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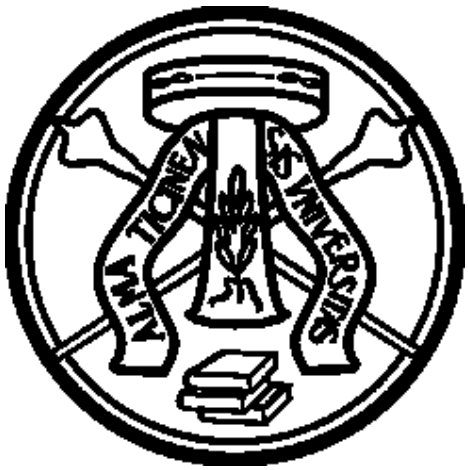

Pilot study of a Multilingual Naming Test in Azerbaijani Population

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ABSTRACT

The Multilingual Naming Test (MINT) is widely utilized for assessing language abilities in various populations, yet its applicability to Azerbaijani-speaking individuals remains underexplored. This pilot study aimed to adapt the MINT for the Azerbaijani population, focusing on 40 healthy subjects and 20 patients diagnosed with Alzheimer's disease or post-stroke aphasia. The study also included bilingual individuals proficient in Azerbaijani and Russian, exploring the impact of bilingualism on test performance.

Results indicated overall effectiveness of the MINT in Azerbaijani contexts, with notable challenges observed in certain picture prompts, highlighting the need for cultural adaptation. A significant portion of bilingual participants responded in Russian, influenced by age and prior exposure to second language use. Patients exhibited substantial difficulties in the naming test, struggling to recall words effectively.

This pilot study underscores the importance of linguistic and cultural considerations in neuropsychological assessment tools, advocating for further adaptation and validation efforts tailored to Azerbaijani-speaking populations.

CHAPTER 1

INTRODUCTION

1.1 LANGUAGE DISORDERS

Language, as a unique and fundamental characteristic of human communication, serves as a powerful tool for the exchange and dissemination of intricate concepts and information among individuals. By articulating a diverse range of sounds through controlled exhalation, humans produce a rich repertoire of tones, hisses, and bursts of air that create vibrations in the surrounding atmosphere. These acoustic signals, upon reaching the eardrums of listeners, undergo neural processing within the auditory system, where they are transformed into cognitive representations and interpretations. This complex interplay between vocalization and auditory perception underscores the intricate mechanisms by which language enables the expression and comprehension of thoughts and ideas, thereby playing a pivotal role in human interaction, knowledge transmission, and cultural evolution (Kiyoshi, 2007).

Despite the remarkable nature of language, its acquisition and use are not always straightforward. Language disorders represent a significant challenge for individuals, affecting their ability to comprehend and produce spoken or written communication effectively. These disorders can vary widely in their nature and severity, ranging from developmental delays in speech and language milestones to acquired conditions following neurological injuries or diseases. For some individuals, the challenges may involve difficulties in processing and interpreting linguistic information, while others struggle with fluency or pragmatics—the social aspects of language use.

Language disorders are complex conditions that defy simple description. But according to the DSM-5, individuals affected by these disorders exhibit persistent difficulties in acquiring and using language across various modalities—such as spoken, written, sign language, or others—due to deficits in comprehension or production (American psychiatric association, 2013). These deficits manifest in several key areas: reduced vocabulary (including both word knowledge and usage), limited sentence structure (the ability to construct sentences by adhering to grammatical and morphological rules), and

impairments in discourse (the ability to effectively use vocabulary and connect sentences to convey information or engage in conversation about a topic or series of events).

Language disorders can stem from diverse origins, including developmental language disorder (DLD), which is categorized as a neurodevelopmental condition and commonly manifests among children. However, the specific origins of the brain differences that result in developmental language disorder (DLD) remain uncertain. Neurodevelopmental disorders like DLD emerge from complex interactions involving genetic predispositions and environmental factors that intricately shape the course of brain development (Nudel et al., 2023). There are three main types of developmental language disorders which are expressive language disorder, receptive language disorder and mixed receptive-expressive language issues. People who suffer from expressive language disorder have trouble getting their message across when they talk. They often struggle to put words together into sentences that make sense. On the other hand, while receptive language disorder, people struggle to get the meaning of what others are saying. Because of this, they often respond in ways that do not make sense. Those with mixed receptive-expressive language disorder experience difficulties in both expressing themselves verbally and understanding the language of others. This dual challenge significantly impacts their ability to communicate effectively in various social and academic settings.

Additionally, there is a language disorder that occupies a significant place in neurolinguistics literature due to its complexity and frequency of occurrence resulting mainly from traumatic brain injury, known as Aphasia. Aphasia is a condition where understanding and producing language are disrupted due to dysfunction in particular parts of the brain. It occurs when the normal process of translating thoughts into language and vice versa breaks down (Pedersen et al., 2004). Individuals with aphasia struggle to convert mental representations into coherent words and sentences. Essentially, their ability to express thoughts through language is impaired, and they may also have difficulty creating mental images in response to spoken or written sentences. Aphasia can result from various neurological injuries affecting the cerebral hemispheres, particularly those impacting language-related regions. Common causes include stroke, head trauma, brain tumors, and degenerative conditions like Alzheimer's disease.

The majority of aphasia-inducing lesions are found in the left cerebral hemisphere, which is predominantly responsible for language functions in both right-handed and left-

handed individuals (Mandonnet & Herbet, 2021). Although most right-handed people exhibit left-sided dominance for language, a small percentage may develop aphasia due to lesions in the right hemisphere, a rare condition known as crossed aphasia.

Among the well-known types of aphasia, Broca's aphasia and Wernicke's aphasia stand out as classic examples, each characterized by unique patterns of language impairment and associated brain areas. Broca's aphasia is named in honor of the French scientist Paul Broca, who in 1861 correlated a specific set of deficits linked to this aphasia with localized brain damage (Lee, 1981). His discovery stemmed from his care of a patient who could only utter the single word "tan." Broca's aphasia is frequently referred to in the literature as "non-fluent aphasia" or "expressive aphasia." Sometimes it also called "motor aphasia" but it is does not mean the problem of the movement, it is about the problem at the motor imaging.

Broca's aphasia occurs when Broca's area, located in the frontal lobe of the dominant hemisphere (typically the left hemisphere), is damaged. This area is primarily associated with speech production functions in the brain. The association between language processing and Broca's area originates from Pierre Paul Broca's observations of language impairments in two patients. These individuals lost their ability to speak due to damage to the posterior inferior frontal gyrus, specifically the pars triangularis (BA45) of the brain. Broca's identified region has since been recognized as Broca's area, with the language production deficit termed Broca's aphasia or expressive aphasia (Clark 2003). Broca's area is anatomically defined as including the pars opercularis and pars triangularis of the inferior frontal gyrus, corresponding to Brodmann areas 44 and 45 in the dominant hemisphere according to Brodmann's cytoarchitectonic map.

The main characteristics of the Broca's aphasia is that, understanding process is not affected but they cannot speak fluently. However, patients clearly understand what other says they struggle to form words. Additionally, they repeat words over and over again but they have problem with repeating back the sentences verbatim. Patient understand the meaning of a sentence, for example, "This coffee looks good" but to their puzzlement they are unable to repeat it. The key characteristic of Broca's aphasia is agrammatism, a condition marked by difficulties in organizing words into grammatically correct sentences and in using grammatical elements like conjunctions, prepositions, auxiliary verbs, and verb endings correctly. This leads to speech that can resemble telegraphic speech, such

as "Read I book yesterday" instead of "I red the book yesterday," where word order rules are not followed and auxiliary verbs may be omitted.

Individuals with Broca's aphasia demonstrate difficulties in accurately producing speech sounds (phonemes). They often distort phonetic features and may add or omit elements that are necessary for correct articulation of a particular phoneme. For instance, they might mistakenly produce the sound /b/ instead of /p/, even though these phonemes differ primarily in how their articulatory components are timed and aligned.

Wernicke's aphasia and Wernicke's area are named after the German neurologist Carl Wernicke, who first associated this particular speech disorder with damage to a specific area in the left posterior temporal lobe of the brain. In Wernicke's aphasia, there is difficulty understanding the meaning of spoken words and sentences, but the ability to produce connected speech remains relatively unaffected. Because of this characteristic, Wernicke's aphasia is also known as 'fluent aphasia' or 'receptive aphasia'.

Wernicke's area is situated within Brodmann area 22, specifically in the posterior part of the superior temporal gyrus in the dominant hemisphere (Damasio 1992). Since approximately 95% of individuals have a dominant left hemisphere, Wernicke's area is typically located on the left side. This region includes the auditory cortex along the lateral sulcus. In contrast, Broca's area is located in the inferior frontal gyrus just above the Sylvian fissure.

Individuals with fluent speech in the Wernicke’s aphasia typically do not experience difficulties in the physical act of speaking. However, their speech often lacks coherence or logical sense. This can manifest in the use of incorrect words or the creation of new words, a phenomenon often referred to as "word salad" by experts. Additionally, these individuals may face challenges in comprehending what others communicate. While they might grasp straightforward sentences, their ability to understand becomes increasingly impaired as sentences or phrases become more complex.

Patients diagnosed with Wernicke's aphasia can articulate individual sounds without difficulty, but they often distort the order of sounds and clusters, and may add or omit them, thereby altering the intended word's phonemic structure. This phenomenon, known as phonemic paraphasias, involves substituting incorrect phonemes or entire words for

the correct ones, leading to errors like "prublic" instead of "public" or "corolful" instead of "colorful."

Despite their ability to produce sounds correctly, individuals with Wernicke's aphasia struggle significantly in selecting appropriate words that convey their intended meaning. This difficulty contributes to errors in naming objects, where substituted words often bear semantic relationships to the intended one which termed verbal or semantic paraphasias. To compensate, patients frequently resort to generic terms like "thing" or "stuff" when they are unable to retrieve specific words.

Conduction aphasia is a less common type of fluent aphasia, which described by Norman Geschwind as “disconnection syndrome”. It is connected with the interruption of white matter pathway which is called arcuate fasciculus. Arcuate fasciculus makes a connection between Broca’s and Wernicke’s areas (Absher & Benson, 1993). Due to that, in this condition symptoms of Wernicke’s and Brocka’s aphasias are not observable. In a broad meaning comprehention and speaking abilities are preserved. Indeed, it marked by difficulties in repeating sentences, issues with using phonemes correctly, and problems with naming objects. The most frequent cause of conduction aphasia is typically a cerebrovascular incident, such as a stroke.

In contrast to conduction aphasia, global aphasia presents a combined manifestation of Wernicke's and Broca's aphasia symptoms. This condition arises from damage to both the frontal lobe and the temporoparietal region of the brain. Consequently, individuals affected by global aphasia experience significant difficulties in both understanding language and producing coherent speech.

Last but not least, there are transcortical aphasias which contain different types, but the main characteristic of all of them is patients are able to repeat sentences normally (Grossi et al., 1991). Motor variant is connected with the damage of the regions close to Broca’s area and sensory variant is the result of lesion near the Wernicke’s region. Relatively on the primary one it shows speech impairments, lately it described with the comprehension problems.

In summary, understanding the complexities of language disorders is crucial for developing effective diagnostic tools and interventions. Building upon this foundation,

the 'Word Finding Tests' offers a targeted approach to assess and diagnose specific challenges in language expression, providing a nuanced perspective on language disorders.

1.2 WORD FINDING TESTS FOR THE DIAGNOSIS OF LANGUAGE DISORDER

In reviewing the literature, various methods for diagnosing language disorders exist, with word finding tests holding an indispensable position among them. The main reason is that, word finding is an essential skill for communication. When individuals choose particular words to express their thought on the conversation, they apply word finding skills. Those who experience difficulties with word finding frequently encounter challenges in locating the precise word they intend to use in their speech or writing. It also manifests through pauses, distorted sounds, using similar-sounding or similar-meaning words instead, incorrect starts, and filler words.

The term "word finding difficulty" word retrieval difficulty is often referred to as “word retrieval difficulty”, although there is disagreement in the literature regarding its use (Rohrer et al., 2007). However, there are various conditions like encephalitis, aphasic stroke, psychosis, head injury and etc. which refer to this impairment, more commonly, it serves as a symptom of aphasia and Alzheimer’s disease. In degenerative diseases, unlike many other conditions associated with word-finding difficulties, the underlying cause may not be immediately apparent or could be the initial concern, necessitating a detailed characterization of the language deficit for accurate diagnosis. This aspect poses a significant challenge in diagnosing word-finding difficulties within the context of degenerative diseases, where the traditional clinical approach to assessing language, largely developed from the study of aphasia in acute stroke, may not suffice.

As we mentioned, word finding is connected with ability to retrieve words from verbal word storage and apply according to the conceptual content of the speech. Sometimes it is calling as the word naming which is more complicated process. Word naming impairment referred as anomia is the one of the essential and silent characteristic of Alzheimer’s disease. It is hard to observe pure anomia, it mainly appears with the word retrieval and verbal storage problems. The cognitive processes are clearly disrupted, and anomia specifically involves difficulties in the word retrieval process, which is a primary cognitive function affected by secondary processes such as visual perceptual impairment

and episodic memory impairment. However, it remains unclear which specific areas are involved in the word naming process. According to research, the middle temporal gyrus (MTG) (22) and the inferior temporal gyrus (ITG) (23) in the left posterior temporal regions are significantly implicated in these processes.

Even in patients who do not initially report word-finding issues as their main concern, poor performance on these naming tasks can reveal underlying difficulties in word retrieval. On the other hand, specific patterns of performance in naming tasks can indicate that the underlying cause of the word-finding difficulty extends beyond the language system or is not limited to it. Naming objects in one's surroundings relies on intact perceptual processing and the activation of relevant semantic associations triggered by perception. Only when these processes are successfully executed can verbal processing continue.

While anomia primarily affects verbal communication, the clinical evaluation and treatment of word retrieval difficulties often involve the picture confrontation naming tasks. The picture naming process is not only about the calling back the lexical phonological forms for words, it also demands visual object and semantic processing mechanisms (Raymer., 2015). It is believed that, crucial parts of the word retrieval during the talk are the semantic and phonological parts, and problems of these processes are connected with aphasia. At the same time, impairment that impact the mechanisms for visual object processing (the agnosias) may conincide with aphasia, adding complexity to the diagnosis through picture naming tests.

Picture naming tests are using for the diagnosis of variety of disorder, especially to evaluate severity and type of language impairment in patients who suffers from aphasia, Alzheimer' disease, hearing loss or dementia. Besides that, it is also using for different purposes like measuring general intelligence and etc.

While applying confrontational naming tests, according to avoiding the problem of not observing tiny deficits (while only using high frequency pictures), it is important to include words of both high and low frequency. Paying attention if there is progress through providing phonological cues (e.g., first letter) or semantic cues (e.g., connected item) is also essential part of using naming tests for diagnosis. Various categories of items should be tested (such as animals, objects, colors, famous face etc.). Significant category-

specific impacts are more frequently noticed in acute brain injuries (like encephalitis) than in neurodegenerative diseases (Morkovina et al., 2024).

All errors made during naming tasks should be documented, as the type of error provides valuable insights into the underlying impairment. Visual perception deficits are evident as 'visual' errors in confrontational naming tasks (Swieca, n.d.). When the verbal knowledge store is primarily affected, there are usually consecutive deficits that impact naming in confrontation tasks, particularly for less common (low frequency) items like 'octopus' more than common (high frequency) items such as 'dog'. Naming errors often manifest as semantic paraphasias: mistaken categorizations (such as calling a tiger a cat from a related category) or putting a broad category instead of a specific one (e.g., labeling both an octopus and a scorpion as 'animals', or all animals as 'cat'). These error patterns are typical in Semantic Dementia (SD), although homogenous errors can also be observed in other dementias like Alzheimer's disease (AD) and vascular dementia (VaD).

There are two common confrontational naming tests and one of the most widely utilized and distinguished test is the Boston Naming Test (BNT). The Boston Naming Test (BNT) stands as a cornerstone in neuropsychological assessment, particularly revered for its role in evaluating word retrieval capabilities across diverse cognitive profile (Del Toro et al., 2011). However, it is beneficial tool for the diagnosis of different disorder, but mainly using for the aphasia.

As outlined in the test manual, the BNT comprises 60 black-and-white line drawings of objects arranged from simplest to most complex. During the test, participants are asked to identify each picture by its correct name within a 20-second time limit per session. If a participant finds a picture challenging from the outset, the examiner may provide a cue, such as the initial sound of the word. The examiner records responses and codes them as correct or incorrect for later evaluation. As a result, it is expected that participants may make mistakes when naming unfamiliar or obscure objects, which are not commonly encountered in daily life. However, patients may also show low scores in naming simple, commonly used words. These results are valuable for diagnosing anomia, as symptom of aphasia and other language disorders, and for devising effective treatment strategies to achieve better outcomes.

Another confrontational naming test is the Multilingual Naming Test, which will be our primary focus in the next chapter, particularly as we use it to diagnose aphasia or Alzheimer's disease in the Azerbaijani population.

1.3 THE LANGUAGE OF AZERBAIJAN

There is an enormous number of languages in the world that belong to different language families. Language families are vast and diverse groupings of languages that share common historical and structural roots, forming intricate networks of linguistic relationships across cultures and continents. One of them is Turkic language family which formed by diverse and historically rich Turkish languages, spanning from Eastern Europe to Siberia and Western China, characterized by shared linguistic features and cultural ties. The Azerbaijani language also belongs to this language family based on similarities in phonological, morphosyntactic, and orthographic features.

Due to genealogical classification, Azerbaijani belongs to the Oghuz group within the Ural-Altaic language family, alongside Turkish, Turkmen, and Gagauz languages, which constitute the southwestern branch of Turkic languages. Azerbaijani is characterized as an agglutinative language, where suffixes are appended to the ends of words. The Azerbaijani literary language has evolved significantly through a complex developmental process influenced by both internal linguistic dynamics and external factors. This developmental trajectory has consistently progressed upward (Sağın-Şimşek & König, 2012). The Turks, who form the ethnic foundation of the Azerbaijani people, arrived in the region at the beginning of the first millennium and became the indigenous inhabitants of the land.

Since the 1st millennium B.C., the roots of the Azerbaijani language began to take shape due to the migration of Hun Turks into Azerbaijan. It is undeniable that the Azerbaijani language underwent significant development until the 3rd century B.C. under the influence of the Huns. Prior to the first millennium, various peoples settled in the region of Azerbaijan, including Iranians, preceding the emergence of the Azerbaijani language associated with Turkic-speaking groups like the Albanians. Despite interruptions caused by Arab invasions in the territory of Azerbaijan, the evolution of the language persisted beyond the 9th century, experiencing diverse changes influenced by Arabic, Persian, and Turkic elements until the 15th century.

Ultimately, the Azerbaijani language attained the status of a state language for the first time during the Safavid Empire (Orujova, 2021). The period of independence in 1918 marked a significant era for the advancement of the Azerbaijani language. In more recent history, during the period of Soviet control, Russian became the official state language of Azerbaijan beside Azerbaijani language. The Azerbaijani language was declared an official language in the Constitution adopted on November 12, 1995, and has remained the official language of Azerbaijan from that time to the present day.

Starting with phonology, Azerbaijani language has 9 vowel sounds: [a], [e], [ə], [i], [ı], [o], [ö], [u], [ü]. These vowels can be classified according to several criteria (Nağısoylu et al., 2012):

1.Articulation Position: Vowels are categorized based on the position of the tongue towards the front or back of the mouth:

Back vowels: [a], [ı], [o], [u]

Front vowels: [e], [ə], [i], [ö], [ü]

2.Height of the Tongue: Vowels can also be classified by the height of the tongue in the mouth:

Close vowels (narrow): [ı], [i], [u], [ü]

Open vowels (wide): [a], [ə], [o], [ö], [e]

3.Lip Position: Another classification criterion is based on the rounding of the lips:

Rounded vowels: [o], [ö], [u], [ü]

Unrounded vowels: [a], [ə], [ı], [i], [e]

In Azerbaijani language, there are numerous words of Arabic and Persian origin where certain vowels are phonetically long. For instance, in words like "əmanət," "etibar," and "şölə," the vowels [a:], [e:], and [ö:], respectively, are phonemically long. Additionally, vowels such as [i] in "gəmi" and [o] in "dovsan" can also be phonetically long. It is noteworthy that the vowels [ı] and [ü] in Azerbaijani are not pronounced as long vowels (Comrie, 2018).

Besides that, there are consonants which are divided into two types according to the involvement of the vocal cords: voiceless consonants and voiced consonants. Voiceless consonants are made of noise only, and the vocal cords are not involved in their pronunciation. Voiced consonants involve the vocal cords and consist of both noise and

sound simultaneously. The pronunciation of silent and voiced consonants in this language is paired:

Voiced consonants: [b] [q] [v] [ğ] [d] [j] [z] [y] [g] [c] [l] [m] [n] [r] -

Voiceless consonants: [p] [k’] [f] [x] [t] [ş] [s] [x’] [k] [ç] - - - - [h]

The sounds [m] and [n] are produced with airflow primarily through the nasal cavity, hence they are called nasal consonants. The Azerbaijani language has 25 consonant sounds, but only 23 letters in its alphabet. Generally, Azerbaijani has 34 distinct sounds represented by 32 letters.

Continuing with the orthographic rules, there are some points that deserve attention. One of them is when there are two identical vowels in a word, they are pronounced as one long vowel. For example: camaat - [cama:t], təəssüf - [tə:ssüf] and so on. However, when there are two “o” vowel in a word, it pronounced as two long “a” vowels. For instance, zoologiya- [zaalogiya], kooperasiya- [kaaperasiya] and etc.

In Azerbaijani, words containing the combinations ai, ei, io, ia, iu, ea, and aü are pronounced by inserting the consonant y between these vowels. For example, 'ailə' is pronounced as [ayilə], and 'zəif' as [zəyif]. However, combinations like əa, üa, and üə do not pronounce the first vowel; instead, the second vowel is pronounced long. For example: səadət - [sa:dət], deputy – [ma:vin], müalicə - [ma:licə], müəllim- [mə:llim] and etc.

In addition to vowel changes, there are also modifications in consonant pronunciation in Azerbaijani. When a word is written with identical unvoiced letters such as kk, pp, and tt, it is pronounced with their voiced counterparts. For example, 'səkkiz' is pronounced as [səkgiz], and 'tappıltı' as [tapbıltı]. However, there are no changes for other double consonants like bb, cc, dd, ff, ll, nn, rr, vv, ss, zz. For instance, 'əlli' is pronounced as [əlli], 'ləzzət' as [ləzzət], 'şəffaf' as [şəffaf], and so on.

In Azerbaijani, many words of Arabic origin end with double consonants, such as 'hiss', 'haqq', 'həd', and others. When adding a suffix that also begins with a consonant, one of the double consonants is omitted. For example, 'hiss' + 'li' becomes 'hisli', 'haqq' + 'sız' becomes 'haqqsız', 'həd' + 'siz' becomes 'hədsiz', and so on.

Azerbaijani morphology is agglutinative, which means stem of the word remains and suffixes adding them. But there are some exemptions like la+qeyd in which word created with prefix, also some words which has no meaning whem we separate suffix from them like bio+loji.

Azerbaijani morphology is agglutinative, meaning the stem of the word remains intact while suffixes are added to it. However, there are exceptions, such as when a word is formed with a prefix, as in 'la+qeyd'. Additionally, there are words where the meaning is lost if the suffix is removed, as in 'bio+loji'.

In the Azerbaijani language, the nouns following the quantitative numbers are used in the singular form: iki top ‘two balls’, 4 tələbə ‘4 students’. Nouns do not need to take a plural suffix to express plural. In addition, the category of affiliation is formed even without the presence of subject pronouns: kitabım ‘my book’, eviniz ‘your house’ and etc. The subject is eliminated in order to create compactness.

The negation category of the verb is formed by adding the suffix -ma/-mə to the verb in the affirmative form. For example: o yazır- o yazmır ‘he writes - he does not write’. But it is also possible to form the negation without the suffix -ma/-mə. There is no need to use the negative suffix of the verb when nə, nə də ‘neither nor’ is used: o nə yazır, nə də oxuyur ‘he neither writes nor reads’.

The degree of intensifying the adjective is made not only with grammatical signs but also with whole words. Instead of təmiz “clean," expressions like aydan arı, sudan duru "clear as the moon, pure as water" are used; instead of qırmızı "red," combinations like qan qırmızı "blood red," lalə kimi qırmızı "red like a tulip" create a more effective style.

Lastly, Azerbaijani, like other languages, features two types of sentences: simple and complex sentences. In simple sentences, the noun typically precedes the verb, which is followed by a corresponding suffix. Generally, determiners precede nouns, and adverbs are used alongside verbs. For example, “Həkim Babək yaxşı oxuyur” (Doctor Babak studying very well).

On the other hand, complex sentences can be categorized into independent and dependent types. Independent complex sentences consist of clauses that convey distinct

meanings and are not grammatically connected to each other. For instance, "Ana izah etdi, uşaq dərsi anladı" (Mother explained, and the child understood the topic).

In contrast, dependent complex sentences feature clauses that are grammatically connected, with a main clause and a subordinate clause that depends on the main clause and lacks meaning without it. For example, "Mən bu kitabı dostuma verə bilmədim, çünki o evə getmişdi" (I couldn't give this book to my friend because he had gone home).

In conclusion, the Azerbaijani language stands out for its intricate linguistic features and historical depth, making it a compelling subject for the multilingual naming test. Its unique phonological structures and agglutinative morphology provide valuable insights into how languages evolve and adapt over time. By exploring its syntactic complexities and lexical richness, researchers can further understand the cognitive processes involved in multilingual naming. As we apply these findings to the multilingual naming test, Azerbaijani not only enriches our understanding of language diversity but also enhances our ability to comprehend the intricate mechanisms underlying language acquisition and processing across different cultural contexts.

1.4 THE NEED FOR MULTILINGUAL NAMING TEST

As previously discussed, numerous tests are available for diagnosing various language disorders, including aphasias. This study primarily concentrates on the picture naming tests, with a key emphasis on their application across different cultural and linguistic contexts. It is essential to recognize the significant need for naming tests to be available in multiple languages to address this diversity effectively.

Although the Boston Naming Test has been effective for diagnosing language disorders in English speakers, recent findings indicate it may not be suitable for other languages. As global mobility increases and multicultural societies become more prevalent, the need for psychological evaluations that accommodate multiple languages grows ever more critical. Multilingual tests, like the Multilingual Naming Test (MINT), enable clinicians and researchers to diagnose and understand cognitive and language disorders in individuals who speak different languages, thus avoiding the biases inherent in monolingual tests. Consequently, Gollan proposed that the Multilingual Naming Test (MINT) offers superior diagnostic utility for both English and Spanish speakers. This has

positioned the MINT as a significant tool in assessing language disorders (Stasenko et al., 2019).

The MINT was designed to assess language skills and dominance in bilingual and multilingual individuals with diverse linguistic backgrounds, featuring 68 items that maintain a consistent level of difficulty across various languages. Its applicability extends beyond these two languages, gaining recognition for its versatility across a wide range of languages. By the time past test is available in multiple languages, including English, Spanish, Mandarin, and Hebrew, and aims to maintain a similar level of difficulty across these languages (Fernandez-Coello et al., 2021). Various studies have confirmed the effectiveness of the MINT as a tool for evaluating bilingual proficiency. This validation has been demonstrated through testing with the MINT in both languages among cognitively healthy Chinese–English children, young adult Spanish–English and Chinese–English bilinguals, as well as older Spanish–English bilinguals.

Beyond its use in assessing language proficiency, the MINT has also been utilized to identify language deficits associated with Alzheimer's disease (AD) and to distinguish between monolingual and bilingual individuals with amnestic mild cognitive impairment (aMCI) or AD (Stasenko et al., 2019). After developing the full version of the MINT, which consists of 68 items, researchers also created a shorter version containing 32 items. While the full version of the MINT successfully distinguished between controls and AD patients, but was less effective in differentiating between controls and patients with mild cognitive impairment (MCI). In contrast, the 32-item version showed significant differences between controls and MCI patients, as well as between controls and AD patients. Consequently, the shortened MINT version has become widely utilized, and we will incorporate it into our pilot study.

One crucial aspect to consider is the cross-cultural validity of the MINT and its effectiveness for diagnostic purposes across various cultures. Gollan proposed that creating culturally fair assessments involves developing equivalent versions of a test in both languages, with some overlapping and some differing items (Gollan et al., 2012). The validity of these parallel forms would be evaluated using data from both monolingual and bilingual participants. Tests that are developed in multiple languages and used across different cultures need to be assessed for cultural fairness, as neuropsychological tests are often subject to cultural biases. A test validated in one cultural context may not be suitable

for individuals from another. Failing to ensure cultural fairness in assessments can lead to underestimating a patient's abilities and incorrect diagnoses. Various methods have been employed to verify the factor structure of cognitive tests across diverse cultural groups and to check for bias.

The Multilingual Naming Test (MINT) is critically needed in psychology due to its widespread applicability, time-efficiency, and its utility in facilitating cross-cultural research comparisons. Firstly, the MINT significantly reduces the time required for neuropsychological assessments, enhancing the efficiency of diagnosing disorders and assessing bilingual language dominance. Additionally, the MINT's capability to function in multiple languages—beyond just English—distinguishes it from other picture naming tests. Lastly, the MINT offers a significant advantage to psycholinguistic research by being available in multiple languages. This multilingual capability facilitates comparative analyses of results from diverse linguistic and cultural contexts globally, thereby advancing the field's understanding and research across different populations.

A review of the literature reveals various studies addressing the cultural and linguistic biases associated with the Multilingual Naming Test (MINT) across different languages. Research involving older Chinese adults indicates that, while the test generally performs adequately, participants often make significant errors (Li et al., 2022). Specifically, certain items were unfamiliar to this population, leading to difficulties in recognition. These findings suggest that, although the MINT is effective with English-speaking populations, it is necessary to modify and adapt the test items to better align with the cultural context of different populations to obtain more accurate and sensitive results.

The Multilingual Naming Test (MINT) has demonstrated considerable success in detecting language dominance among bilingual individuals. Research involving Spanish-English bilinguals reveals that the MINT effectively aligns with self-reported measures of spoken language dominance (Gollan et al., 2012). This indicates that the MINT is not only successful in identifying language proficiency but also provides reliable results that correspond well with individuals' own assessments of their linguistic abilities.

Numerous studies have demonstrated that the Multilingual Naming Test (MINT) performs effectively in experiments involving both healthy controls and patients with Alzheimer's disease (AD). Research indicates that AD patients exhibit significantly more

errors and notably lower scores on the naming test compared to control participants. This disparity highlights the sensitivity of the MINT in distinguishing between cognitive impairments associated with AD and typical performance levels observed in healthy individuals (Ivanova et al., 2013).

Findings also indicate that contextual diversity and image ability, rather than word frequency or the number of senses associated with words, uniquely account for variance in naming impairments observed in Alzheimer's disease (AD). This suggests that the naming difficulties experienced in AD may involve a semantic component.

It is common result that bilingual individuals with Alzheimer's disease (AD) named significantly fewer pictures compared to control subjects. While AD appeared to impact both languages similarly on the surface, further analysis revealed that the extent of impairment varied with item difficulty. In the dominant language, AD had a more substantial effect on difficult items compared to easy ones (which were near ceiling for both patients and controls). Conversely, in the non-dominant language, AD affected items across all levels of difficulty in a more uniform manner. Therefore, to effectively identify naming impairments associated with AD in bilingual individuals, it is most effective to conduct tests primarily or exclusively in the dominant language.

In conclusion, the Multilingual Naming Test (MINT) represents a significant advancement in the field of neuropsychological assessment, addressing the need for culturally and linguistically versatile tools. Its design, which accommodates multiple languages and varying levels of difficulty, makes it a powerful resource for diagnosing language disorders across diverse populations. The MINT's effectiveness extends beyond mere language proficiency, offering valuable insights into cognitive impairments associated with conditions such as Alzheimer’s disease. By adapting the test for different cultural contexts and continuing to validate its accuracy across various linguistic groups, researchers and clinicians can enhance diagnostic precision and improve patient care (Gálvez-Lara et al., 2015). The ongoing efforts to refine the MINT’s cultural and linguistic applicability underscore its potential to facilitate more equitable and accurate assessments in multilingual and multicultural settings, ultimately contributing to a deeper understanding of language and cognition in diverse populations.

CHAPTER 2

EXPERIMENTAL STUDY

2.1 DEVELOPMENT OF THE STUDY

In the area of neuropsychological assessment, the Multilingual Naming Test (MINT) has become as an important tool for assessing linguistic and cognitive functions throughout various languages and populations. However, it was primarily designed to evaluate naming skills and lexical access in multiple languages, over time, MINT has become widely used in different cultural contexts to enhance understanding of language systems and cognitive processes.

This pilot study is respectively designed to examine the adaptation of the MINT to diverse linguistic environments, with a special focus on its usefulness within the Azerbaijani samples. There are two main goals. First, to measure how well the MINT works when applied to Azerbaijani language users, and next, to improve a version of the test that precisely reflects the linguistic and cultural characteristics of the Azerbaijani population.

Analyzing the adaptation process is crucial for ensuring that psychological evaluation tests, such as the MINT, are both valid and reliable across different languages. This study will scrutinize if the existing structure of MINT needs modification to adjust to the Azerbaijani language and cultural nuances. By answering these questions, the research aims to give a glimpse into the alteration of the MINT, thus increasing its effectiveness for assessing multilingual cognitive abilities in different cultural settings.

The insights gained from this study will not only support the development of a culturally and linguistically appropriate version of the MINT but also contribute to the broader field of multilingual psychological assessment, helping to ensure that such tools are effective and applicable across various linguistic contexts.

To date, the Multilingual Naming Test (MINT) has not been utilized within the Azerbaijani population, and there is a notable absence of data or research concerning its application in Azerbaijan. This study represents a preliminary investigation into the use of the MINT with Azerbaijani participants, with a focus on several key objectives.

The primary aim of this research is to investigate the successfulness of the MINT when administered to the Azerbaijani population. This includes evaluating whether the test functions as intended and the results are useful within this particular cultural and linguistic environment.

A secondary objective of the study is to identify and address any cultural mismatches within the test stimuli. This involves determining which pictures or items may be culturally inappropriate or unfamiliar to the Azerbaijani population, with the aim of providing recommendations for future adjustments to better align the test with Azerbaijani cultural norms.

Additionally, considering the historical language influences in the region, which have resulted in approximately 90% of Azerbaijani adults being bilingual, this study will also examine the MINT's performance with bilingual individuals. The research will assess whether the test effectively evaluates naming and linguistic functions in individuals who use multiple languages, addressing a crucial concern given the bilingual nature of the Azerbaijani population.

In total, the research sample comprised 60 participants. It included 40 people who were cognitively normal and older than 40, as well as 20 patients with dementia and aphasia. Every participant's ethnic background was Azerbaijani. The Central Neftchiler Hospital of the Azerbaijani Republic's Ministry of Health was the source of the patients with dementia or aphasia. We took into consideration the following inclusion/criteria to include participants in the dementia (DEM) group: individuals who have been diagnosed by their primary care physician as having Alzheimer's disease (AD) dementia, in accordance with the National Institute of Neurological and Communicative Disorders and Stroke–Alzheimer's Disease and Related Disorders Association criteria.

Participants in the control group were volunteers recruited from Baku, Azerbaijan. Adults matched the following inclusion criteria for the control group: adults aged 40 or older, absence of subjective memory complaints explicitly declared by the subject and a clinical interview with a reliable informant (an immediate or close family member, such as partner, offspring, nephews, or nieces) to determine a normal cognitive state.

First of all, we created a preliminary questionnaire in which we asked the participant to write their initials, age, gender, handedness, education level and language background. Afterwards, we used the Multilingual Naming Test as a main tool of this research. This test consists of 32 pictures representing different categories, mainly animals and daily used objects. All the pictures were drawn with the black lines on white paper. Before starting, we gave the clear instructions to the participants. The instruction was: “Try to say the names of the objects you see in the picture”. After 20 seconds, if the participant failed to recall the name we gave them a cue, i.e. the initial phoneme of the word. After 30 seconds, if he or she still cannot respond, we proceeded to the next picture.

Throughout the process, the experimenter took notes and also some recordings with the permission of participants for evaluating data later.

In the statistical analysis, we used two methods in SPSS. To examine the effect of age and education level on test results, we applied One-Way ANOVA to the outcomes of 40 healthy participants. Additionally, we conducted an Analysis of Covariance (ANCOVA) to investigate differences in MINT scores while controlling for age and education variables across both healthy and diagnosed participants. Statistical significance was set a priori at $p=0.05$.

2.2 PILOT DATA IN HEALTHY SUBJECTS AND PATIENTS

Overall 60 participants were included in 2 groups. The control group comprised 40 participants, including 17 men and 23 women, who were recruited across four age groups: 40-49, 50-59, 60-69, and 70-79. In the healthy participants group approximately 40% had graduated from university or college, while 60% had only completed secondary education. Only 3 people were left-handed and the rest of them were right-handed. All of their nationality was Azerbaijani, with Azerbaijani as their mother tongue. Only 5 participants did not know Russian, while the rest were bilingual, with Russian as their second language.

The patient's group consisted of 20 participants and 8 of them were male and 12 were female. 30% had graduated from university or college and 70% had completed only secondary education. All of them were right-handed and according to their relatives and

our observation 13 of them were bilingual in Azerbaijani and Russian. Similar to the control group, all participants were Azerbaijani, with Azerbaijani as their mother tongue.

Looking to the connection between MINT scores with age of the healthy participants, we used One-Way ANOVA. According to the results, our p-value (p=0,002) is smaller than 0,05 which demonstrates the significant relationship between age of the participants and MINTS scores (Table 1). Specifically, members of the younger age group exhibited higher scores, while participants in the 70-79 age group showed significantly lower scores.

Table 1.

ANOVA

recoded results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2,821	2	1,410	7,371	,002
Within Groups	7,079	37	,191		
Total	9,900	39			

Continuing with the examining the correlation between MINT scores with education level of healthy participants, we also used One-Way ANOVA. Participants were divided into 3groups (secondary school education, college and university) according to their answers. On this analyze, our p-value (p= 0,034) was also less than 0,05 which demonstrates significant relationship between participants' education level and MINT scores (Table 2). Secondary school educated participants exhibit low test scores compare to those with the university degree.

Table 2.

ANOVA

recoded results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2,100	3	,700	3,231	,034
Within Groups	7,800	36	,217		
Total	9,900	39			

After determining the effects of age and education level on the MINT results, we used ANCOVA to examine differences between the scores of healthy and Alzheimer's or Aphasia-diagnosed participants while controlling the age and education factor. We categorized healthy and diagnosed participants' results in the two groups. ANCOVA analysis shows a p-value (Table 3) smaller than 0,05 which also means there is a significance difference of the MINT results and healthy and pathological groups, with healthy participants demonstrated higher scores than Alzheimer's or aphasia-diagnosed groups'.

Table 3.

Tests of Between-Subjects Effects

Dependent Variable: Recoded results

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5,224[a]	3	1,741	10,885	<,001	,368
Intercept	4,464	1	4,464	27,906	<,001	,333
Age2	,094	1	,094	,586	,447	,010
Education2	,675	1	,675	4,222	,045	,070
Groups2	3,046	1	3,046	19,039	<,001	,254
Error	8,959	56	,160			
Total	129,000	60				
Corrected Total	14,183	59				

a. R Squared = ,368 (Adjusted R Squared = ,335)

According to the results, some items were easy and familiar, which is why a great percentage of them were correctly named by the participants. There was one item (i.e., sock) display a 100% correct response across both groups. Several other items like "scissors", "lightbulb", "globe", "ruler", "cow" also had very few wrong answers in both control and patient groups. Conversely, items such as "harp", "pineapple", "snail", "rolling pin", "slipper slide" and "bowling pin" yielded a relatively high nonresponse rate (i.e., "I don't know")

As we mentioned, most participants were bilingual in Azerbaijani and Russian, and some items were primarily answered in Russian. For example, while "anchor" is translated as "lövbər" in Azerbaijani, 90% of participants used the Russian term "якорь". Similarly, although "snail", "stool", “glasses” and "sling" should be called "ilbiz", "oturacaq" and "sapand" in Azerbaijani, participants referred to them as "улитка," "табуретка," and "рогатка" in Russian. This preference for Russian terms reflects the influence of Russian language use during the Soviet era. People even use these words during daily conversations.

One notable point of discussion was the use of dialects in certain items. For example, in the items “rolling pin” and “lake,” some participants used “vərdənə” instead of “oxlov” and “qrabel” instead of “dırmıx.” This variation arose from participants who had moved to the city, such as Baku, from rural areas.

In general, the statistical analysis yielded significant results regarding the effect of demographic data on the usefulness of the MINT for both healthy participants and patients from Azerbaijan. Additionally, the analysis provided important insights into the weaknesses of the MINT items within the Azerbaijani population, which will be valuable for making future improvements to the test.

CONCLUSION

In this study, we found that the test performance of Azerbaijani-speaking older adults was correlated with age and education as expected. This correlation demonstrates sensitivity of the test to the demographic characteristics. Furthermore, our results indicated that the MINT successfully detects naming impairments in Alzheimer's and Aphasic patients. Data from these patients revealed reduced performance with low scores and multiple errors.

On the other hand, results from healthy participants demonstrate MINT's usefulness in the Azerbaijani language, but it also displays some cultural biases in different items. For example, almost 90% of participants make errors while naming "pineapple", "harp" and "bowling pin". It can be explained by the culturally unfamiliarity of items. For instance, pineapple is a tropical fruit that is not consumed a lot by the Azerbaijani population because of the richness of local fruits and taking into consideration that the participant's age is older than 40, it can be a culturally biased item while using this test in this population. The harp is also not widely used in Azerbaijani music culture. The elderly population generally listens to traditional music in which they use traditional instruments like "tar" and most of them even do not have any idea about the harp or how it is named in the Azerbaijani language. Bowling pin is also going through the same explanation. We can undoubtedly say that none of our participants ever played or watched a bowling match. This is because the game is not commonly played in Azerbaijan, particularly among the elderly.

Overall, the present study shows that some MINT items are generally familiar to Azerbaijani older populations, but some items should be replaced with more culturally appropriate items to improve sensitivity of the test.

The present study also has several limitations. First of all, it is conducted with a limited number of participants. To improve the reliability of the test, it is advised to use a large sample size in future research. In addition, language and cultural differences of people living in different regions of Azerbaijan can also affect the results of the test. It should be noted that the results may vary in different regions as the study was only conducted with the citizens of Baku. It would also take into consideration expanding the applied region of the test while developing the MINT for the Azerbaijan population.

In conclusion, despite the clinical utility of the MINT for English speakers, our findings suggest that there is a need to investigate the existing MINT items when used in speakers of a language other than English. Although potentially biased items were identified in Azerbaijani older adults, further research should be conducted to examine if item difficulty levels are sufficient to explain performance differences in English and Azerbaijani monolinguals. To our knowledge, it is the first paper reporting the potential biases in the Azerbaijani version of the MINT. Our study highlights that cultural and linguistic differences leading to unfamiliarity of picture-naming items can influence the test results and indicate the need for a proper linguistic and cultural adaptation of any neuropsychological test material (Ardila 2021).

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APPENDIX

Italian Uniform Data Set (IUDS)

Stimoli