.1% and 57.7% for VP, German and English respectively), verbs especially seem to have significantly higher production levels in German than English. Two examples of omitted pronouns and verbs are given below.

and then naughty [/] naughty

hm klettern Auto klettern

### 7.3 Summary

In conclusion, this study analysed impaired English and German agreement and syntax to discover if regular differences occur between the two languages and if so, why. The first research question concerned the availability, use, and degree of problematicity of features, while the second question focused on direct comparisons between English and German.

The availability of complex inflectional morphology in German, key to its synthetic grammar, appears to cause significantly lower impairment of agreement and syntax than in English. Inflectional morphology seems to be not at all as problematic as would be expected from speakers whose grammar is severely impaired. Noun cases and complex tense marking were used regularly in German, mostly in unproblematic ways.

English verbal inflections proved difficult, with only about half of all produced verbs realised correctly. Although the only personal inflection in English is *-s*, this particular morpheme was, apparently, very problematic to speakers, with one English participant only producing 12.5% of their verbs correctly.

The syntax data told a largely similar story. German word order, though theoretically free-standing, appears to have been helped by the presence of case markers on articles and nouns, which help agrammatic speakers in their correct production of sentences. English syntax, which relies entirely on word order and prepositions, was more impaired (possibly due to the fact that prepositions are a particularly difficult class of words for agrammatic speakers to produce), and production of relevant subject pronouns and verbs suffered accordingly.

Although the data were far from homogenous, and aphasia is by definition a variable condition, it can be concluded that due to the availability of a greater selection of morphemes and case markings in German, impairment is less severe, probably due to higher cue cost associated with German verbs. The more involved the correct marking of verbs is, the more agrammatic patients seem to be able to correctly produce them. The same applies, in general, to syntax. Noun cases are used almost entirely in unimpaired ways by German agrammatic speakers, causing their syntax to be more intact than in English. Speakers of English struggled

more with syntax and the formulation of comprehensible sentences, as evidenced by the data, and produced fewer subject pronouns and verbs than German speakers.

In short, the Competition Model's predictions that the more salient the linguistic feature, the less impaired said feature will be, appear to be supported by the data this study has analysed. English grammar relies mainly on unmarked word order, pragmatics, and prosody, while German grammar is marked by inflections, morphology, and freer word order. This causes agrammatic German speakers to be more competent in producing sentences correctly.

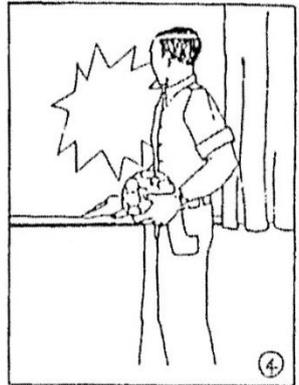
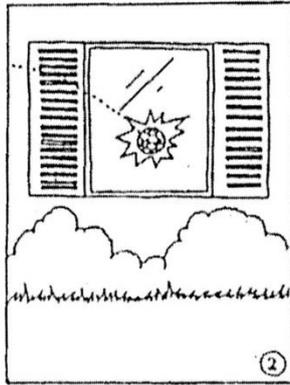
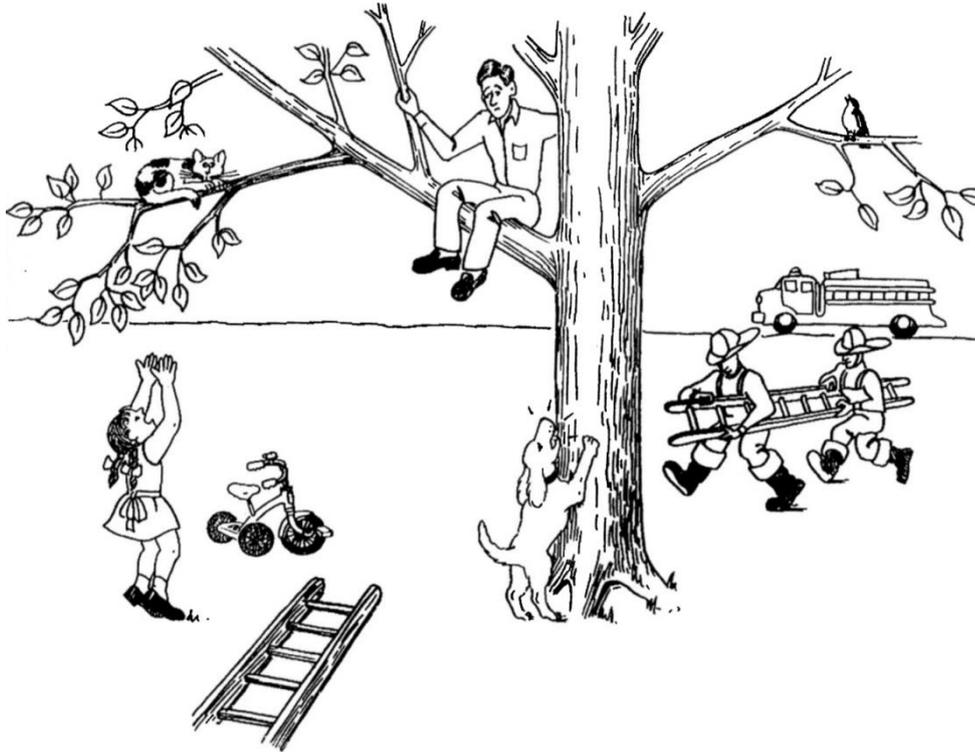
## **7.4 Applications**

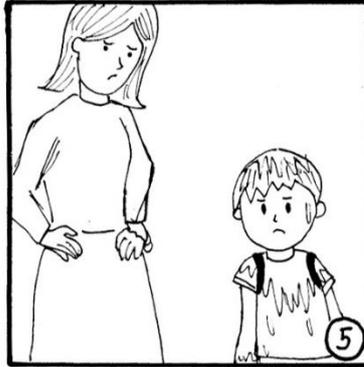
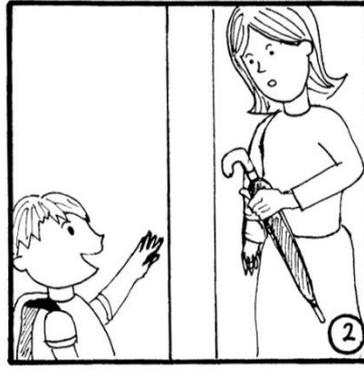
Cross-linguistic aphasiology research can be applied to speech and language therapy in multiple languages (e.g. Bernhardt & Gilbert, 1992; Albright & Albright, 1959). In this study, central features of agrammatic impairment have been identified in English and German – features which could guide the focus of speech and language therapy sessions with aphasia patients. For instance, by recognising the problematic nature of third person –s in English, therapists may focus sessions on realising this inflection correctly.

Bernhardt and Gilbert (1992: 123) refer to this process of linguistics influencing language therapy as “facilitating logical goal-setting for intervention”, a phrase which encapsulates what linguistic aphasiology intends to do. By formulating language-based models of which features are more impaired, linguists can help improve patient care, working in co-operation with psychologists and medical scientists to come to a full understanding of how best to treat agrammatic patients.

**Word count: 7,560**

# Appendix A - Picture-naming sets





## References

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Figure 1: lateral view of the left hemisphere, detailing Broca's and Wernicke's areas; adapted from Gaillard (2008).

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