



## Using a translanguaging framework to examine language production in a trilingual person with aphasia

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### ABSTRACT

When language abilities in aphasia are assessed in clinical and research settings, the standard practice is to examine each language of a multilingual person separately. But many multilingual individuals, with and without aphasia, mix their languages regularly when they communicate with other speakers who share their languages. We applied a novel approach to scoring language production of a multilingual person with aphasia. Our aim was to discover whether the assessment outcome would differ meaningfully when we count accurate responses in only the target language of the assessment session versus when we apply a translanguaging framework, that is, count all accurate responses, regardless of the language in which they were produced. The participant is a Farsi-German-English speaking woman with chronic moderate aphasia. We examined the participant's performance on two picture-naming tasks, an answering wh-question task, and an elicited narrative task. The results demonstrated that scores in English, the participant's third-learned and least-impaired language did not differ between the two scoring methods. Performance in German, the participant's moderately impaired second language benefited from translanguaging-based scoring across the board. In Farsi, her weakest language post-CVA, the participant's scores were higher under the translanguaging-based scoring approach in some but not all of the tasks. Our findings suggest that whether a translanguaging-based scoring makes a difference in the results obtained depends on relative language abilities and on pragmatic constraints, with additional influence of the linguistic distances between the languages in question.

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## Introduction

Multilingual individuals with aphasia – an acquired language impairment due to brain injury – often exhibit deficits, such as word-retrieval difficulties, in all their languages. The extent of the deficits, which varies across individuals and languages, is typically assessed in each language separately. But many multilingual people use more than one language while communicating with other multilingual individuals, and separate their languages or restrict their production to one language less frequently. In the present paper we explore the differences that emerge when performance of a multilingual person with aphasia is scored

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for each language separately versus when all productions are considered, regardless of the language of testing.

### ***Aphasia in multilingual people***

Early as well as more recent reports of multilingual people with aphasia (MPWA) suggest that whereas in many cases, the acquired aphasia affects all the languages of the individual to a similar degree, some individuals experience non-parallel impairments in their languages (Goral, 2022; Paradis, 1983, 2004). Non-parallel impairments mean greater deficits in one language compared to another, in a manner that does not mirror the relative abilities prior to the aphasia onset. In such cases, in which one of the languages of a multilingual person appears less impaired than another, factors such as earlier age of acquisition or more extensive use at the time of the onset may predict the differential degree of impairment (Goral & Lerman, 2020; Kuzmina et al., 2019; Peñaloza et al., 2020).

To determine the degree of impairment in each language in MPWA, comprehensive language testing is performed in each language separately. Such an assessment yields a profile of impairment in each language, which can then be compared. However, access to comparable assessment tools in various languages is not trivial. Currently, the Bilingual Aphasia Test (BAT) and the Comprehensive Aphasia Test (CAT) are two available aphasia batteries, developed to address this need. The BAT, available in over 70 languages, was designed with the aim of testing bilingual people (Paradis & Libben, 1987). The CAT was developed in English and has later been adapted to multiple additional languages, taking into account a number of psycholinguistic and psychometric properties (Fyndanis et al., 2017; Swinburn et al., 2022). Additionally, experimental tests have been developed and used in the literature to compare performance between languages (e.g. Kiran et al., 2013; Lerman et al., 2022).

However, there is little normative data from multilingual individuals' performance on these tests, and the heterogeneity inherent to multilingual individuals (in terms of age of language acquisition and patterns of language use, for example), makes it difficult to establish the relevant comparison population. There are at least two additional challenges associated with the assessment of language abilities in MPWA, to which we turn next.

### ***Challenges in assessing MPWA***

Two challenges to the traditional approach of testing each language of MPWA separately are the difficulty in assuring that the different versions of the assessment tool across different languages are indeed comparable, and the typical tendency of many multilingual people to mix their languages. The first challenge has been acknowledged in the literature, and prior attempts to overcome it include the careful construction of the versions of tests such as the BAT and the CAT, and the matching of experimental tests on psycholinguistic variables such as word frequency and length (e.g. Green et al., 2011; Kuvač Kraljević et al., 2020; Peristeri & Tsapkini, 2011). As well, researchers have acknowledged the importance of adapting stimuli to be culturally appropriate and of considering linguistic-specific variations across languages (Norvik & Goral, 2021).

Regarding the challenge of language mixing in aphasia, much discussion exists in the literature about the frequency and type of MPWA's language mixing (e.g. Goral et al., 2019;

Muñoz et al., 1999) and whether language mixing in aphasia mirrors the typical mixing observed in multilingual people without aphasia, or is, rather, atypical (Fabbro et al., 2000; Fyndanis & Lehtonen, 2022). Language mixing (including mixing and switching) can be defined as the use of more than one language within a conversation or an utterance. Several models and various terms are found in the literature on mixing (e.g. Alexiadou & Lohndal, 2018, Muysen, 2000; Myers-Scotton, 2002; Poplack, 1980); for the purpose of the current study, we use the term *translanguaging*, defined below. Whereas pragmatic skills of language choice are often preserved in MPWA, speakers may engage in language mixing when they experience word retrieval difficulty (e.g. Goral et al., 2019). Goral et al. (2019) analysed connected language produced by 11 MPWA to examine language mixing behaviour. Each participant told a story describing a picture series or in response to a verbal prompt, in each of their languages, separately. The authors tabulated the number of words produced in the target language (the language of the testing session) versus in another language. They found that greater language mixing was associated with greater aphasia severity and with greater relative impairment in the target language, pointing to the use of mixing as a strategy to overcome word-finding difficulties in the target language. Nevertheless, in some cases, involuntary or inappropriate (e.g. addressing an interlocutor in a language they do not understand) mixing has been reported (Fyndanis & Lehtonen, 2022). If the mechanisms responsible for language inhibition and activation in bilingualism are impaired as a result of the brain injury, atypical mixing patterns may be expected as target words in a non-target language interfere and compete for selection. In their chapter, Fyndanis and Lehtonen (2022) reviewed reports of typical and atypical language mixing in aphasia and addressed the role of language control mechanisms in language selection in aphasia. Whether the origin of the mixing is impaired control mechanisms or strategic behaviour to overcome communication breakdown, many MPWA mix their languages when communicating. In the present paper, we will not tackle the greater question of typical versus atypical mixing, rather, we aim to incorporate language mixing in the evaluation of language production in aphasia.

### **Scoring performance of MPWA**

Unlike the question of whether mixing in MPWA is typical or atypical, the question of how to score language production of MPWA while taking into account language mixing has received relatively little attention in the published literature. Traditionally, when each language is evaluated separately, correct responses in the non-target language are coded as errors. Yet, for MPWA who are used to communicating with interlocutors who share their languages, this approach may need to be reconsidered, especially when the MPWA are tested by multilingual examiners.

Such an approach to scoring has been used with bilingual children. In assessing bilingual children with and without specific language impairments, Peña and Bedore and colleagues have discussed *conceptual scoring*, demonstrating that counting all correct responses produced by bilingual children, in either of their languages, results in higher scores than when counting correct responses in each language separately (e.g. Bedore et al., 2005; Gibson et al., 2022). Gollan et al. (2007) used this approach to study naming performance of bilingual older adults. The authors found that balanced bilingual participants scored higher when correct responses were counted

in either language than when they were counted in each of their languages separately. Participants who reported better proficiency in one of their two languages, however, did not benefit from the alternative scoring method, as there was no difference between the scoring in the dominant language versus either language. To our knowledge, this type of conceptual approach has not been applied to the study of MPWA to date.

Considering all correct responses regardless of the target language of response is consistent with the idea that language mixing is the norm among many multilingual people. Such an idea is promoted within a framework used to study the phenomenon of mixing, termed *translanguaging*. This framework highlights the natural use of all languages in one's repertoire (e.g. Otheguy et al., 2015; Wei, 2022). Whereas some debate exists concerning the usefulness of referring to languages as separate systems, greater consensus exists regarding the idea that multilingual individuals make use of their complete linguistic repertoire when communicating. When pragmatically appropriate, that is, when conversing with interlocutors who share languages, mixing elements from more than one language is natural and effective. When observed in the production of MPWA, considering language mixing can add to the assessment of the communicative ability of the speaker.

### **The present study**

In this study we applied a translanguaging approach to assessing the language production of a trilingual person with aphasia. We asked whether scoring the language output will differ meaningfully when we count accurate responses in only the target language of the assessment session versus when we apply a translanguaging framework, that is, count all accurate responses, regardless of the language in which they were produced. We predicted that overall, scoring accuracy regardless of language will yield higher scores than scoring accuracy in the target language only. More specifically, we hypothesised that for the language(s) of lower post-stroke abilities, a translanguaging approach to scoring will yield better performance than a traditional approach to scoring, because the speaker will mix elements from her stronger language (Goral et al., 2019). In contrast, for the language(s) relatively less impaired post-stroke, the scoring approach will not yield meaningful differences, as less mixing is expected from a weaker language to a stronger one. If indeed the consideration of all languages results in higher accuracy, this would suggest that the currently more common practice of scoring each language of multilingual people with aphasia separately should be revisited as the current approach may not adequately reflect one's communicative abilities. For a complete, ecologically valid assessment, both communicative contexts – single language and multilingual contexts should be examined.

### **Methods**

This is a descriptive case study comparing the performance of a trilingual woman with aphasia in her three languages. The study protocol (#291190) was approved by the CUNY Institutional Review Board.

**Table 1.** Language background information.

Language	Farsi	German	English
Age of acquisition in years	0 (birth)	6	12
Place of acquisition	Iran	Germany	Germany (some exposure in Iran)
Self-rated overall proficiency pre-CVA	7/10	10/10	10/10
<i>Speaking</i>	8/10	10/10	10/10
<i>Comprehending</i>	7/10	10/10	10/10
<i>Reading</i>	2/10	10/10	10/10
<i>Writing</i>	2/10	10/10	10/10
Self-rated overall proficiency post-CVA	4/10	5/10	6/10
<i>Speaking</i>	1/10	3/10	7/10
<i>Comprehending</i>	7/10	6/10	8/10
<i>Reading</i>	1/10	3/10	5/10
<i>Writing</i>	1/10	3/10	5/10
Self-reported language use <sup>a</sup>	10%	<1%	90% <sup>b</sup>
Language use context	With mother, friends	Watching TV	With immediate family; in the environment

<sup>a</sup>self-reported current use of the three languages for a total of 100%. <sup>b</sup>Language of the environment.

### Participant

The participant is a trilingual woman with chronic aphasia. Her first language was Farsi, which she acquired at home and continued to use with her family. Her second acquired language was German, in which she was immersed upon moving to Germany at age six. Her third language was English, to which she was exposed briefly in early childhood and then learned as a foreign language at school in Germany. She completed a university degree in Germany, before moving to the United States at age 27, where she was immersed in English and used it professionally. Her self-reported proficiency and use of her three languages was high. Following a stroke in her left cerebral hemisphere at age 28, she experienced difficulty communicating in all her languages, with English being the most preserved of the three. At the time of the study, 25 years post onset, she reported using all her languages but to different degrees. On the basis of her self-report, English was her most used language and the least impaired. English has been the language of the environment since her stroke, and also the main language in which she had received speech-language therapy. She continued to be exposed to German and Farsi but rarely used them productively. She rated her German as less impaired than Farsi. Information about her language acquisition, use, and proficiency is presented in Table 1. Initial evaluation using the Western Aphasia Battery Revised (WAB-R, Kertesz, 2006) revealed moderate impairment of verbal expression and good auditory comprehension skills, with an Aphasia Quotient (AQ) of 75. Her performance on the Cognitive Linguistic Quick Test (CLQT, Helm-Estabrooks, 2001) revealed no cognitive impairment, with scores within normal limits on all subtests (see Table 2).

### Material and procedure

Four subtests of an experimental cross-linguistic battery (Goral & Borodkin, unpublished) were administered to the participant in each of her three languages over three sessions per language. The subtests consisted of language production tasks at the word, sentence, and discourse levels. Two tasks at the word level were Action Naming and Object Naming; one

**Table 2.** Assessment results.

WAB-R	Score	CLQT	Score	Severity Rating
Spontaneous Speech	14/20	Attention	200	WNL
Auditory Comprehension	8.35/10	Memory	163	WNL
Repetition	6.4/10	Executive Function	27	WNL
Naming & Word Finding	9/10	Language	30	WNL
Aphasia Quotient	75.5/100	Visuospatial	96	WNL

WAB = Western Aphasia Battery-Revised (Kertesz, 2006); CLQT = Cognitive Linguistic Quick Test (Helm-Estabrooks, 2001); WNL = within normal limits.

task at the sentence level was Answering Wh-Questions; and one task at the discourse level was elicited Narrative Production. A brief description of the tasks, instructions, and outcome measures is provided in Table 3. The target words for the picture naming stimuli in the original battery were matched across the languages for length and frequency; in Farsi, many verbs take a compound form resulting in longer and morphologically more complex words and therefore the Action Naming stimuli were not well matched. The prompts for the Answering Wh-Question task were adapted to sound natural in each language (see Appendix). Native or highly proficient speakers of each language administered the tests. Each language was tested in a separate session by a different examiner who tested her only in that language. The three sessions in each language were administered, in a pseudo-random order, on different days within a span of two weeks. The target language of each session was made clear, and the examiner used only that language in all interactions with the participant, though we note that the participant was aware that each of the examiners was also a speaker of English in addition to the language they used during the assessment. The sessions were recorded and the participant's production was transcribed and then scored. Transcription and scoring were reviewed and discussed in depth by all authors to assure accuracy and consistency. Scoring criteria were generated and discussed by all authors, and any scoring procedure discrepancies across the languages were discussed and resolved. The participant provided informed consent prior to the beginning of the testing.

### Scoring and analysis

For the picture naming tasks, a correct response was considered a noun (for the Object Naming task) or a verb (for the Action Naming task) that was the target or a synonym, as listed in Bastiaanse et al. (2002) and Gollan et al. (2012), respectively (see Table 3). For the Answering Wh-Question task, we coded whether the response was interpretable (0 = no; 1 = yes) and whether it answered the question (0 = did not answer the question; 1 = answered the question). For example, the following response received a score of 1 as interpretable and a score of 0 in answering the question: Q: *What does your family do to celebrate the New Year?* A: *'... this Sunday my family uh and uh cousin going to celebrating Bar Mitzvah ...'* For the Narrative task, similarly, we scored whether each utterance was interpretable (0/1) and if it was related to the topic (0/1). Scoring was reviewed and discussed among the authors and any differences were resolved.

We scored each task twice: once considering responses in the target language only (single language method) and once considering responses in all languages (translanguaging method). For example, when the participant produced the English word *digging* in response to a picture of an individual digging in the Action Naming task, which was administered in

**Table 3.** Task and outcome measures.

Level/Task	Source	Description	Example	Outcome Measures
Word: Action Naming	Subset of the VAST	Naming a picture of an action	<i>Writing</i>	Accuracy of verb (max score 27)
Word: Object Naming	Subset of the MINT	Naming a picture of an object	<i>Basket</i>	Accuracy of noun (max score 30)
Sentence: Answering Wh-Qs	Our lab	Answering a Wh-Q in one sentence	<i>What do you like to do on your birthday?</i>	-Interpretability of the sentence (max score 18) -Whether it answered the question (max score 18)
Discourse: Narratives	Our lab	Telling a story in response to a prompt	<i>Tell me about a vacation you took</i>	Interpretability of each sentence -Whether each sentence was related to the topic

VAST = Verb and Sentence Test (Bastiaanse et al., 2002); MINT = Multilingual Naming Test (Gollan et al., 2012).

German, this response would be marked as incorrect when considering the target language (German). In the second method of scoring, where we considered her responses in all languages, the English word *digging* would be marked as correct. We tabulated the scores obtained in the single language method (only elements in the target language are counted towards the score) and in the translanguageing method (elements from all languages are counted towards the score) for each outcome measure in each language per task (see Table 3 and Figures 1–3). Because these are data from one participant and one time point, descriptive statistics are provided.

## Results

The participant's scores per task are presented in Table 4. Overall, performance was highest in English, followed by German, with the lowest scores observed in Farsi. Accuracy in English for the single word production tasks was 81% and 90% in the Action and Object naming tasks, respectively; 100% and 94% on the interpretability and relatedness on the Sentence level task, and 100% for both measures on the narrative task. Whereas not all of her sentences were complete and grammatical in English, they were interpretable and related to the topic. In German, accuracy was 33% and 53% in the Action and Object single word tasks, 89% and 72% for the interpretability and relatedness in the sentence task, and 67% and 54% in the narrative task. In Farsi, accuracy was low with 19% and 33% in the single word tasks, 67% and 39% for interpretability and relatedness in the sentence task, and 25% and 33% in the narrative task. See Table 4 for the raw scores and percentages in each task in each language. The participant's performance was generally lower in the tasks that required a specific target word (e.g. *frying*), whereas her answers to the questions and the narratives she produced yielded higher scores in all languages.

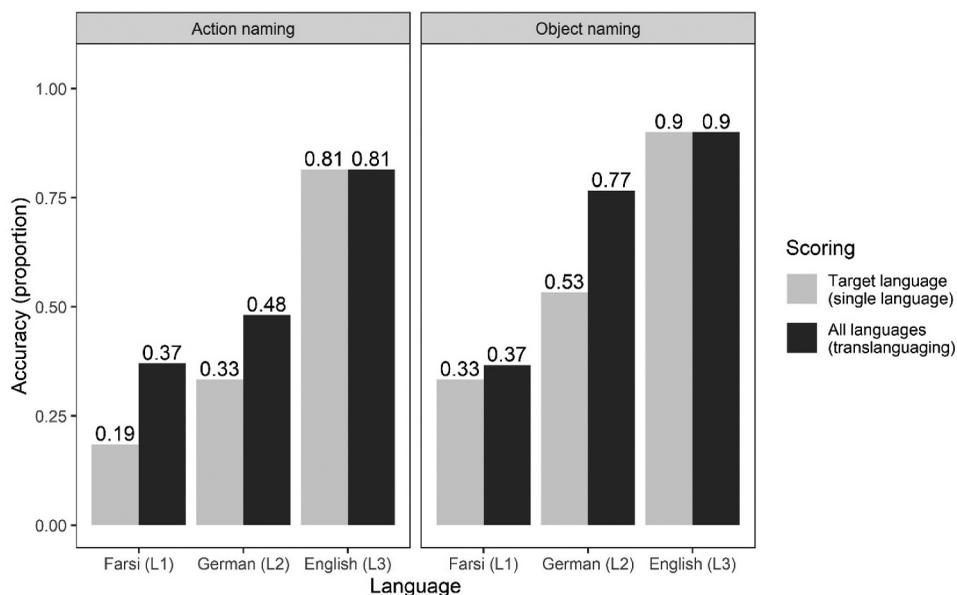
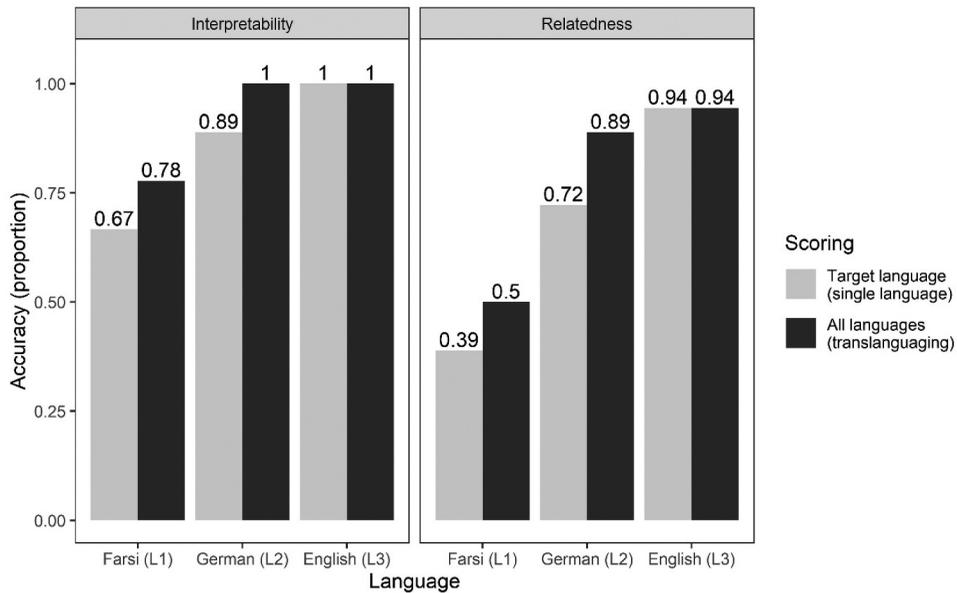
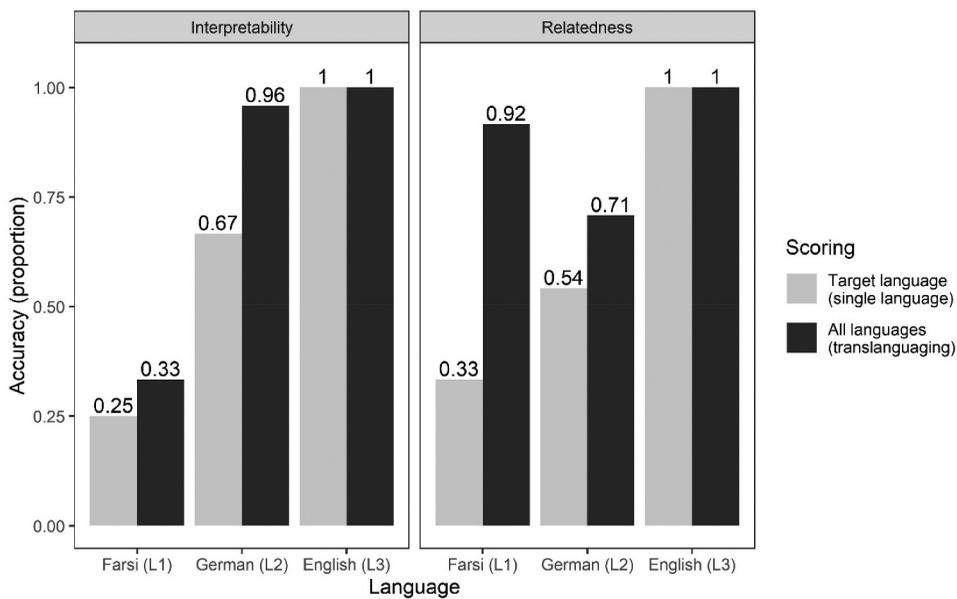


Figure 1. Accuracy in action and object naming in the two scoring methods.



**Figure 2.** Accuracy in answering Wh-questions in the two scoring methods.



**Figure 3.** Accuracy in narrative production in the two scoring methods.

Our main comparisons focused on the two scoring methods: the standard, single language method of scoring accuracy when correct responses are produced in the target language of testing and the translanguaging method, whereby responses in all languages are considered (see Figures 1–3). Differences between the two sets of scores were noted for German in all measures of all four tasks, with higher scores obtained when production in

**Table 4.** Scores per task per language in the two scoring methods.

	Language					
	English		German		Farsi	
	Single Language	Translanguaging	Single Language	Translanguaging	Single Language	Translanguaging
Object Naming (Accuracy)	27 (90%)	27 (90%)	16 (53.33%)	23 (76.67%)	10 (33.33%)	11 (36.67%)
Action Naming (Accuracy)	22 (81.48%)	22 (81.48%)	9 (33.33%)	13 (48.15%)	5 (18.52%)	10 (37.04%)
Sentence Level						
Answering Wh-Qs (Interpretability)	18 (100%)	18 (100%)	16 (88.89%)	18 (100%)	12 (66.67%)	14 (77.78%)
Answering Wh-Qs (Relatedness)	17 (94.44%)	17 (94.44%)	13 (72.22%)	16 (88.89%)	7 (38.89%)	9 (50%)
Discourse Level						
Narratives (Interpretability)	44 (100%)	44 (100%)	16 (66.67%)	23 (95.83%)	3 (25%)	4 (33.33%)
Narratives (Relatedness)	44 (100%)	44 (100%)	13 (54.17%)	17 (70.83%)	4 (33.33%)	11 (91.67%)

Raw scores are shown in the table, with percentages in parenthesis. For object naming, the max possible score is 30. For action naming, the max possible score is 27. For Answering Wh-Qs, the max possible score for both interpretability and relatedness is 18. Max possible scores for interpretability and relatedness in the Narratives task differs by language depending on the number of utterances produced in each language: For English the max score is 44, for German the max score is 24, and for Farsi the max score is 12.

either language was considered than when production in German only was scored. Differences were observed in Farsi for some but not all of the measures. Specifically, differences were noted for Farsi in the Action Naming accuracy, in the interpretability and relatedness of the Answering Wh-Questions, and in the relatedness (but not interpretability) of the Narrative Production task. For English, scores did not differ when comparing the two scoring methods, reflecting the participant's tendency to rarely mix languages when testing was conducted in English.

## Discussion

In this study, we applied a translanguaging approach to scoring production performance of a multilingual person with aphasia. We compared the scores obtained per task per language when responses in all languages (translanguaging method) were considered compared to when the standard approach to scoring each language separately was applied. Our findings demonstrate that the participant used all her languages during the testing sessions (except during the English testing) and suggest that the degree to which a translanguaging-based scoring makes a difference in the results obtained depends on relative language abilities, and, possibly, on the linguistic distance between the languages. An additional variable concerns pragmatic rules and the language(s) of the interlocutor. We address our findings in regards to these three variables.

### *Scoring differences and post-stroke abilities*

The participant's scores in each of her three languages across all tasks were consistent with her self-reported proficiency: English was the better-preserved language and Farsi was the weakest one. In accordance with our prediction, the participant did not mix words from her weaker languages while performing in English, her strongest language. Consequently, her English scores did not differ between the two scoring methods. In contrast, she did mix English words and phrases in her production when the target languages were German and Farsi, her two more impaired languages. Performance in German, the participant's moderately impaired (due to the acquired impairment and to potential attrition) L2, benefited from a translanguaging-based scoring across the board. That is, when the English words the participant mixed in while attempting to communicate in German were counted towards accuracy and relevance, her scores were higher than when only German words were considered. In Farsi, her weakest language post-CVA (due to likely attrition in addition to the aphasia), the participant's scores were higher under the translanguaging-based scoring method in some but not all of the tasks. Moreover, her performance in Farsi yielded low scores even when some English words were mixed. Her low performance in Farsi could be due to three factors: the effect of the aphasia, potentially incomplete acquisition of Farsi, as the participant left Iran when she was six, and to language attrition, as she used Farsi less in the years post her stroke, or a combination of all three factors.

The results for English and German are consistent with the patterns reported in Goral et al. (2019) of greater mixing during production in languages of lower abilities/greater impairment than in better preserved languages. The results for Farsi, in contrast, are less consistent with the relative abilities prediction. Though unexpected, it is possible that when the language is severely impaired, the challenge

of producing verbal responses is great and the person with aphasia does not attempt supplementing the production by inserting words or phrases from another language. Indeed we noted that the participant tended to mix English less when being tested in Farsi than she did during her German production when tested in German. An alternative explanation to this pattern is the role of linguistic distances. Specifically, that the relative distance between German and English as compared to Farsi and English impacted performance. We turn to this possibility next.

### ***Scoring differences and language distance***

Linguistic distance between languages has been proposed to affect the manifestation of aphasia across languages in multilingual people as well as to influence cross-language treatment effects (Ansaldò & Ghazi Saida, 2014; Goral et al., 2010). In some cases, a limited role of language distance has been observed (e.g. Faroqi-Shah et al., 2010), whereas many studies did not address this issue directly. A surprising finding in our study was the relatively limited mixing that the participant demonstrated when being tested in her weakest language, Farsi, as compared to when she was tested in her L2 German. If relative severity of impairment was the only variable affecting mixing behaviour, we would have expected greater mixing while speaking in the most impaired language, Farsi (e.g. Goral et al., 2019). We therefore speculate that the greater linguistic similarity between German and English compared to between Farsi and English lent itself to greater mixing between the former than the latter pair.

German and English share some syntactic structures and many lexical items, including cognates (i.e. words across languages that overlap in form and meaning). Indeed, at times it was difficult to ascertain whether the participant produced an accented English word or its cognate in German (e.g./maʃin/for ‘machine’ in English, ‘Maschine’ in German). It might have been more natural for the participant to supplement a word from English into a German sentence due to comparable structures of the two languages, or to find the translation equivalent in English while searching for a word in German when the two translation equivalents shared lexical and semantic properties (e.g. ‘Ich gehe geh. . . in in den uh bath bad uh . . .’: ‘I go go . . . in in the uh *bath* bath uh . . .’). The cognate effect is consistent with the triggering hypothesis, that suggests that certain lexical items (e.g. cognate words, proper names) facilitate the switch from one language to another (e.g. Clyne, 2003; Winter et al., 2023). In contrast, because Farsi and English share fewer cognates and differ in terms of sentence structure (e.g. word order; verb phrase structure), this may have contributed to why the participant avoided mixing English words into Farsi structures. Of course, language mixing has been documented for multiple language pairs, including Farsi and English (e.g. Mahootian, 1996; Sanei, 2022); it is possible that linguistic distance determines primarily the type of mixing not the frequency of mixing. For example, dissimilar languages may accommodate mostly single word insertions, whereas in languages that share phrase structures and morphological structures, within-phrase and within-word mixing may be observed (Alexiadou & Lohndal, 2018). As well, languages that share cognates with complete or partial phonological overlap may exhibit more cognate than non-cognate mixing.

### ***Language mixing in multilingual speakers with and without aphasia***

Given that scores improved when the translanguaging method was applied for assessing production during German testing, switching to English during testing was favourable for communication. A similar finding was noted in a study by Carpenter et al. (2020), where bilingual PWA were asked to complete a verbal fluency task in three conditions: a single language condition, cued language switching condition, and a self-switch condition wherein participants could freely switch between their languages. Performance was highest in the self-switch condition, followed by the single language condition, with the lowest scores in the cued switching condition. When the task allowed participants to freely select words from their entire linguistic repertoires at will, scores improved, suggesting that bilingual PWA leverage language mixing for meeting task goals.

Moreover, as also noted by Carpenter et al. (2020), the ability to freely mix between languages reduces the cognitive control demands of a task relative to when production is constrained to a single language. These findings are consistent with those reported by Gollan and colleagues for younger and older neurotypical bilingual participants, who showed the typical switch cost (slowed responses for language switched items) during cued naming but no switch cost when they were free to name in either language (Gollan & Ferreira, 2009). When language choice is not restricted, lexical items in a would-be non-target language no longer serve as competitors per se; rather, they become pragmatically acceptable word choices. When the translanguaging method of scoring was applied in the present case, scores for German testing improved, while Farsi scores did not, due to little mixing during Farsi testing. Relative to Farsi and English, German and English share linguistic structures and elements and thus a greater opportunity for interference from cognates and false friends (i.e. words across languages that overlap in form but not meaning). Thus, our results speak to an interface between language choice and interference that is affected by factors such as linguistic distance.

More generally, our findings of language mixing are consistent with language mixing reported for multilingual people with and without aphasia: Multilingual people mix their languages when their interlocutors share their languages (e.g. Gollan & Ferreira, 2009; Muñoz et al., 1999). Consistently, our participant mixed her languages while keeping pragmatic norms, as she only used words from a language other than the target language if the non-target language was shared with her interlocutor (e.g. she used English while speaking German with a German-English bilingual person, but not German while speaking with a Farsi-English bilingual person). Our participant's use of more than one language, even when there was an obvious target language (due to the formal testing situation), is reflective of the natural behaviour of multilingual people to use their complete linguistic repertoire and select the best lexical items in the context, providing that they determine that their interlocutor can follow (Wei, 2022). It is also consistent with multilingual people's tendency to adapt to the context of their communication situations (Green & Abutalebi, 2013). For MPWA, language mixing can offer a strategy to be used when encountering word retrieval difficulty in one language (e.g. Lerman et al., 2019). This could be related to the relative abilities in each language or to a temporarily inaccessible lexical item, common in aphasia. If the goal is to maximise communication in aphasia (e.g. Doedens & Meteyard, 2022; Galletta & Barrett, 2014), there is merit to not discouraging language mixing in assessment and in intervention practices with MPWA.

### **Clinical implications**

We argue that for multilingual people with aphasia who regularly use their languages with interlocutors in their communication context, allowing language mixing during assessment and treatment sessions could maximise functional communication and the relevance of the clinical practices to the individuals' life participation. People with aphasia do mix their languages, mostly when pragmatically appropriate, and there is benefit in considering the whole of their production, rather than separating their language. We note that not in all instances, the translanguaging method yielded higher scores (as variables such as degree of impairment and pragmatic consideration seem to influence the benefit of language mixing). Moreover, for multilingual people who do not typically mix their languages, there may be less merit in considering a translanguaging method, for example, in situations of single-language and dual-language contexts (Green & Abutalebi, 2013).

The use of a translanguaging-based approach to assessment and intervention could be challenging, however. Practitioners will need to determine who should conduct the assessment (e.g. only speakers of the same languages as the MPWA?), what language should be used for prompting the individual being tested, and how the interlocutor should respond in cases of language mixing.

Our results speak to the need to conduct testing in a manner that allows individuals to freely switch between their language. Important insights, including information about whether an individual experiences interference between lexical alternatives in their repertoire, can be uncovered when testing is done in a way that makes language mixing a pragmatically appropriate behaviour. These insights would add to those revealed when testing is constrained to one language and the pragmatic context dictates a refrain from mixing; in such instances, uninhibited interference might result in inappropriate mixing. For the field of speech-language therapy, it is crucial to increase the number of bilingual individuals who are trained to become clinicians or to offer testing alternatives that allow MPWA to utilise all their languages. For example, translation services that allow MPWA to engage with a provider that otherwise does not share their languages, are essential. Though these logistical considerations are challenging, mixed-language assessment and intervention in aphasia could help improve our clinical services for multilingual individuals.

### **Limitations**

Our analyses of the data were primarily quantitative, as we aimed to establish whether better performance is evident when language production by an MPWA is considered as a whole, rather than separated by language. A question that has been discussed in the literature on language mixing by MPWA is whether mixing in aphasia is atypical, quantitatively and qualitatively, compared to mixing observed in people without aphasia (e.g. Fabbro et al., 2000; Fyndanis & Lehtonen, 2022). The question of typical versus atypical mixing in aphasia is beyond the scope of the present paper but future analyses can examine whether the degree and directionality of language mixing we observed is typical of people with similar language background and context. We do note that our participants followed typical pragmatic norms by always using the languages that were known by her interlocutors.

Furthermore, qualitative analyses could examine the type of mixing observed. For example, our participant tended to insert single noun from English while speaking German (e.g. *in den uh bath ... bad. uh 'bedroom'*), which is consistent with the typical finding of nouns being a commonly mixed word type (e.g. Parafita Couto & Gullberg, 2019). While speaking Farsi, she inserted mostly phrases and expressions from English (e.g. to the question about staying in shape (see Appendix), she replied: *Man sobh um ... raftam raftam ok man emruz Ethan Joshua madrese raftam va va um 'twice two times' um um thirty thirty minutes walking' amadam.*). We deliberately avoided classifying her language mixing in this work because we set out to examine the participant's performance within a translanguaging framework, thus we did not define nor examine the types of language mixing we observed. Much work has been dedicated to understanding types of mixing observed by multilingual people, including seminal work by Muysen (2000) and Myers-Scotton (2002) as well as more recent work examining different language combinations (e.g. Parafita Couto & Gullberg, 2019; Valdés Kroff & Dussias, 2023; Winter et al., 2023). Future analyses could examine whether the type of mixing and the mixing units observed for people with aphasia differ from those observed for people without aphasia.

Regarding the context of testing, we attempted to establish a clear target language for each testing sessions, with an examiner who used only one language throughout the session. Nevertheless, the examiners in this study were speakers of English in addition to the non-English language of testing (Farsi, German), which may have influenced the participant's language mixing choice. English was also the language of the greater environment, and the language in which the participant had received speech-language therapy. It is therefore difficult to tease apart whether the participant's mixing of elements from English was influenced by her own abilities in English compared to the other two languages, or by pragmatic factors such as the context, or both. Similarly, it is challenging to tease apart whether the difficulties the participant experienced in German and especially in Farsi were due, in part, to language attrition (e.g. Lerman et al., 2023).

Finally, the battery we used is experimental (see Appendix). In short-term treatment studies (as was the case here, though the treatment and the additional testing portions of the project are not reported in this paper), aphasia batteries (such as the BAT and the CAT) are often used only for the initial examination, whereas specific experimental tasks are used to capture change following treatment (e.g. Kiran et al., 2013). In the experimental battery we used, we attempted to match the stimuli for the more structured naming tasks on psycholinguistic variables, such as word length and frequency. Nevertheless, we note that we did not aim to directly compare performance across the three languages; rather compare the effect of the scoring approach on performance within each language.

## Conclusion

The present study provides evidence for the functional merit of using a translanguaging-based approach to assessment in multilingual people with aphasia. On the basis of one case study, limited conclusions can be drawn, but the data suggest that relative language proficiency, linguistic distance, and the languages of the interlocutors, may contribute to the degree to which multilingual people with

aphasia benefit from being assessed while considering all their responses, not only those in one designated language.

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## Appendix.

### Experimental Battery

#### Action Naming: Items per Language

English	German	Farsi
writing	schreiben	neveshtan
wringing	auswringen	chelandan
peeling	schälen	pust kandan
smoking	rauchen	sigar keshidan
knitting	stricken	baftan
ploughing	pflügen	shokhm zadan
throwing	werfen	partab kardan
blowing	blasen	fut kardan
crying	weinen	gerye kardan
hanging	hängen	avizan shodan
tearing	reißen	pare kardan
fishing	fischen	mahigiri kardan
picking	pflücken	gol chidan
walking	gehen	rah raftan

(Continued)

English	German	Farsi
stirring	rühren	be ham zadan
shaving	rasieren	rish tarashidan
polishing	polieren	bargh abdakhtan
sitting	sitzen	neshastan
driving	autofahren	ranadegi kardan
pushing	schubsen	hol dadan
sawing	sägen	are kardan
running	laufen	davidan
combing	kämmen	shaneh kardan
digging	graben	kandan
reading	lesen	khandan
milking	melken	shir dushidan
sewing	nähen	dukhtan

### Object Naming: Items per Language

English	German	Farsi
key	Schlüssel	kelid
fish	Fisch	mahi
scissors	Schere	gheichi
bear	Bär	khers
witch	Hexe	jadugar
cake	Kuchen	cake
cage	Käfig	ghafas
lock	Schloss	ghofl
well	Brunnen	chah
nest	Nest	laneh
bone	Knochen	ostokhan
leaf	Blatt	barg
apple	Apfel	sib
iron	Bügeleisen	otu
fork	Gabel	changal
tie	Krawatte	keravat
saw	Säge	arre
candle	Kerze	sham
sun	Sonne	khورشid
king	König	shah
hat	Hut	kolah
basket	Korb	sabad
snail	Schnecke	halazun
moon	Mond	mah
wig	Perücke	kolah gis
bridge	Brücke	pol
screw	Schraube	pich
tree	Baum	derakht
watch	Armbanduhr	saat
whale	Wal	val

**Answering Wh-Questions: Items per Language**

English	German	Farsi
1. What do you like to do on your birthday?	Was tun Sie gerne an Ihrem Geburtstag?	Baraye tavalodat che kar mikonid?
2. What do you like to do when you are visiting a new city?	Was tun Sie gerne, wenn Sie eine neue Stadt besichtigen?	Che kari dust darid anjam bedahid vaghti az shahre jadidi didan mikonid?
3. What can you tell me about one of your family members?	Was können Sie mir über eines Ihrer Familienmitglieder erzählen?	Che chizi dar morede yeki az azaaye khanevadeat mituni be man begid?
4. What do Americans do to celebrate Thanksgiving?	Was machen Amerikaner, um Thanksgiving zu feiern?	Baraye shokrgozari che kar mikonid?
5. What did you do before coming here today?	Was haben Sie getan, bevor Sie hierhin gekommen sind?	Ghabl az molaghate emruz che kar kardid?
6. What do you do to keep in touch with your family?	Was tun Sie, um mit Ihrer Familie in Kontakt zu bleiben?	Che kari anjam midahid ke ba khanevade dar ertebat bashid?
7. What do you like to do on weekends?	Was tun Sie gerne am Wochenende?	Dar akhare hafteha che kari dust dari anjam bedahid?
8. What do you like to do when you have visitors from out of town?	Was tun Sie gerne, wenn Sie Besuch von außerhalb bekommen?	Che kari dust dari anjam bedahi vaghti az khareje shahr kasi be didanat miayad?
9. What happened recently in the news that made an impression on you?	Was ist kürzlich in den Nachrichten geschehen, dass auf Sie Eindruck gemacht hat?	Che chizi akhيران dar akhbar etefagh oftade ast?
10. What does your family do to celebrate the new year?	Was macht Ihre Familie, um das neue Jahr zu feiern?	Khanevadeye shoma sale no ra chetor jashn migirand?
11. What will you do after you leave here today?	Was werden Sie tun, nachdem Sie von hier gehen?	Bad az inke injara tark kardid che kari mikonid?
12. What do you do if you want to get in shape?	Was tun Sie, um in Form zu kommen?	Che kari anjam midahid ta badane salemi dashte bashid
13. What do you like to do on a rainy day?	Was machen Sie gerne an einem regnerischen Tag?	Che kari dust dari anjam bedahi dar ruze barani?
14. What do you like to do when you are spending the day with your family?	Was tun Sie gerne, wenn Sie den Tag mit Ihrer Familie verbringen?	Che kari dust dari anjam bedahi vaghti mikhahi ba khanevadeat zaman bezozarani?
15. What can you tell me about your first job?	Was können Sie mir über Ihren ersten Job erzählen?	Che chizi dar morede avalin shoghlat mitavani be man begui?
16. What do politicians do to get elected?	Was machen Politiker, um gewählt zu werden?	Siyasatmadaran che kari anjam midahand baraye inke dar ray giri entekhab shavand?
17. What do you do most mornings?	Was machen Sie meistens morgens?	Bishtar sobha che kari anjam midahid?
18. What do you do to keep your place clean?	Was tun Sie, um Ihre Wohnung sauber zu halten?	Che kari mikonid ke khane ra tamiz negah darid?

**Narratives: Prompts per Language**

English	German	Farsi
Please tell me about what you did and where you were on 9/11.	Bitte erzählen Sie mir, was Sie am 11. September gemacht haben und wo Sie waren.	Lotfan begid 11 September che kar mikardid va koja budid.
Please tell me about a happy memory or something good that happened to you.	Bitte erzählen Sie mir über einen glücklichen Moment oder etwas Gutes, das Ihnen passiert ist.	Lotfan dar morede yek khatereye khub ke baraye shoma etefagh oftade sohbat konid.
Please tell me about a recent trip that you took.	Bitte erzählen Sie mir über eine kürzlichen Reise, die Sie gemacht haben.	Lotfan dar morede safare akhiretun sohbat konid