

# The manifestation of grammatical deficit in the speech of the Azerbaijani-speaking monolingual Broca's aphasics

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## Abstract

This research explores how Broca's aphasia manifests itself in Azerbaijani-speaking monolingual patients. Many patients are in need of customized diagnosis tests and rehabilitation plans designed by neurolinguists and this work is the first step. As Azerbaijani aphasics are among the underrepresented populations in the field, the paper explores the main grammatical deficits in their speeches. This paper tests the findings against the most popular theses and hypotheses in the area to see if a language with a typologically different structure from English aligns with them. It also aims to uncover the universal and language-specific deficits in the participants to create a pioneer characterization of Azerbaijani aphasia. To fulfill this aim, 10 participants with mild aphasia have been involved in 15-30 minutes' interviews where their speeches were recorded with a high-quality microphone. Special tasks targeting Azerbaijani grammar have been developed for this purpose. The recordings have been transcribed and analyzed to estimate the frequency and quality of deficits. The results show that there are more morphological errors than syntactic ones which can be explained by a low cue cost of Azerbaijani syntax. The results were also contrasted to secondary data of English-speaking patients as this is a typologically polar language to Azerbaijani. The comparison has shown a vital role of language-specific features in aphasia. Furthermore, vulnerability and resistance patterns of grammatical forms in Azerbaijani patients supported the Competition model. Interestingly, the most recent and popular PADILIH theory has not been supported by the data set presented in the work. These findings are unique as they play an indispensable role in developing the first diagnosis and rehabilitation batteries for Azerbaijani-speaking aphasia patients.

**Keywords:** Broca's aphasia, Azerbaijani language, grammatical deficit, neurolinguistics

## Introduction

### *Background of the study*

Aphasia is among the most widespread language impairments: it occurs in more than half (54,3%) of patients with brain stroke (Azhar et al., 2017). Considering that the

real figure is much higher, as stroke is not the only cause for aphasia, the issue becomes of urgent importance and the negligence is unacceptable. Although aphasia incidences in the USA are leading after heart disease and cancer (180,000 new aphasia patients per year) a survey shows that 86.2% of people living in the USA have never heard the term “aphasia” (National Aphasia Association, 2020). If the leading country in aphasia has these devastating statistics, it is not hard to predict the disappointing level of aphasia awareness and its development in less popular countries. Interesting how this globally spread and frequently-occurring issue is majorly neglected or in the best scenario understudied. Aphasia is not language selective and may appear in all speakers regardless of language typology.

### ***Statement of the problem and purpose of the study***

As a first step in the neurolinguistic development of aphasia, it is vital to create linguistic descriptions of aphasia symptoms for those languages which have been disfavored in research. These descriptions lay the foundation for future aphasia diagnosis tests and rehabilitation planning. Nevertheless, they exist only for several limited languages, while other languages, like modern Azerbaijani, are not popular subjects of study. The data on Azerbaijani aphasics is not just scarce but is simply non-existent.

The lack of systematic descriptions in aphasia is a classic problem. It was back in 1988 when Crystal expressed his primary concern that the need for comprehensive linguistic descriptions of aphasics is not addressed yet. He was one of the first to highlight the usefulness of such linguistic descriptions for aphasia assessment and rehabilitation. In his seminal work, Jakobson highlighted the usefulness of detailed aphasic speech descriptions of various languages in terms of grammar, phonology, and lexics (1971). Despite the existence of the issue for so long, the descriptions are still not full or consistent. At present, roughly three decades later, it cannot be said that the need for symptoms' descriptions is still neglected. Data on some languages like Chinese or English are prevailing in aphasia studies, but the description of Azerbaijani aphasics' symptoms remains as one of the major lacks.

This work is fundamental as it pioneers to undertake the academic linguistic description of Azerbaijani aphasics' symptoms, and specifically, the grammatical deficit.

### ***Research question***

The central research question of this research work is,

"what are the grammatical manifestations of Broca's aphasia in Azerbaijani monolingual patients?"

### *Aims and Objectives*

Thus, the aims and objectives of this study are:

- to investigate the manifestation of grammatical deficit in Azerbaijani monolingual aphasics;
- to identify the universal and language-specific grammatical symptoms in Azerbaijani aphasics;
- to define the deficit-resistant and deficit-vulnerable grammatical forms of Azerbaijani patients;
- to discuss the possible reasons for the selective resistance or vulnerability of certain forms;
- to test findings against the most popular theories and hypotheses in aphasiology.

### *Significance of and justification for the study*

This work is fundamental as descriptions lay the basis for future aphasia diagnosis tests and rehabilitation planning. The existing bias towards the subjects is surprising, as aphasia is not language-selective and may appear regardless of language typology.

The absence of description leads to a low-quality diagnosis experience, ineffective treatment, and rehabilitation (if any), and poor life quality for aphasic people. Over time, this will cause social and psychological difficulties for a considerable layer of society. Stroke survivors will be the biggest group within this layer, which means that most probably these people will also suffer from physical paralysis and other parallel disabilities.

There is a lack of investigations and statistics on aphasia cases in Azerbaijan, so it is hard to present the exact figures on the actuality and urgency of the topic. However, to grasp an overall picture, it is reasonable to present the related issues. The place of stroke and the frequency of stroke cases have a direct link to aphasia and add to the actuality of the aphasia problem. The UK stroke association informs "while stroke isn't the only cause of aphasia, it's by far the biggest" (Stroke Association, 2017). Therefore, it is necessary to look at stroke statistics and the stroke-

induced disabilities rate. According to the World Health Organization's most recent statistics, stroke is the second frequent reason for death in Azerbaijan (World Life Expectancy, 2018). Specialists inform that stroke may happen at any age and there is a high risk of becoming physically and/or linguistically disabled, which makes it an acute and actual medical-social issue (Sağlamlıq Saytı, 2018). According to the Ministry of Health of the Azerbaijani Republic statistics in 2017, the percentage of people who need assistance after stroke equals 30 (Yenixeber.Org, 2017). By 2030

the number will keep rising, and people will be physically or linguistically disabled (Ismayilova, 2020). The assistant at the Neurology department of Azerbaijan State Advanced Training Institute for Doctors named after A. Aliyev Mr. Rahim Aliyev reports that cases will rise because stroke preventive measures are weak in Azerbaijan (Yenixeber.Org, 2017). Although stroke ranks second for mortality, it is the number one reason for disability (Ismayilova, 2020). So stroke is an enduring and frequent issue that leads to different disabilities, involving linguistic ones. At least one-fourth of all stroke survivors result in language impairments (U.S. Department of Health and Human Services, 2020).

Patients after stroke receive only their first consultations at hospitals, and later they are discharged to home (Gabulova, 2018). Further rehabilitation is only available at few clinics. Certainly, there is a need in Azerbaijan to increase the number of centers with adequate geographical distribution among the regions too. It is noted that the reasons for the lack of rehabilitation facilities in the country are the shortage of rehabilitation centers and qualified personnel, as well as state funding. The rehabilitation center launched in 2014 in Baku (National Institute of Sports Medicine and Rehabilitation) offers only exercises by the physician, special diet, lifestyle teaching, and psychological support. There is nothing about language and speech pathology rehabilitation; rehabilitational training tailored to region-specific needs in the country is absent. Resolving the shortage of personnel issue is not possible until theoretical descriptions and diagnostic-rehabilitational batteries are ready.

Azerbaijani Republic Ministry of Health has published a stroke diagnosis and rehabilitation protocol in 2009 (Azerbaijani Republic Ministry of Healthy, 2009). According to this protocol, aphasia is diagnosed by simple oral responses of a patient and ranked simply as 0 – no disability, 1- light aphasia, 2- acute aphasia, 3 – mute. Also, the protocol says "patients with stroke need rehabilitation with a physiotherapist, rehabilitational specialist, psychologist, and social worker" with no mention of linguist/neurolinguist whatsoever. The given scale is useless as it covers no special symptoms, and provides no basis for rehabilitational planning. Patients do not receive linguistic assistance and therapy afterwards.

## **Literature review**

This section presents the issue from theoretical and empirical points of view by highlighting the key existing theories and presenting similar studies in other languages. Also, there is a separate brief section dedicated to Azerbaijani language grammar to show the modern grammar conventions for further reference and analysis.

## **On aphasiology and aphasia types**

Neurolinguistics is the field that studies brain and language connections. Various types of developmental and acquired voice, speech, and language disabilities have been diagnosed and explored such as apraxia, dyslalia, dysarthria, dyspraxia, stuttering, Special Language Impairment, and others. The evidence from the site of the lesion of linguistically impaired people helps to uncover how language is organized in the brain and which areas are responsible for different functions.

Aphasiology is the scientific study of aphasia and its history dates back to the 1800s when Paul Broca discovered the location of lesion that was causing the language deficit (Traxler, 2012). Aphasia is a complex impairment that is interdisciplinary by nature, just like the field of neurolinguistics itself. There are many definitions of the term aphasia, but they are relatively identical. Aphasia is an 'acquired disorder of language, i.e. disorders following brain damage in people who have previously been normal speakers and hearers of their own language' (Lesser, 1981).

There is no universally accepted aphasia typology per se. Nevertheless, the most acknowledged aphasia types are fluent aphasia and non-fluent aphasia (Le and Lui, 2021). As may be guessed from their names, the former affects the comprehension and the latter affects the production abilities of people. They may also be called receptive and expressive aphasia types accordingly. Each type is further split into subtypes based on the modularity model of the brain and on the principle that language has an internal rule-based organization (Basso et al., 2013). Hence, due to the human mind's high modularity and domain-specificity, an injury to certain sections is independent of one another (Crystal, 1988).

Broca's aphasia is the main focus of this study and manifests itself in broken production and intact comprehension. Speech of Broca's aphasics is also called telegraphic, i. e. the meaning is conveyed by a limited set of forms (Caramazza and Berndt, 1978). Broca's aphasia is characterized by the omissions of function verbs, main verbs, or both; the substitution of lexical items; incorrect use of infinitives and finite verbs; problems with tense and aspect; erroneous case inflections on nouns; word-order difficulties; disturbed syntax and overuse of zero syntaxes (Paradis, 2001).

## **Theories and hypotheses on aphasia**

Based on the English-only-oriented trend, Closed Class theory has emerged. It was believed that grammatical inflections and function words are selectively damaged in Broca's aphasics across all languages (Penke & Westermann, 2006). However, cross-linguistic investigations of aphasia became popular soon, and Closed Class theory has been rejected (Bates et al., 1991). The cross-linguistic case studies found unique symptoms that manifested only in certain languages. As a result of this new

trend, the Competition Model was formed, and it predicted the vulnerability or resistance level based on cue validity and cue cost role in language processing. The Competition Model was confirmed and supported by many studies. Nevertheless, one of the most fundamental hypotheses was the Tree Pruning Hypothesis (TPH), which suggests that the vulnerability of grammatic (mainly syntactic) forms depends on its position in a syntactic tree (Grodzinsky & Bastiaanse, 2000). Undoubtedly, TPH was not a fit-all one-size universal theory and had its shortcomings. Finally, there was some evidence of the past tense's selective vulnerability across languages. This idea first expressed by Avrutin (2006) laid the basis for the modern and actively investigated hypothesis called Past Discourse Linking Hypothesis (PADILIH) which suggests that agrammatic speakers suffer from selective deficits concerning the past through grammatical inflections because it requires discourse linking.

Different theories were thriving to explain the grammatical symptoms, but none of them fit all the languages. This reminds of the fact that the damage to Broca's area is identical in deep structure, but it is different on the surface structure and is manifested depending on the linguistic peculiarities of a language. There is a necessity to describe symptoms of languages individually to uncover these languagespecific symptoms, not shared by all.

This individualized approach and formal linguistic descriptions tradition has been laid by R. Jakobson (cited in Tesak & Code, 2008). He first highlighted the necessity to write linguistic descriptions to identify some language-specific (non-universal) -symptoms not established for English or other languages. For example, symptoms of Chinese patients described by Bastiaanse and others (2011) showed that there are difficulties in tense processing for all tenses, not only for the past tense as in English or most of the languages. A rare Akan language has been investigated in a recent aphasiology study (Tsiwah et al., 2020), and it was found that although production and comprehension of verb grammar forms were damaged as expected, in some tests patients were perfectly intact. In Indonesian, patients surprisingly demonstrated quite a normal grammar production as well as non-canonical word order. This is explained by their language specificity: they often use inverted order, and it is "anchored" in their minds. Thus, no verb form disadvantage is observed in Indonesian (Anjarningsih et al., 2012). Studies with Korean showed that grammatical disadvantages may show in one modality but not the others: the past was disadvantaged in comprehension, but not in production, which is different from the majority of languages. In Persian, besides the cross-linguistic symptoms, some peculiar cases were found: the omission of the Persian verb to be (*budan*) and substitution of the infinitive for the inflected form (Nilipour & Raghibdoust, 2001). Polish showed disturbances in verb prefixation, which for Polish denotes the aspect category. This was not observed in other languages before (Ulatowska et al., 2001).

As seen, Broca's description as "halting, effortful but meaningful speech with grammatical errors" is not enough to see the whole picture. Existing tests, plans, and theories cannot explain the cases outlined above. In the conditions where the individual approach is needed, languages like Azerbaijani are not being studied at all. Language-specific and universal symptoms of Azerbaijani patients have not been described, efficient plans and tests have not been developed for Azerbaijani aphasics. This work is the first step to tackle the issue and bridge this gap.

## Methodology

This research is mixed by nature: while it is interested in the nature of errors occurring, it also takes into account which errors are more frequent and appear in most of the participants.

## Participants

This study involved 10 local aphasic patients who are Azerbaijani-speaking monolinguals. The sampling type was purposive as there was a need for a special group of people. All patients had Broca's aphasia confirmed by a neurologist. No other neurological conditions (like Alzheimer's) were involved. None of the participants was mute, all had a minimum to average production level, and the neurological causes of aphasia were varying. Table 1 summarises the participants' information.

**Table 1.**

*Details of the study participants*

#	Gender	Age	Education	Handedness	Diagnosis	Neurological deficit cause	Aphasia severity	Post onset period (months)	Residence City
#1	Male	60	Higher	Right-handed	Broca's aphasia	Ischemic brain stroke	Moderate	1	Baku
#2	Female	43	Secondary	Right-handed	Broca's aphasia	Brain tumor	Moderate	12	Gakh

#3	Male	16	Secondary	Right-handed	Broca's aphasia	Head injury after a car accident	Mild	12	Baku
#4	Female	42	Higher	Right-handed	Broca's aphasia	Ischemic brain stroke	Mild to moderate	6	Baku
#5	Female	29	Higher	Right-handed	Broca's aphasia	Brain stroke induced by unsuccessful Caesarean section	Mild	12	Baku
#6	Female	49	Secondary	Right-handed	Broca's aphasia	Ischemic brain stroke	Moderate	8	Baku
#7	Male	42	Higher	Right-handed	Broca's aphasia	Head injury after a car accident	Moderate	8	Sheki
#8	Male	48	Higher	Right-handed	Broca's aphasia	Head injury <i>because of</i> gunshot	Moderate	9	Baku
#9	Female	55	Higher	Right-handed	Broca's aphasia	Ischemic brain stroke	Moderate	9	Sumgayit
#10	Female	37	Higher	Right-handed	Broca's aphasia	Ischemic brain stroke	Moderate to severe	6	Khachmaz

## Instruments

Normally, there are examination/diagnosis batteries for aphasia to carry out this type of investigation. But as main tests are limited to English, Spanish, Portuguese, French, Hindi, Finnish, and a few other related European languages, the researcher had to create tasks that potentially trigger the key forms of the Azerbaijani grammar. These four instruments aim to cover all the key grammar aspects:

1. interview - short, structured interviews with patients were conducted to gather the patient's basic background information. It has been noted in previous studies that in interviews with aphasics, only some of the ideas



were generated by participants, and others belonged/ to the interviewer, or were extrapolated by the interviewer. So, it is important to encourage patients' self-generated ideas to this open-ended section (Luck and Rose, 2007).

2. a picture-guided sentence-completion task – this was conducted to examine mostly nouns and verbs. Their inflections (case, number, etc.) will be evaluated in this task as well. Mainly pictures similar to (but not limited to) those used by Turkish therapists will be used as Turkish is typologically close to the Azerbaijani language (Duman, 2009).
3. picture-description tasks - the popular “Cookie Theft” picture from the Boston Diagnostic Aphasia Examination will be used to deduct the majority of verb tenses and time references as it is the “ideal assessment tool” (Cummings, 2019). This picture only takes a few minutes to describe, but it captures an overall aphasia severity (Keator et al., 2019).
4. short story-telling - the participants will be encouraged to retell their favorite folklore fairy tale (Red Riding Hood, for example). If there is no folklore story to retell, the participant will be motivated to describe their last memorable days such as a birthday celebration, or simply daily routine. This task involves complete freedom in oral production and allows for creativity and the self-selection of forms. This is a perfect task to examine word order, clause usage, sentence structures, and closed-class words' use. Lexical prompts (such as names) will be available if required.

### **The procedure of data gathering**

The potential participants met the researcher and gave their consent. The researcher had the recorder on, explained to the participant the code of actions, rules, and reminded the study objectives. Before each activity, the researcher provided instructions orally, used gestures to clarify the task, and assured it is wellunderstood.

Dialogue with vulnerable people is a challenging task and even professionals sometimes lack knowledge on communication with them. There are important protocol rules for a successful examination (Dalemans et al., 2009):

1. participants must possess minimum speech level; they can't be **completely** mute;
2. some tasks **must** elicit open-ended answers; all references involved must be well-known and culturally recognized by patients;

3. there should be **no** time constraint to measure accuracy rather than fluency;
4. there should be several **breaks** at reasonable periods chosen by participants;
5. instructions **must** be maximally simple and involve augmentative communication and high-frequency words;
6. all materials and instructions **must** be both spoken out and presented on the hard-copy print out;
7. any written material **must** be in the most optimal format for aphasics: font Verdana, size 16 minimum, a lot of white space between each key point, bolding key concepts;
8. the setting **must** be reasonably chosen for participant's maximum comfort with no distractions as it may hamper their responses;
9. the interview **must** be audio-taped and transcribed according to a chosen system;
10. if there is a central caregiver, he/she will be invited for behavioristic only assistance during the examination;
11. there must be field notes of **nonverbal** language as it may indicate the comprehension of the questions by patients;
12. instructions **must** be patiently repeated if needed;
13. **no** writing should be involved.

It is important to remember that aphasia patients are sometimes not involved in studies due to these long protocols and difficulties. Thus, aphasics' needs are not adequately addressed. It is vital to keep dedicated to the above-mentioned rules. All recordings were later numbered, transcribed and coded by the Jefferson Transcription System and passed onto the analysis stage.

## Results and Findings

To summarize findings from all 10 patients, Table 2 has been created. It only contains the summary of morphosyntactic errors as this is the main focus of the paper. The table has been color-coded: red color indicates that the structure is affected in the given patient; no color shows that the structure is intact. Structures that were damaged occasionally will still be coded in red.

**Table 2.**

*Summary of grammatical errors for each participant*

Error	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Nominal number inflections	■			■			■			
Nominal case inflections	■	■				■	■	■	■	■
Nominal personal inflections			■						■	■
Verb present inflections				■						
Verb past inflections		■								
Verb future inflections	■	■					■	■	■	■
Verb number inflections										
Verb person inflection						■	■	■	■	■
Verb negation inflections									■	■
Causative verb form	■	■	■			■	■	■	■	■
Passive voice	■	■				■	■	■	■	■
Numerals										
Comparative adjective form										
Superlative adjective form	■			■	■				■	■
Use of past subjunctive mood										
Question making										
Word order										
Conjunction <i>amma</i>	■			■						■
Conjunction <i>gah</i>		■				■	■	■		■
Conjunction <i>çünki</i>		■					■	■		
Full-sentence structure/Complex sentences	■	■				■	■	■	■	■

## Discussion

### *Morphological errors*

Grammatical deficits were found to different severity but consistently in all patients. The most important finding is that while morphological issues were found with a regular frequency, this investigation did not detect any evidence for major syntactic issues such as wrong word order. This is one of the most important clinically relevant findings, and this leads to some comprehensive implications regarding theories.

As table 2 suggests, the majority of patients struggled with noun case inflections and verb person inflections. Even though the lexical naming of nouns was much more defective than that of verbs, nominal inflections were more resistant than verbal inflections. Number category was completely intact for verbs, and number and person categories were preserved to an average level for nouns. This is understandable as the noun case inflections system, as well as the verb personal inflections system, are very elaborated in Azerbaijani, as described in the Literature Review chapter (Siegel, n.d.). This means they load more neural processing to their usage and memorizing, thus, they possess higher cue cost. This automatically implies low cue validity, and, as a result, more vulnerability.

Coming to tense inflections, present tense was most actively and correctly used. Significantly, there are almost no issues in the use of past time references like in many other languages:

*Patient 1 (speaking about the incident when he just got a brain stroke while driving): polis məni buraxdı, dedilər çıx get... mən də sürdüm gəldim. Saat 12 idi. (Police let me go, they told me to go away...and I drove away. It was 12 o'clock. - Azer.)*

The total intactness also applies to the subjunctive mood of the verb as it is also linked to the past time. This is a major finding as issues in the past time reference and PADILIH have been actively researched across languages, as it was mentioned in the Literature Review. This finding can be the preliminary evidence to reject PADILIH for Azerbaijani. This is also curious as Turkish – a very close language to Azerbaijani – is among the first supporters of PADILIH and there is strong evidence for it (Bastiaanse et al., 2011).

The finding that draws attention is that the future tense was damaged in the majority of patients compared to non-future. Patients mostly avoided the future tense and replaced it with present simple or present perfect tense inflections:

*Patient 8: Gələn il getmişəm yeni həkimə, Türkiyədə. (Next year I have visited a new doctor, in Turkey. -Azer.)*

A similar finding was mentioned in the investigations of the Thai language in the Literature Review (Siriboonpipattana et al., 2020). Researchers studying Thai aphasics concluded that this phenomenon depends on the language structure, which might be the case for Azerbaijani as well. It is difficult to explain this result, but it might be related to the neural load future tense imposes: while present links to the current event and past reference links to a previous experience, future has not linkage per se. To avoid constructing this zero-linkage, aphasics opt for easier forms. Besides, in Azerbaijani, the usage of the present tense to refer to definite future plans is acceptable. Although this does not apply to future perfect cases like in the example

above, this may at least explain the cases where the present simple was used for future time reference.

Creating negation in Azerbaijani verbs is not high in cue cost, but is high in cue validity, so it was majorly well-preserved. This cannot be said about passive voice forms. A reason for passive voice vulnerability could be the fact that generally, passive voice is not frequently used even by healthy Azerbaijani speakers. It is less popular than in English, and the impersonalized suffix for passive is not widely used. Besides, it is possible that passives are damaged because they involve action encoding onto someone else who is not even defined. If action encoding-decoding and thematic role establishment are hard per se (Nadeau, 2012), then constructing them for unspecified persons is even harder.

Another form that remained intact was numerals. This was expected as it is the main part of speech with little inflection included.

Finally, 90% of all participants could not produce the Causative verb and opted for easier verb forms. The possible reason for this tendency could be that, just like passive voice, causative involves complicated encoding: transferring an action onto someone else, which again adds to the neural load and cue cost of the form, thus making the form vulnerable.

The damaged superlative adjective form can be explained merely by the optional nature of the word *ən* for superlatives in Azerbaijani. Saying just *böyük fil* (*big elephant*) rather than *ən böyük fil* (*the biggest elephant*) is not always a grammatical error, but can be a matter of choice, at least in this task set. This is underpinned by the fact that comparative forms were used correctly by all patients.

### ***Syntactic errors***

Coming to syntax, all patients had majorly fragmented and incomplete sentences. There was very limited use of complex sentences or clauses. This met the expectations regarding syntax as limited use of complex structures is a universal symptom. They mostly lacked either a subject or a predicate, or were in the most basic form:

*Patient 1 (describing a picture): Avtobusa yuxarı qalxıb...istəyir baxa ora əli çatanda götürüb....o tərəfdə qadındı. Qapağı var.....nə Bilim...order peka...tuka...kuxnada yerləşir (Got on the bus.. wants to watch when hans reaches there takes...on that side, there is a woman. She has a lid...I don't know..peka..tuka..locates in the kitchen. – Azer.).*

The use of conjunction *Çünki* (“because”- Azer.) was damaged in 3 of the patients and replaced with synonymous *Ona görə ki* (*for this reason* – Azer.) by one of the participants. The other 3 patients had difficulties with the conjunction *Amma* (*but* – Azer.). These are expected findings as conjunctions classify as function words that

link parts of complex sentences. Both function words and complex sentences are two vulnerable structures for aphasics. Conjunction *Gah* (*now – Azer.*) was damaged even more: half of the patients could not get the answers right. The reason for such selective vulnerability could be the fact that conjunction *Gah* is double conjunction, i.e. it consists of two repeated parts, which makes it more challenging for the patients.

Word order in Azerbaijani is semi-fixed and absolutely all patients used typical word order for Azerbaijani, normal question construction, and right postposition placement. The reason for selective resistance of word order could be its high cue validity and low cue cost. This is discussed more in detail in the subchapter below:

*Researcher: Məndən yaşımı necə soruşarsız? (How would you ask my friend? - Azer.)*

*Patient 9: Neçə yaşınız var? (How old are you? - Azer.)*

### ***Universal and language-specific symptoms***

Patients have demonstrated both universal and language-specific symptoms during the interviews. Among the universal symptoms were halted speech, short fragmented sentences, lexical substitutions, naming issues, frequent tip-of-the-tongue experiences. Just like aphasics all over the world, they showed irritation by their poor word memory and frustration for not responding correctly to the question. Also typical of aphasics they would get tired of speaking quickly and were offered to take breaks during the interview to release stress from speaking.

Among the language-specific symptoms were the erroneous use of tense suffixes – *acaq/-əcək* (future tense suffixes), difficulties producing superlative adjective forms with *ən* (but this should be further studies), difficulty producing doubled conjunctions typical of Azerbaijani (like *Gah..gah*), and passive voice issues (due to its limited usage in natural speech).

### ***Evidence for theories and hypothesis***

The evidence from this study can also be used to contribute to the theoretical grounds of the field, at least to the most discussed theories and hypotheses. First, it can be said that Closed class theory has been partially supported in this study. Participants exhibited errors in function words/inflections, but this is not to say all of them are damaged. This theory still fails to explain why, for example, present tense inflections are intact while future tense affixes are damaged. So, it can be said that Closed class theory is true to some extent.

It is also worth noting that many forms were intact for their high cue validity, and many forms were selectively damaged due to their high cue cost. This implies that the manifestation of aphasia in Azerbaijani syntax aligns with the Competition model

described in the literature review. According to the Competition model, forms with high cue validity and low cue cost are predicted to be more resistant to impairment in aphasia. For example, word order in Azerbaijani is marked with high cue validity which means that word order possesses considerable information value in Azerbaijani. This is indeed true, as the Azerbaijani language has a semi-fixed word order, and the change in this order may lead to misleading meanings. At the same time word, the order is marked with low cue cost, which means very low type and amount of processing and memory is required to establish the word order in Azerbaijani. Thus, chances to observe damaged word order in Azerbaijani are very low. With the same logic, verb inflection, for example, is very damaged as they carry a high cue cost.

Furthermore, the Tree Pruning Hypotheses states that the tense inflection is impaired in aphasics. The results of this study showed that Azerbaijani patients used some (but not all) of the tenses incorrectly. To be more specific, they struggled to use future tense across all tasks and preferred to replace it with the present continuous form. Hence, TPH is supported in our study to a partial extent as well.

Finally, regarding the PADILIH, this research presents no sign of past time reference issues. On the contrary, it shows a significant issue with future tense production compared to non-future just like in the Thai language presented in the literature review. This contrasts with all other languages, as their future tenses were either well preserved, or equally affected, but never worse than non-future. So, this study rejects PADILIH for Azerbaijani aphasics.

### *Comparison with deficits of English-speaking aphasics*

Previous studies evaluating aphasia symptoms were inconsistent, especially in studies of agglutinative languages. For this reason, an extensive comparison of the current study with them is difficult. At the same time, comparison with other agglutinative languages would have been inconclusive as there should be a contrasting language to reveal the language-specific features. To serve this purpose, the paper compares these findings to other studies on English-speaking aphasics.

Comparing with English is important as it is the polar opposite of Azerbaijani in terms of typology. Being an analytical language with some degree of synthesis, it possesses a different linguistic structure and any differences revealed will account for the language-specific feature. The dataset presented in Aphasia Bank (MacWhinney et al., 2011) helped to find out some of the aspects of English aphasia manifestation and compare them to Azerbaijani cases.

First of all, there is no one-to-one relation between tense and time reference in English like in Azerbaijani. English has 3 tenses with temporal meaning expressed via simple forms (walks), or by the combination of periphrastic and simple ways (have walked). Importantly, verbs are split into regular and irregular types, which is

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a language-specific feature of English and has no corresponding form in Azerbaijani. The dissociation occurs at verb tenses: Azerbaijani patients had issues with the future tense, whereas English speakers had selective past tense damage and non-past remained intact.

Nevertheless, the majority of inflections with errors were verb endings rather than nominal suffixes in both English and Azerbaijani. In both languages, noun inflections are more resistant to the deficit when compared with verb inflections that carry higher cue cost. Although there are fewer inflections for verbs in English when compared to Azerbaijani, they were still omitted frequently. The dissociation occurs at the passive voice as well where it is better preserved in English compared to Azerbaijani as it is better 'anchored' in English by its frequent usage.

Contrastingly, English speakers usually struggle more with verb naming whereas Azerbaijani aphasics found object naming harder. This may be because Azerbaijani verbs have more saliency by their sentence-final location than in English where they are located sentence-medially. This may be also linked to the semantic load that is usually stronger at the end of the sentence, which makes verbs semantically more important for Azerbaijanis and nouns for English. It is worth noting that Azerbaijani also has no correspondence to the English articles, and any damages observed are specific to English only.

Syntactically, English-speaking aphasics, just like Azerbaijani speakers, preserve the word order well and only struggled with building comparatively longer sentences. As it was already said, this is due to the word order high cue validity in both languages. The same equality in languages also applies to findings on question making and conjunctions usage. The sentences used by both English and Azerbaijani aphasics were fragmented and simple, which is expected as it is a universal symptom.

When it comes to the evidence for current theories and hypotheses, English was the first language that served as a ground for Closed class theory and is taken as full support for this theory. Nevertheless, it is important to note the concern of critics who state that Closed Class theory is only partially supported by English aphasics it cannot explain the resistance of some inflections such as –ing. But if to take a general stance on the matter, English served as a ground of this theory, whereas this research on Azerbaijani could only support the theory to a little extent.

Coming to the Competition model, the English language fully supported its theory just like the Azerbaijani language. Thus, it was expected that English speakers will demonstrate more errors in articles as they have a high frequency in their speech. However, the Competition model predicted correctly that articles will not be affected as they carry a high cue validity and low cue cost.



Next, English evidence shows that it cannot account for the Tree Pruning Hypothesis per se as its structure does not possess the syntax saliency as Azerbaijani: English verb stems are bare whereas in Azerbaijani they are inflected. The overt inflections of Azerbaijani could only partially support the TPH.

Finally, English evidence suggests that past time reference is mostly affected in English aphasics more than the present or future. Thus, different from Azerbaijani, English supports PADILIH.

Taken all stated into consideration, one can conclude that language-specific features matter in the manifestation of aphasia greatly. Implications and conclusions of this will be elaborated in the final chapter of the study.

## **Conclusion**

The main goal of the study was to create the first description of grammatical errors of Azerbaijani aphasics. Besides, comparison to the English dataset helped to identify language-specific and universal symptoms of speakers. It has been identified which forms are vulnerable and which are resistant to aphasia. The possible reasons for vulnerability and resistance have been also suggested in the discussion chapter. Finally, the study tested the findings against the most popular theories regarding aphasia symptoms and found interesting patterns.

In the end, it was possible to get a picture of which morphological and syntactic forms are mostly damaged in Azerbaijani speakers. Shortly, verb inflections are more vulnerable to damage than noun inflections. At the same time, the naming of nouns was much harder than naming verbs. The future tense is the most damaged and is mostly replaced with the present tense. Causatives are hard to produce and they are usually replaced with present continuous form. Passive voice is another source for errors, mostly produced in the active voice or skipped altogether. The superlative form of the adjectives is damaged in half of the patients and may be regarded as "optional" in speech. Comparative adjective forms were found intact in all patients. Ordinal numerals were also absolutely intact, as well as the questionmaking ability, word order, and pronouns production. Negations do not present a major issue for the majority of patients, which means it possesses an over average level of resistance. Conjunctions remained intact in half of the patients showing its average vulnerability level. Complex sentences remain a major issue for aphasics globally, including those involved in the current study.

Surely, a truly comprehensive theory of aphasia could be only established in comparison, and for this reason, this study is cross-linguistic. The comparison with English showed how important it is to consider the language-specific features in aphasia cases. Every language had its peculiarities, and using just one standard battery by simply translating would not cover the necessary forms. Making

comparisons was challenging, as the two languages have forms exclusive for their structure, like an article or irregular verbs for English, and numerous inflections for Azerbaijani. Sometimes, it was necessary to draw parallels between the two: damaged function words in English were equal to the word inflections in Azerbaijani as it is agglutinative by nature.

Language-specific findings of this small dataset have been identified as well. Passive voice and future tense, for example, are selectively damaged in Azerbaijani speakers. This is a language-specific finding and it needs an individual approach. Universal symptoms like simple fragmented speech and effortful naming have also been observed.

Another important point is that the relevance of the Competition model is supported by the findings from English and Azerbaijani: for example, high cue validity for word order in both languages provided their resistance to damage. At the same time, Closed class theory was not fully supported by the Azerbaijani dataset, and English evidence was not strong enough either. TPH was barely supported by any of the languages involved. PADILIH has been refuted by Azerbaijani evidence, whereas English data has supported it.

### **Practical and Theoretical Implications**

These comparisons have confirmed that aphasia is language-sensitive. The most obvious insight is that diagnosis batteries and rehabilitation plans cannot be taken and translated from other languages. They should be at least adapted or, ideally, specifically tailored for the needs of a language user. This study has raised important questions about the nature of symptoms and it revealed that the clinical work has to be upgraded to meet the needs of the field. This leads to the implication that in the languages with undeveloped individual test batteries and rehabilitation plans, which do not take into account these language-specific features, the usefulness of therapies (if any at all) must be questioned.

Thus, it can be said that symptoms can be predicted by the language typology as language-specific features in a way 'dictate' them. It can be suggested to use typologically close language batteries as a base for new batteries. For example, using Ege Aphasia Test (used for Turkish patients) in establishing the Azerbaijani test would make more sense than using the world-known Western Aphasia Battery (WAB) which targets English only. So, the practical implication could be to create batteries by using typologically related ones as a base.

Now, knowing the peculiarities found in this study it is possible to improve aphasiology in Azerbaijan and close the unawareness gap mentioned at the beginning of the study. By knowing which structures are more vulnerable and by creating

focused targeted rehabilitation kits, it would be possible to address the issues directly. Step by step, aphasiology in Azerbaijan would come closer to the international levels and standards where language disabilities are not neglected.

The insights gained from this study may be of assistance to clinical workers, neurolinguists, or language assistants to take the first step in the creation of standardized Azerbaijani aphasia battery, and in a longer perspective – the individual rehabilitation plans. This approach will prove useful in creating the batteries with minimum effort and time and maximum effectiveness targeting the specific needs.

The principal theoretical implication of this study is that these findings mean that studying people with aphasia is important for neurology and neurolinguistics in general. The types of errors they make help to identify the brain's functioning and processing. A small self-correction from a patient helped to understand the underlying neural mechanisms clearer. This work also provided evidence to some of the epistemological matters in neurolinguistics like mind and language dissociation: aphasic's behavior showed the self-awareness of intact mind. Moreover, these findings have significant implications for the understanding of how the brain works: detailed observation of their errors has added to the theoretical evidence of the brain's algorithmic word-building processes. Furthermore, this study provided evidence to the brain's lexical storage understanding by showing that the words are grouped in semantically associated networks. Moreover, this investigation contributed to the testimony of several theories and hypotheses in the field. Finally, this work evened the disbalance in aphasia studies as they were centered around “popular” languages, and some insights from less investigated languages have been added to the growing body of aphasiology.

### **Suggestions for future research**

There were some phonological and lexical errors described, and a closer look into this matter can be very fruitful. Once phonetic and lexical manifestations are found, it would be possible to embark on test adaptation. Since there are already ready-made tests in typologically related languages like Turkish, it would be interesting to look into the similarity of errors of two languages and proceed with the first test adaptation for Azerbaijani aphasics. Further research could usefully explore cases of bilingual aphasics in Azerbaijan. It is a known fact that bilingual aphasics are an extremely complicated situation where a tailored approach should be taken. As the population in Azerbaijan is varying and multilayered, there is a huge chance of bilingual aphasic cases. Treating these people will require the description of symptoms for both languages, including Azerbaijani, which is now finally presented.

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