

Book of Abstracts

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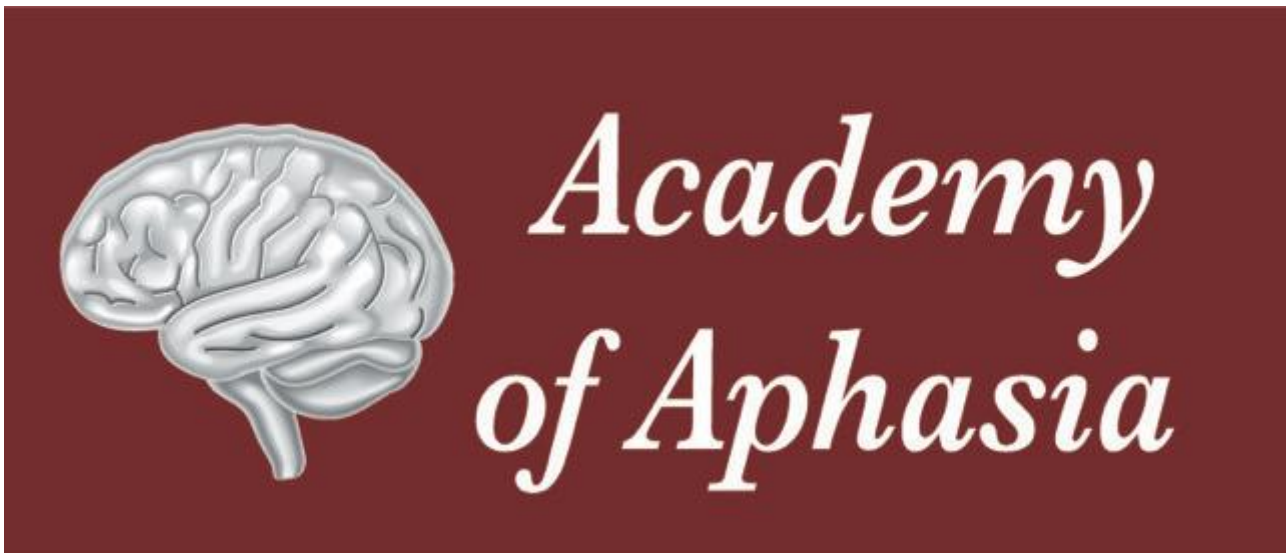


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Alexia with agraphia (AWA) following focal brain lesions in Arabic speakers: A case-series analysis

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Introduction

The study of AWA, in its pure form or in association with aphasia, might offer insights into the neural underpinnings of the interface between reading and writing, as originally suggested by Joseph-Jules DeJerine in 1890. A recent systematic scoping review disclosed several lesion sites (Levy et al., 2023, Kim et al., 2015, Kirschner & Webb, 1982, Purcell et al., 2014) and the symptom complex associated with AWA in speakers of English language (Balasubramanian et al., 2023). An important question to be asked, in this context, is this: Does AWA syndrome look the same across languages/scripts? This issue has implications for both cognitive and neural models of the interface between reading and writing.

The current study explores the nature of AWA in Arabic speakers who had focal brain lesions. It focuses on the following questions: What are the lesion sites associated with the AWA syndromes in Arabic speakers? What type of alexia-agraphia combinations characterize Arabic cases with AWA?

Methods

The method of the current study is the same as that of a larger study done by the first author (Aldera, 2017).

Subjects. From the first author's comprehensive doctoral research project on dyslexia and dysgraphia in Arabic speakers, data pertaining to six AWA cases were identified for a case-series analysis (see Schwartz & Dell, 2010). Demographic details on these six AWA cases can be seen in Table 1.

Procedure. The choice of the test materials was based on the Dual Route Model of lexical processing. A clinical evaluation was completed for each case using a comprehensive aphasia battery. For the identification of alexia and agraphia, a word list containing 412 Arabic words was assembled. The choice of words closely followed the criteria used in the Psycholinguistic Assessments of Language Performance in Aphasia (Kay, Lesser, & Coltheart, 1992). Further details on the word list are available in Aldera's work (2017).

Results

Each of the six Arabic AWA cases had a unique site of lesion (see Table 1 for details): Case 0116: Basal ganglia lesion, Case 0216: left peri-insular, frontal, and superior temporal, Case 0516: Left posterior parietal-temporal, Case: 0616: Left temporal lobe and precentral gyrus, Case 1416: Left temporal lobe and post central gyrus, and Case 1516: Left anterior superior frontal lobe (Neuroimaging data will be included in the presentation).

AWA characteristics for these cases included, respectively: Graphemic buffer (GB) dysgraphia and deep dyslexia (DD), Mixed dysgraphia and phonological dyslexia, GB dysgraphia and mixed dyslexia, phonological dysgraphia & phonological dyslexia, GB dysgraphia and DD, and GB dysgraphia and letter by letter reading. Both concordant and discordant combinations of alexia with agraphia were noted in these cases.

Conclusions

Multiple lesion sites associated with AWA require some anatomically and cognitively based explanations. Previous studies have suggested that a lesion in the left supramarginal gyrus could result in AWA (Baldo et al., 2018). However, our findings, in the context of Boes and colleague's work (2015), suggest that the interface between reading and writing rests on complex neural networks consisting of components that are spatially distributed.

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Table 1. Demographic data.

Case	Time post stroke	Site of lesion	Aphasia Type
0116	3 MM	Left MCA and subcortical (BG) infarction	Subcortical (BG)
0216	10 MM	Left MCA, left peri-insular, frontal and superior temporal area.	TCM
0516	7 MM	Left MCA, left posterior parietotemporal lobe	Anomia
0616	13 MM	Left lateral temporal lobe & precentral gyrus infarct	Jargon
1416	4 MM	Left parietal lobe extending to the postcentral gyrus	Broca's
1516	8 MM	Left MCA in anterior superior frontal lobe	TCM
Average	7.5 MM		

Note: Months (MM), Middle Cerebral artery (MCA), Basal Ganglia (BG), Transcortical Motor (TCM).

Arabic adult language standardized tests for aphasia: A systematic review

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Introduction

Aphasia is a language disorder resulting from brain damage, that affects one or more language aspects: speaking, listening, reading, and writing. Aphasia presents with different types and language symptoms. Speech-language pathologists (SLPs) assess People With Aphasia (PWA) using standardized tools to identify language impairment, guide therapy plans, and track progress. Unlike in English and some other languages, there is a high ambiguity in the availability of standardized language tests for aphasia for Arabic speakers. Clinicians rely heavily on translated versions of English aphasia tests or use Arabic language tests that are not necessarily standardized or have been validated for Arabic speakers with aphasia. Therefore, there is a need to systematically identify the available Arabic language tests for aphasia and critically analyze them to improve Arabic clinical and research language measures for aphasia.

Methods

The purpose of the study is to systemically search the literature to quantify available standardized Arabic language tests for aphasia and critically analyze their validity and reliability in diagnosing language impairment in Arabic speakers with aphasia. A systemic review design was used to search several databases (PubMed, ScienceDirect, Scopus, and Dar Almandoumah) to identify available standardized Arabic aphasia tests published in peer reviewed journals. PRIMSA guidelines (Figure 1) were used with the following inclusion criteria: 1) the test construction and validation data must be published in a peer reviewed journal, 2) the language test items must be in Arabic, 3) the test population must be adult with aphasia, and 4) Articles must be published in Arabic or English. The final included studies were critically evaluated for their quality using Scottish Intercollegiate Guidelines Network (SIGN) checklist by two reviewers independently.

Results

Nine articles representing Arabic standardized language tests/articles met the inclusion criteria and were finally included in the review (Abou-Elsaad et al., 2018; Abou El-Ella et al., 2013; Al-Thalaya et al., 2018; AlSwaiti, 2019; Altaib et al., 2021; Alyahya & Druks, 2016; El Ouardi et al., 2023; Yaari & Almaflehi, 2013a, 2013b). The final included published tests were conducted between 2013 and 2023 originated from different Arab countries (Saudi Arabia, Lebanon, Egypt, Morocco, and Jordan) which represent different distinctive Arabic dialects (Table 1.). The published tests varied in their characteristics, sub-tests, and quality level with regard validity and reliability.

Conclusions

This review summarized the evidence on available Arabic standardized language tests for aphasia. The review also provides insight on the psychometric properties of the identified tests and their quality based on critical appraisal tools. The identified tests resemble different

distinctive dialects suggesting that one test may not be applicable for all Arabic speakers. The findings of this review provide essential information for clinicians and researchers in the Arabic aphasia field. The results are expected to help researchers and clinicians in decision making regarding the use of Arabic language measures for aphasia.

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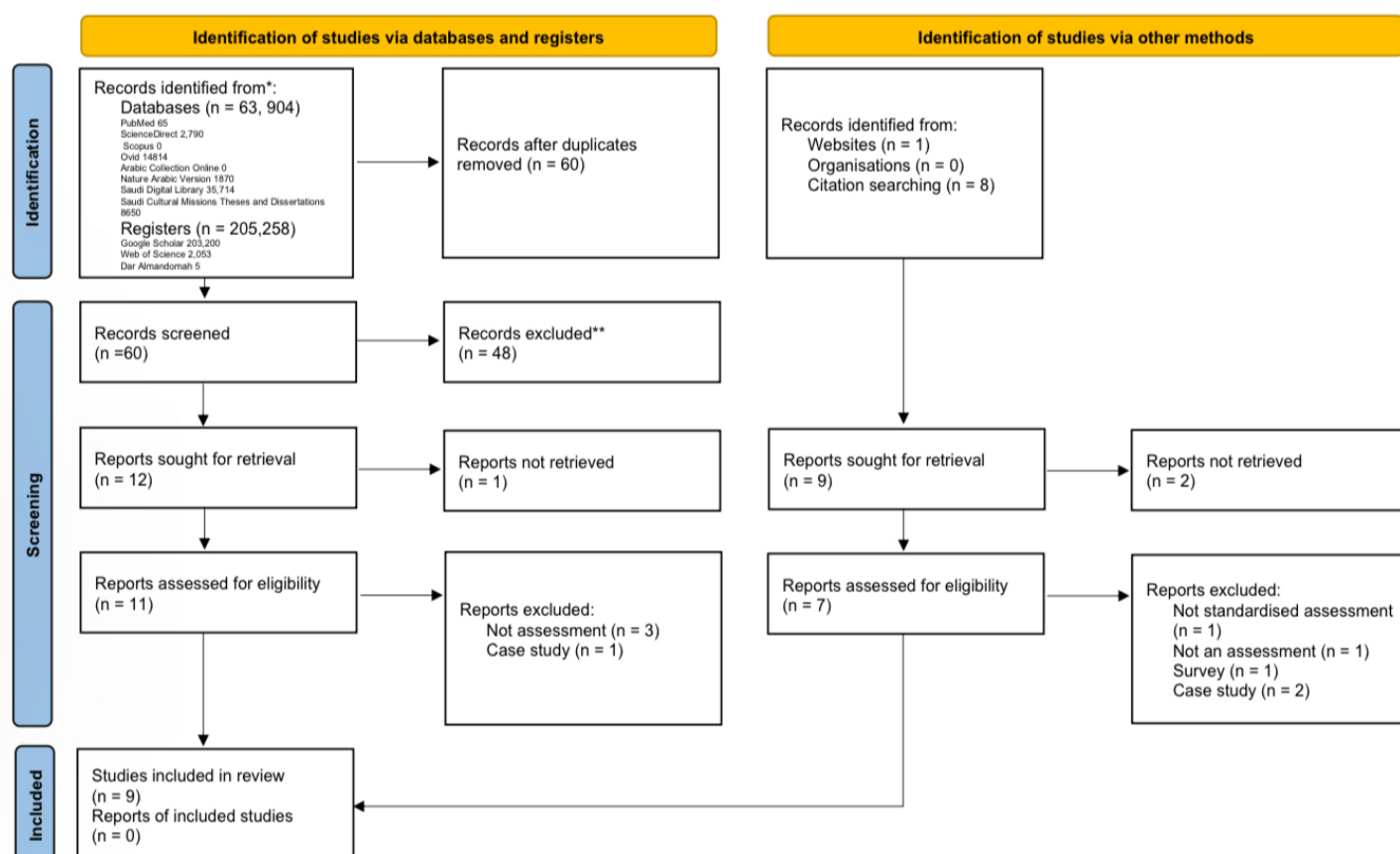


Figure 1. PRISMA flowchart for the identified studies.

Table 1. Characteristics of the included studies/tests

Study title	Year	Age of participants	Number and Gender	Language	quality of the study
1. Modification and standardization of Arabic version of the Comprehensive Aphasia Test	Abou El-Ella et al., 2013	20 to 70 years old	Males PWA 67(67%) control 29(58%) Females PWA 33(33%) control 21(42%)	Arabic-Egypt	Modified CAT: psychometrically well-constructed and reveals a high degree of reliability and validity.
2. Validity and Reliability of Assessment of Language-Related Functional Activities (ALFA): Evidence from Arab Aphasics	Yaari& Almaflehi, 2013	16 to 65 years old	100 s (50 male and 50 females)	Arabic- Saudi	ALFA was proved to be a valid and reliable test. Moreover, outlined results pointed out the importance of assessing not only aphasics' language, but also their language-related functional activities.
3. Communication Activities of Daily Living- Second Edition (CADL-2)	Yaari &Almaflehi et al., 2013	16 to 65 years old	100 (50 male and 50 females)	Arabic- Saudi	CADL-2 is a validated tool for the assessment of Arab aphasic patients of both sexes. The results provide quantitative data for the diagnosis of language impairments in Arab aphasic patients.

4.	The adaptation of the Object and Action Naming Battery into Saudi Arabic	Alyahya& Druks, 2016	25 to 70 years old	30 participants: 18 females and 12 males	Arabic- Saudi	The study pictures have a high level of name agreement. The battery also provides normative data for variables such as spoken-word frequency, imageability, age of acquisition, and visual complexity of the verbal labels for the object and action pictures.
5.	Reliability and validity of bedside version of Arabic Diagnostic Aphasia Battery (A-DAB-1) for Lebanese individuals	Al-Thalaya et al., 2017	18 to 75 years old (control group) 22 to 80 years old (target)	Control group (19 males and 41 females) target (15 males and 15 females)	Arabic- Lebanese	The assessment is a valid and reliable clinical tool for screening aphasia at the bedside in Lebanese Arabic-speaking individuals. It demonstrated good content validity.
6.	Developing an Arabic Screening Test for Adult-Onset Chronic Aphasia	Abou-Elsaad et al., 2018	36 to 76 years old (group A) 46 to 77 years old (group B) 40 to 65 years old (control)	(group A) were 12 males and 18 females. (group B) were 21 males and 9 females. (control) 13 males and 17 females	Arabic-Egypt	MASAT demonstrated statistically high reliability and validity.
7.	Content validation of the JAATt: an aphasia assessment designed for Jordanian Arabic speaking population	Alswaiti, 2019	n=70 was between the ages of 18 to 35 (42%), n=68 were between the ages of 36 to 60 (41%), and n=26 were aged above 60 (16%).	n=100 were females (61%) and n=64 were males (39%).	Arabic- Jordanian	The results of this study signal the importance of implementing a scheme of content validation and item development process that paves the way for better test construction practices.
8.	From informal to formal: the preliminary psychometric evaluation of the short aphasia test for Gulf Arabic speakers (SATG)	Altaib et al, 2021	21 to 71 years old (Control) 32 to 68 (PWA)	Control (12 males and 25 females) (16 males and 15 females) PWA	Gulf Arabic	Results indicate that the SATG is a reliable and valid aphasia assessment. Further study is needed to examine the efficacy of the SATG to screen for the presence of aphasia, standardization with a wider range of control participants.
9.	The Moroccan Arabic Bedside Western Aphasia Battery–Revised: Linguistic and Psychometric Properties	ALQuardi et al., 2023	22 to 74 years old (Control). 26 to 58 years old (PWA)	Not mentioned	Arabic- Moroccan	The Bedside MA-WAB-R is the first standardized quick aphasia assessment tool with associated psychometric properties for clinical use with an MA-speaking population, particularly within the 26- to 58-year age range.

Semantic blurring and atrophy progression in individuals with primary progressive aphasia due to FTLD-TDP-C

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Introduction

In semantic-variant Primary Progressive Aphasia (PPA-S), which is often caused by Frontotemporal Lobar Degeneration TDP-43 Type C (FTLD-TDP-C) pathology (Mesulam et al., 2023), naming deficits typically precede word comprehension deficits. The latter usually take the shape of a progressive dissolution ("blurring", Mesulam et al., 2013; Mesulam et al., 2015) of the distinction in meaning between members of the same category (e.g., elephant and horse, hereafter "intra-category blurring") and eventually between different semantic categories (e.g., fruits and vegetables, hereafter "inter-category blurring").

Methods

Twenty-four participants with diagnosis of PPA-S (mean age: 60.8 ± 6.0 , 15 female) and autopsy-confirmed FTLD-TDP-C diagnosis were included in the study. Individuals were asked to name 20 common pictures and perform a written word definition and a word-to-picture matching task on the same items. Participants were assigned to the anomic stage, if they exhibited impairments on naming and not word-to-picture matching tasks. Participants exhibiting impairments on both naming and word-to-picture matching tasks were assigned to the intra-category blurring stage if errors solely consisted of pointing to items within the same semantic category as the target, or to the inter-category blurring stage if errors also included pointing to items from other semantic categories. Individual atrophy maps were generated using Voxel-Based Morphometry (VBM), by comparing gray matter volume maps obtained from each participant to those obtained from a group of healthy age-matched individuals. For each stage, maps obtained from each participant were binarized and overlaid onto each other to identify brain regions in which all participants within a stage had significant atrophy.

Results

In the anomic stage, all participants showed atrophy in the left temporopolar region (area TG), the anterior inferior lateral temporal cortex, the parainsular region and the perirhinal entorhinal cortex, with no evidence of subcortical involvement. In the intra-category blurring stage, in all participants, atrophy further encompassed the most anterior portions of the middle and superior temporal gyri, parts of the parahippocampal and entorhinal cortex, the head of the left hippocampus and the amygdala. In the inter-category blurring stage, atrophy encompassed the entire middle and part of the posterior portion of the left middle temporal gyrus, as well as part of the posterior fusiform gyrus.

Conclusions

The study provides a description of atrophy progression in PPA due to FTLT-TDP-C based on the symptoms. Left Area TG, which is considered a “coordinating hub” (Pascual et al., 2015) in the temporal lobe, appears to be atrophic in the earliest stages of the disease, even before semantic blurring is detected. While disruption of the boundaries between members of the same semantic category appears to be linked to anterior lateral temporal atrophy, involvement of extrastriate regions (i.e., the posterior portion of the fusiform gyrus) becomes apparent only when the boundaries between separate semantic categories begin to dissolve.

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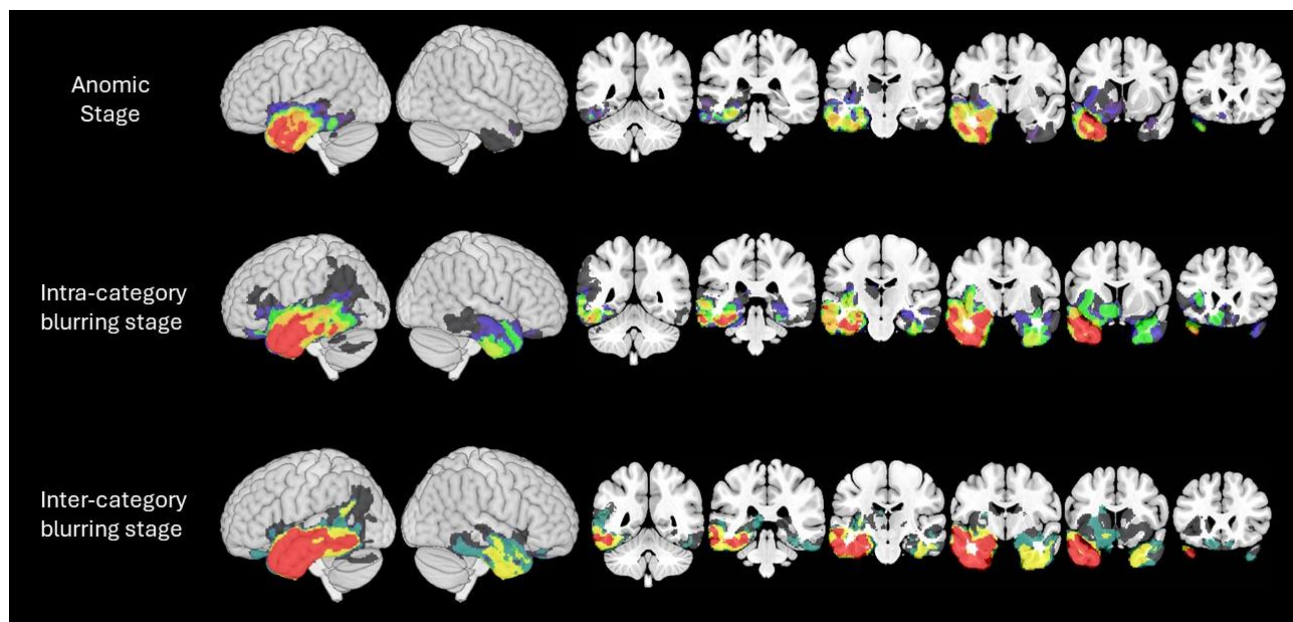


Figure 2. Overlap of atrophy maps in individuals with PPA due to FTLT-TDP-C at the anomic, intra-category blurring, and inter-category blurring stages. Red areas indicate regions where all individuals within the group showed significant atrophy compared to a group of age-matched healthy individuals.

Advanced disconnectomic analyses reveal repetition pathways in a case of mixed transcortical aphasia

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Introduction

Mixed transcortical aphasia (MTA) represents an uncommon aphasic syndrome, characterized by severe deficits in both comprehension and production across oral and written linguistic modalities, in contrast with retention of repetition abilities, often manifesting as echolalia. In the present single case study, we report the case of a woman who presented with MTA symptoms after a left hemisphere ischemic stroke involving perisylvian areas, with substantial preservation of reading abilities. The neural underpinning of her residual repetition and reading capacities is explored here employing recently developed lesion-based approaches for white matter disconnections' probabilistic estimation.

Methods

Language abilities were evaluated with the ENPA battery (Capasso & Miceli, 2001) 6-days post-stroke.

We employed the BCB Toolkit (Foulon et al., 2018) and the Lesion Quantification Toolkit (Griffis et al., 2021) to reveal which white matter tracts are likely related to the reported pattern of language impairment. The first toolkit calculates the probability with which every tract is affected by the lesion, together with the proportion of lesioned volume of each tract. The second one, instead, calculates the percentage of streamlines that are crossed by the lesion, for each white matter bundle.

Results

Our patient presented with poor comprehension and reduced spontaneous production abilities, while repetition was preserved for words, short sentences, and complex number words up to three digits (e.g., three-hundred-forty-six). Notably, her reading abilities remained intact, in contrast with several previously reported MTA cases. An impairment of verbal and nonverbal short-term memory (verbal span – digit span = 2; spatial span – Corsi block-tapping test = 3) was found.

The results from the two disconnectomics estimation toolkits showed a major disconnection of the left arcuate fasciculus, left inferior fronto-occipital fasciculus, left inferior longitudinal fasciculus, left optic radiation, and anterior commissure. Specifically, regarding the arcuate fasciculus, she presented with disconnected long and posterior branches, while the anterior one was preserved.

Conclusions

Following recent results by Forkel and colleagues (2020), the observed impairments of the patient in the repetition of long sentences and of complex numbers exceeding three digits' might be explained based on the disconnection of the arcuate fasciculus' long and posterior branches, related to impaired short-term memory abilities. Conversely, her preserved ability

to repeat and read limited verbal material seems to be supported by the intact anterior branch of the left arcuate fasciculus.

In conclusion, this case report represents the second documented endeavor within the extant literature to provide a comprehensive delineation of white matter tracts' involvement, utilizing state-of-the-art toolkits, in elucidating plausible mechanisms underlying brain disruption in an infrequent aphasia syndrome.

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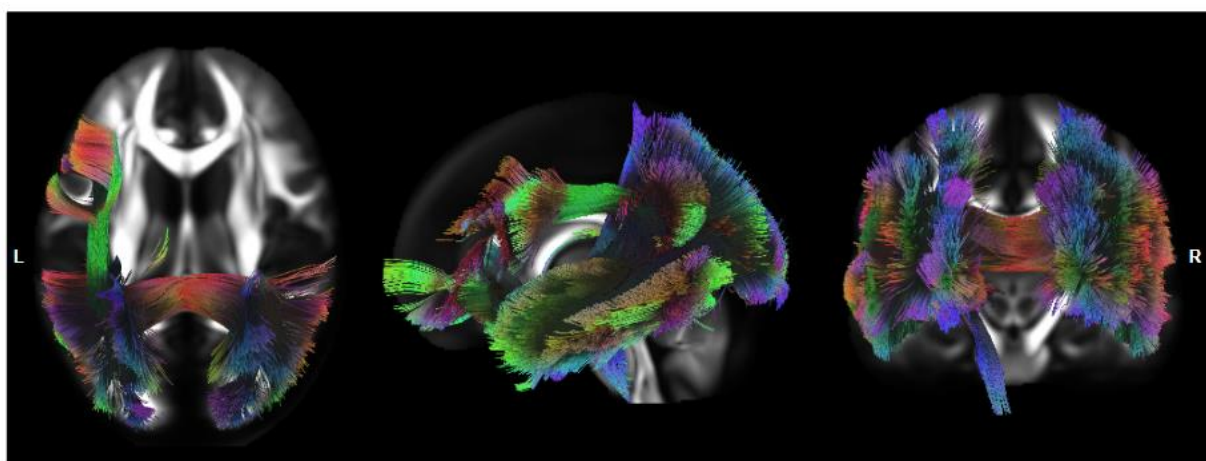


Figure 1. 3D representation of probabilistic white matter tracts' disconnection from the patient's lesion, according to the Lesion Quantification Toolkit (Griffis et al., 2021).

Co-design of a unified international aphasia awareness campaign

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Introduction

Over the last two decades, more than 20 studies across 20 countries have demonstrated that awareness of aphasia is persistently low (Bennington et al. in preparation). This is despite numerous campaigns designed specifically to raise aphasia awareness (Bennington et al. 2024). Simmons-Mackie et al. (2020) identified possible reasons for the lack of campaign success: (1) campaigns have not had a unified and compelling message; (2) campaigns have not been coordinated across organisations and campaigns; (3) campaigns tend to target people who are already aware of aphasia; (4) campaigns are not informed by theory or research; (5) people living with aphasia and health-care professionals are not always included in their design; and (6) the impact of campaigns has not been evaluated. This study aimed to co-design a blueprint for a unified, international aphasia awareness campaign, as well as a strategy to operationalise it, with the ultimate aim of raising awareness of aphasia globally.

Methods

A codesign approach, that sits under the banner of Patient and Public Involvement (PPI), was used (McMenamin et al., 2022). This involved a team of people from different backgrounds and with different expertise, collaborating in the design process. This involvement was reported per the Guidance for Reporting Involvement of Patients and the Public (GRIPP) 2 shortform (Staniszewska et al., 2017). The international co-design team comprised of three people with lived experience of aphasia; three representatives of national and international aphasia, stroke, and neurorehabilitation organisations; and three people with media, marketing, health promotion and implementation science expertise. This team collaborated to co-design the campaign in a series of 18 online iterative workshops. In addition to the expertise of the team, the workshops were informed by two previous studies (Bennington et al. 2024 and Bennington et al. in preparation). The workshop topics included: (1) individual experience, motivations, and preferences for working together; (2) campaign outcome and target audience; (3) campaign message; (4) campaign format and design; (5) campaign call to action and operationalisation; and (6) final review and celebration.

Results

The desired outcome of the campaign was: "One day the world's population will understand aphasia and all people with aphasia will be treated with respect and kindness." This outcome directed all other campaign elements, including the target audience (the general public),

messages (an understanding of what aphasia is/is not and its impact) call/s to action, and a tag line (Recognise Respond Respect). This is illustrated in Figure 1.

A multistep plan for how best to operationalise the campaign was co-developed. This included seeking funding to develop the campaign assets, translating the campaign into other languages and identifying campaign champions in as many countries as possible to help promote, distribute, and evaluate the campaign.

Conclusions

A blueprint for a culturally sensitive, unified, international aphasia awareness campaign, and a plan to operationalise it were co-designed. Future directions include co-development of the campaign and materials, including multi-lingual translation, implementation, and scale up.

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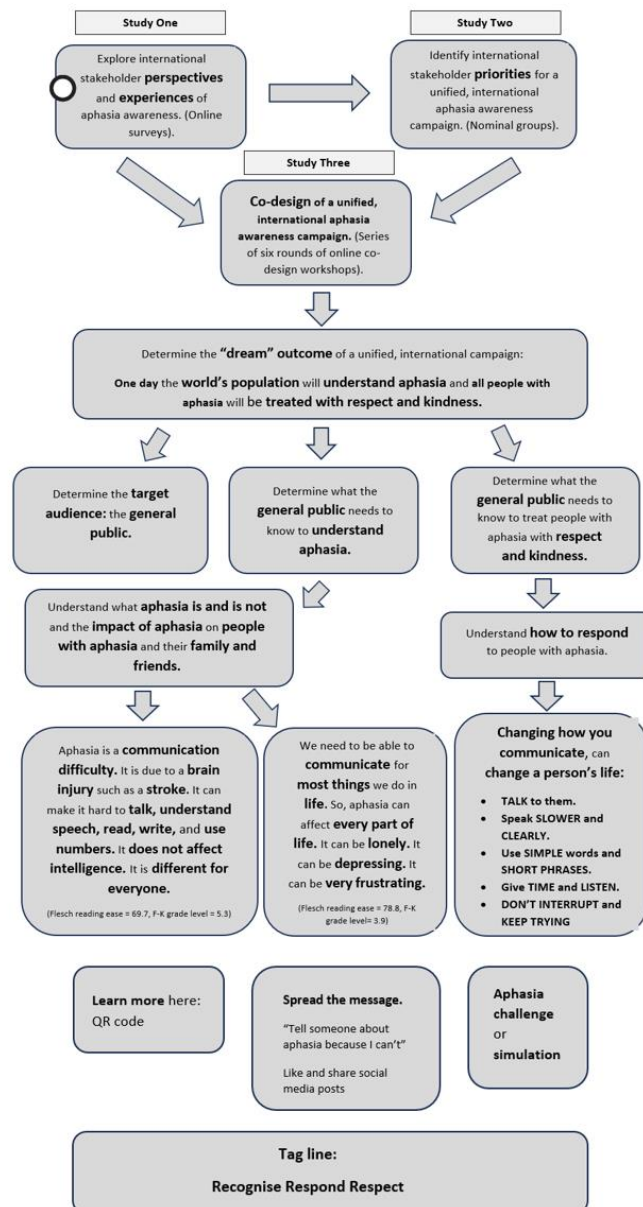


Figure 1. Outcomes of the iterative co-design decision making process.

Basque-Spanish bilingual aphasia: A case-study to inform bilingual language organization

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Introduction

Despite multilingual individuals being the majority of the world's population, a lack of research on this population has resulted in researchers not having an answer to the fundamental question: do bilingual individuals rely on a shared language system or is each language represented independently? Theoretically, it could be that once a neural mechanism is in place for some linguistic process (e.g., plural inflection), that neural population will subserve this operation regardless of the input language, supporting a unified language architecture impervious to the specifics of an individual's language experience. Alternatively, each language may develop its own neural mechanisms based on the formal structure of each language and the age at which it was acquired. Here, we turned to a 23-year-old Basque-Spanish early balanced bilingual suffering from post-stroke anomic aphasia (PwA) to tease apart these two possibilities.

Methods

We developed a naming-from-definition task, where the PwA heard a definition and had to guess the corresponding word. Importantly, target words (180 total; 60 cognates) were orthogonally manipulated along a purely lexical dimension (Frequency) and a semantic dimension (Concreteness). We matched these values as well as word and definition length across Basque and Spanish. If bilinguals have a universal, shared language system for both of their languages, we would expect parallel and symmetric decline in linguistic functions across both languages (main effects). If bilinguals' languages are distinctly represented, we would expect differential patterns of loss attending to frequency and concreteness across languages (interactions). A control group of 26 early balanced-bilinguals completed the task to differentiate language loss in PwA from typical lexical retrieval in healthy, age-matched individuals.

Results

Data were analyzed with GLME models (fixed-effects: Language, Frequency, Concreteness, Cognate status, Length, and Group; random-effects: Item). The PwA made significantly more errors than the control group ($p < .001$), and both Concreteness ($p < .001$) and Frequency ($p < .032$) influenced lexical retrieval. Cognate status was not significant. Importantly, there was no interaction between Concreteness and Group, showing that lower Concreteness makes lexical retrieval harder, but it isn't particularly taxing in aphasia. In contrast, a reliable ($p < .001$) interaction between Frequency and Group showed that lower frequency items were exponentially harder to name for the PwA than for our control group. Crucially for our purposes, there were no interactions between Language and either of the lexical variables or Group, showing no evidence for distinct language loss across languages.

Conclusions

The PwA exhibited remarkably similar impairment profiles in Basque and Spanish, suggesting that the underlying deficits in lexical-semantic access are common to both languages. The fact that i) the PwA's linguistic impairments are not confined to one language, and ii) that there is a shared disruption to the underlying cognitive-linguistic mechanisms has theoretical implications: these results point towards a unified language architecture in bilingual individuals that contains elements and structures of both languages and where the same neural population will subserve a linguistic operation regardless of the input language.

Acknowledgments

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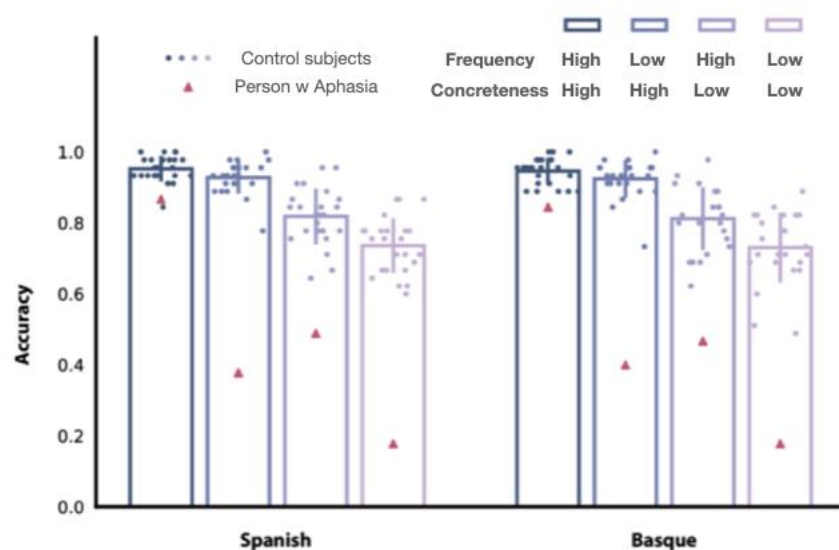


Figure 3. Barplot showing accuracy rates for person with aphasia and healthy control group as a function of language, frequency and concreteness.

Aphasia-friendly communities

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Introduction

Aphasia Friendly Canada created an educational training program called the Aphasia Friendly Business Campaign (AFBC) to address the lack of public knowledge of aphasia. Our initial work demonstrated that in-person delivery of the AFBC improved trainee's aphasia knowledge and perceived self-efficacy to use supportive communicative techniques; Borsatto et al., 2021). Similarly, when translated to an online platform, the AFBC training content significantly improved trainee's ability to communicate with persons with aphasia and their confidence in doing so (Borsatto, 2023). Across both modalities, AFBC training content was perceived as relevant and comprehensive, and trainees reported that they remembered and translated communication skills into their daily lives. Armed with this knowledge our current work expands this successful program across different sites in a way that we hope will maximize our reach. This poster will describe those efforts and provide demonstrations of our program in different languages.

Methods

The online AFBC training is accessible to interested individuals through the project website (aphasiafriendlycanada.ca). Previous recruitment has occurred through word of mouth, community outreach, and promotion through media and social media platforms. However, to reach a greater audience, we have recently partnered with aphasia researchers and advocates in Switzerland, Japan, and at the University of Alberta, Canada (e.g., Kim et al., 2023) among other places. We are currently targeting communities in these places to encourage all client facing businesses to become 'aphasia friendly' through our short online course. To assist in this, our AFBC training content has been translated into other languages (Urdu, Japanese, German, French, Italian, and Arabic). Our goal is to establish aphasia friendly communities in countries around the globe within the next five years. We will describe how we select these communities and will provide examples of how this targeted approach has been used in a Canadian city to successfully recruit businesses and individual learners.

Results

As of August 2023, 258 individuals had participated in the online AFBC training. Most participants were located in Ontario, Canada, but geographical reach extended across other provinces in Canada, the USA, and internationally. Since AFC's new partnerships, many more participants have taken our English training. These participants came from many of our targeted countries/cities and we anticipate much greater participation when our translated versions are released and when the community targeting is fully operational. The Town of Amherstburg, Ontario has recently signed up to be our very first Aphasia Friendly Community and we will describe the challenges and successes of this endeavor.

Conclusions

We know that the AFBC online training program is a cost-effective (free), time-efficient (20-30 minutes), and efficacious training program that translates to real-world change. Program

expansion started when AFBC training was transferred to an online platform and has continued to grow through new international partnerships. Translation to multiple languages and introduction to multiple targeted cities will help us make a real difference in the lives of people with aphasia.

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Discourse planning and production in aphasia: Evidence from pauses, clauses, and executive function measures

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Introduction

We know very little (but cf. Angelopoulou et al., 2024; Peach, 2013) about real-time discourse planning and production in aphasia with possible attributions to the linguistic and/or executive function (EF) processes. We performed detailed pause and clause analyses to determine whether duration of pauses is predicted by measures of EF, clause type, and location (before- or within-clauses).

Methods

Sixteen people with chronic aphasia (mean age=62.5; mean education level=13.8 years; 9 female; 7 male) with a wide range of severity participated.

Spoken Cinderella narratives were analyzed using Praat (Boersma & Weenink, 2023) following temporal segmentation and coding of: a) Speech segments, silent pauses [≥ 150 ms], filled pauses, other audible disfluencies, and mazes; b) clauses as independent, dependent, conjoined or minor. Minor clauses were either semantically and/or grammatically erroneous. Pauses (silent and filled) were coded as occurring either before- or within-clauses (cf. Peach, 2013).

The EF measures were: Word fluency (combined number of correct words in timed semantic and letter fluency), Trail Making Test (ratio of parts A and B), Stroop (ratio of congruent and incongruent), and working memory (combined digit forward and backward).

Analyses comprised four linear mixed-effects models (one per EF measure).

Results

Table 1 summarizes the results of the analyses. Main effects of EF measures were not evident. Significant three-way interactions between pause location, clause type and EF measures were evident in the word fluency and Trail models (figure 1). Word fluency interacted with pause location and clause type. Participants with poorer word fluency produced longer pauses for minor clauses than independent or dependent clauses, regardless of pause location. Participants with better word fluency showed similar pause durations *within* clauses of all types, but significantly longer pauses *before* minor clauses (i.e., clauses that would turn out erroneous).

The Trail measure also interacted with pause location and clause type. Participants with poorer shifting ability produced longer pauses *within* rather than *before* minor clauses. Pause behavior in minor clauses was not affected in participants with better Trail scores. In independent and dependent clauses, poorer Trail scores affected pause duration *within* clauses such that pause durations increased in independent clauses and slightly decreased in dependent clauses. Those with better Trail performance produced shorter pauses *within* rather than *before* independent clauses.

Stroop interacted only with within-clause pause duration. Working memory did not interact with any other variables.

Conclusions

Apart from working memory, the other three EF measures appeared to somehow influence clause planning, especially for erroneous (i.e., minor) within-clause pauses. Individual differences in word fluency and Trail tasks discerned different profiles of discourse planning behavior. Both measures relate to shifting, a subcomponent of the complex EF construct responsible for alternating between multiple cognitive operations (Friedman & Miyake, 2017). Our findings suggest that individual differences in these measures appear to determine planning behavior as indicated by before- and within-clause pauses differently in higher and lower EF individuals. Only better word fluency related to a reduction in within-clause pauses in minor clauses as compared to before-clause pauses. Better Trail performance did not.

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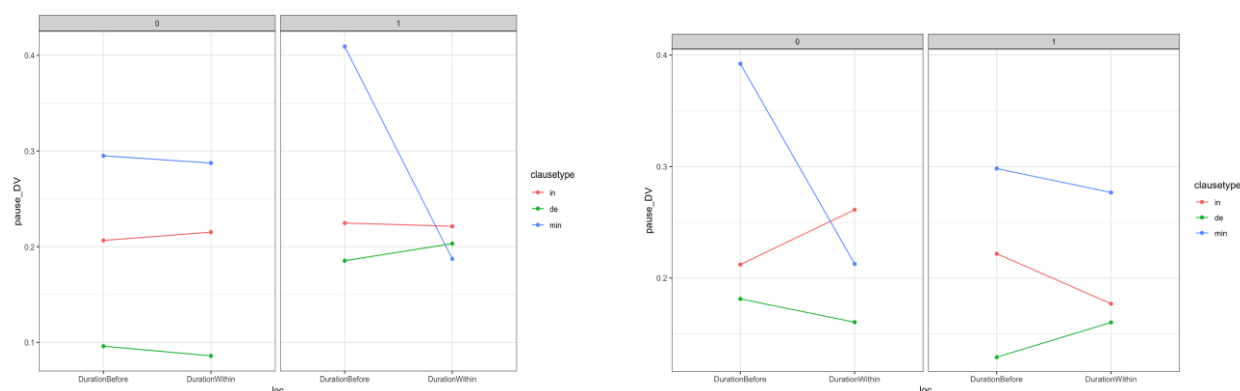


Figure 4. Word fluency (left) and trail (right) three-way interactions between high and low ef participants

Table 1. Summary of the four statistical models

Predictors	Statistical Models			
	Word fluency	Trail	Stroop	Working memory
<i>(Intercepts)</i>	<.001	<.001	<.001	<.001
pause location [within]	<.001	-	-	-
clause type [dep]	-	-	-	<.05
clause type [min]	-	<.001	<.001	<.001
EF	-	-	-	-
location [within] × clause type [dep]	-	-	-	-
location [within] × clause type [min]	<.05	<.001	<.001	<.001
location [within] × EF	-	<.05	<.05	-
clause type [dep] × EF	-	-	-	-
clause type [min] × EF	<.001	-	-	-
pause location [within] × clause type [dep] × EF	-	-	-	-
pause location [within] × clause type [min] × EF	<.001	<.05	-	-

Note. dep = dependent clause; min = minor clause; EF = executive function measures;
 - = non-significant (p >.05) results

The incidence of dysphagia in aphasic patients in stroke unit in Albania

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Introduction

Stroke is a major cause of serious disabilities in adults. While communication and deglutition deficits post stroke are prevalent, early detection of them is important during acute and sub-acute phase. (1) In Albania the situation is similar to other countries, but there are limited studies to this field. Aphasia and dysphagia are common in stroke unit (2) and we conducted a study to see the incidence of dysphagia in aphasic patients.

Methods

We collected data from 05.04.2024-24.05.2024 in the stroke unit in University Hospital Center "Mother Teresa", Neurology Department from 27 patients who met our criteria. We included only patients who had ischemic or hemorrhagic stroke, were over 50 years old and had any form of aphasia. We examined the incidence of dysphagia in aphasic patients following a stroke.

Results

Dysphagia was present in 51,85% of aphasic patients (14/27 patients). The average age of our patients was 75,59 years old. 51,8 % of our patients were female and 48,2 % were male. In our study only 1 patient was of hemorrhagic nature (sinister part of the brain), the other 26 were of ischemic nature (8 dexter and 18 sinister part of the brain).

Conclusions

The high incidence of more than 50% of dysphagia symptoms in aphasic post- stroke patients provides clear motivation for speech and language pathology intervention (3)(4) in the early phase of post stroke rehabilitation not only for communication, but also for swallowing and deglutition problems. Early rehabilitation improves the quality of life of post-stroke patients.

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Cued and memory-based language switching in bilingual patients with PPA

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Introduction

Lexical retrieval deficits are central to the language impairments observed in patients with Primary Progressive Aphasia (PPA), notably in the logopenic variant (lvPPA) and semantic variant (svPPA) (Migliaccio et al., 2016). However, there is limited understanding of lexical deficits within the context of dual-language naming in bilingual patients with PPA (Grasso et al., 2023). In this study, we tested two versions of a naming task that assess cued and memory-based processes of language switching (LS).

Methods

Two versions of LS were administered to a cohort of 25 healthy bilinguals (age range: 20-45), with a preliminary assessment conducted on 3 patients diagnosed with lvPPA and 3 with svPPA. All participants were Catalan-Spanish bilinguals who acquired both languages simultaneously and exhibited high proficiency in both Catalan and Spanish.

In the cued LS, participants were required to name pictures, alternating languages every three trials in response to a cue. In the memory-based LS, participants were instructed to switch languages every three trials without the aid of a language cue. Each task version includes 28 switch trials and 96 repeat trials, equally distributed between the two languages.

Results

In healthy individuals, results from both versions of the task revealed that switch trials were named slower than repeat trials ($p < .05$). However, the switching cost in the memory-based LS (73 ms) was significantly larger than in the cued LS (38 ms, $p < .05$) (see Figure 1). Naming accuracy was not significantly influenced by the type of trial.

Overall, lvPPA patients tended to exhibit larger switch costs (204 ms) compared to svPPA patients (99 ms), along with more errors. Additionally, two out of three patients with lvPPA experienced greater difficulty in switching between languages, particularly in the memory-based LS for accuracy. In svPPA patients, the type of task did not significantly affect naming accuracy (see Table 1).

Conclusions

The two versions of the LS have demonstrated the ability to differentiate between cued and memory-based processes of naming in dual-language conditions. In particular, in identifying

memory-based internal monitoring applied to lexical retrieval for efficient switching to a new language (Keisel et al., 2010).

Additionally, preliminary results from patients suggest that lvPPA patients are more affected by switching, particularly in memory-based LS. This finding can be interpreted as the result of more pronounced working memory deficits in lvPPA compared to other variants, as shown in previous studies with monolinguals (Eikelboom et al., 2018).

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Acknowledgments

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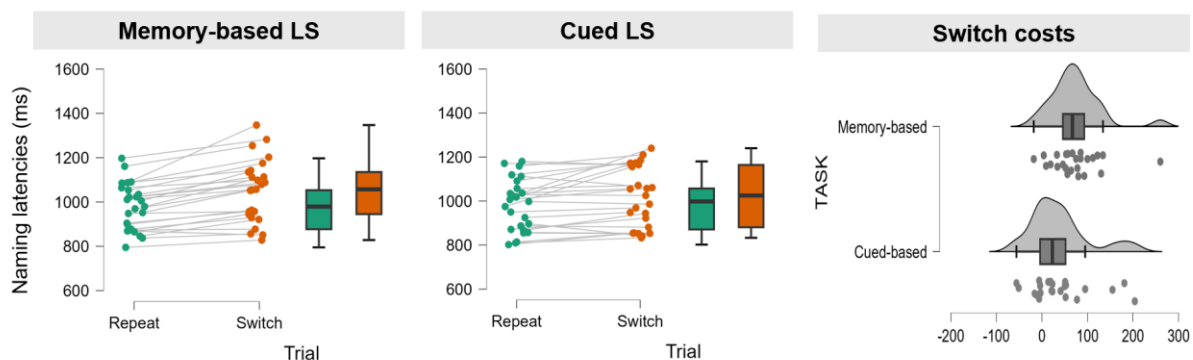


Figure 1. Naming latencies in healthy individuals across cued and memory-based language switching (LS).

Table 1. Accuracy and naming latencies in patients with PPA across cued and memory-based language switching (LS).

Patient ID	Accuracy		Naming latencies (ms)		Switch cost
	Repeat	Switch	Repeat	Switch	
Cued LS					
svPPA01	88.8	89.2	1228	1380	152
svPPA02	95.7	100	1115	1281	166
svPPA03	84.7	85.7	1172	1322	150
Means	86.4	91.6			156
lvPPA01	78.5	75.0	1268	1433	165
lvPPA02	44.8	35.7	1369	1866	497
lvPPA03	78.5	77.5	1448	1554	106
Means	67.3	62.7			256
Memory-based LS					
svPPA01	87.7	89.2	1185	1237	52
svPPA02	97.9	100	1100	1267	167
svPPA03	81.3	71.4	1198	1104	-94
Means	88.9	86.8			42
lvPPA01	91.8	92.6	1220	1242	22
lvPPA02	52.1	21.4	1508	1709	201
lvPPA03	81.7	42.8	1196	1432	236
Means	75.2	52.3			153

Naturalistic language production is associated with distinct word production errors in acute post-stroke aphasia

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Introduction

Although error analysis of responses produced on word production tests is a useful way of isolating speech-language processing impairments in aphasia (Dell et al., 1997), these tests do not necessarily reflect everyday language use (Fromm et al., 2017). Naturalistic language production (connected speech) is a closer approximation, presumably because it reflects the integration of all speech-language processes (Prins & Bastiaanse, 2004); however, its relationship to word-level errors (and thereby underlying processes) remains largely unexplored. The present study aimed to quantify associations between naturalistic language production and word production errors in acute post-stroke aphasia, affording a unique window into behavioral performance prior to neuroplastic reorganization (Kümmerer et al., 2013).

Methods

Leveraging a large longitudinal study (Wilson et al., 2023), we extracted audiovisual recordings from 118 participants with aphasia following left-hemisphere stroke who were evaluated using the Quick Aphasia Battery (QAB; Wilson et al., 2018) at 1–5 days post-onset (Table 1). Incorrect responses on word-level items of the QAB's Picture Naming, Repetition, and Reading Aloud subtests ($n=14$) were error-coded into seven categories (Figure 1A): Lexical, Sublexical, Omissive, Apraxic, Corrective, Delayed, and Morphological. Naturalistic language samples were elicited using semi-structured interview as part of the QAB and scored using Auditory-Perceptual Rating of Connected Speech in Aphasia (APROCSA; Casilio et al., 2019), a validated approach that yields scores on four dimensions (Casilio et al., 2023): Paraphasia (mis-selection of words/sounds), Logopenia (paucity of words), Agrammatism (morphosyntactic omissions), and Motor speech (impaired speech-motor programming/execution). Scoring was completed by trained research staff. Counts from the seven error categories, offset by the total items observed by each participant, were modeled as a function of the four APROCSA dimension scores using negative binomial regression.

Results

Visual inspection of rootogram plots (Figure 1B) revealed no systematic under- or over-prediction. The seven error categories were associated with distinct APROCSA dimensions (Figure 1C). Lexical errors were associated exclusively with Logopenia ($p=.027$). Sublexical errors were associated exclusively with Paraphasia ($p<.001$). Omissive errors were associated with both Paraphasia ($p=.004$) and Logopenia ($p=.039$). Corrective errors were associated with both Paraphasia ($p=.002$) and Motor speech ($p=.009$). The remaining three categories were not significantly associated with any APROCSA dimension; however, there

was a trend toward significance for associations between Apraxic errors and Motor speech ($p=.115$) and Morphological errors and Agrammatism ($p=.116$).

Conclusions

Multiple word production errors were scalable to naturalistic language production, aligning with one prior study (Stark et al., 2017). Lexical and Sublexical errors dissociated the Logopenia and Paraphasia dimensions, suggesting each may reflect differing semantic and phonological processing demands (Dell et al., 1997; Stark et al., 2017). Omissive errors, which may reflect a more general processing bottleneck (Dell et al., 2004), were associated with both dimensions. Corrective errors were associated with Paraphasia and Motor speech, dimensions characterized by comparable behaviors (e.g., false starts) or comorbid disorders (e.g., apraxia of speech). Despite promising trends for Apraxic and Morphological errors, these and Delayed errors ultimately were not scalable, potentially reflecting an inherent limit to word production tests in drawing inferences about naturalistic language production.

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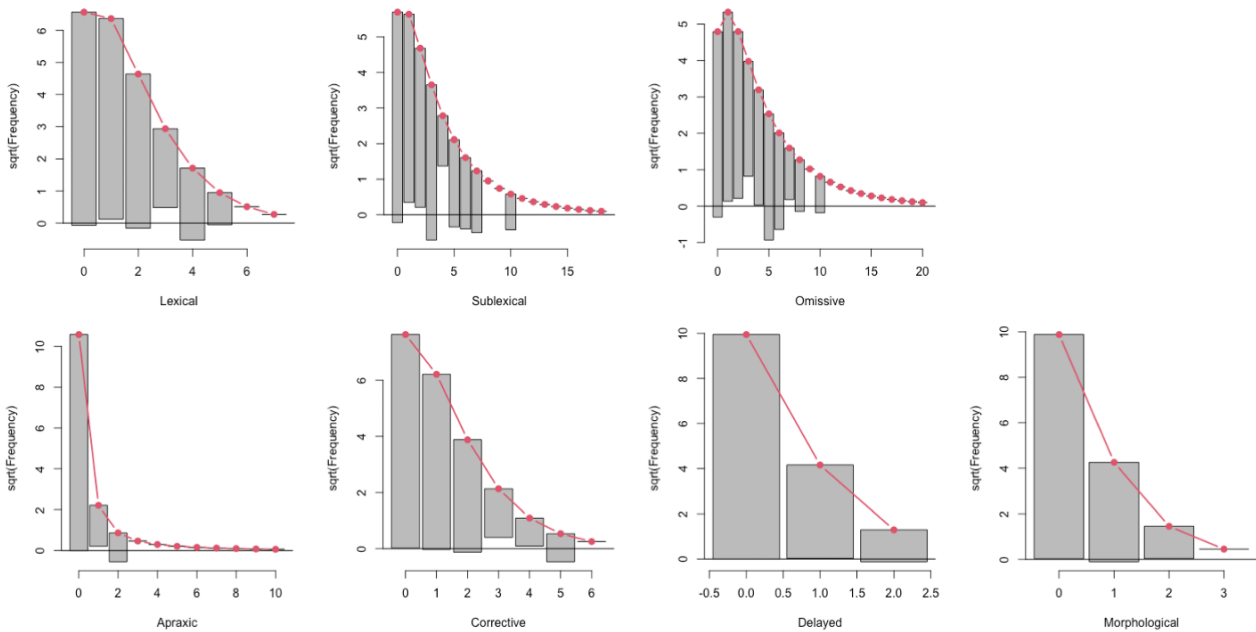
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A

LEXICAL semantically related and unrelated errors semantically related circumlocutions perseverations	OMISSIVE no response or after >6 sec semantically unrelated circumlocutions phonological fragments or mumbling	CORRECTIVE self-corrected response or item that is repeated
SUBLEXICAL phonemic errors neologisms	APRAXIC distortions or distorted substitutions due to apraxia of speech	DELAYED correct response in >3 sec but <6 sec
		MORPHOLOGICAL alternation of a bound morpheme

B



C

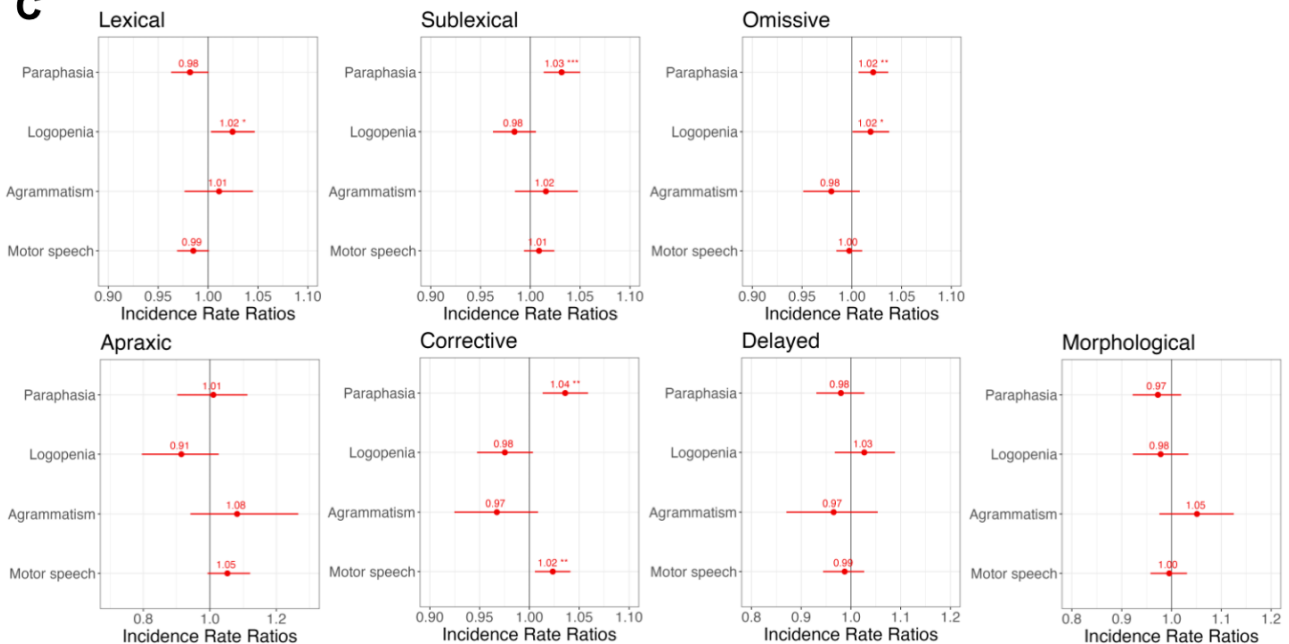


Figure 5. Methods and key results. (a) The response types constituting the seven word production error categories from the qab. (b) Rootgrams of the observed and predicted counts of word production errors across the seven categories. The square-root frequency (y axis) is plotted as a function of the binned untransformed counts. The red line represents the predicted counts while the gray bars show the observed counts. Bars above zero on the y axis represent over-prediction while bars below zero represent under-prediction. (c) Forest

plots of the exponentiated beta coefficients (incident rate ratios) from the negative binomial models. The red circles depict the exponentiated beta coefficient, which is printed above each, and the lines show the 95% confidence interval. The black vertical bar reflects the point of statistical significance for the exponentiated coefficients. These coefficients can be interpreted as follows: for every unit increase in a given aprocsa dimension score, the rate of word production errors within a given category is expected to increase by a factor of that coefficient while holding the remaining aprocsa dimension scores constant. *=significant at $p<.05$; **=significant at $p<.01$; ***=significant at $p<.001$

Table 1. Demographic and clinical characteristics of the participant sample

Characteristic	Value
Age	64.1 $\pm$ 13.4 (21–87) years
Sex	72 Male; 46 Female
Handedness	105 Right; 11 Left; 2 Ambidextrous
Race	97 White; 20 Black; 1 Native Hawaiian
Education	12.9 $\pm$ 3 (3–20) years
TOAST stroke type	
Large-artery atherosclerosis	21 (18%)
Cardioembolism	35 (30%)
Small-vessel occlusion	4 (3%)
Undetermined etiology	36 (30%)
Hemorrhage	22 (19%)
Hemorrhagic transformation	17 (14%)
Lesion extent	34.3 $\pm$ 38.2 (0.6–261) cm ³
Atrial fibrillation	26 (22%)
Coronary artery disease	25 (21%)
Cardiac arrhythmia	15 (13%)
Diabetes Mellitus	34 (29%)
Hyperlipidemia	75 (64%)
Hypertension	98 (83%)
Myocardial infarction	11 (9%)
NIHSS on admission (0–42) ^a	7.5 $\pm$ 6.2 (0–25)
Days post-stroke on evaluation	2.9 $\pm$ 1.3 (1–6)
Apraxia of speech	12 (10%)
Dysarthria	30 (25%)
QAB overall (0–10) ^a	6.72 $\pm$ 1.68 (2.42–8.87)
QAB error category counts (0–14) ^b	
Lexical	1.08 $\pm$ 1.14 (0–5)
Sublexical	1.85 $\pm$ 1.96 (0–10)
Omissive	2.38 $\pm$ 2.21 (0–10)
Apraxic	0.07 $\pm$ 0.31 (0–2)
Corrective	0.75 $\pm$ 0.94 (0–5)
Delayed	0.18 $\pm$ 0.43 (0–2)
Morphological	0.19 $\pm$ 0.44 (0–2)
APROCSA dimension scores (0–100) ^a	
Paraphasia	22.03 $\pm$ 15.13 (0–61.11)
Logopenia	33.13 $\pm$ 18.10 (6.25–81.25)
Agrammatism	13.56 $\pm$ 9.99 (0–50)
Motor speech	22.16 $\pm$ 17.76 (0–80)

^a Higher scores denote greater impairment.

^b 13 participants were missing 1–4 responses each across the 14 word-level items, yielding a total of 23 missing responses out of 1652 total responses (~1% of the data). Missing responses were accounted for in the offset covariate of the negative binomial models.

A scoping review of phonological treatments for anomia

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Introduction

Anomia is a pervasive symptom of aphasia. Treatment for anomia is efficacious (Brady et al., 2016) and commonly administered by speech-language pathologists (Raymer & Roitsch, 2023). However, treatment selection and critical ingredients necessary for therapeutic success at both individual and group levels have not been fully specified (Boyle et al., 2022). Successful word retrieval requires multiple levels of linguistic processing, including semantic and phonological processing (Dell et al., 1997; Rapp & Goldrick, 2000). Anomia may arise due to breakdown in semantic processing, phonological processing, or both. Thus, treatment for anomia may require identifying where the breakdown in word retrieval is located, allowing for targeted improvement of those breakdowns (Laine & Martin, 2024; Nickels & Howard, 1995; cf. Kristinsson et al., 2021).

The purpose of this scoping review was to identify what anomia treatments are available for people with aphasia that target phonological processing, and the nature of these treatments. The focus on phonological processing is driven, in part, by recognition that most people with aphasia have some degree of phonological processing impairment (Kohn, 1988; Milberg et al., 1988), due to the frequent overlap of brain regions critical for phonological processing and the location of stroke (Vigneau et al., 2006).

Methods

A scoping review was conducted following established guidelines. Literature search by a librarian of EMBASE, PubMed, Scopus, PsycINFO, Web of Science, and CINAHL resulted in 2,566 articles for review. Two phases of review occurred to determine study inclusion (see Table 1), first by reviewing titles and abstracts and second by reviewing the full text. For all remaining papers after review, we extracted study information with consensus.

Results

There were 122 papers identified for extraction. We identified several phonological-focused anomia treatments. There are protocolized treatments, like Phonological Components Analysis (Leonard et al., 2008) and Phonomotor Treatment (Kendall et al., 2008), as well as several variants of phonologically-focused cueing hierarchies (Wambaugh et al., 2001). Additional approaches incorporated phonological treatment in conjunction with orthographic treatment (Beeson et al., 2019). We will discuss the ingredients of each treatment approach. Across the phonologically-focused anomia treatments, results indicated improvement of word finding for trained words (e.g., through confrontation naming), demonstrating treatment acquisition and efficacy of treatment, for at least some patients. Generalization of phonologically-focused anomia treatment to untrained words and untrained contexts is more heterogeneous across treatment approaches and across patients within a treatment approach. Comparison of phonologically-focused treatments to semantically-focused treatments also demonstrated individual differences in responsiveness to type of treatment

(Kristinsson et al., 2021). We will discuss characteristics of patients who benefited (and who did not benefit) from each treatment approach.

Conclusions

This scoping review identified a variety of anomia treatment approaches that target improvement of phonological processing. These treatment studies demonstrate the efficacy of using a phonological-focused anomia treatment. While some approaches are more established than others, there is certainly a need for continued investigation into optimal treatment design for phonologically-focused treatment for anomia and identifying individual differences in phonologically-focused anomia treatment outcomes (Kristinsson et al., 2021; Nickels, 2002).

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Table 1. Study eligibility criteria.

	Inclusion	Exclusion
Study Characteristic		• Review papers • Conference abstracts • Articles not written in English
Population	• Aphasia • Adults (18+ years of age)	• Aphasia due to progressive condition • Pediatrics
Intervention	• Phonological-based treatment for anomia	• No intervention
Comparator/Context	• Any, including no treatment, usual care, and other intervention approaches	
Outcome	• Changes in production of trained items • Any other outcomes	• No specific outcomes related to phonological-based treatment (e.g., when phonological cues are used in a comprehensive approach, but not outcomes reported specifically for the effect of phonological cues)

Modelling lexical networks in discourse production by Mandarin aphasia patients

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Introduction

Language is a system of interdependent terms in which the value of each term results solely from the simultaneous presence of the others (Saussure, 1959). Modelling discourse production data as a complex network provides a powerful means to quantify the structure of lexical semantic and syntactic representations and their interconnections (Castro et al., 2020; Liu et al., 2021). It remains unresolved whether/how networks constructed with aphasia discourse data may differ from those of healthy controls.

Methods

Transcripts of 15 Mandarin aphasia patients and 15 age-and-education-matched controls in three tasks (e.g., picture description, procedural description and story telling) from the AphasiaBank (Lai et al., 2019; MacWhinney et al., 2011) were tokenized into words and used as nodes in the network (see Figure 1). To establish the connections between words, we utilized a pre-trained model *fasttext* trained on large-scale data (Grave et al., 2018) to represent each word in a 300-dimension space and calculated the cosine similarity between two words as vertices. We calculated macro-level (e.g., network size, density, diameter, Average Shortest Path Length, or ASPL, global clustering coefficient, and Small-Worldness Index, or SWI), meso-level (edge-betweenness modularity) and micro-level (degrees) features for each group and each task (see Table 1).

Results

Relative to healthy controls, at the macro level, networks of aphasia patients were smaller in size ($t = 3.84$, $p = 0.06$) and in SWI ($t = 9.71$, $p = 0.01$) but higher in network density ($t = -5.63$, $p = 0.03$), suggesting limited vocabulary range (small vocabulary size), overuse of semantically similar lexical resources (high density) and potentially less efficiency in organizing discourse (small SWI).

In addition, networks of aphasia discourse were also lower in modularity than those of controls at the meso level, suggesting lack of community structures in their discourse at the lexical level. At the micro level, content word nodes with high degrees (i.e., central nodes) in the networks of aphasia patients were more general words compared with those of controls (e.g., 炒炒 “fry” versus 煸炒 “stir-fry”), suggesting lower lexical richness. Nevertheless, aphasia networks still retain complex network characteristics typical of the human language system as indicated by systematic and efficient associations among lexical nodes (SWI larger than one), stronger community structure than random networks, and central nodes with function words similar to control-group networks. This reflects the resilience of the human language system in maintaining stability when subjected to disruptions caused by aphasia.

Conclusions

In conclusion, our study demonstrates the utility of modeling discourse production data as a complex network for examining differences between aphasia patients and healthy controls. Overall, our findings contribute to a deeper understanding of aphasia discourse production,

shedding light on the underlying mechanisms of language impairment, and may inform the development of targeted interventions aimed at improving communication and language rehabilitation strategies for individuals with aphasia.

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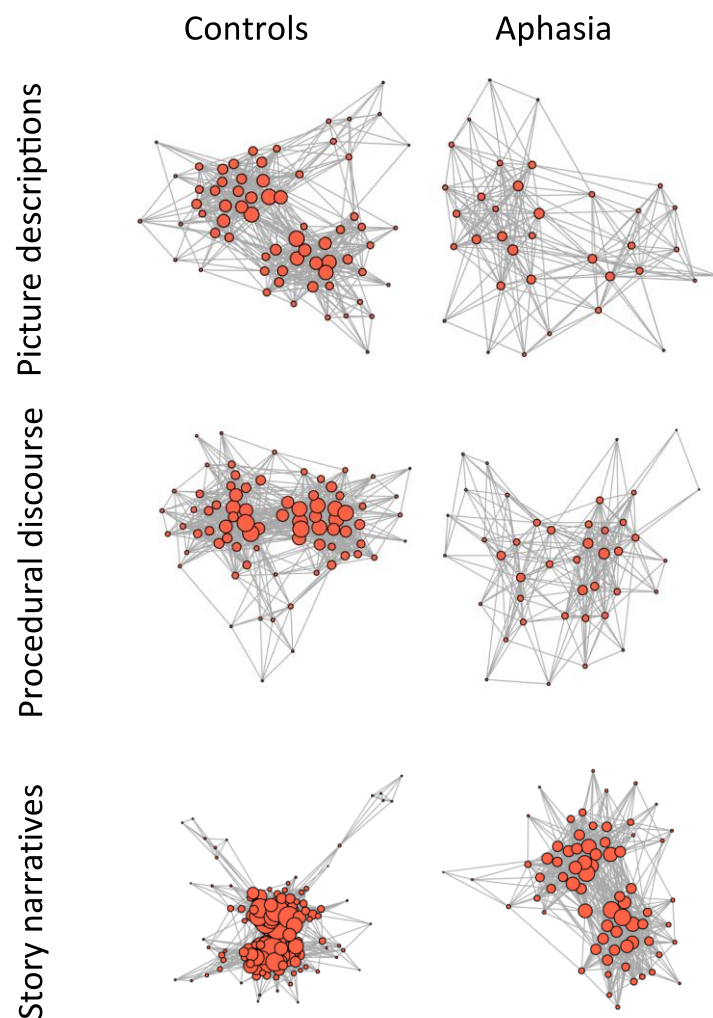


Figure 6. Networks of discourse productions by Mandarin aphasia patients and healthy controls.

Table 1 Network measures of discourse produced by Mandarin aphasia patients and healthy controls. ASPL= Average Shortest Path Length; SWI= Small-Worldness Index

Task	Groups	Size	ASPL	Density	Diameter	Clustering	SWI
Procedural discourse	Control	112	2.167	0.131	6	0.582	4.061
	Aphasia	60	2.145	0.166	5	0.585	3.065
Picture description	Control	107	2.169	0.114	5	0.598	5.653
	Aphasia	63	2.239	0.136	5	0.594	4.862
Story narratives	Control	208	2.758	0.094	9	0.613	5.042
	Aphasia	110	2.305	0.136	6	0.686	4.334

Lexical retrieval therapy for native Cantonese speakers with semantic-variant primary progressive aphasia

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Introduction

Background. Primary Progressive Aphasia (PPA) is a progressive neurodegenerative disorder that is revealed predominantly with speech and language impairment, while other mental functions remain preserved (Dial et al., 2019; Gorno-Tempini et al., 2011). SvPPA is one of the variances in PPA. SvPPA is associated with impairments in object recognition and lexical retrieval. Those afflicted with svPPA often produce peripheral or imprecise utterances, characteristically omitting nouns, indicative of a contracted scope of expressive lexicon (Hodges & Patterson, 2007). Researches support that the application of Lexical Retrieval therapy (LRT) is the most extensively documented approach among treatments in PPA (Carthery-Goulart et al., 2013; Jokel et al., 2014). LRT aims to improve word retrieval through techniques such as phonological and semantic cueing (Gorno-Tempini et al., 2004; Gorno-Tempini et al., 2011; Jokel et al., 2014). While LRT has shown to be effective for patients with PPA, researches has primarily focused on English speakers and has not explored its impact on Cantonese speakers, taking into account the differences in orthographic and phonemic systems between two languages.

Purpose. The study examines LRT, specifically tailored with adjusted cueing techniques that suit the Cantonese language system, benefits patients with svPPA who are native Cantonese speakers of Cantonese. It investigated the impact of amended syllabic and orthographic cueing on the Cantonese-speaking population.

Methods

This multiple baseline design investigated the effects of self-cueing lexical retrieval therapy on naming 180 daily object items for two individuals with svPPA. This intervention combined semantic, syllabic, and orthographic levels of language production and drew on autobiographical memory. Changes in accuracy in retrieving treated and untreated items (pre-treatment, post-treatment, maintenance) were determined using one-way, within-subjects ANOVA with repeated measures with follow-up Mauchly's test of Sphericity and post-hoc analysis.

Results

All participants showed significant improvement and generalisation after LRT in naming treated items with small to medium effect sizes (see table 1 and figure 1 below).

Conclusions

This study proves that patients with svPPA showed improved lexical retrieval following tailored Cantonese specific LRT. The finding suggests generalization and eliminated daily life communication barrier with communication partners.

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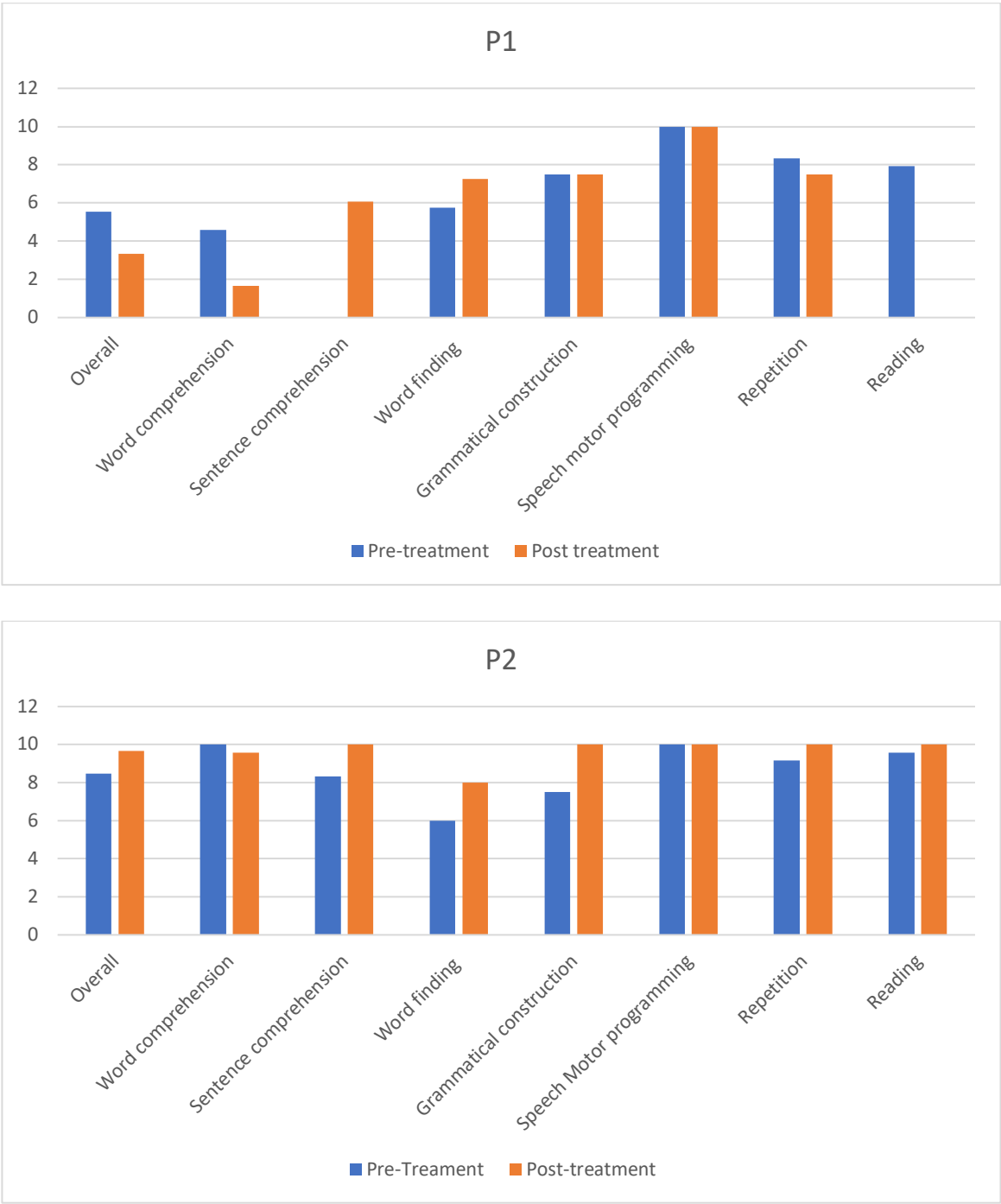
Acknowledgments

The authors would like to thank all the participants and their families.

Table 1. Backgrounds of Participants

Participants	P1	P2
Age; Gender	55;M	77;M
Diagnose; Year	- Younger Onset Dementia - ALS, FTD - svPPA; 2012	- svPPA; 2018
Education	Tertiary education	Tertiary education
Language spoken	Cantonese, English	Cantonese, English

Figure 1: Baseline changes of Par4cipant (P1) and Par4cipant (P2) a; er LRT



The establishment of Mandarin Chinese core-lexicon checklists during picture-sequence description and storytelling tasks

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Introduction

Discourse analysis has gained considerable attention over the last 20 years. There have been a variety of methods to analyze the discourse performance in typical and clinical populations. Among them, analysis of the typical vocabulary used during narrative tasks could provide a transcription-less and time-efficient method to overcome some time limitations in clinical settings (MacWhinney et al., 2010). Dalton and Richardson (2015) have used the core lexicon analysis to establish a list for a picture-sequence description from a sample of control participants and compared the performance between individuals with aphasia (IWA) and control participants. Kim and Wright (2020) further investigated the psychometric properties of core lexicon measure and found good validity and acceptable reliability. The clinical setting of speech and language rehabilitation in Taiwan is not the same as western countries. Speech and language pathologist (SLP) working in the health care system under National Health Insurance Scheme often have high caseloads and could only provide service in a 30-minute session; hence, it is challenging for SLPs to collect and analyze discourse samples. Therefore, the aims of this current study include developing the Mandarin Chinese core lexicon checklists for the picture-sequence description task (Broken Window) (Menn et al., 1998) and storytelling task (Three Little Pigs) and comparing the performance between IWA and individuals without aphasia.

Methods

Two groups of participants (aphasia group and non-aphasic group) will be recruited to participate the current study. The elicitation tasks include the Broken Window picture-sequence and Three Little Pigs story. For the Broken Window task, pictures are presented to participants and they are asked to tell the story. For the Three Little Pigs task, participants are given a picture book without text on each page and they are allowed to read the book. Then participants are asked to tell the story on their own words. The investigator will not provide any cueing during the elicitation tasks. All of the responses are videotaped and recorded.

The narratives will be transcribed in the CHAT transcription format (MacWhinney, 2000). Then the spoken lexicon used by the non-aphasic participants during both tasks will be identified by using the Computerized Language Analysis (CLAN) command. Lemmas produced by 50% or more of the non-aphasic participants will be included in the core lexicon checklist, and the checklist will be established for both elicitation tasks. In addition, other lemmas used by fewer than 50% of the non-aphasic participants will also be included in order to accomplish the top 40 lemmas checklist. Also, the lemma produced by IWAs will be compared with the non-aphasic group.

Results

This study is still in the data collection phase. Up till the present moment, 35 individuals without language impairments (21males and 24 females, age range 20-86 years) and five IWAs (three males and two females, age range 40-80 years) had participated the study. However, the recruitment for both groups is continued. The core-lexicon checklists for both

Broken Window and Three Little Pigs will be presented and shared at the conference. The performance between two groups will also be presented at the conference.

Conclusions

With the results of this study, the investigator hopes to provide a convenient and transcription-less discourse analysis tool (i.e., the core lexicon checklists of picture-sequence description and storytelling task) for SLPs in Taiwan to use. In addition, the investigator hypothesizes that there will be differences in the lemmas produced by two groups.

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Effects of noun- and verb-based semantic feature analysis treatment on real-time semantic processing in Korean-speaking individuals with aphasia

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Introduction

Semantic Feature Analysis (SFA; Boyle & Coelho, 1995) is a widely-used treatment for people with aphasia (PWA) designed to facilitate recovery from anomia. SFA enhances the semantic connections between words and their associated features, improving lexical retrieval and generalization. The efficacy of SFA has been reported in various studies; however, relatively few studies have examined the real-time processing changes after treatment. This study applied SFA and compared changes in real-time processing using an eye-tracking paradigm before and after treatment. Specifically, we compared the noun- and verb-SFA treatments to identify which approach more effectively enhances semantic network processing for Korean-speaking PWA.

Methods

Participants. The PWA were randomly assigned to either the noun- or verb-SFA treatment, with five individuals in each group. There were no statistically significant differences in age ($p = 0.46$), years of education ($p = 0.51$), or months post-onset ($p = 0.4$) between groups.

Procedures. Before and after 20 treatment sessions, each group conducted an eye-tracking paradigm consisting of 45 trials. A target image was presented, followed by four Areas of Interest (AOI). The AOIs were divided according to semantic relatedness:

- Type(1): semantic features directly depicted in the image
- Type(2): semantic features but not depicted
- Type(3): unrelated distractors but sharing a feature with Type 2
- Type(4): unrelated distractors

After 6000ms, the target image was presented again, and participants were asked to name the word(Figure 1).

Statistical analysis. We compared the naming accuracy and analyzed eye movements (fixation counts and durations) for each AOI before and after treatment. The linear mixed effects model analyses were performed in R (R Core Team, 2019).

Results

The naming accuracy significantly improved after both noun- ($p < 0.001$) and verb-SFA ($p < 0.001$) treatments. For the noun-SFA, fixation counts across all AOIs remained unchanged before and after treatment. In contrast, the verb-SFA exhibited a significant increase in fixation count for Type1 ($p < 0.001$) and a decrease for Type4 ($p = 0.008$), indicating more frequent fixations on related semantic features and fewer on distractors. Additionally, while the fixation duration for the noun-SFA showed significant reductions only for Type4, the verb-SFA led to significantly shorter fixation durations across all AOIs (Table 1).

Conclusions

Consistent with prior research (Li & Kiran, 2023), both SFA treatments enhance the semantic network, improving lexical retrieval abilities. This enhancement is also reflected in real-time processing changes. After verb-SFA treatment, PWA exhibited faster and more efficient real-time processing patterns. These results indicate that the verb-SFA group experienced less disruption from semantic relatedness interference. They maintained

relatively stable and quicker processing durations during semantic processing, showing similar patterns to neurotypical individuals (Yee et al., 2008).

Korean linguistic features, such as the verb-final structure and pre-verb linking of thematic roles, enhance the effectiveness of verb-SFA treatment. These linguistic features strengthen the semantic network and improve anomia recovery more effectively in Korean. The efficacy of verb network strengthening treatment that reflects the characteristics of Korean verbs for PWA has been reported (Kim et al., 2022; Kwag et al., 2014). These findings underscore the importance of incorporating language-specific characteristics into aphasia treatment.

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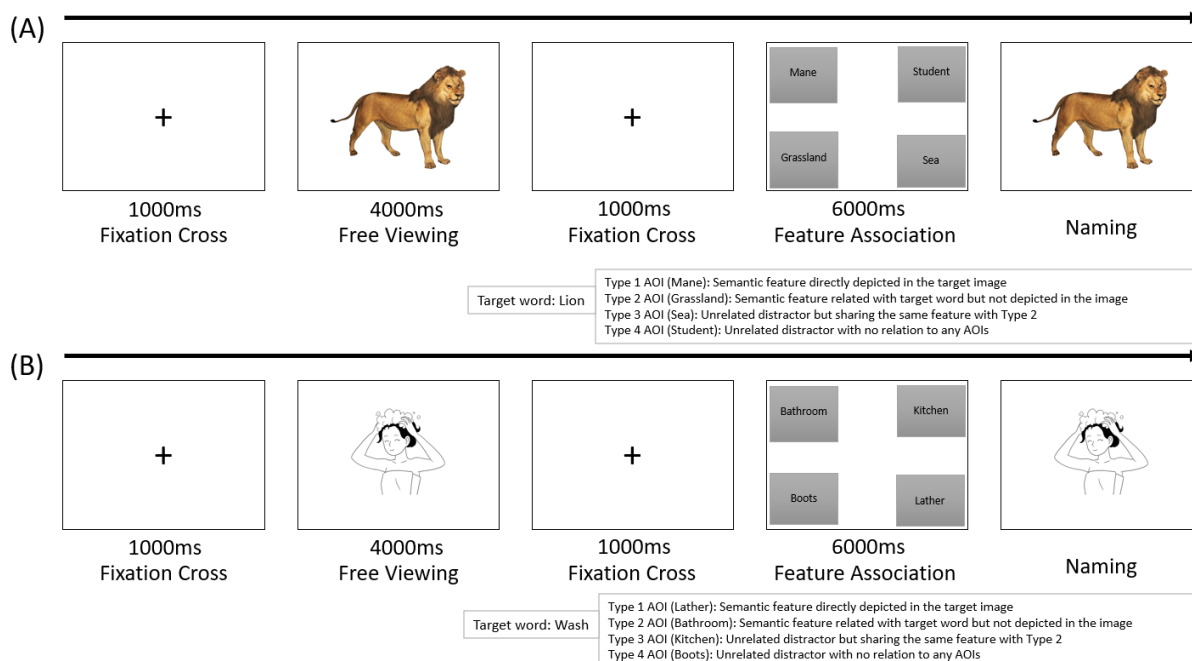


Figure 1. Examples of eye-tracking paradigms and AOI types in each eye-tracking paradigm; (A) noun-SFA group (B) verb-SFA group

Table 1. Results of mixed effects models on the fixation count and duration before and after SFA treatment within each group

Predictor	Group	AOI type	Estimate	Standard Error	Z value	P value
Fixation Count	Noun-SFA	Type 1	-0.02	0.026	-0.782	0.434
		Type 2	-0.049	0.026	-1.836	0.066
		Type 3	-0.051	0.026	-1.903	0.057
		Type 4	0.015	0.034	0.43	0.667
	Verb-SFA	Type 1	0.074	0.037	1.981	0.047*
		Type 2	-0.032	0.038	-0.844	0.398
		Type 3	-0.017	0.03	-0.56	0.575
		Type 4	-0.067	0.025	-2.63	0.008**
Fixation Duration	Noun-SFA	Type 1	0.0007	0.001	0.455	0.649
		Type 2	0.003	0.001	1.722	0.085
		Type 3	-0.001	0.001	-0.832	0.405
		Type 4	-0.045	0.001	-26.97	<.000** *
	Verb-SFA	Type 1	-0.220	0.004	-49.192	<.000** *
		Type 2	-0.402	0.005	-74.988	<.000** *
		Type 3	-0.359	0.004	-81.97	<.000** *
		Type 4	-0.102	0.004	-22.19	<.000** *

Note. Type 1=Semantic features directly depicted in the target image; Type 2=Semantic features related to the target word but not depicted in the image; Type 3=Unrelated distractor but sharing the same feature with Type 2 AOI; Type 4=Unrelated distractor with no relation to any AOIs; R model equation: Fixation count (or fixation duration) ~ Assessment point + AQ + (1 | Subject). The Aphasia Quotient (AQ) was set as the covariate. The predictor for the assessment point was sum-coded (+1 for post-assessment, -1 for pre-assessment).

Sentential context induces preplanning of spoken words: Acquiring fundamental knowledge for aphasia assessment and therapy

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Introduction

Word retrieval difficulty is one of the most common problems in aphasia, assessed by a variety of tasks such as naming objects and completing sentences (e.g., Kertesz, 1982). Although object naming has been well elucidated by research on healthy speakers, much less is known about sentence completion. To fill this gap, we combined the two tasks and examined object naming in a sentential context, with the aim of gaining fundamental knowledge that can be used to improve the use of sentence completion in aphasia assessment and therapy (e.g., Berndt et al., 2002; Pashek & Tompkins, 2002). We investigated how far word preplanning proceeds during comprehension of a sentence with an intention to speak, in particular, whether (a) lexical selection and phonological encoding are preplanned, and (b) the phonological form is preplanned beyond initial phonemes.

Methods

We collected picture naming response times (RTs) in three experiments using context-driven object naming. In this task, participants name pictures preceded by a constraining (*The cat is chasing a ... [mouse]*) or an unconstraining (*The spot looks like a ... [mouse]*) auditory sentence. In the constraining condition, comprising sentences similar to those used for elicitation in therapy (Berndt et al., 2002), representations primed by the sentential context tend to be preplanned before picture presentation (Piai et al., 2014). To determine the extent of this preplanning, we investigated lexical and phonological processes via the effects of lexical frequency (high frequency words are named faster than low frequency words), word length (shorter words are named faster than longer words) and phonological priming (phonological overlap speeds up naming) within constraining and unconstraining contexts. Presence of the effects in RTs suggests that the processes occur during the corresponding planning stage after picture onset, while their absence indicates planning completion before picture onset.

In Experiment 1, we reanalysed existing RT data ($N=58$), using lexical frequency and word length of the targets as proxies for lexical-semantic and phonological processes, respectively. In Experiment 2 and 3 (each $N=24$), using the same task and stimuli, we presented the pictures ([mouse]) simultaneously with phonologically related or unrelated auditory fragments (Experiment 2: final fragments, related: 'ous', unrelated: 'ain'; Experiment 3: initial fragments, related: 'mou', unrelated: 'tray'). We used Bayesian modeling with the *brms* package in R (Bürkner, 2017) for RT analysis.

Results

Experiment 1 demonstrated the presence of lexical frequency and word length effects following unconstraining sentences only. In the constraining sentences, the effect was the opposite for lexical frequency (shorter RTs for higher frequency words) and absent for phonemic length (see Figure 1). In the ongoing Experiments 2 and 3, occurrence of

facilitation effects in the unconstraining but not constraining sentences will provide further evidence for phonological preplanning.

Conclusions

The present results suggest that sentential context facilitates both lexical-semantic and phonological preplanning before speech initiation in individuals without language impairment. These findings characterize preplanning of spoken words at the crossroads of language comprehension and production, providing fundamental knowledge that may be used in aphasia assessment and therapy.

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Acknowledgments

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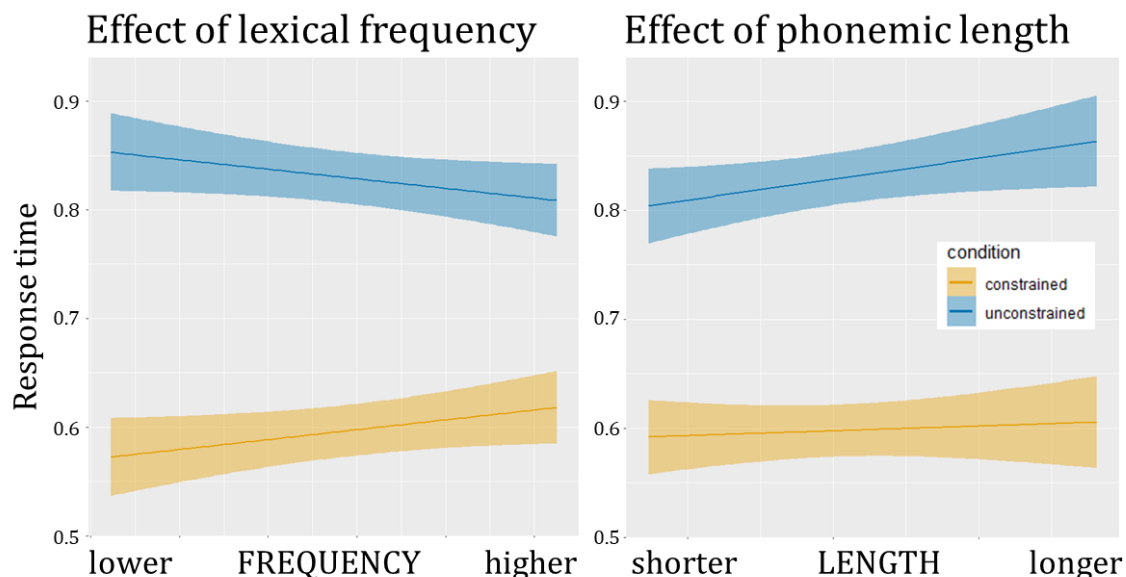


Figure 7. Interaction effects of condition (constrained, unconstrained) from experiment 1 (n=58). Left panel: interaction with lexical frequency (zipf frequency from subtex-nl, range 2.5 – 5.7, mean = 4.2) right panel: interaction with word length in phonemes (range 1 – 9, mean = 4.3). The y-axis shows response times in seconds. The shaded areas represent 95% uncertainty intervals.

Spontaneous speech before, during and after awake brain surgery in glioma patients

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Introduction

Patients with gliomas (primary brain tumor) often report language complaints which can have devastating effects on daily life (Antonsson et al., 2024). Previous studies showed that spontaneous speech appeared to be impaired before and after glioma surgery and that it did not correlate with performance of standard language tests (Satoer et al., 2013, 2018). These findings underlined the added value of spontaneous speech monitoring next to standard tests. During awake brain surgery, spontaneous speech monitoring can guide tumor resection via detection of errors followed by detailed task selection which contributes to better language preservation (Collée et al., 2022, De Witte et al., 2015). Detailed analyses of intraoperative spontaneous speech has never been conducted yet. In this study, we aim to investigate spontaneous speech in patients undergoing awake glioma surgery with comparisons between the pre, intra- and postoperative phases.

Methods

We elicited, transcribed and coded 300 words from spontaneous speech samples (according to Bastiaanse & Prins, 2004, McWinney, 1991) of 8 patients with gliomas (6 high-grade, 2 low-grade) in eloquent areas selected for awake brain surgery preoperatively (T1), intraoperatively (T2) and 2.0-3.5 months (T3) postoperatively. We extracted the following spontaneous speech variables: Type Token Ratio (TTR, to measure lexical diversity), Mean Length of Utterance of words (MLUw), minimal utterances and total errors. A wide range of individual errors were coded and categorized by linguistic level: semantics, phonology/articulation, syntax, and lexico-syntax. Five most frequent error types were selected. Reliable Change Index (RCI) scores were calculated for the spontaneous speech variables and error types to objectify changes between time points (T1-T2, T2-T3 and T1-T3, significant $\geq 1.96/-1.96$). Patterns of total errors were constructed based on RCIs: stable, decrease or increase during surgery.

Results

Most patients remained stable in their spontaneous speech between each time point: T1-T2, T1-T3, T2-T3 (see Table 1). Most errors across time points occurred at the level of lexico-syntax (58.0%), followed by errors in phonology/articulation (23.3%), syntax (18.2%), and semantics (0.5%, only in 3 patients). Five most frequent error types were Self-corrections, Incomplete sentences, Omitted obligatory grammatical elements, Repetitions and False starts. In 5/8 patients Incomplete Sentences deteriorated significantly postoperatively compared to intraoperatively (see Figure 1). Total error patterns were revealed: 3 patients remained stable, 2 patients decreased and 3 patients increased (significant RCI $\geq 1.96/-1.96$).

Conclusions

Awake surgery with intraoperative language monitoring was successful as most spontaneous speech variables remained relatively stable over time in the majority of the patients. However, the parameter Incomplete sentences was sensitive for postoperative decline, reflecting earlier findings (Satoer et al., 2013, 2018; Rofes et al., 2018). This error type seems to be a robust marker for lexical-syntactic difficulties and should be prioritized in spontaneous speech analysis, especially to determine intra- to postoperative deterioration. The administration of a sentence completion task (with a grammatically complex constituent) during direct electrical stimulation and tumor resection as a standard procedure may add to the reduction of postoperative decline. A comparison to standard language tasks will be conducted as well as long-term outcome in future automated spontaneous speech analyses.

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Table 1. RCIs across time points for TTR, MLUw, minimal utterances and total errors for all individual patients

Patient	TTR			MLUw			Minimal utterances			Total errors		
	T1-T2	T1-T3	T2-T3	T1-T2	T1-T3	T2-T3	T1-T2	T1-T3	T2-T3	T1-T2	T1-T3	T2-T3
1	-0.544	-0.442	0.102	0.387	1.180	0.794	1.197	0.527	-0.670	-2.537*	0.000	2.537*
2	0.204	0.612	0.408	-0.901	0.038	0.939	-1.101	-0.527	0.575	-0.211	-1.268	-1.057
3	-0.987	-0.816	0.170	-2.083*	-0.038	2.045*	-0.096	0.910	1.006	-2.748*	-2.959*	-0.211
4	0.272	-1.565	-1.837	0.896	2.678*	1.782	-1.293	-1.293	0.000	2.959*	1.057	-1.903
6	-3.742*	-3.334*	0.408	-0.014	0.473	0.487	0.048	0.862	0.814	0.211	-0.211	-0.423
7	-0.816	-2.654*	-1.837	-0.499	-0.136	0.363	1.485	0.096	-1.389	0.846	0.000	-0.846
8	-0.136	-1.021	-0.885	-1.730	-1.532	0.198	0.239	-0.670	-0.910	10.57*	4.862*	-5.708*

* indicates a reliable change based on a RCI of $\geq 1.96/-1.96$.

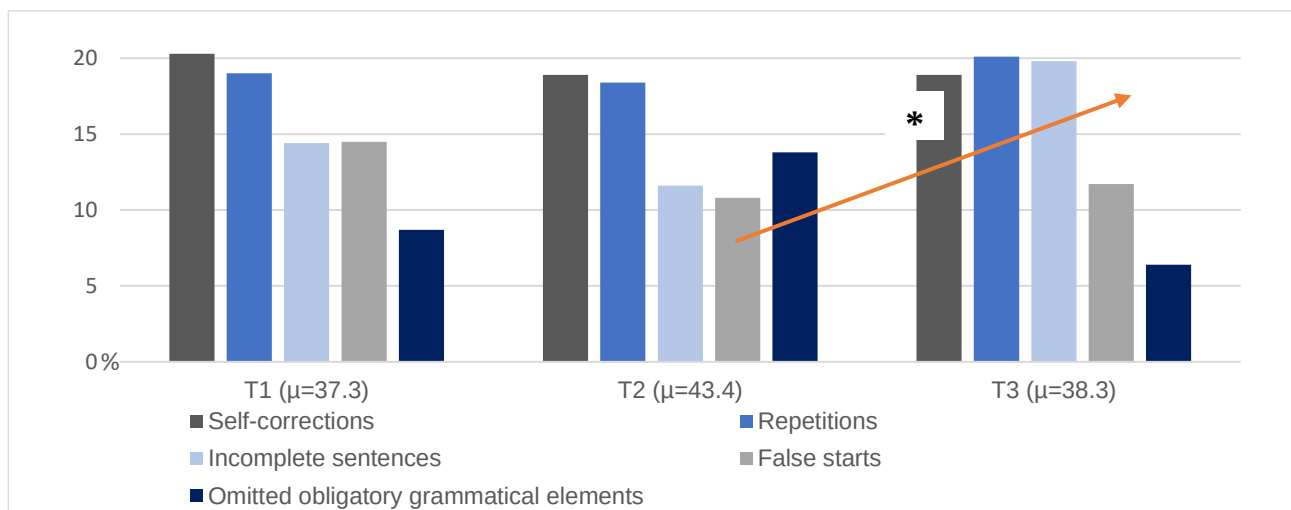


Figure 1. The five most occurring errors at group level in percentages at T1 (preoperatively), T2 (intraoperatively) and T3 (postoperatively) out of the mean number of errors of the group (μ). *Reliable change based on a RCI of $\geq 1.96/-1.96$ in 5/8 patients in Incomplete sentence between T2-T3.

A comparison of grammatical deficits between bilingual and monolingual aphasia: A systematic review

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Introduction

Grammatical impairments present in people with aphasia (PWA) are frequently divided into receptive agrammatism (errors in understanding grammar structures), expressive agrammatism (reduction of grammatical structures/complexity), and paragrammatism (over and misuse of grammatical structures) (Matchin et al., 2020). The theoretical understanding that bilingual individuals possess a unified language system that underlies all languages (Grosjean, 1989) contributes to recent renewed interest in examining crosslinguistic behavioral overlap in bilingual people with aphasia (BWA) and monolingual PWA. Previous reviews (Kuzmina et al., 2019) examined recovery progression across languages, but not specifically grammatical errors. Therefore, we ask: have bilingual people with aphasia been noted to make different grammatical errors from monolingual people with aphasia in: a) sentential structuring b) morphosyntax and/or c) lexical syntactic categories?

Methods

As part of a larger review which included a combined search of five databases for peer reviewed sources published after 1980 presenting original data on grammatical processing by bilingual adults with aphasia, seven articles were identified as including grammatical errors of BWA and PWA. For each study, we scored quality from 0-1: (0) indicating absence of information; (1) indicating inclusion of information. Quality indicators included: bilingualism description (identification of languages acquired, age of acquisition, language proficiency, language dominance, c.f. Surrain & Luk, 2019); aphasia diagnostic characteristics (etiology, subtype, fluency, diagnosis of grammatical deficit, c.f. Farooqi-Shah et al., 2010); linguistic description of errored structures; and statistics (significance, sampling, c.f. Robey, 2007). See *Figure 1*.

Results

Sources included three case studies, two experimental studies, and two treatment studies. Participants, ranging from three to 203, spoke Spanish, German, English and 12 South Asian languages. See Table 1. Quality indicators demonstrated 60% of bilingual background features, 64% of aphasia quality indicators, 100% of the linguistic quality indicator, and 43% of statistical indicators were present across studies.

Findings from studies that contributed to this RQ of the review suggested: (a) no differential preference between BWA and PWA for initial nouns in production of SOV (c.f. Vaid & Chengappa, 1988) or sentence comprehension based on thematic argument order (Arantzeta et al., 2019); (b) no differential sensitivity to morphological cues in noun-verb agreement word-selection tasks; (c) no differential preference for animate over inanimate

nouns (c.f. Vaid & Chengappa, 1988); (d) for Spanish-only and Spanish-English speakers, no differential preference for lexical preservation of questions in responses (c.f. Schnitzer, 1989).

Conclusions

Though other prior research comparing BWA to PWA has found distinct (surface-level) error patterns (Dutta et al., 2024), the studies included herein do not present distinct patterns of grammatical deficits cross-linguistically. Nevertheless, small samples and included studies mean that cross-language and population generalizations about error patterns comparing BWA to PWA are not possible for a) sentential structuring b) morphosyntax or c) lexical syntactic categories. Collectively, the studies included few direct comparisons of grammatical deficits between BWA and PWA. However, the limited individual findings that indicated no differences in specific grammatical deficits prompts discussion about a unified grammar system (Grosjean, 1989). Larger, cross-linguistic experimental studies are needed to better understand patterns of deficits of BWA and PWA.

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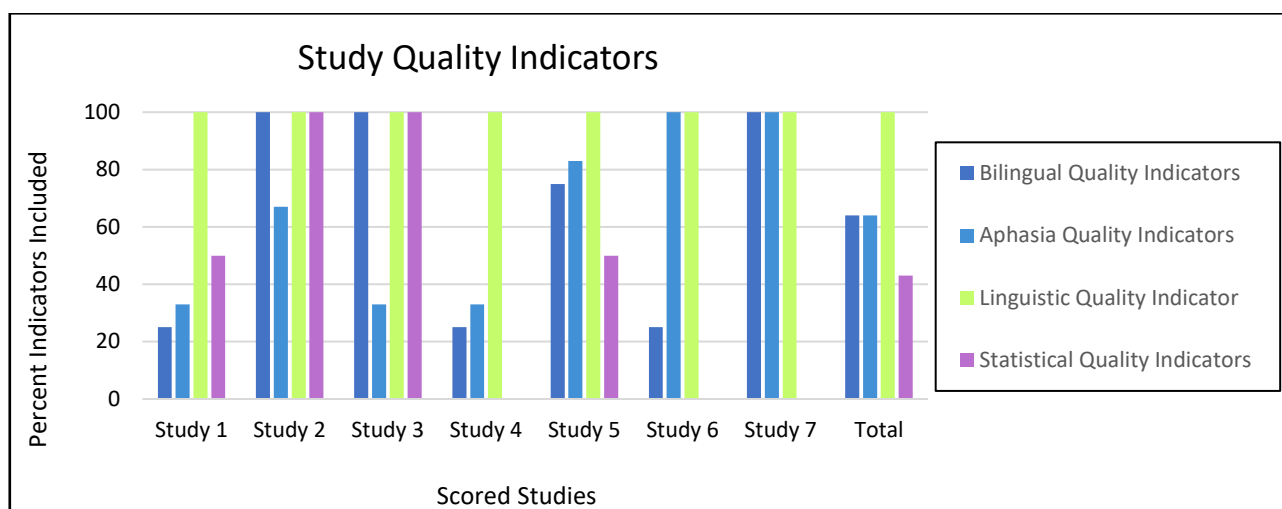


Figure 1. Percent of Bilingual, Aphasia, Linguistic, and Statistical Quality Indicators Included in Studies

Table 1. Participants and Languages

Study	Number of Bilinguals with Aphasia	Number of Monolinguals with Aphasia	Languages Included
Study 1 Observational/ Cross-Sectional	53	155	Bengali, English, Hindi, Urdu
Study 2 Experimental	7	7	Basque, Spanish
Study 3 Experimental	21	8	Kannada, English
Study 4 Clinical Trial	5 ^a	9	Spanish, English
Study 5 Observational/ Case Study	6	11 ^b	Swahili, English, Bantu, Nilotic,
Study 6 Observational/ Case Study	8	3	Persian, English, German, Arazi, Badrudi, Armenian
Study 7 Clinical Trial Single Subject Study	1	2	Persian, German
Total	101	195	17

Notes: ^aSeven additional participants designated as 'L1 dominant'. ^bMonolinguals compared for assessment purpose only.

Once upon a time... Tense production in the narratives of French speakers with fluent and non-fluent aphasia

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Introduction

Tense production is crucial for conveying the temporal context of discourse, yet people with aphasia (PWA) often experience difficulties in this domain (see Cordonier et al., 2024 for a review). Existing research has predominantly focused on sentence-level tasks to assess tense production deficits in PWA (e.g., Fyndanis et al., 2018), overlooking the nuances of tense usage in more naturalistic discourse tasks. Moreover, the few studies that have investigated tense production in discourse tasks have only included participants with non-fluent aphasia (PWAnf; e.g., Nerantzini et al., 2020; Siriboonpipattana et al., 2020), despite emerging evidence of time reference deficits in people with fluent aphasia (PWAf; Cordonier et al., 2024). The present study aimed to address these gaps by investigating tense production in both PWAf and PWAnf with a discourse task paradigm.

Methods

Twenty-one French-speaking PWA (10 PWAf and 11 PWAnf) and 21 matched healthy controls (HC) were presented with six sequential scenes of six pictures each (Fossard et al., 2018). Three story conditions (past, present, future) were created by means of a sentence written above each scene, indicating whether the story took place in the past (e.g., "Last week, Peter went shopping at the supermarket."), present (e.g., "Anne is buying new shoes.") or future tense (e.g., "Next week, James will plant flowers."). Participants were instructed to tell what happened in the scene while adhering to the tense specified by the sentence cue.

Generalized linear mixed models with a negative binomial distribution (count data) were conducted to analyze the number of verbs produced in each tense, with the group (PWAf, PWAnf, HC), story conditions (past, present, future) and their interactions as independent variables. Individual variations in total word count were included as covariable.

Results

Likelihood ratio tests revealed no significant group effect for all three tenses but a significant effect for the story condition, with a majority of expected tenses produced in each story condition (e.g., more past verbs than present and future verbs in the past story condition) (see Figure 1 and Table 1). The interaction between group x story condition was significant for the number of past and future verbs: PWAf produced more past verbs in the future and present conditions and more future verbs in the present condition compared to PWAnf and HC. Notably, there were no significant differences between PWAnf and HC.

Conclusions

Our findings suggest that PWA are able to produce sufficient verbs appropriate to the temporal context of the discourse. This competence could be attributed to the naturalistic nature of the task, which allows them to use effective compensatory strategies (e.g., the use of morphologically simple, more frequent, or less diverse verbs; El Ouardi, 2021; Nerantzini et al., 2020). Interestingly, only PWAf showed a tendency to produce more non-conventional tenses, suggesting that the underlying causes of tense difficulties may differ between the PWAf and PWAnf. Further studies are needed to replicate these findings and to explore

tense production across various discourse tasks, given the impact of task type on tense production (Park et al., 2024).

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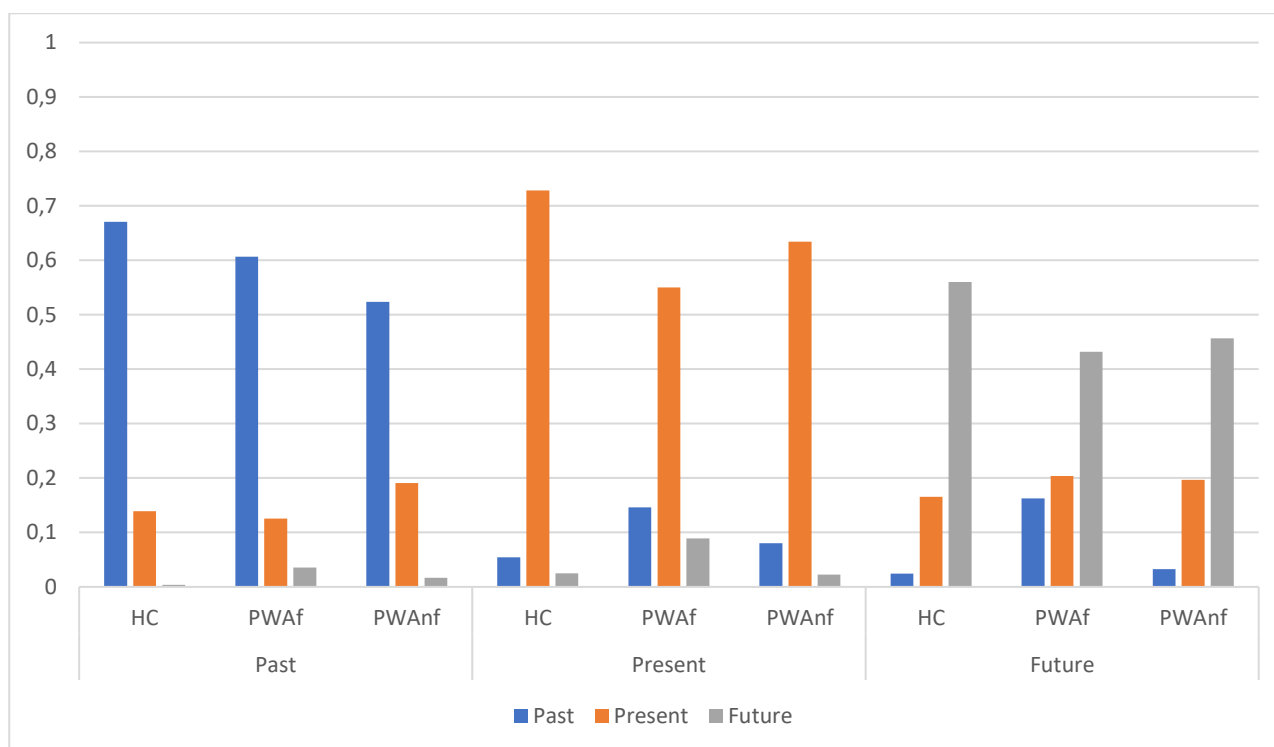


Figure 8. Ratios of verbs produced in the past, present and future tenses in each story condition (past, present, future) for the healthy control participants (HC), participants with fluent (PWAf) and non-fluent (PWAnf) aphasia.

Table 1. Results of the Likelihood ratio tests

	Past verbs	Present verbs	Future verbs
Group effect	$\chi^2(2) = 0.92$, $p = .632$	$\chi^2(2) = 0.72$, $p = .696$	$\chi^2(2) = 0.33$, $p = .847$
Story condition effect	$\chi^2(2) = 162.86$, $p < .001$ [future = present] < past condition	$\chi^2(2) = 110.29$, $p < .001$ [past = future] < present condition	$\chi^2(2) = 205.23$, $p < .001$ [past = present] < future condition
Interaction group x story condition	$\chi^2(4) = 21.59$, $p < .001$	$\chi^2(4) = 2.32$, $p = .678$	$\chi^2(2) = 22.64$, $p < .001$

Exploring the efficacy and accessibility of online speech therapy for stroke survivors – in the Indian context

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Introduction

Aphasia is defined as a language disorder that results from damage to the parts of the brain responsible for language processing. It occurs as a result of stroke or brain injury. Digital speech therapy refers to the use of the technologies such as video conferencing, to provide speech therapy remotely. It allows Person with Aphasia to receive speech therapy from certified Speech Language Pathologist. Digital speech therapy applications have the advantages of being personalized and easily accessible. However, evidence for their efficacy is not rigorous. This study aims to investigate the efficacy and feasibility of digital speech therapy applications in addressing communication in stroke survivors in India.

Methods

10 caregivers of Persons with Aphasia (5 Broca's and 5 Anomic aphasia) who are attending online aphasia speech therapy were included and 5 Tele aphasia therapists were also participated in the study. The majority of the caregivers were spouses of persons with aphasia. Speech therapists with more than one year of online aphasia therapy experience were included. The study included semi structured interview questionnaires which was developed for caregivers and speech therapist. The major domains include, accessibility, feed-back and monitoring, cost effectiveness, technical issues, patient satisfaction, implementation of therapy techniques. After determining its validity, the questionnaires were administered on the caregivers and speech therapist.

Results

The patient and caregiver satisfaction are high for online aphasia speech therapy. From the caregiver questionnaire it was observed flexibility is a major advantage for all the stroke survivors. Tele therapy is particularly benefiting stroke survivors residing in rural and underserved areas of India where access to in-person therapy is limited. Making rehabilitation more affordable. Caregivers were satisfied with the improvement and progress via online therapy. From speech therapist questionnaire it is evident, Speech therapists in India have shown adaptability in transitioning to online platforms, with training programs enhancing their proficiency in utilizing telecommunication technology and remote monitoring tools effectively for aphasia therapy.

Conclusions

Overall, the results suggest that online speech therapy holds significant promise as an effective and accessible intervention for stroke survivors in India, with potential for widespread implementation and impact on rehabilitation outcomes. Continued research, collaboration, and policy support are essential for optimizing the delivery and uptake of online speech therapy within the Indian healthcare system.

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Scalar implicatures in Italian-speaking individuals affected by frontotemporal dementia: Preliminary results

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Introduction

Frontotemporal dementia (FTD) is a progressive neurodegenerative disorder that affects frontal and temporal lobes of the brain. Studies reported that FTD patients have cognitive, speech, and language impairments (Blair et al., 2007; Harciarek & Cosentino, 2013). FTD is classified into three major subtypes based on its predominant symptoms: behavioral variant of FTD (bvFTD), semantic variant of primary progressive aphasia (svPPA), and corticobasal syndrome (CBS) (Kurz et al., 2014). BvFTD patients exhibit difficulties in inference-making tasks (Adenzato, Cavallo, & Enrici, 2010), associated with their progressive frontal and anterior temporal atrophy that results in inappropriate behavior and executive difficulty (Rascovsky, et al., 2011). CBS patients have difficulties judging sentences containing quantifier words and numbers due to temporal-parietal atrophy (Halpern et al., 2007). We investigated number knowledge and scalar implicatures (SIs) in Italian-speaking participants with FTD. SIs are a type of pragmatic inference that arises when a weaker quantifier, such as *some*, is used in place of a stronger and more informative quantifier, such as *all* (Horn, 1972).

Methods

A Truth-Value Judgment (TJVT) task using a modified version of the gumball paradigm (Kursat & Degen, 2020) was administered to assess SIs with quantifiers (*some* and *all*), and number words (i.e., two, three, four) to patients diagnosed with CBS (n = 1; years of age = 74; years of education = 18), non-amnesic MCI (n = 1; years of age = 56; years of education = 8), bvFTD (n = 2; years of age = 66, 66; years of education = 16; 18) and healthy controls (HC) (n = 10; mean years of age = 52; mean years of education = 16) (see Table 1). Additionally, patients were administered the MMSE to screen for cognitive deficits the Digit Span Backward to measure working memory, and the Token Test to measure sentence comprehension. Seventy-two sentences were administered to each participant. Sentences were administered in the long (i.e., "Some of the blue candies dropped to the lower compartment", "three of the blue candies dropped to the lower compartment") and short (i.e., "Some of the blue candies dropped", "three of the blue candies dropped") conditions to examine working memory load effects.

Results

Results showed that the CBS participant responded more accurately (L001 = 97%) than the non-amnesic MCI (L002 = 85%) and bvFTD patients (L000 = 87%; L003 = 75%) to experimental items. BvFTD and MCI performed worse than CBS and healthy controls in underinformative *some*-statements in the short condition (e.g., "Some of the blue candies dropped"). A better performance was registered on *all*-statements in the short and long condition (e.g. "All the blue candies dropped") where both patients and HC scored higher than on *some*-statements.

Conclusions

These findings are consistent with previous literature reporting low accuracy for bvFTD patients in underinformative sentences with quantificational terms (e.g., *some*) (Spotorno, et al., 2014). However, an unexpected result is that the CBS patient performed as accurately as healthy controls. Additional participants are being recruited, which will help corroborate these results.

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Table 1. Patients' demographic data and cognitive scores

	L1	Higher education degree achieved	Occupation	Sex/ Ethnicity	First symptoms of the disease	Diagnosis	MMSE (max=30)/ Digit Span Backward/Token Test scores (max= 36)
L000	Italian	BS	Nurse	F/Caucasian	6 months ago	bvFTD	27/3/31
L001	Italian	MA	Engineer	M/Caucasian	4 years ago	CBD	28/3/33
L002	Italian/Veneto dialect	Middle school	Construction worker	M/Caucasian	1 year ago	Non-amnesic MCI	26/4/29
L003	Italian	MA	Public administrator	M/Caucasian	4 years ago	bvFTD	22/4/17

A hierarchical ensemble approach to predicting response to phonological versus semantic naming intervention in aphasia using multimodal data

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Introduction

Treatment selection for persons with aphasia (PWA) is aided by improved prediction of treatment response in general, but especially to specific types of intervention. For lexical production problems in aphasia, several studies have attempted to predict response to 'phonological' interventions, focused on word-form representations, versus 'semantic' interventions, focused on meaning representations, based on biographical, behavioral (cognitive-linguistic) or neurological variables in isolation. We hypothesized that it is rather the combination of variables from different modalities that determines propensity for treatment response. Here, we tailored predictions to individual PWA by integrating multimodal information while considering multivariate relationships of various complexities.

Methods

93 PWA received both phonological and semantic interventions and 34% exhibited a clinically-meaningful improvement on the Philadelphia Naming Task (>9/175 points), with 9 responding to phonological and 23 to semantic treatment. Response was predicted in a nested leave-one-out cross-validation scheme using a set of 345 baseline biographical, behavioral, and neuroimaging variables. Based on our prior modeling efforts, behavioral variables included latent constructs of impaired domains (Walker et al., 2018). Neuroimaging variables included regional brain lesion load, task-based BOLD-response, cerebral blood flow, fractional anisotropy, medial diffusivity, and functional and structural connectivity. We adopted a flexible hierarchical modeling approach. We first trained a binary classifier to predict general treatment response. Then, a second binary classifier was trained on 'responders' to adjudicate between the two interventions. Both classifiers were ensembles of decision trees, boosted using RUSBoost. Model tuning included identification of the most reliably predictive features through stability selection, enhanced by combining multiple complementary algorithms for forming the feature ensemble (Teghipco et al., in press).

Results

General treatment response was predicted with 77% balanced accuracy and 0.72 AUC ($p<0.0001$). For the correctly predicted responders, the second model achieved 85% balanced accuracy and 0.79 AUC ($p<0.0001$). The combined model had an overall balanced accuracy of 72% and AUC of 0.77 ($p<0.0001$). Different patterns of feature weights drove model performance (see Figure 1 and Table 1), and feature importance did not correlate between the two models ($p=0.4$). Non-responders were more strongly predicted by high ventral functional connectivity, inconsistency of picture-naming errors, lesion-load

characteristics, low performance on semantic judgment, reduced cerebral blood flow, and higher overall clinical stroke severity. Semantic responders were more strongly predicted by high perilesional temporal-lobe BOLD-response, while phonological responders were more strongly predicted by high fractional anisotropy across the brain, but especially in the dorsal stream. No biographical variables were among the top predictors for treatment response.

Conclusions

A machine-learning approach applied to large-scale comprehensive neuroimaging, behavioral and biographical data demonstrated that response to impairment-based therapy is complex, but can be predicted with relatively high accuracy. Importantly, response to impairment-based therapy is not solely dependent on the linguistic impairment (as assumed in reinforcement approaches where PWA with phonological linguistic impairments should respond to phonological treatment, and the same for semantics, or compensatory, where the opposite approach is used). Instead, neurobiological factors offer key personalized determinants of response and could be used in future decision-making for clinical trials or translational interventions.

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Figure 1. Radar plot of the top influential features for each class based on programmatic elbow detection (maximum distance method) of mean SHAP values (SHapley Additive exPlanations).

Table 1. Top influential features for each class based on programmatic elbow detection (maximum distance method) of mean SHAP values (SHapley Additive exPlanations) sorted in descending order, with correlation signs to features providing direction of influence (Dir.).

Feature	SHAP	Class	Dir.
LH ventral functional connectivity (proportional to ventral bilateral)	0.012619876	NonResponders	▲
Variance between correct reponses on multiple PNTs	0.007027668	NonResponders	▼
White-Matter lesion load	0.003969529	NonResponders	▲
Grey-Matter lesion load proportional to total lesion load	0.002068498	NonResponders	▼
LH cerebral blood flow	0.001738847	NonResponders	▼
Pyramids and Palm Trees Test	0.001602932	NonResponders	▼
Bilateral cerebral blood flow	0.001556348	NonResponders	▼
White-Matter lesion load proportional to total lesion load	0.001141713	NonResponders	▲
Lexical-Semantic MPT ability point estimate baseline 2	0.001114826	NonResponders	▼
Phonemic errors on Naming-40 task	0.001108501	NonResponders	▲
Unconventional Stroke Type	0.001053052	NonResponders	▼
Bilateral CSF lesion load	0.000940167	NonResponders	▲
NIH Stroke Scale	0.000848835	NonResponders	▲
White-Matter lesion load in lang. areas, prop. to total lesion load	0.000792424	NonResponders	▼
Lexical selection MPT ability point estimate baseline 2	0.000610609	NonResponders	▲
Variance Semantic Errors PNT across baseline sessions	0.007604	Semantic	▲
Mean Semantic Errors PNT across baseline sessions	0.001633	Semantic	▲
Bilateral cerebral blood flow	0.000649	Semantic	▲
Lexical-Semantic Variance MPT baseline 2	0.000593	Semantic	▲
Lexical-Phonological Variance MPT baseline 1	0.000391	Semantic	▲
Semantic Variance MPT Baseline 1	2.79E-04	Semantic	▲
LH CSF lesion load	0.00026	Semantic	▲
Lexical-Phonological Variance MPT Baseline 2	1.36E-04	Semantic	▲
LH temporal perilesional BOLD (9mm around lesion)	1.01E-04	Semantic	▲
Bilateral dorsal fractional anisotropy	0.00522561	Phonological	▲
Bilateral white-matter fractional anisotropy	0.003168933	Phonological	▲
Lexical-Semantic Variance MPT Baseline 1	0.002332981	Phonological	▼
Bilateral grey-matter fractional anisotropy	0.001993232	Phonological	▲
RH fractional anisotropy	0.001908308	Phonological	▲
Phonological Variance MPT Baseline 1	0.001798417	Phonological	▲
RH white-matter fractional anisotropy	0.001778395	Phonological	▲
Bilateral fractional anisotropy	0.001610818	Phonological	▲
Phonological Variance MPT Baseline 2	0.001450598	Phonological	▼
LH fractional anisotropy	0.000977706	Phonological	▲
Bilateral white-matter fractional anisotropy in language areas	0.000485561	Phonological	▲
Lexical-Selection Variance MPT Baseline 1	0.000446968	Phonological	▼
Semantic Variance MPT Baseline 2	0.000361824	Phonological	▼
Western Aphasia Battery-R Repetition	0.000191867	Phonological	▼

A non-randomised phase II trial of the comprehensive, high-dose aphasia treatment (CHAT) program

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Introduction

Intensive Comprehensive Aphasia Programs (ICAPs) are an evidence-based service delivery model incorporating best-practice principles for aphasia rehabilitation. However, this novel service delivery model is not routinely utilised in clinical practice (Rose et al., 2021). The Comprehensive, High-dose Aphasia Treatment (CHAT) program is the first modified-ICAP to be embedded within an Australian health service (Dignam et al., 2023). This study evaluated the effectiveness of CHAT on participants' language, communication and quality of life when implemented by the speech pathology service at the Surgical Treatment and Rehabilitation Service (STARS), a tertiary-teaching rehabilitation facility in Brisbane, Australia.

Methods

A non-randomised Phase II hybrid clinical implementation and effectiveness design was employed.

CHAT includes 50 hours of comprehensive, evidence-based aphasia therapy, tailored to participants' communication goals. Therapy was delivered by STARS speech pathologists and allied health professionals to 14 cohorts of participants from February 2021 to December 2023. Sixty-seven participants with post-stroke aphasia (48M, 19F; mean age = 65.6 SD = 13.3; mean time post stroke = 28.8 months, SD = 61.2) consented to participate. Outcome measures evaluated participants' language impairment (Comprehensive Aphasia Test, CAT), functional communication (Communicative Effectiveness Index, CETI; Communication Confidence Rating Scale for Aphasia, CCRSA) and communication-related quality of life (Stroke and Aphasia Quality of Life Scale, SAQOL-39) and were administered post-therapy and at 3 months follow-up. Quantitative data from 13 cohorts were analysed using Linear Mixed Models (LMM) and Cohen's *d* effect size.

Individual participant data were analysed using published test-retest reliability data for the CAT modality mean ($p < .05$, one-tailed; Swinburn et al., 2004) and published Minimal Detectable Change (MDC₉₀) scores for the CETI (>11.53) and SAQOL-39 (>0.36) (Menahemi-Falkov et al., 2022).

Results

Sixty-six participants completed the CHAT program. Two participants withdrew due to medical and/or personal reasons. LMM revealed a significant effect of time, with improvements across outcome measures at post-therapy (CAT $p < .001$, $d = 0.3$, CETI $p < .001$, $d = 1.2$, SAQOL $p < .001$, $d = 0.5$, CCRSA $p < .001$, $d = 0.6$) and 3 months follow-up (CAT $p < .001$, $d = 0.3$, CETI $p < .001$, $d = 1.2$, SAQOL $p < .001$, $d = 0.4$, CCRSA $p < .001$, $d = 0.6$).

With respect to the number of participants demonstrating change greater than test-retest reliability and/or MDC₉₀, analysis of individual participant data revealed variability in participants' response to CHAT at post-therapy (CAT 16/62; CETI 37/43; SAQOL-39 25/62 participants) and 3 months follow-up (CAT 20/56; CETI 29/33; SAQOL-39 22/56).

Conclusions

The CHAT program resulted in positive and enduring improvements across participants language, communication and quality of life when delivered as part of a routine clinical speech pathology service.

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Evaluating the feasibility and efficacy of a low-dose, technology-enabled home maintenance program: CHAT-maintain

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Introduction

There is limited evidence for the long-term benefits of intensive aphasia therapy (Brady et al., 2016) and ongoing intervention may be required to support the maintenance of aphasia therapy gains long-term (Menahemi-Falkov et al., 2022). There is high-level evidence for the clinical efficacy of technology-delivered home-based therapy (Palmer et al., 2020) and technology-delivered therapy has the potential to support long-term self-management for people living with aphasia (Nichol et al., 2019). The aims of this study were to evaluate the feasibility and preliminary efficacy of CHAT-Maintain, a low-dose technology enabled home maintenance program, when delivered after intensive therapy for people with post-stroke aphasia.

Methods

A prospective, non-randomised, feasibility design was employed. Twenty-two adults (8F, 14M; mean age = 65.3 years, SD = 11.8; mean time post onset = 23.4 months, SD = 37.7) with post-stroke aphasia were recruited from the Comprehensive High-dose Aphasia Treatment (CHAT) and TeleCHAT (CHAT via telerehabilitation) programs.

Participants received training in the use of evidence-based aphasia treatment software and completed an individualised, technology-delivered home program for a minimum of 1 hour per week for 6 months. Home practice was supplemented with regular support calls from a trained speech pathologist.

The feasibility of CHAT-Maintain was measured according to treatment dose and adherence, and semi-structured interviews with people with aphasia and speech pathologists. Interview data were analysed using content analysis (Graneheim & Lundman, 2004). The clinical efficacy of CHAT-Maintain was measured using the Comprehensive Aphasia Test (CAT), Communication Effectiveness Index (CETI), Communication Confidence Rating Scale for Aphasia (CCRSA), and the Stroke and Aphasia Quality of Life Scale-39 (SaQOL-39). Clinical outcome measures were administered post-treatment, at 3-months and 6-months follow-up. Quantitative data were analysed using paired-samples t-tests. Maintenance of therapy gains was considered successful if follow-up scores were significantly higher than baseline ($p < .05$) and there was no significant deterioration from post-therapy to follow-up ($p > .05$).

Results

Sixteen participants completed CHAT-Maintain. Two participants withdrew from the study and four participants were lost to follow-up. Participants completed an average of 40.3 hours self-directed practice (range 10.3-115.5 hours, SD = 24.9), with 13 out of 16 participants completing the minimum 1 hour per week of home practice. Participants received an average of 6 support calls (range 3-9, SD = 1.67).

Group-level therapy gains were maintained for the CAT, CETI, CCRSA and the SaQOL-39 at 3 months follow-up and for the CETI and CCRSA at 6 months follow-up.

Qualitative analysis of participants' perspectives of CHAT-maintain revealed that while the home program was acceptable to people with aphasia, there were potential barriers to establishing and conducting the program, including limited access to the appropriate technology (e.g., home computer, therapy applications), limited family member or carer support, and the need for further professional development for speech pathologists in the field of counselling and aphasia when delivering a remote model of care.

Conclusions

CHAT-maintain is a feasible, low-dose, technology-supported model of care which has the potential to support the maintenance of communication and quality of life gains post-intensive therapy.

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Recovery of verbal working memory depends on left hemisphere white matter tracts

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Introduction

Researchers argue that the recovery of language function following stroke depends on reorganization to perilesional regions in the left hemisphere and/or on reorganization to homologous regions in the right hemisphere (Kiran, 2012). Many investigations of recovery focus on changes in the role of gray matter regions (e.g., Turkeltaub et al., 2011), whereas relatively few examine the role of white matter tracts (e.g., Schlaug et al., 2009) and none address the role of these tracts in the recovery of verbal working memory (WM). The present study addressed this gap, examining the role of left vs. right hemisphere tracts in the recovery of phonological and semantic WM from acute to chronic timepoints post-stroke.

Methods

We recruited 24 monolingual, English-speaking participants with left hemisphere stroke who completed working memory assessments at the acute (mean 4 days, range 2-12 days) and chronic (> 6 months) timepoints post-stroke. To measure phonological WM, we used digit matching span (Allen et al., 2012), in which participants judge whether two lists of digits are the same (e.g., 3592 - 3952). To measure semantic WM, we used category probe (Martin et al., 2021), in which participants judge whether a probe word is in the same category as any preceding list word (e.g., list: tulip, desk, hat; probe: rose). For both tasks, list length increased until performance fell below 75% correct.

High resolution T1- and diffusion-weighted images were obtained at the chronic stage. Three WM-related tracts (Horne et al., 2021) were selected and dissected bilaterally including the arcuate fasciculus (AF), inferior longitudinal fasciculus (ILF), and inferior frontal-occipital fasciculus (IFOF). For the AF, we identified three subsegments including the anterior, direct, and posterior segments following their hypothesized different contributions to language processing (see Figure 1, top; Forkel et al., 2019). We performed deterministic tractography and calculated fractional anisotropy (FA) values for each tract. To relate tract integrity to WM performance, partial correlations were computed between FA values and changes in WM performance from acute to chronic timepoints, controlling for WM performance at the acute stage and the sum of gray matter damage at tracts' termini.

Results

Similar variability was observed in WM changes for both tasks. Paired *t*-tests indicated that semantic WM improved significantly between the two timepoints ($t=2.36$, $p=0.03$), whereas phonological WM did not ($t=0.21$, $p=0.84$). Table 1 shows the results of the partial correlation analyses for semantic and phonological WM with the left and right hemisphere tracts. After FDR correction, significant correlations were observed for semantic WM and three left hemisphere tracts (DAF, IFOF, and ILF; Figure 1). No correlations involving phonological WM or right hemisphere tracts reached significance.

Conclusions

The results confirm the role of white matter tracts in language recovery and support the involvement of the left rather than right hemisphere in the recovery of semantic WM. In contrast to other language domains which reorganize in part to the contralateral hemisphere after brain damage (e.g., Schlaug et al., 2009), these results suggest that left hemisphere regions are uniquely critical to semantic WM function at least during spontaneous recovery.

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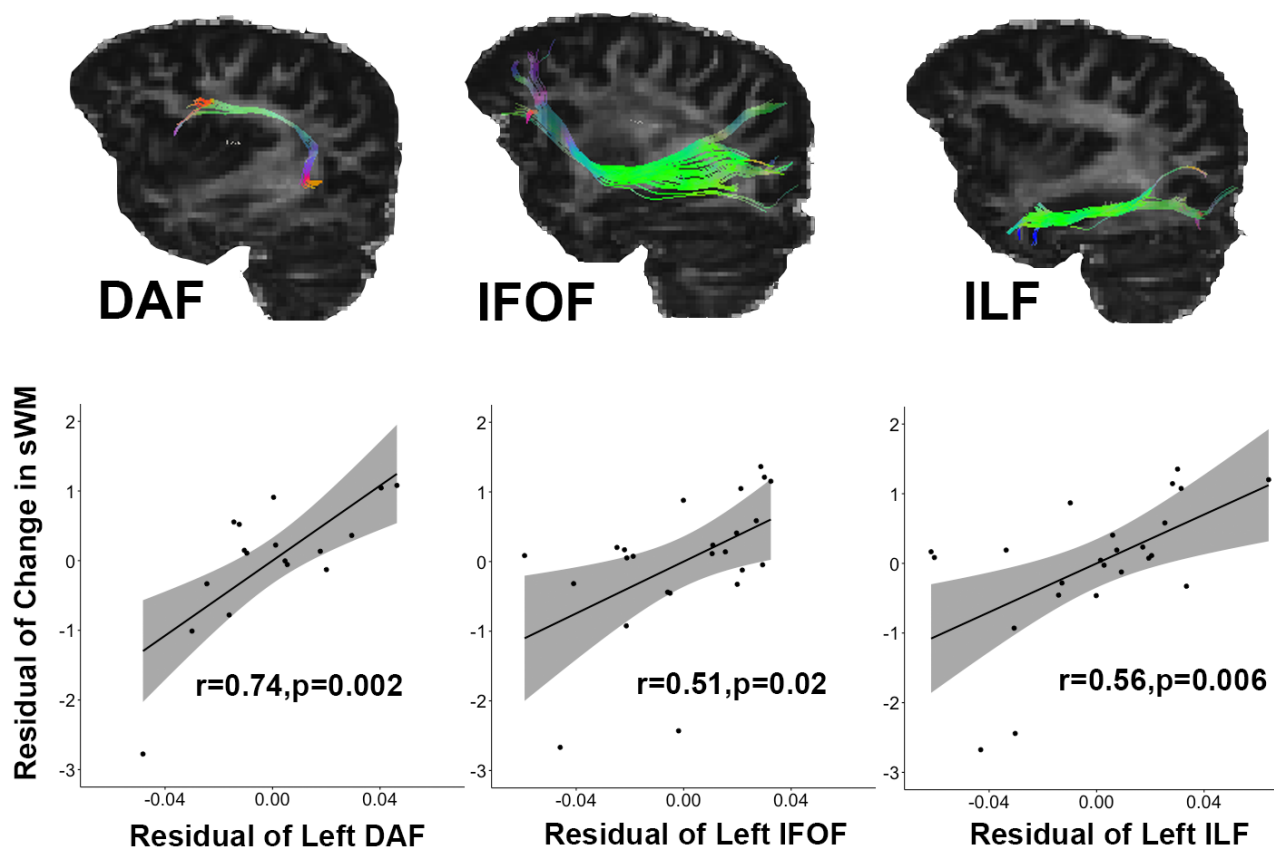


Figure 1. The significant effect of tract's FA on changes in semantic working memory performance. DAF: direct segment of arcuate fasciculus; IFOF: inferior fronto-occipital fasciculus; ILF: inferior longitudinal fasciculus; sWM: semantic working memory.

Table 1. Partial correlations between FA and WM change controlling for acute WM and lesion size at tract termini. (P-values in bold indicate correlations meeting FDR correction and numbers in parentheses are the number of participants for whom the tract could be identified; sWM = semantic working memory, pWM = phonological working memory).

	sWM		pWM	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
LH				
AAF (n=20)	0.39	0.11	0.30	0.23
DAF (n=17)	0.74	0.002	0.29	0.30
PAF (n=18)	0.33	0.21	0.52	0.04
IFOF (n=24)	0.51	0.02	0.35	0.11
ILF (n=24)	0.56	0.006	0.43	0.05
RH				
AAF (n=23)	0.44	0.04	0.40	0.06
PAF (n=21)	0.30	0.20	0.35	0.13
IFOF (n=24)	0.44	0.04	0.26	0.23
ILF (n=24)	0.44	0.04	0.32	0.14

Extension of the Dutch Linguistic Intraoperative Protocol (DuLIP-Extended): New standardized items and tasks for intraoperative language monitoring for mild, moderate and severe aphasia

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Introduction

Awake surgery with intraoperative language monitoring is the standard treatment for low-grade glioma patients (De Witt Hamer et al., 2012), and seems to result in better surgical outcomes, also in glioblastoma patients (Gerritsen et al., 2022). The Dutch Linguistic Intraoperative Protocol (DuLIP, De Witte et al., 2015) is a validated tool for intraoperative language monitoring and is available in several languages. However, in clinical practice, addition of tasks and items appeared to be necessary to 1) enlarge item variation for intraoperative selection (mild and moderate aphasia), 2) include more linguistic processes (mild aphasia), 3) add less complex tasks for glioblastoma patients with preoperative severe aphasia (Donders-Kamphuis et al., 2022). Therefore, we aimed to develop an extended version of DuLIP (DuLIP-Extended).

Methods

All new items were controlled for the linguistic variables word frequency, age of acquisition, prevalence and phonological complexity (Brysbaert et al., 2019; Ghyselinck et al., 2003; Keuleers et al., 2010). For an overview of the extra items and tasks, see Table 1.

DuLIP-Extended was administered in 151 healthy native speakers of Dutch. These were 90 females and 61 males with a median age of 52 years (range 18-83 years). For participants above 70 years, a score above 26/30 on the Montreal Cognitive Assessment was needed to participate.

Accuracy rate was calculated in percentages per item and per task. Items and tasks needed to have an accuracy rate of $\geq 80\%$ and $\geq 90\%$ respectively. Differences on task performance between groups of sex (male, female), age ($\leq/\geq 55$ years) and education ($\leq/\geq 12$ years of education) were investigated with Mann Whitney U Tests.

Results

All tasks had an accuracy rate of $\geq 90\%$. The tasks that elicited most errors were the semantic association task (accuracy rate: 92%) and the rhyming judgment task (accuracy rate: 94%). In total, seven items were removed from rhyme production, word pairs, semantic association and sentence completion, because of an accuracy rate below 80%.

No effect of sex were found in test performance. Younger participants (< 55 years) performed significantly better than older participants (≥ 55 years) on repetition of one syllabic words ($p<.001$), rhyming judgment ($p=.001$) and rhyming with a cue ($p<.001$). Higher educated participants (> 12 years of education) performed significantly better than lower

educated participants (≤ 12 years of education) on word repetition of two syllabic singular words ($p < .001$) and converting sentences from the present tense to the past tense ($p < .001$).

Conclusions

DuLIP-Extended appeared to be feasible in a large group of healthy participants. Like the original DuLIP, the new items and tasks have a good accuracy rate and some effects of age and education were found. DuLIP-Extended will enable the linguist to select from a larger variety of items and tasks at different linguistic levels for mild to severe aphasic glioma patients. This allows for a more inclusive neuro-oncological care in the pre-, intra- and postoperative phase. In future research, validation and application of DuLIP-Extended in glioma patients, according to cortico-subcortical areas will be performed. Adaptation to other languages will follow.

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Table 1. Overview DuLIP Extended

Domain	DuLIP 2015	DuLIP Extended			
		Mild aphasia		Moderate – severe aphasia	
		Extra items	New tasks	Extra items	New tasks
Phonology	Repetition of words (2-3 syllables with/without clusters)	Repetition of words (compound words with/without clusters)	Reading sentences aloud	Repetition of words (1-2 syllables with/without clusters)	
	Reading with odd word out		Rhyming		Rhyming with a cue
	Sentence judgment		Rhyme judgment		
			Onset phonemes judgment		Onset phonemes judgment
Semantics	Naming with odd picture out	Naming with odd picture out	Word pairs (category, synonyms, antonyms)		Word pairs (category)
	Semantic association	Semantic association			Matching pictures to categories
	Sentence completion	Sentence completion			Matching pictures to written words
	Reading with odd word out				Matching written words to pictures
	Sentence judgment				
Syntax	Action naming		Sentence completion (active and passive sentence with infinitive or past participle)		
	Verb generation		Converting sentences: present to past tense		
	Sentence judgment				
Naming	Object naming			Object naming of high-frequency words	
Verbal diadochokinesis	Verbal diadochokinesis				

The adaptation procedure of the comprehensive aphasia test into Moroccan Arabic

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Introduction

The comprehensive aphasia test (CAT, Swinburn et al., 2004) is an assessment tool that evaluates the cognitive, linguistic and psychosocial abilities of persons with aphasia. The CAT was adapted to different European languages by members of the Aphasia Assessment & Outcomes Working Group of the Collaboration of Aphasia Trialists. However, a Moroccan Arabic (MA) version is not available yet. The objective of this study, which is in progress, is two-fold: (a) to cross-linguistically/culturally adapt the cognitive screening, language battery and aphasia impact questionnaire components of the English CAT into MA, and (b) to evaluate the psychometric properties of the adapted version.

Methods

The guidelines of Ivanova and Hallowell (2013) will be followed to adapt the CAT into MA. The lexical and visual stimuli of the MA CAT will be controlled for name agreement, word frequency, imageability, visual complexity, and age of acquisition using Rami et al.'s (2022) normative database of MA nouns and verbs. The test will be piloted on 40 persons with and without aphasia (20 each) to ensure its appropriateness for testing a Moroccan population and to fix any issues with the stimuli or instructions before testing a larger number of participants. Following the modifications made as a result of the piloting process, normative data will be collected from a larger sample of typical MA-speaking participants (+150) and persons with aphasia (+150), stratified by age and level of education. The MA CAT's validity will be established by verifying its content, construct, and concurrent validity. The test's reliability will be evaluated by examining its interrater, intrarater, test-retest reliability in addition to internal consistency.

Results

The adaptation process of the test into MA is a work in progress. We hypothesize that the test will have good to excellent psychometric properties and will be a useful aphasia assessment measure, both for clinical and research purposes.

Conclusions

Standardized aphasia assessment tools that are linguistically and culturally suitable for a Moroccan population are scarce. A MA version of the CAT will provide an invaluable resource for speech-language pathologists and aphasiologists in the country to screen for the presence of aphasia, assess patients' strengths and weaknesses, and track changes in language and cognitive recovery over time. The test will also serve as a cross-linguistic tool that will enable researchers to make valid inferences about the performance of persons with aphasia across different languages.

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Does therapy on verb inflection improve verb tense accuracy in narrative discourse by people with aphasia?

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Introduction

After a stroke, people with fluent or non-fluent aphasia may exhibit difficulty with verb inflection. Specifically, verb tenses are often more impaired than other morphological markers (such as agreement) because they are more complex semantically, syntactically, and conceptually, making them harder to encode and retrieve during speech (Faroqi-Shah & Thompson, 2007; Kok et al., 2007). Verb tenses play a central role in communication, as they transmit essential semantic information for structuring discourse and increasing its informativeness. Consequently, verb tenses errors can disrupt and impair the informativeness of discourse, contributing to communication difficulties (Bastiaanse et al., 2006). While improving discourse production is prioritized by people with chronic aphasia (Wallace et al., 2017), a major challenge in treating aphasia is providing interventions that generalize to everyday communication. The purpose of this study is to evaluate the transfer of gains toward narrative speech from a therapy designed to improve the accuracy of verbal tenses.

Methods

Four people with chronic post-stroke aphasia (three non-fluent; one fluent) took part in a four-week therapy program with three weekly sessions. Each two-weeks period of therapy focused on a different verb tense (past or future). A narrative discourse task was collected three times prior to treatment, once between the two treatment periods, once just after the treatment and twice following the treatment (at two and four weeks). The narrative discourse task consisted in telling two sequential scenes of six pictures each representing activities of daily life (Fossard et al., 2018), with a defined temporal context (one past; one future). Participants' ability to inflect verbs correctly was analyzed using a measure of verb tense accuracy (appropriateness of verb tense use according to the given temporal context). A ratio (correctly inflected verbs to the total number of verbs) was calculated for each picture (a maximum of six points could be awarded per sequential scene).

Results

After the treatment, one participant showed significant improvement for both temporal contexts treated in therapy (past and future) and maintained gains two to four weeks post-treatment (see Figure 1 for past tense). Two other participants showed significant improvement for past tense in follow-up measures but not for future tense (although one of these participants showed significant effects immediately after treatment of the future tense, the gains were not maintained after the past tense treatment). The last participant, who only received two weeks of therapy due to an early withdrawal from the study, showed no significant improvement in tense accuracy.

Conclusions

Our findings suggest that our verb inflection therapy was effective in improving the accuracy of tenses in a narrative discourse task for the majority of our participants. However, when analyzing the transfer of gains into the discourse we encountered a lack of stability in our measure (accuracy of verb tense) over time, with performances sometimes significantly

different (improvement or deterioration) from one pre-test to the next. It should be noted that this reliability of the test-retest has been identified as a major difficulty in the evaluation of discourse in aphasia (Dietz & Boyle, 2018).

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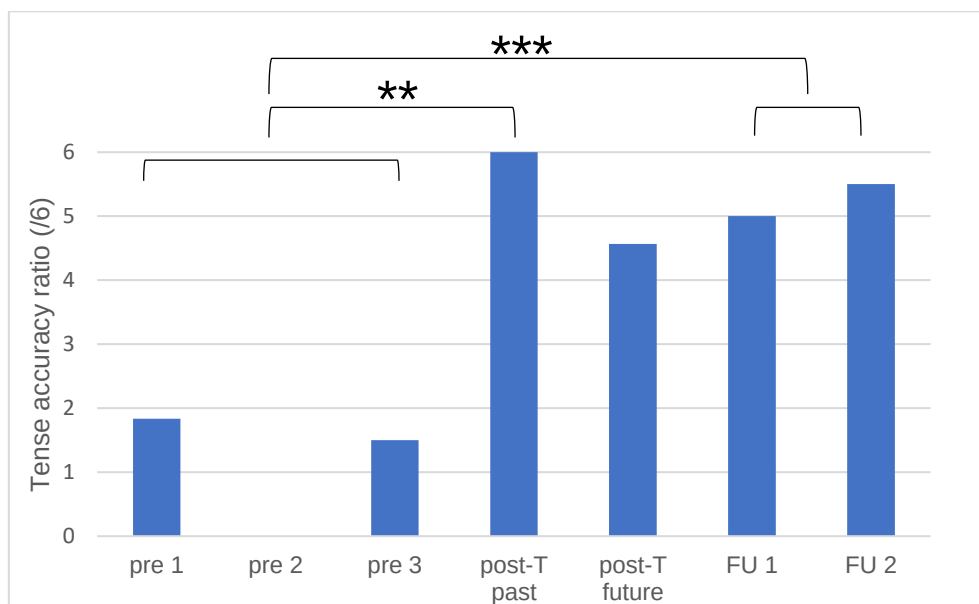


Figure 9. Tense accuracy ratio for P1 on past tense sequential scene description. Ratio of correctly inflected verbs to the total number of verbs was calculated for each picture, a maximum of six points could be awarded. *** = $p < .001$; ** = $p < .01$

Cross-linguistic treatment effects in bilingual agrammatic aphasia: A systematic review

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Introduction

Although bilingual aphasia research has demonstrated that treatment in one language can transfer to a non-treated language (Faroqi-Shah & Chengappa, 1996; Paradis, 1993), there are many variables that influence the extent to which cross-linguistic transfer occurs. Previous reviews of cross-linguistic transfer (Faroqi-Shah, 2010; Goral, 2023), have not specifically examined grammatical errors. This systematic review evaluates current research on bilingual agrammatism to answer the research question: which syntactic structures do cross-linguistic transfer of treatment effects extend to including a) sentential structuring, b) morphosyntax, and/or c) lexical syntactic category access?

Methods

The systematic review searched 5 databases for peer-reviewed sources published after 1980 with original data on grammatical processing by bilingual adults with aphasia. The review produced 131 articles fitting the inclusion criteria, but only 12 addressed cross-linguistic transfer. Each study's quality was scored from 0-2: (0) indicating absence of information, (1) indicating any information, and (2) indicating adequately described information. Quality indicators included: bilingualism description (identification of languages acquired, age of acquisition, language proficiency, language dominance; c.f. Surrain & Luk, 2019); aphasia diagnostic characteristics (etiology, subtype, fluency, diagnosis of grammatical deficit, c.f. Faroqi-Shah et al., 2010); linguistic description of errored structures; and statistics (significance, sampling, c.f. Robey, 2007).

Results

Quality Indicators. Only two of the twelve sources included more than one participant (Li, 2020; Goral, 2013) and all studies included English as one of the languages. 42% of articles were categorized as Good (possessing 11-13 of 14 indicators), 25% Fair (9-10 indicators) and 33% Low (5-9 indicators). See Table 1 for number of participants, languages and quality ratings. Across all sources, quality indicators were included 97.9% of the time for bilingualism, 74.0% of the time for aphasia factors (most frequently excluding discussion of syntactic comprehension deficits), 92.0% of the time for linguistics, and 50% of the time for statistics. Most of the literature utilized a single-subject multiple baseline design, which did not meet the statistics quality indicator for experimental sampling. See figure 1 for quality indicators by study.

Findings. Cross-linguistic transfer was evident across 10 studies but often limited. Cross-linguistic transfer occurred across all three language structures, with evidence of improved sentential structure (Goral, 2013; Faroqi-Shah & Chengappa, 1996; Lerman et. al., 2019; Knoph et. al., 2015), morphosyntax (Goral, 2010; Altman et. al., 2012), and lexical syntactic

category access (Croft et. Al., 2015; Li et. al., 2020; Goral et. al, 2012; Edmonds & Kiran, 2006). Findings suggested that transfer effects were stronger in high-proficiency languages than low-proficiency languages (Conner, 2018; Faroqi-Shah & Chengappa, 1996), more evident in discourse tasks than word-level tasks (Lerman, 2019), and responsive to Verb Network Strengthening Treatment (VNeST) (Li, 2020; Lerman, 2019) and Semantic Feature Analysis (SFA) treatments (Knoph, 2015; Goral, 2012).

Conclusions

Although cross-linguistic transfer has been demonstrated for a) sentential structures b) morphosyntax and c) lexical category access, small samples and variations in treatment approaches, assessments, and participants' language backgrounds limit generalizations. Larger studies of transfer effects are necessary and could lead to improved treatment efficacy for bilinguals with aphasia.

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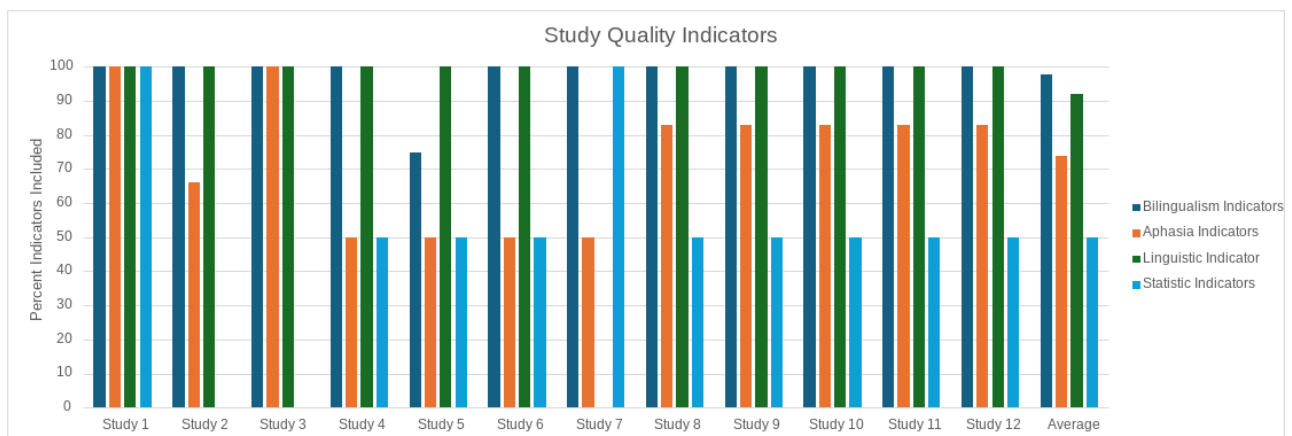


Figure 1. Percent of quality indicators included per study

Table 1. Number of participants, quality rating and languages of studies

Study	Number of Bilinguals with Aphasia	Quality Rating	Languages Included
Study 1 Case Study	1	Good	English, Hindi, Kannada, Telegu
Study 2 Case Study	1	Fair	Hebrew, English, French
Study 3 Case Study	1	Good	Hebrew, English
Study 4 Case Study	1	Low	Spanish, Catalan, German, French, English
Study 5 Case Study	1	Low	Hebrew, English, French
Study 6 Case Study	1	Low	Japanese, English, Norwegian, German
Study 7 Experimental	3	Fair	English, Spanish
Study 8 Case Study	1	Good	Bengali, English
Study 9 Case Study	1	Good	Persian, German, English
Study 10 Case Study	1	Good	Flemish, French, German, Afrikaans, English, Danish, Swedish, Norwegian, Spanish, Portuguese, Russian
Study 11 Case Study	2	Good	Mandarin, English
Study 12 Case Study	1	Fair	French, German, English, Italian
Total	15	6 Good, 3 Fair, 3 Low	22

How many patients profit from intensive post-stroke aphasia therapy? A possible role of communicative action embedding

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Introduction

Clinical studies emphasize the importance of therapy intensity in chronic post-stroke aphasia neurorehabilitation; however, intensity alone may not ensure effective language recovery. This study compares therapy response rates in two groups undergoing two intensive speech-language therapies: Intensive Language-Action Therapy (ILAT/CIAT) and Intensive Naming Therapy (INT). ILAT comprises three core principles: massed practice, communication embedding, and guidance by pragmatic communicative constraints (Pulvermüller & Berthier, 2008), while INT focuses mainly on naming objects and identifying object-related words, without embedding them in a communication context. We hypothesize that ILAT will have a significantly higher responder rate, reflecting language abilities and depressed mood improvements, compared to INT.

Methods

The study included 79 right-handed patients with aphasia from randomized controlled trials (Stahl et al., 2016; Stahl et al., 2018), with 50 receiving ILAT and 29 receiving INT. Patients, aged 32-84 years, were at least one year post-onset of a single ischemic or hemorrhagic stroke. In the ILAT condition, three patients and a therapist engaged in card games, embedding language in action/communication (Pulvermüller et al., 2001; Difrancesco et al., 2012). INT had the same setup but focused solely on picture naming. Both therapies had equal intensity and duration, ranging between 2 and 4 weeks with 6 to 12 hours per week. Pre- and post-therapy assessments included 4 subtests of the Aachen Aphasia Test (AAT), particularly the AAT mean (mAAT) and mean of the AAT production (AATpro) subtests (naming and repetition), alongside the Beck Depression Inventory (BDI-V). Patients were considered responders if their improvements exceeded the Minimal Detectable Change (MDC) with 90% confidence (Menahemi-Falkov et al., 2021). A Chi-square and Mann-Whitney U tests were used to assess responder proportions across therapy types and potential covariate differences, including age, therapy hours, aphasia severity, time since disease onset, and education years among patients receiving different therapies.

Results

There were no significant differences between therapy groups in age ($U=667$, $p=0,555$), therapy hours ($U=694$, $p=0,986$), and aphasia severity ($U=588$, $p=0,163$). However, differences were

observed in the time since disease onset ($U=466$, $p=0.009$) and education years ($U=205$, $p<0.001$). ILAT showed significantly higher improvement rates compared to INT in mAAT (68% vs. 38%, $\chi^2 = 6.77$, $p = 0.009$) and AATpro (78% vs. 34%, $\chi^2 = 14.8$, $p < 0.001$). Although ILAT had a numerically higher proportion of patients with improved BDI scores than INT (66% vs. 45%), the difference did not reach statistical significance ($\chi^2 = 3.38$, $p = 0.066$). Within the ILAT group, the proportion of responders was significantly higher than non-responders ($\chi^2 = 5.12$, $p = 0.024$).

Conclusions

These findings suggest that ILAT outperforms INT in improving language performance and potentially alleviating depressive symptoms. Therefore, the belief that intensity is the only factor that influences the efficacy of aphasia therapy cannot be maintained. The communicative function of language use during therapy is an additional important factor determining the success of post-stroke speech-language therapy. However, further investigation into BDI differences is needed. Potential disparities in the time since disease onset and education levels between groups must be considered.

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A preliminary investigation of phonological neighborhood density effect on semantic activation in people with aphasia

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Introduction

In the process of lexical retrieval, semantic access is affected by the phonological structure of a lexicon. Treatment studies involved people with aphasia (PWA) showed that high phonological neighborhood density (PND) targets led to better naming accuracy and less semantic errors in comparison to low PND targets. However, evident has been inconsistent across PWA and limited evident is available to verify if the same applies to word-level auditory processing. Therefore, this study sets out to investigate the potential effect of PND on semantic access in auditory lexical processing in PWA.

Methods

Four Chinese-speaking PWA of various subtypes (mean age = 56.25 years, $SD = 2.98$) were recruited along with 10 age-matched controls (mean age = 59.5 years, $SD = 4.91$). The demographic information of PWA are demonstrated in Table 1. An eye-movement task, modified from Apfelbaum et al. (2011), was adopted to observe lexical processing. The participants heard an object name and were to fixate on the corresponding picture presented in a four-picture-array until the end of each trial. The critical trials consisted of a target of high/low PND, a semantically related distractor, and two phonologically and semantically unrelated objects. The baseline trials contained a target with medium phonological density and three unrelated pictures.

Two-way mixed analyses of variance were adopted to analyze eye-movement patterns. Firstly, the effect of PND (high vs. low) on the time course of target fixation performance of the two groups was explored. Secondly, the effect of PND on magnitude of semantic priming (MoP) across the groups was investigated. The MoP score was computed by subtracting the averaged proportion of looks to the unrelated pictures from the proportion of looks to the semantic distractor.

Results

PND did not significantly affect the fixation time course ($F_{(1, 12)} = 0.23, p = 0.64$). However, significant group effect was reported ($F_{(1, 12)} = 67.19, p < 0.01$) and interaction was found between the variables ($F_{(1, 12)} = 28.27, p < 0.01$). The post-hoc analysis suggested the significant group difference laid in the high PND condition ($p < 0.01$) but not in the low PND ($p = 0.62$). The patterns of fixation time course of the groups are shown in Figure 1. On the other hand, PND had no significant effect on MoP ($F_{(1, 12)} = 0.07, p = 0.81$). Yet, significant group effect was reported ($F_{(1, 12)} = 9.11, p = 0.01$). Interaction between the two variables was marginal significant ($p = 0.59$). The post-hoc analysis revealed significant difference between the groups in high PND condition ($p < 0.01$).

Conclusions

The findings of this study revealed reduced PND effect in PWA. High PND target lead to shorter time to fixation and greater MoP in healthy elderly participants. Yet, these patterns were not observed in PWA. Reduced PND effect suggested potential phonological processing deficit. This deficit might further affect the effectiveness of semantic activation leading to delayed or failure in auditory lexical processing.

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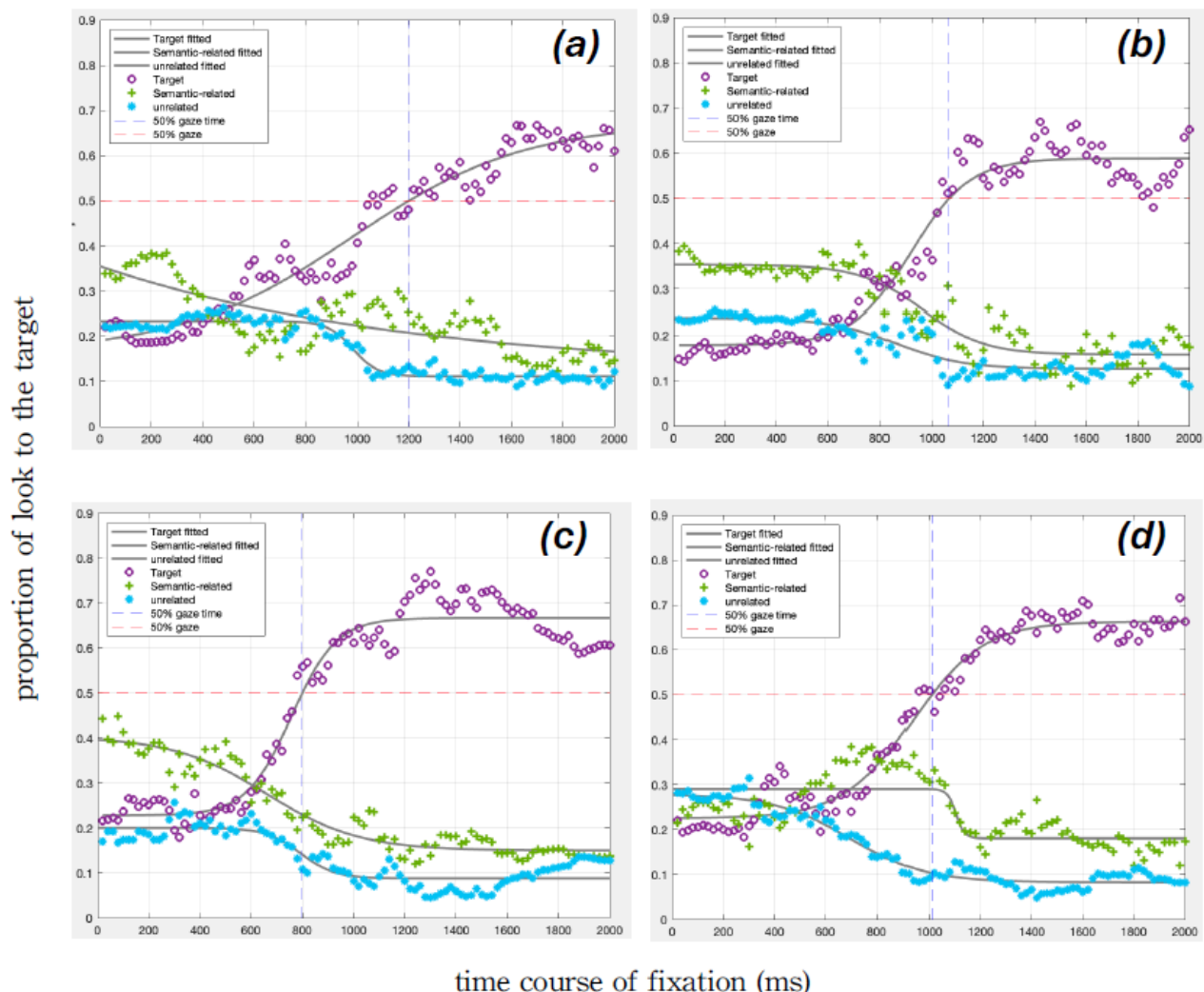


Figure 10. The purple dots demonstrate the proportion of looks to the targets across a 2000ms time window since auditory-stimuli-onset. Eye-movement patterns generated by PWA in (a) HD and (b) LD conditions are contrasted to the performance of the controls in (c) HD and (d) LD conditions respectively.

Table 1. Demographic information of PWA.

participant no.	age	severity & subtype	years of onset
1	53	mild transcortical sensory aphasia	9
2	60	mild anomic aphasia	12
3	55	mild transcortical motor aphasia	5
4	57	mild transcortical mixed aphasia	2

Quantifying the relationship between noun and verb naming tests: A structural equation modeling approach

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Introduction

Word production integrates multiple cognitive processes, where semantic representations are generated and mapped to a lemma with its associated grammatical markers and phonemic forms (Dell et al., 1997). Aphasic word production has been extensively studied to understand this underlying architecture (Schwartz et al., 2006). However, it is debated whether the cognitive processes involved in word production differ by word class and the extent to which measurement of single verbs versus nouns captures unique clinical information (Alyahya et al., 2018; Caramazza & Hillis, 1991).

For this project, we quantified the relationship between the constructs underlying two common confrontation naming tests (CNTs), one with noun stimuli and another with verb stimuli, in a large and representative sample of participants with aphasia. We specifically aimed to test three hypotheses: noun and verb CNTs measure the same construct (Figure 1A), related constructs (Figure 1B), or distinct constructs (Figure 1C).

Methods

Archival data from 107 individuals with aphasia who were administered both the Verb Naming Test (VNT; Cho-Reyes & Thompson, 2012) and the Boston Naming Test–Short Form (BNT; Kaplan et al., 2001) were extracted from AphasiaBank (MacWhinney et al., 2011). For a detailed description of inclusion criteria, demographic/clinical data, and participant identifiers please see Fergadiotis et al. (2023).

Item-level scores were then evaluated using structural equation modeling, an analytic framework useful for exploring the construct validity of different tests. Specifically, three factor analytic models were specified consistent with the stated hypotheses (Figure 1) and evaluated based on global fit indices (Kline, 2010; benchmarks in Table 1). Further, models were directly compared via nested model χ^2 difference tests. Analyses were conducted the *lavaan* R package (Rosseel, 2012).

Results

Model B, which was consistent with the hypothesis that the BNT and the VNT measure distinct yet related constructs, demonstrated the best fit to the data (Table 1). Nested model comparisons confirmed that Model 2 outperformed both Model A, which assumed the two tests measure the same construct ($\Delta\chi^2(1)=6.748$, $p=.009$), and Model C, which assumed the BNT and the VNT measure independent constructs ($\Delta\chi^2(1)=124.19$, $p<.001$). Importantly, the correlation between the two constructs in Model B was estimated to be .915 (Figure 1D).

Conclusions

The BNT and VNT measure distinct yet related constructs. Their high correlation suggests that noun and verb retrieval share a common underlying cognitive architecture despite potentially engaging processes specific to their respective word classes. This aligns with theories that propose a shared semantic system for both nouns and verbs, with differences possibly emerging at later processing stages (Gordon & Dell, 2003; Vigliocco et al., 2011). From an applied standpoint, these findings suggest there may not be sufficient incremental value in administering both the BNT and VNT for clinical purposes, given the high degree of overlap between their underlying constructs. From a theoretical one, future research should aim to further delineate the cognitive processes contributing to the observed relationship between the constructs underlying noun and verb CNTs, potentially through explanatory item-based models (Casilio et al., 2023) that include relevant behavioral and neural variables.

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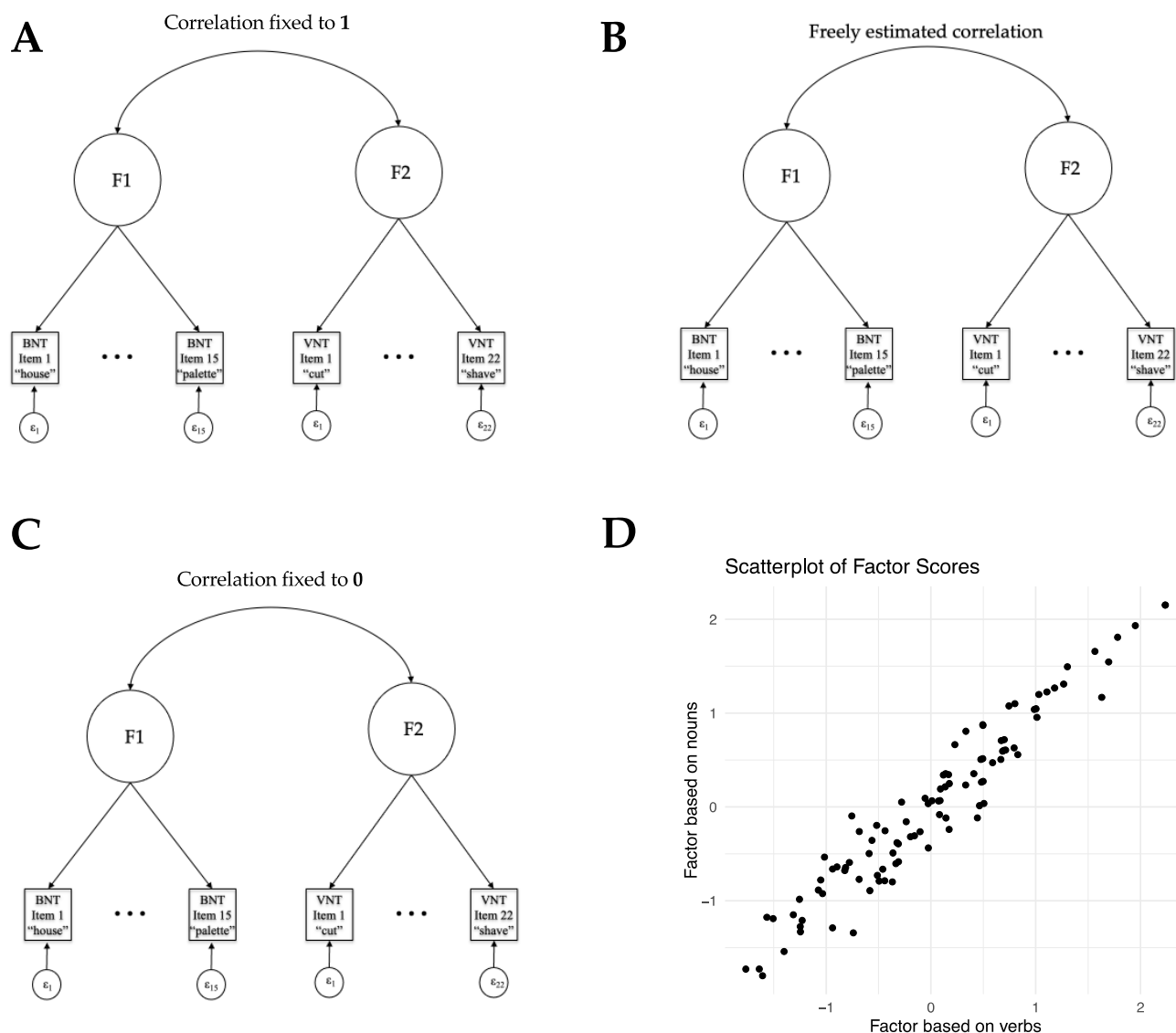


Figure 1. Key Methods and Results.

(A) Path diagram for Model A, where both tests measure the same construct (equivalent to a unidimensional model). (B) Path diagram for Model B, where both tests measure distinct, yet related constructs and the strength of the relationship is estimated from the data. (C) Test measure independent constructs. For all three models, loadings are freely estimated (equivalent to a two-parameter logistic model). (D) Scatterplot of factor scores for the best-fitting model (Model B).

Table 1. Global Fit Indices for the Three Competing Models.

Model	Model Description	Scaled χ^2	<i>df</i>	<i>p</i>	CFI	RMSEA [90% CI]
Model A	Hypothesis 1: The BNT and VNT measure the same construct.	656.490	629	.217	.981	.021 [.000, .039]
Model B	Hypothesis 2: The BNT and VNT measure related constructs.	651.366	628	.251	.984	.019 [.000, .038]
Model C	Hypothesis 3: The BNT and VNT measure distinct constructs.	1468.93	629	<.001	.427	.117 [.109, .125]

Note. CFI=Comparative Fit Index; RMSEA=Root-Mean-Square Error of Approximation. Adequate fit is indicated by a nonsignificant χ^2 , a CFI higher than .95, and a RMSEA with the upper bound of the 90% CI below .05.

Preliminary results of a usability study on a web laboratory with language exercises in aphasic patients

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Introduction

Regarding aphasia rehabilitation, technology-mediated therapy presents advantages in terms of its versatility, availability, and portability compared to traditional therapy (Vuuren & Cherney, 2014). Our research team focuses on developing a web-based cognitive stimulation laboratory for older adults (labpsi.mdp.edu.ar/ejercicioscognitivos). The current study aims to assess the usability of language exercises of the LABPSI platform in individuals with aphasia. Usability is the quality of a computer system that enables users to use the program's tools easily, efficiently, and effectively, thereby determining the degree of satisfaction with the software (Enriquez & Casas, 2013). Usability encompasses general aspects such as text readability, intuitive menus, and understandable instructions; and particular aspects in the case of LABPSI such as appropriate complexity gradients, accessibility, level of autonomy, and the degree of necessary prior training. For the recording of indicators, an empirical technique was used (Enriquez & Casas, 2013), including objective and subjective metrics extracted from the Mobile Goal Question Metric model (Hussain, 2012).

Methods

Sample: Three aphasic patients and one patient with anarthria due to focal lesion, all native Spanish speakers from Argentina. Materials: Interaction with LABPSI was conducted using a 10" tablet. A pilot exercise in LABPSI involving language tasks was employed. A digital competence questionnaire (DCQ) was administered to assess familiarity with the use of technological devices, with the raw score used (min:34; max:136). Procedure: steps followed to reach the exercise and to perform the exercise were recorded. The platform usability was measured using three attributes (ISO 9241-11): effectiveness (successful steps and error rates), efficiency (task completion time and successful steps within 3 minutes), and satisfaction (via a Likert questionnaire). Error types were recorded, and participants' autonomy was assessed. Data analysis: Descriptive statistics were calculated, and recurrences in subjective data were recorded.

Results

Only one participant (n°3) could complete all steps to reach the exercise autonomously, while the others required assistance. Most recurring errors included "touching outside the icons" and "other errors". Exercise performance mirrored entry performance, as shown in Table 1, with a positive association between DCQ scores and unassisted successful steps. Regarding efficiency, time spent to reach the exercise averaged 2 minutes and 22 seconds (Median: 153 seconds; Range: 62-198), while exercise completion averaged 14 minutes and 35 seconds (Median: 959 seconds; Range: 186-1395) also showing a negative association with DCQ scores (Table 1). Only participant No. 3 completed all 19 steps within 3 minutes. Regarding satisfaction with LABPSI, survey results are presented in Figure 1.

Conclusions

Most participants (75%) faced challenges completing steps autonomously, both during the steps to reach the exercise and in the exercise itself. Common errors stemmed from touchscreen use (e.g., holding instead of pressing). Higher scores on the DCQ were negatively associated with exercise completion times and positively associated with a greater number of successful steps without assistance and successful steps within 3 minutes, suggesting the need for additional support for less tech-savvy patients. Lastly, despite challenges, participants expressed overall satisfaction with the platform, which is relevant if continued LABPSI usage by the patients is intended.

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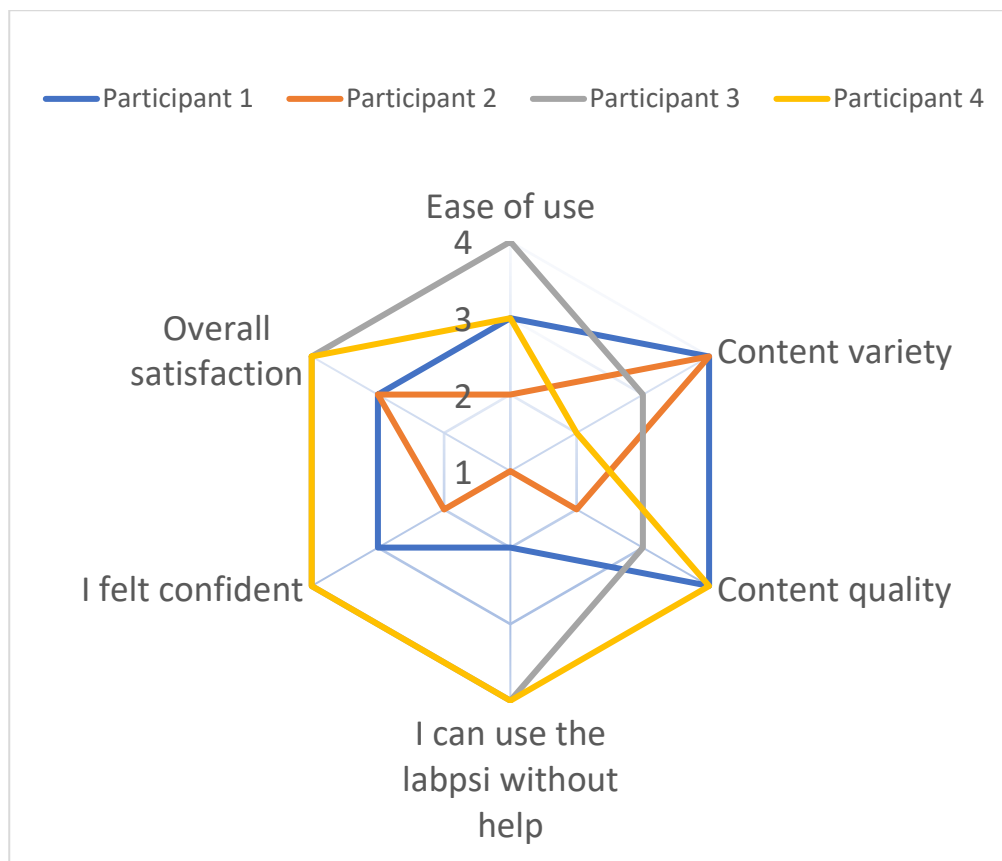
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Table 1. Exercise performance and types of errors

	Subjects			
	1	2	3	4
Digital skills score	68	57	99	40
Exercise completion time*	11:57	23:15	03:06	20:01
Successful steps without help	3	2	19	1
Total errors	3	37	0	8
Tap outside the icon	0	11	0	2
Doesn't slide down	0	0	0	0
Doesn't know how to continue	1	13	0	0
Leaves the Page	0	2	0	0
Doesn't know how to return	0	0	0	0
Doesn't check the text box	0	2	0	0
Other errors	2	9	0	6

*time format: MM:SS



* 1=bad; 2=fair; 3=good; 4=excellent

Figure 1. Satisfaction survey results

Development of self-made gestures as an adaptive strategy for communication in an individual with childhood apraxia of speech

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Introduction

Children with childhood apraxia of speech often face greater challenges in expressive language compared to receptive language. Consequently, they may find alternative modes of communication advantageous. In this regard, the use of signs, in combination with communication boards, or sign language, has been suggested and employed for children with childhood apraxia of speech. However, to our knowledge, there have been no reports on the use of gestures by these individuals. Here, we present a case of a child with childhood apraxia of speech who utilized pointing as a means of communication at the age of 2¼ years, progressing to self-made gestures at the age of 3½.

Methods

To clarify the related factors for the development of pointing and subsequent self-made gestures, we conducted a neurologic examination, neuropsychological testing, and a speech evaluation, as well as a detailed assessment of our patient's pointing and self-made gestures. These assessments were performed in four phases—before the appearance of the gestures, during the appearance of the gestures, during the period of gradual decline in the use of gestures, and after the disappearance of the gestures—to identify how our patient's development of self-made gestures was related to his development of speech production and cognitive function.

Results

Starting at the age of 2¼ and peaking at age 4, he relied on pointing and gestures as his primary means of communication due to extreme difficulties with speech. In addition to common gestures, such as those for 'bye-bye' or 'come here,' our patient also developed his own original gestures. For example, to express his hunger and his desire to eat, he put his hands on his stomach (meaning "being hungry") and then put his hands on his mouth (meaning "I want to eat"). He covered his mouth with his right hand to express that the meal he had eaten was delicious. His original gestures included not only word-level expressions, but also sentence-length ones. For example, when expressing "I am going to bed," he pointed his index finger at himself (meaning I) and then put both his hands together near his ear (sleep). When trying to convey the meaning of "I enjoyed the meal and am leaving," he covered his mouth with his right hand (delicious), then joined both of his hands in front of himself (finish) and finally waved his hands (goodbye). These original gestures and pointing peaked at the age of 4 and then subsided and completely disappeared by the age of 7, when he was able to make himself understood to some extent with spoken words.

Conclusions

The present case demonstrates an adaptive strategy for communication that might be an inherent competence for human beings. Even young children ages 3–4 years possess the ability to develop original forms of communication when they are unable to express themselves verbally.

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Discourse production in people with aphasia: An fNIRS pilot study

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Introduction

Aphasia is a kind of language disorder, comprehension, and expression impairment due to brain damage, which negatively affects the quality of life of people with aphasia (Sjöqvist Nätterlund, 2010). Discourse assessment can provide more details on the communication quality in people with aphasia (Caselli et al., 2022). However, how the brain works during discourse production in people with post-stroke aphasia is still unclear. Recently, researchers focused on functional near-infrared spectroscopy (fNIRS) in aphasia studies (Klingbeil et al., 2019) (Kim et al., 2022). This pilot study explored the neural mechanism by quantifying the fractional amplitude of low-frequency fluctuations (fALFF) during varied discourse production tasks in people with fluent aphasia (PFA) and people with non-fluent aphasia (PNA).

Methods

We recruited four male people with post-stroke aphasia (two PFA and two PNA) in our study. The age ranged from 32 to 51 years old. The diagnosis of aphasia type was by Western Aphasia Battery- Chinese. A trained speech therapist followed the Mandarin AphasiaBank protocol to collect discourse samples. We applied the fNIRS device to the participant's head during the discourse production session. For each task, we marked the start time when the participants began to talk. And the end time was when he stopped talking. We explored the differences in cortical blood oxygenation using fNIRS in PFA and PNA. During the expression session, we measured each task's fALFF.

Results

The tasks related to fALFF in the PNA differed from those in the PFA. In the PNA group, fALFF increased mainly in the frontal and parietal regions, especially in the left Broca's area and in the right Broca's homologous region. However, the increase in fALFF in the PFA group was primarily in the occipital region and the primary motor cortex. The tasks showed a significant effect on groups based on the multivariate tests. Tasks and groups showed significant interaction effects.

Conclusions

The current findings indicate the distinct patterns of brain activity between people with non-fluent aphasia and those with fluent aphasia during discourse production. The different fALFF patterns may reveal the neural mechanism underlying language fluency in people with post-stroke aphasia.

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Table 1 the demographic data for participants

PName	Gender	Age(Y)	Aphasia Type	AQ
Wpp	Male	34	Broca's Aphasia	61.1
Lw	Male	32	Transcortical Motor Aphasia	39.4
CHzh	Male	51	Conductive Aphasia	54.3
SHy	Male	36	Anomic Aphasia	89.4

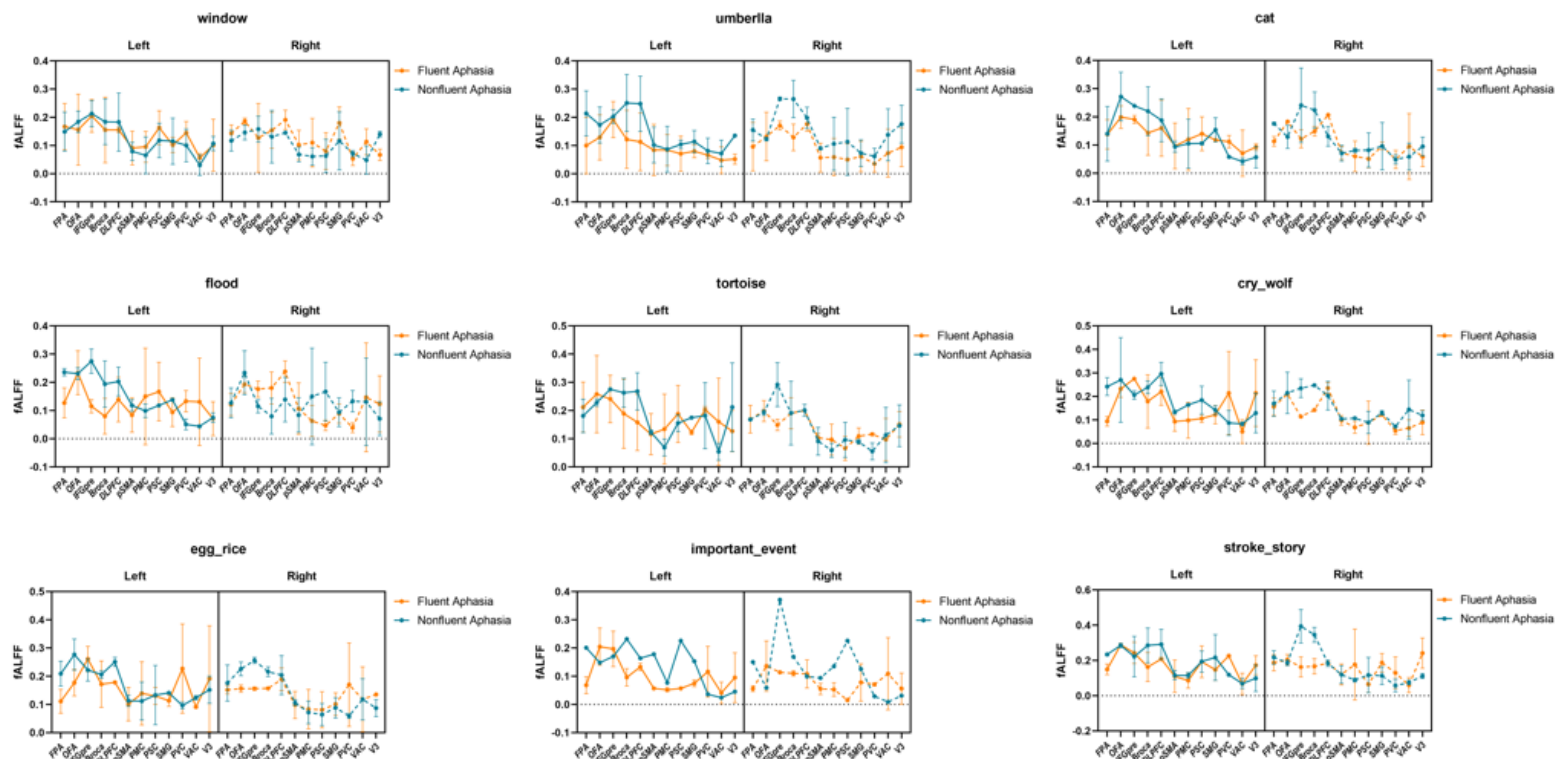


Figure 11 fALFF in each task between two groups

Characterizing verb argument structure production in discourse in chronic aphasia

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Introduction

Verb production and verb argument structure production are often affected in people with aphasia. Measuring verb argument structure production in spontaneous speech can help characterize grammatical deficits in aphasia, but it usually requires intensive manual coding (Malyutina et al., 2016). In this study, we aimed to assess verb argument structure production impairments using dependency parsers to automatically extract verb use and argument structure production in controls and people with aphasia. Dependency parsers allow for a fast and use-based characterization of verb argument structure by identifying verbs in sentences and their dependent relations.

Methods

First, we created a bank of verb use in text by running the Stanford dependency parser on narrative samples of text (Chen & Manning, 2014). From this, we extracted the average number of arguments verbs are usually used with, the types of arguments (i.e. dependency relations) associated with each verb, and the configurations of argument types for each verb (subcategorization options). We then quantified verb use in the Cinderella narrative in speakers with chronic aphasia (n = 105) who participated in an intervention study and in controls from AphasiaBank (n = 254) with the same approach. Using linear mixed-effects models, we compared the likelihood of verb selection among controls and aphasia groups (anomia, Broca's, Conduction, Wernicke's) based on verb characteristics derived from the verb bank of standard use in text and baseline verb frequency and length. The number of arguments produced for each verb was also compared between groups.

Results

The mixed-model results show that speakers with aphasia across the board produced fewer verbs and were less sensitive to baseline verb characteristics when selecting verbs than controls. In particular, speakers with aphasia were less likely to select verbs used with more arguments on average, more likely to select verbs used with many different types of arguments, and less likely to select verbs used in many configurations than controls. Pairwise comparisons show some differences between groups, with speakers with Broca's aphasia differing most strongly from controls. In addition, speakers with Broca's aphasia produced significantly fewer arguments than other aphasia groups and controls (Fig. 1). Post-hoc analyses show that agrammatic speakers deviated more from controls relative to non-agrammatic speakers in their verb and argument structure use.

Conclusions

Overall, the results show that dependency parsers are able to characterize relevant dimensions of verb argument structure use in spontaneous speech. These automatically-derived measures successfully identify differences across aphasia types classified by the Western Aphasia Battery-Revised diagnosis relative to baseline use in controls. This approach also captures variability within aphasia types and isolates a key feature of agrammatism, thus potentially providing a tool to better characterize grammatical behavior from discourse in people with aphasia.

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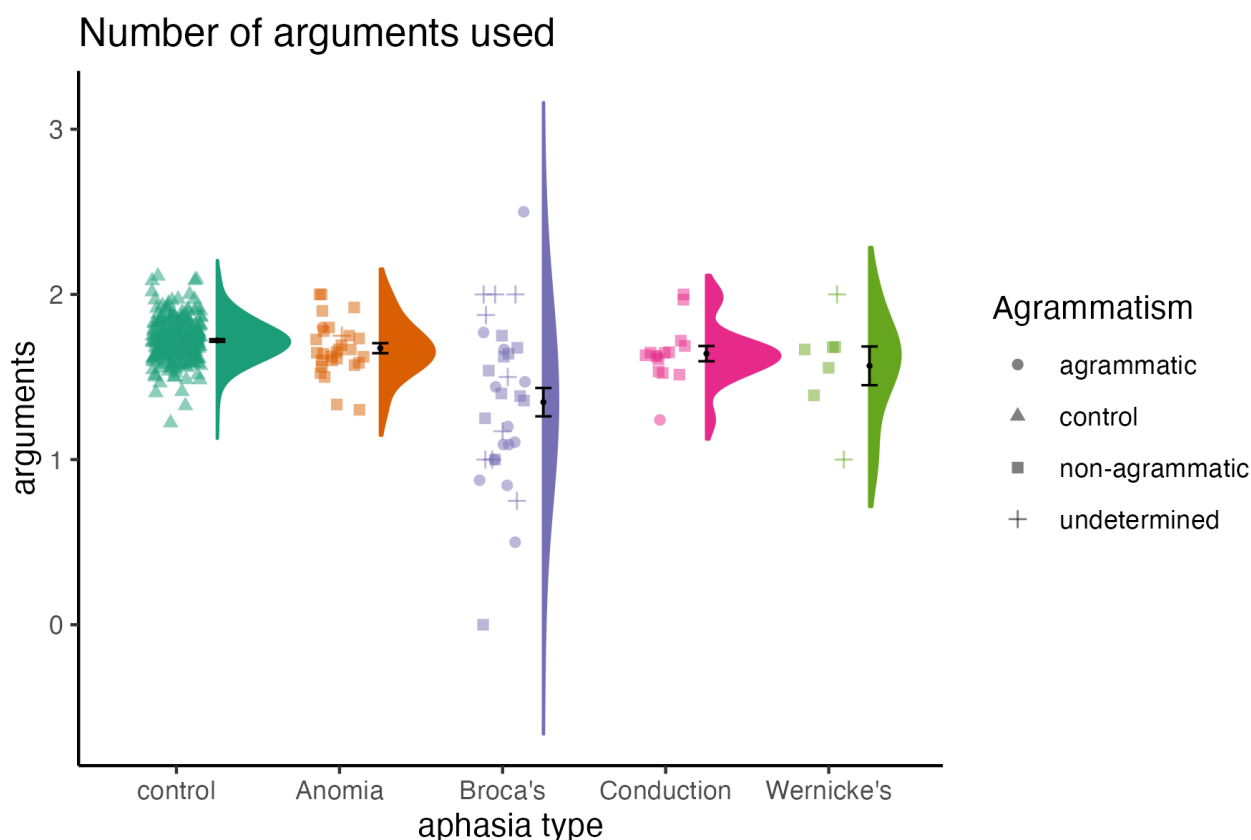


Figure 1. Average number of arguments used by each group of participants. Colored shapes reflect individual means, while black points and error bars represent group mean $\pm$ SEM.

Agrammaticality in post-stroke aphasia: Verb retrieval and verb conjugation

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Introduction

Individuals with nonfluent aphasia frequently exhibit reduced use of function words, compromised syntactic and morphological abilities, and troubles with verbs (Park et al., 2024). There is still much debate over the specific difficulties associated with verb retrieval and verb inflection in nonfluent aphasia (Faroqi-Shah, 2023; Faroqi-Shah & Thompson, 2004). We investigated verb production across three tasks in bilingual speakers with nonfluent aphasia to examine whether there is a dissociation between conjugated verb production and verb retrieval.

Methods

Two bilingual Spanish-English participants with mild-to-moderate chronic aphasia (see Table 1) were tested in both their languages in three tasks. An action naming test comprised 27 drawings from the Verb and Sentence Test (VAST, Bastiaanse et al., 2002) was used to assess retrieval. A verb inflection test, developed by Faroqi-Shah (unpublished) was used to elicit verb conjugation across three tenses. A semi-spontaneous narrative elicitation task was used to assess connected language production, including verb retrieval and verb conjugation. We scored performance on each task for accuracy, and error frequency and types. In the action naming task, verbs were scored for correct, wrong, and other. In the verb inflection task, verbs were scored as correct, incorrectly conjugated, or incorrect tense. In the narrative task, utterances were coded using several categories, including number and proportion of verbs produced.

Results

Findings showed that overall participants had higher accuracy on the action naming test (Participant 1: Eng = 89%; Spa = 74%; Participant 2: Eng = 70%; Spa = 70%) than on the verb inflection task (Participant 1: Eng = 55%; Spa = 70%. Participant 2: Eng = 26%; Spa = 37%). Participant 1 was more accurate in his L2 (English) than his L1 (Spanish) on the action naming task, and more accurate in Spanish (L1) than in his L2 in the verb inflection test. On the narrative task, Participant 1 produced more correctly conjugated verbs in Spanish L1 (99%) than in English L2 (86%). Participant 2 was as accurate in Spanish as in English (70%) in the action naming task and had comparably low accuracy rates on the verb inflection test in both languages (Eng = 26%; Spa = 37%). On the narrative tasks, she produced fewer verbs than Participant 1, however, the verbs produced were correctly conjugated in both English (99%) and Spanish (100%).

Conclusions

The results show a clear dissociation between verb retrieval and verb conjugation, suggesting that verb conjugation is difficult for people with aphasia (Faroqi-Shah, 2023). Verb conjugation complexity might arise from processing demands and conceptual semantic differences between tenses (Faroqi-Shah & Friedman, 2015), though we note that our participants also made agreement errors. Difficulty that was observed in both languages (e.g., tense errors in Participant's 2 performance on the verb inflection test) is likely related to their aphasia, whereas dissociations between the languages (e.g., conjugation errors in

the verb inflection test observed in Participant 1) could be associated with pre-onset proficiency. Bilingualism and cross-language interference might have played a role in increasing verb conjugation difficulty.

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Table 1. Participants' information

	Years of age/sex	Years of education	Years post-stroke	WAB AQ (English)	Etiology	L1	Age of immigration to the US	Age of acquisition of L2
Participant 1	74/M	18	1	87.5	Left CVA	Spanish	36 y/o	14 y/o
Participant 2	54/F	14	1	74.8	Left CVA	Spanish	13 y/o	15 y/o

The role of blood-based biomarkers in post-stroke cognitive impairment

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Introduction

Stroke is a medical condition that annually affects more than 16 million people, usually leaving motor, psychological or cognitive deficits (Strong et al., 2007). Among this, 30-70% of stroke survivors suffer from post-stroke cognitive impairment (PSCI), a subtype of vascular cognitive impairment that can impact diverse cognitive domains such as language, attention, memory or reasoning (Kulesh et al., 2018). Since the evolution of this condition is highly variable, identifying means for early diagnosis and outcome prognosis could enable the implementation of early and personalized treatments. Recent research highlights the clinical value of blood-based biomarkers for the early assessment of cognitive decline risk. After a stroke the brain suffers neurochemical alterations that lead to changes in the concentration of several biomarkers, such as neurofilament light chain protein (Nfl) or glial fibrillary acid protein (GFAP), which are neuronal and axonal proteins that reflect neuroinflammation and which can be detected in the plasma or serum of patients (Kawata et al., 2018). Although both biomarkers have been linked to higher clinical severity (Akhoundzadeh and Shafia, 2021; Lewis et al., 2008), their relation with PSCI is still poorly understood. Thus, the aim of the present study is to test whether stroke patients show higher levels of Nfl and GFAP biomarkers compared to healthy controls, and additionally, if the level of these biomarkers correlate with performance in language and cognitive tasks. We use a longitudinal design in which language and cognitive assessment, together with biomarker concentration, is monitored both in the acute and subacute stage post stroke (see Figure 1).

Methods

We report preliminary results from a small sample of acute-stroke patients (N=12, all native speakers of Spanish) admitted to the Neurology Department at Cruces University Hospital (Bilbao, Spain), with mild aphasia (see Table 1), as assessed with a battery of language tasks in Spanish (including repetition, discrimination, sentence elicitation and verification, grammaticality judgment and picture naming task) as well as domain-general tests (including Attention Network Task, Raven's Coloured Matrices, visual and digit spans). Stroke patients' biomarker concentration was compared to that of 30 healthy donors and analysed using SIMOA.

Results

Preliminary results showed higher levels of Nfl and GFAP in stroke patients compared to healthy controls. In some patients, higher levels of GFAP were associated with lower overall language scores, while no association between this biomarker and domain-general cognitive functions emerged in this small sample of patients. Similarly, the data showed no relation between Nfl levels and language/cognitive functions.

Conclusions

Our results confirmed previous findings, showing that the concentration of NfL and GFAP was higher in stroke patients than in controls already within few hours post symptoms onset. The relation (or lack thereof) between biomarkers and language/cognitive functions should be confirmed with a bigger sample of patients and in subsequent post-stroke stages (data collection is currently ongoing). Future work also involves investigating the role that lesion size and location play in biomarker concentration and PSCI.

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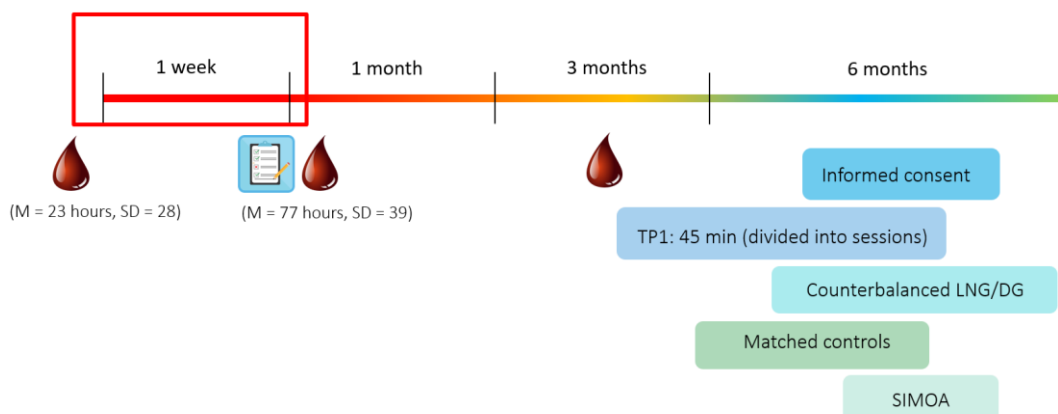


Figure 12. Study longitudinal design.

Table 1. Overall language/cognitive assessment and biomarker concentration (mean, SD in parenthesis). Legend: “*” indicates impairment (with respect to 12 age-, education-, and sex-matched control participants); ANT: Attention Network Test; RCPM: Raven’s Colored Progressive Matrices.

	Stroke Patients	Biomarker control group
Language overall	91.5 (5.93)*	
ANT	87.24 (24.35)	
Digit Span (forward)	5.6 (0.7)*	
Digit Span (backward)	4 (1.56)*	
Visual Span (forward)	5 (1.22)	
Visual Span (backward)	3.67 (1.12)*	
RCPM	24 (7.56)*	
GFAP (pg/mL) (M, SD)	1347.47 (2253.83)	62.58 (32.55)
Nfl (pg/mL) (M, SD)	64.57 (103.65)	7.06 (3.1)

Subject-verb agreement in Italian non-fluent aphasia

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Introduction

This paper examines how clinical speech data may contribute to refining linguistic theory by providing an analysis of subject-verb agreement errors in Italian non-fluent aphasia using Distributed Morphology (DM). Drawing on Pfau's (2009) study on speech errors in typical populations, I argue that a language production model which incorporates DM allows for a better account of the impairment patterns observed. Despite DM's compatibility with psycholinguistic models, it is still underrepresented in aphasiology (but cf. Thompson et al., 2002; Dickey et al., 2008; Wang et al., 2014). There have also not been any attempts to apply the theory to Italian data yet (but for prior studies on Italian verb production and inflection impairments cf. Miceli et al., 1983; Miceli & Mazzucchi, 1989; Chinellato 2002; Rossi & Bastiaanse 2008; Garraffa 2011).

Methods

I investigated the inflectional productions of three agrammatic subjects in a sentence completion task with alternating tense and person specifications (cf. Martínez-Ferreiro, 2010). Participants were exposed to a complete sentence with a clause initial temporal adverbial and then to an incomplete sentence. The incomplete sentence was a partial repetition of the complete sentence, but with either a different initial temporal adverbial in order to trigger a change in tense, or with a different subject as to induce a change in subject-verb (person and number) agreement. The task included 96 critical sentences (144 in total); verbs were selected based on their frequency, conjugation, (ir)regularity, and auxiliary selection in the past tense.

Results

Findings reveal that there are certain consistent error patterns across subjects, irrespective of aphasia type and severity. Upon closer examination, two distinct groups of errors emerge: those stemming from the manipulation of morphosyntactic features (e.g., favoring singular over plural, 1SG over 3SG), and those involving post-error repair strategies (e.g., overgeneralization of the theme vowel -a- to verbs outside the first conjugation), cf. (1) for select examples. DM allows us to pinpoint these errors more precisely. I suggest that combining Pfau's (2009) hybrid model with some aspects of Krauska & Lau's (2023) non-lexicalist model (e.g., cognitive control) accounts for all encountered inflection errors (Figure 1). Semantic substitutions emerge before accessing List 1, while tense selection occurs within List 1, with manipulation or modification during the early stages of grammatical encoding in the Formulator (prior to potential morphosyntactic structure alterations). Erroneous morphosyntactic feature copies/shifts arise in the Formulator's component encoding morphosyntactic structure. The performance difference between person and number may be related to the merge order of the phi-features in the morphological component of the Formulator. As for impairments concerning the overgeneralization of theme vowels, I suggest localizing them in the model's lower component, dedicated to the phonological encoding of the verb.

Conclusions

This paper shows that although DM was not initially conceived of as a psycholinguistic language production model, there are many features that are compatible between it and other models of language processing/production. Further, the analysis of error patterns in aphasia shows how clinical data can play a pivotal role in optimizing the theoretical set-up of the theory.

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(1) Sample errors

a. Il portinaio prend-o-**no** le chiavi.
the doorman take-tv-**3pl** the keys
The doorman takes the keys.

(SI; number switch)

b. L'uomo mostr-**o** una foto.
the-man show-**1sg** a photograph
The man shows a photograph.

(ER; person shift)

c. Il cane cad-**a** nel buco.
the dog fall-tv.**are** in-the hole
The dog falls into the hole.

(VE; incorrect theme vowel)

d. Il gatto **miagol**-a la pioggia.
the cat **meow**.tv.are the rain
The cat meows at the rain.

(SI; semantic substitution of stem)

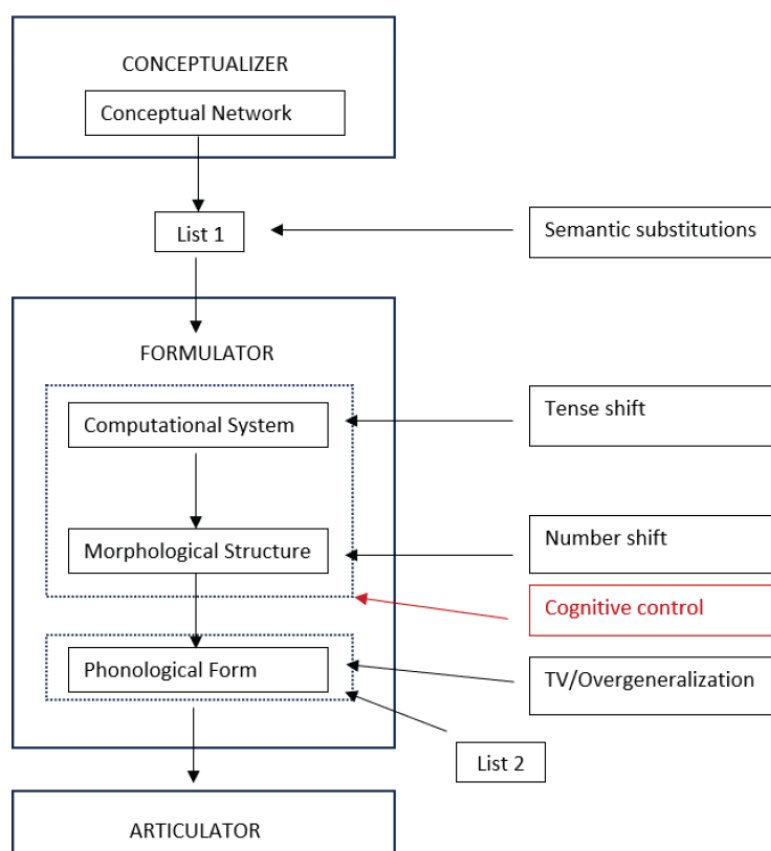


Figure 13. Modified DM-model

Characterizing the effects of video implemented script training for aphasia in bilingual speakers with primary progressive aphasia

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Introduction

Primary progressive aphasia (PPA) is a neurodegenerative disorder characterized by progressive worsening of speech and/or language (Gorno-Tempini et al., 2011). There is an increasing body of research indicating that restitutive interventions improve communication in PPA (Wauters et al., 2021); nevertheless, pessimism persists regarding the benefits of intervention in the context of neurodegenerative disease. Much focus has been on monolingual English speakers with semantic (svPPA) and logopenic (lvPPA) variants of PPA, with limited representation of those with nonfluent/agrammatic variant PPA (nfvPPA) or those from culturally and linguistically diverse backgrounds (Grasso et al., 2023). We report immediate and longer-term outcomes from a Stage 2 (Onken et al., 2014) intervention study wherein bilingual participants with nfvPPA were administered Video-Implemented Script Training for Aphasia (Henry et al., 2018; VISTA).

Methods

A total of 11 bilingual individuals with mild to moderate nfvPPA were enrolled. Participants were bilingual Spanish-Catalan speakers from the region of Catalunya, Spain. VISTA was provided in two sequential phases, one for each language. VISTA is an approach to script training which consists of daily, independent rehearsal of personalized, functional scripted targets with an audiovisual model, coupled with twice weekly intervention sessions with the clinician targeting memorization and functional usage of scripted content (Henry et al., 2018). Treatment in each phase was provided by a licensed SLP who was a native speaker of the language of treatment administration. Eligible targets were randomly assigned to trained and untrained conditions and were matched for linguistic characteristics both within and across conditions (trained vs. untrained) and languages (Spanish and Catalan, Grasso et al., 2021). Participants received treatment twice per week, over a 9-week period. Follow-up assessments were conducted up to 12-months post-treatment to investigate maintenance effects. Percent correct, intelligible scripted words served as the primary outcome measure, and analyses of acoustic and linguistic measures derived from PRAAT (Jadoul et al., 2018) and natural language processing tools (Honnibal et al., 2017; Macwhinney et al., 2010), respectively, are ongoing in order to more robustly characterize intervention effects. Data were analyzed at the group level using permutation tests.

Results

A significant treatment effect was observed with maintenance up to a year post-treatment, in both the dominant and nondominant language ($ps < .05$; see Figure 1A). In addition, cross-language transfer effects were observed bidirectionally, indicating that script training in one language, resulted in significantly improved production of scripted content in the untrained language ($ps < .05$; see Figure 1B). The magnitude of the within- and between-language gains were comparable, indicating that treatment administered in both the dominant and nondominant language result in significant and lasting improvements.

Conclusions

The current study confirms that VISTA leads to significant improvements in the production of scripts of personal import in bilingual speakers living with nvPPA. Bilingual speakers with progressive aphasia show a clear ability to improve speech production and fluency in both their dominant and nondominant language. Given that the PPA literature currently lacks 1) evidence for intervention options for individuals with nvPPA, and 2) representation of individuals from culturally and linguistically diverse backgrounds, this study serves to characterize the positive effects of intervention in nvPPA using a culturally-sensitive bilingual treatment model.

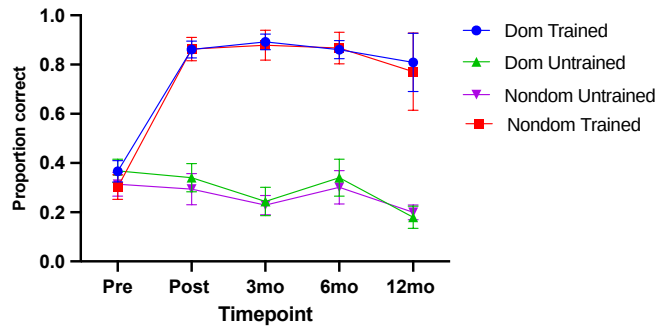
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Within-Language Script Accuracy



Cross-Language Transfer Script Accuracy

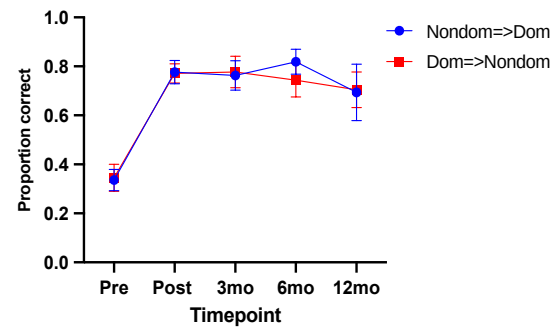


Figure 14. Improvements in percent correct, intelligible scripted words in bilingual speakers with PPA (n= 11). A) Within-language improvements b) Cross-language transfer effects.

Exploring dyslexia subtypes through computational modeling

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Introduction

Bayesian computational modeling has emerged as a powerful tool for unraveling the complexities of cognitive development (e.g., Gopnik & Bonawitz, 2005; Glassen & Nitsch) as well as various developmental (Schneebeli et al., 2022; Voorspoels et al., 2018) and neurodegenerative diseases (Alexiou et al., 2017; Seixas et al., 2014). This approach enables researchers to simulate and investigate the intricate nature of these disorders and the cognitive processes involved. In this study, we aim to combine the well-known dual-route cascaded model of reading (Coltheart et al., 2001) with Bayesian computational modeling to explore and characterize dyslexia subtypes (Friedmann & Coltheart, 2018). Specifically, we investigated surface dyslexia, letter position dyslexia (LPD), phonological dyslexia, vowel dyslexia, letter identity dyslexia, and attentional dyslexia among 94 dyslexic children.

Methods

We assessed 335 children aged 9–12 using the FRIGU Dyslexia Battery (Güven & Friedmann, 2015). The initial screening involved oral reading of words/nonwords and word pairs sensitive to different types of dyslexia. Subsequently, 94 children who fell below the threshold underwent further investigation using stimulus sets tailored to specific dyslexia subtypes: irregular words/nonwords for surface dyslexia, phonologically complex words/nonwords for phonological dyslexia, and words/nonwords containing letter migrations for LPD.

Bayesian Hierarchical Model. To investigate the characteristics of different dyslexia subtypes and accurately identify them, we employed a Bayesian hierarchical model. This model was chosen for its ability to account for individual variability and estimate both individual-level and group-level parameters, offering a robust framework for subtype classification.

Model Specification. We utilized a Bayesian hierarchical structure to model the reading performance of each child, incorporating both group-level parameters (common characteristics across all children) and individual-level parameters (unique characteristics of each child). Non-informative priors were used to allow the data to primarily influence the posterior estimates. Markov Chain Monte Carlo methods were employed to draw samples from the posterior distribution of the model parameters. Convergence was assessed using trace plots, the Gelman-Rubin statistic, and effective sample sizes. Posterior predictive checks were performed to evaluate the model's fit to the observed data, and model comparison metrics, including Leave-One-Out Cross-Validation, were used to assess model performance.

Results

The Bayesian hierarchical model demonstrated good convergence across all parameters, with well-mixed chains and effective sample sizes indicating reliable estimates. The model confirmed distinct dyslexia subtypes within the studied population (N=94) and demonstrated high accuracy in classifying children into the correct dyslexia subtypes, ranging between

75% and 87%. The model provided insights into each subtype's varied impact on specific reading tasks, revealing significant differences in task performance across dyslexia subtypes. Credible intervals underscored the substantial effects, emphasizing the distinct impact of each dyslexia subtype on specific tasks. Posterior predictive checks indicated a good fit between the observed and simulated data, with observed reading accuracies falling within the 95% credible intervals of the predicted accuracies, suggesting that the model effectively captured the underlying patterns in the data.

Conclusions

Employing a robust Bayesian approach, this study contributes to understanding the complexity of dyslexia subtypes. Early identification using specific stimuli and computational modeling could facilitate timely and customized intervention strategies.

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Longitudinal brain volume changes in chronic post-stroke aphasia

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Introduction

Healthy aging is associated with observable and measurable changes in brain volume, particularly the reduction of cortical and subcortical gray matter, as evidenced by MRI data¹. Abnormal patterns of cortical atrophy have also been observed in clinical populations, especially in neurodegenerative diseases like Alzheimer's and related dementias. Recent imaging research indicates that chronic stroke impacts brain sites far distant from the putative lesion site, particularly in the contralesional hemisphere⁴. It has been hypothesized that such changes may be the result of alterations in connectivity (structural or functional) or changes in cerebral blood flow¹². Longitudinal investigations of cortical changes in chronic stroke are sparse, but two studies have demonstrated that lesions expand well into the chronic phase^{6,8,10}. Critically, no study has yet examined longitudinal changes in gray matter volume (GMV) in persons with chronic post-stroke aphasia (PWcA). This is a critical first step to understanding the relationship between the health of distal areas and the potential for recovery, which is a necessary precursor to designing apt rehabilitative treatments or brain stimulation interventions.

Methods

The aims of this study are to compare and quantify longitudinal patterns of brain atrophy in normal aging and PWcA in the intact RH, explore (L-R) differences in GMV that explain the extent of impairment, and examine the relationship between longitudinal patterns of cortical atrophy and changes in WAB and PNT scores.

We leveraged volBrain GMV data from healthy adults (N = 2995) as the basis of comparison for our clinical population (N = 220). We submitted enantiomorphically healed T1-weighted structural MRI images at multiple timepoints to this pipeline, which automatically produces regional estimates of GMV. By comparing longitudinal changes in PWcA to changes observed in healthy aging we will, for the first time ever, isolate patterns of atrophy associated in PWcA. Using comprehensive demographic and language data, we will examine the relationship between longitudinal patterns of brain atrophy in the intact RH (homologues of LH language areas) and longitudinal changes in aphasia severity (WAB) and ability to name objects (PNT).

Results

Results from one-sample t-tests comparing GMV in various RH brain regions between PWcA and healthy adults are shown in Table 1. Average RH GMV values in PWcA consistently fall below those of healthy adults (Table 1, Figure 1). This reduction is evident across regions, with the most pronounced differences observed in the middle frontal gyrus (-1.225%), middle temporal gyrus (-0.941%), precentral gyrus (-0.860%), and superior frontal gyrus (-0.748% and -0.316%).

Conclusions

Our analysis revealed several regions in the RH showing atrophy disproportionately in PWcA. These results suggest that chronic LH stroke affects the immediate lesion area, leading to significant structural changes in the contralesional hemisphere. These changes are likely attributable to alterations in neural connectivity, compensatory mechanisms, or vascular changes extending beyond the lesion site.

Understanding these patterns of atrophy is crucial for developing rehabilitation strategies that address the direct effects of the stroke and the broader impacts on brain structure and function. This study highlights potential for longitudinal investigations into GMV changes in PWcA.

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Table 1. Results of one-sample t-test for mean differences in specified brain region.

One Sample T-Test

	t	df	p	Mean Difference	Cohen's d	SE Cohen's d
Middle frontal gyrus right volume %	-139.482	244	< .001	-1.225	-8.911	0.408
Middle temporal gyrus right volume %	-141.998	244	< .001	-0.941	-9.072	0.415
Precentral gyrus right volume %	-168.267	244	< .001	-0.860	-10.750	0.490
Sup. frontal gyrus right volume %	-94.044	244	< .001	-0.748	-6.008	0.279
Planum temporale right volume %	432.346	244	< .001	0.954	27.622	1.249
Angular gyrus right volume %	-91.423	244	< .001	-0.757	-5.841	0.271
Thalamus right volume %	-155.460	244	< .001	-0.530	-9.932	0.453
Cerebrum GM right volume %	-2.639	244	0.009	-0.118	-0.169	0.064
Precentral gyrus medial segment right volume %	-43.908	244	< .001	-0.102	-2.805	0.142
Sup. frontal gyrus medial segment right volume %	-65.471	244	< .001	-0.316	-4.183	0.199
Supplementary motor cortex right volume %	-54.997	244	< .001	-0.173	-3.514	0.171
Fusiform gyrus right volume %	-8.533	244	< .001	-0.046	-0.545	0.068
Sup. temporal gyrus right volume %	-102.587	244	< .001	-0.424	-6.554	0.303
Temporal pole right volume %	-13.139	244	< .001	-0.068	-0.839	0.074
Parietal lobe right volume %	-2.249	244	0.025	-0.035	-0.144	0.064
Postcentral gyrus right volume %	-3.947	244	< .001	-0.018	-0.252	0.065
Precuneus right volume %	-2.446	244	0.015	-0.014	-0.156	0.064
Sup. parietal lobule right volume %	-1.709	244	0.089	-0.009	-0.109	0.064
Occipital lobe right volume %	-2.622	244	0.009	-0.047	-0.168	0.064
Lingual gyrus right volume %	-51.465	244	< .001	-0.290	-3.288	0.162
Occipital fusiform gyrus right volume %	-21.867	244	< .001	-0.082	-1.397	0.090
Inf. occipital gyrus right volume %	-50.917	244	< .001	-0.276	-3.253	0.160
Middle occipital gyrus right volume %	-7.654	244	< .001	-0.035	-0.489	0.068
Limbic cortex right volume %	-0.289	244	0.773	-0.002	-0.018	0.064
Anterior cingulate gyrus right volume %	-38.312	244	< .001	-0.155	-2.448	0.128
Middle cingulate gyrus right volume %	-3.484	244	< .001	-0.010	-0.223	0.065
Parahippocampal gyrus right volume %	-8.554	244	< .001	-0.016	-0.547	0.068
Parietal operculum right volume %	-15.782	244	< .001	-0.029	-1.008	0.078
Inf. lateral ventricle right volume %	-7.041	244	< .001	-0.012	-0.450	0.067
Lateral ventricle right volume %	-12.846	244	< .001	-0.401	-0.821	0.074

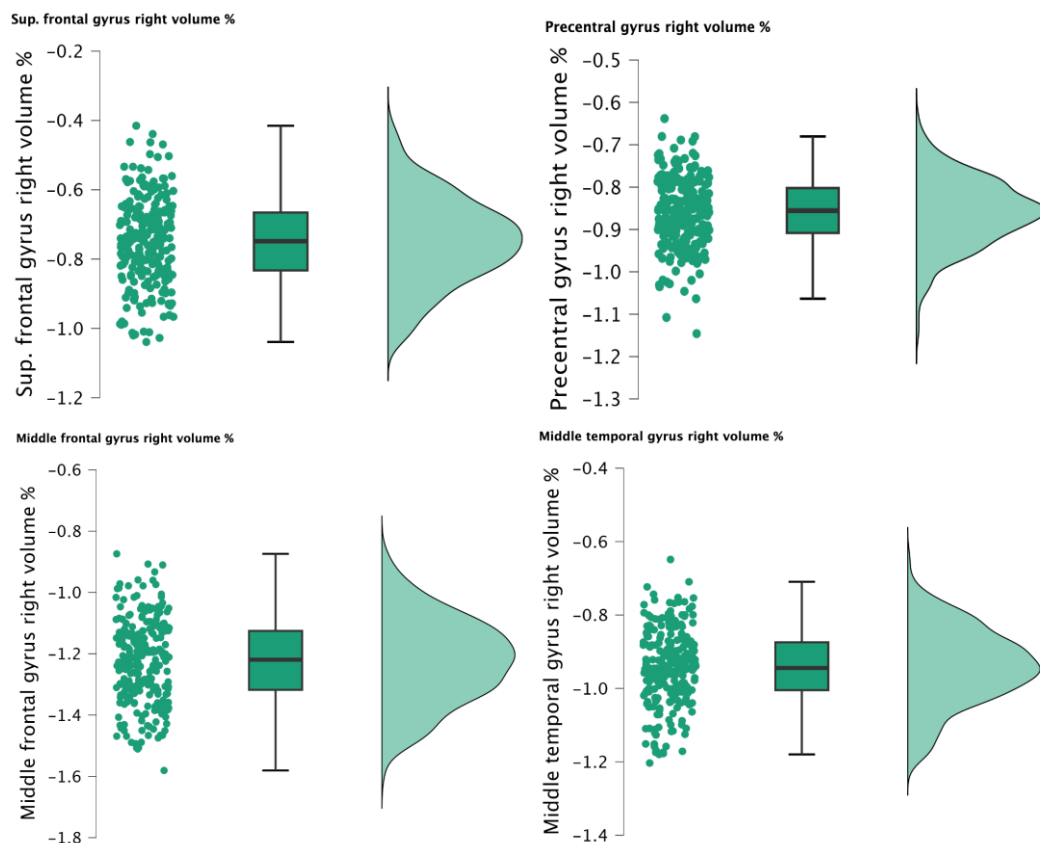


Figure 1. Raincloud plots of mean differences in significant brain regions.

A Japanese patient with progressive word deafness and logoclonia

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Introduction

We report a case with phonological paraphasia, apraxia of speech, impaired speech sound cognition, and logoclonia with disease progression. We investigated the relationship between symptoms, word deafness, and speech disorders.

Methods

The patient was a 75-year-old, right-handed female with 12 years of education. Her first visit was at the age of 69 years, with complaints of difficulty in finding words and responding via telephone. The patient was neurologically normal; had no apraxia, agnosia, or memory impairment; and was independent in activities of daily living. Although she had moderate hearing loss, her speech-related hearing loss was disproportionately high. Regarding spoken language comprehension, she complained of difficulty in understanding at 70 years of age. A year later, she complained that she was able to hear sounds but not understand words, and that it was difficult to recognise speech sounds and comprehend them auditorily. Although she did not have full written language comprehension, she was able to communicate by writing or using speech-to-text applications. At the age of 70 years, phonological paraphasia and AOS were observed, and two years later, logoclonia with repetitions of the last sound began to occur frequently. Even at the age of 75, she has no behavioral abnormalities and is able to come to the hospital by herself without making mistakes on the date and time. In her writing, her use of kanji (Japanese morphograms) was much better than her use of kana (Japanese syllabograms); particles were omitted and became agrammatical. Her consciousness was clear and she was neurologically normal, except for moderate hearing loss. From the age of 69 years, the patient underwent a standard protocol of neurological and neuropsychological examinations, language and auditory assessments, and neuroimaging.

Results

Following neuropsychological tests were administered at the interval of one or two years. <MMSE> 29 [69 years old (y/o)], 26 (70 y/o), 10 (72 y/o), 2 (22 by written instructions) (73 y/o) <Western Aphasia Battery> AQ; 89.5, 87.4, 12.2, 9.0, 1.5 (69, 70, 72, 73, 74 y/o, respectively), Auditory comprehension; 8.9, 9.4, 1.7, 1.1, 0.75, Repetition; 8.8, 7.6, 0.6, 0.3, 0, Naming; 9.1, 8.7, 0.8, 0.1, 0, Reading; 9.0, 9.6, 7.4, 5.3, 4.7, Writing; 9.6, 9.8, 4.8, 6.1, 1.0. <Wechsler Memory Scale-Revised> Verbal Memory; 87, Visual Memory; 116, Attention/Concentration; 79, Delayed recall; 102 (70 y/o). <Token Test> 158/167 (70 y/o). Pure-tone audiometry threshold values were 47.5 dB (right ear) and 41.3 dB (left) (74 y/o). Dilation of the left Sylvian fissure, atrophy, and hypoperfusion of the superior temporal gyrus were prominent, and hypoperfusion of the lateral frontal lobe was observed. Cerebrospinal

fluid examination revealed no evidence of Alzheimer's disease and decreased uptake was observed on a dopamine active transporter scan.

Conclusions

Word deafness was thought to be the most likely cause of the dissociation between spoken and written language in our patient. Our case and previous studies suggested that there is a syndrome presenting word deafness and speech movement disorders among patients with progressive communication disorders as a different entity from primary progressive aphasia.

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Syntax-related regions in native signers activated commonly during comprehension of sentences and of non-verbal inputs

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Introduction

It has been argued that thinking abilities are based upon the faculty of language. Fostering thinking abilities in children particularly who are deaf or hard of hearing thus requires acquiring a sign language as their “mother tongue,” but its neuroscientific evidence remains unclear. To examine whether the critical regions for sentence comprehension commonly subserve non-verbal mental processes in native signers, we conducted functional magnetic resonance imaging (fMRI) experiments and measured cortical activations during both a sign comprehension task and an illustrative mental task.

Methods

We recruited eighteen participants (11 females; 30.0 ± 7.3 years; right-handed), who were all native signers of the Japanese Sign Language (JSL). Among them, twelve were Deaf signers and the other six were Children of Deaf Adults (Cocas). In the sign comprehension task, we presented storytelling videos in JSL, in which small circles in colors similar to surroundings were also presented randomly in time and place. Under the language condition, questions about the story were subsequently presented also in JSL, and the participants chose the most appropriate answer among three choices. Under the control condition, the participants reported the number of circles presented. For the illustrative mental task, we presented a newly prepared set of 50 quizzes, consisted of five conditions: cartoon completion (completing the middle of three phases), analogical reasoning, mental rotation, sequential reasoning, and figure completion. All quizzes were graphically illustrated without any verbal explanations, and the participants chose the most appropriate answer among three choices. MRI scans were conducted in a 3.0 T scanner (GE, Signa HDxt) with EPI (TR = 2 s, TE = 30 ms, 30 slices/volume, resolution = $3 \times 3 \text{ mm}^2$). The fMRI data were analyzed in a standard manner using the SPM12 software (FDR corrected $p < 0.05$ for the cluster level).

Results

Under both language and control conditions in the sign comprehension task, we observed significant activation in the left frontal gyrus (L. IFG), the left posterior superior/middle/inferior temporal gyri (L. pSTG/MTG/ITG), and the right posterior superior/middle temporal gyri (R. pSTG/MTG) (Figure, upper half). All of these regions were previously reported as critical regions in the syntax-related networks (Kinno et al., 2014). We then defined the significant clusters under the language condition as the regions of interest (ROIs), and calculated signal changes during the illustrative mental task. We observed significantly higher signal changes in all of three ROIs under the cartoon completion condition compared with other conditions ($t(17) > 2.1$, FDR corrected $p < 0.05$ for each ROI; Figure, lower half), indicating consistency and selectivity of activations during discourse processing for both verbal and non-verbal inputs. Such selectivity could not be explained by general cognitive loads or task difficulty,

because the cartoon completion condition was neither the hardest nor easiest among the five conditions.

Conclusions

Our results provide neuroscientific evidence for the existence of common structure-making processes between language and thought. With regards to the illustrative mental task, further comparisons of activated regions between signers and non-signers would show modality-independent thinking processes.

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Acknowledgments

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Regions activated during story comprehension in JSL

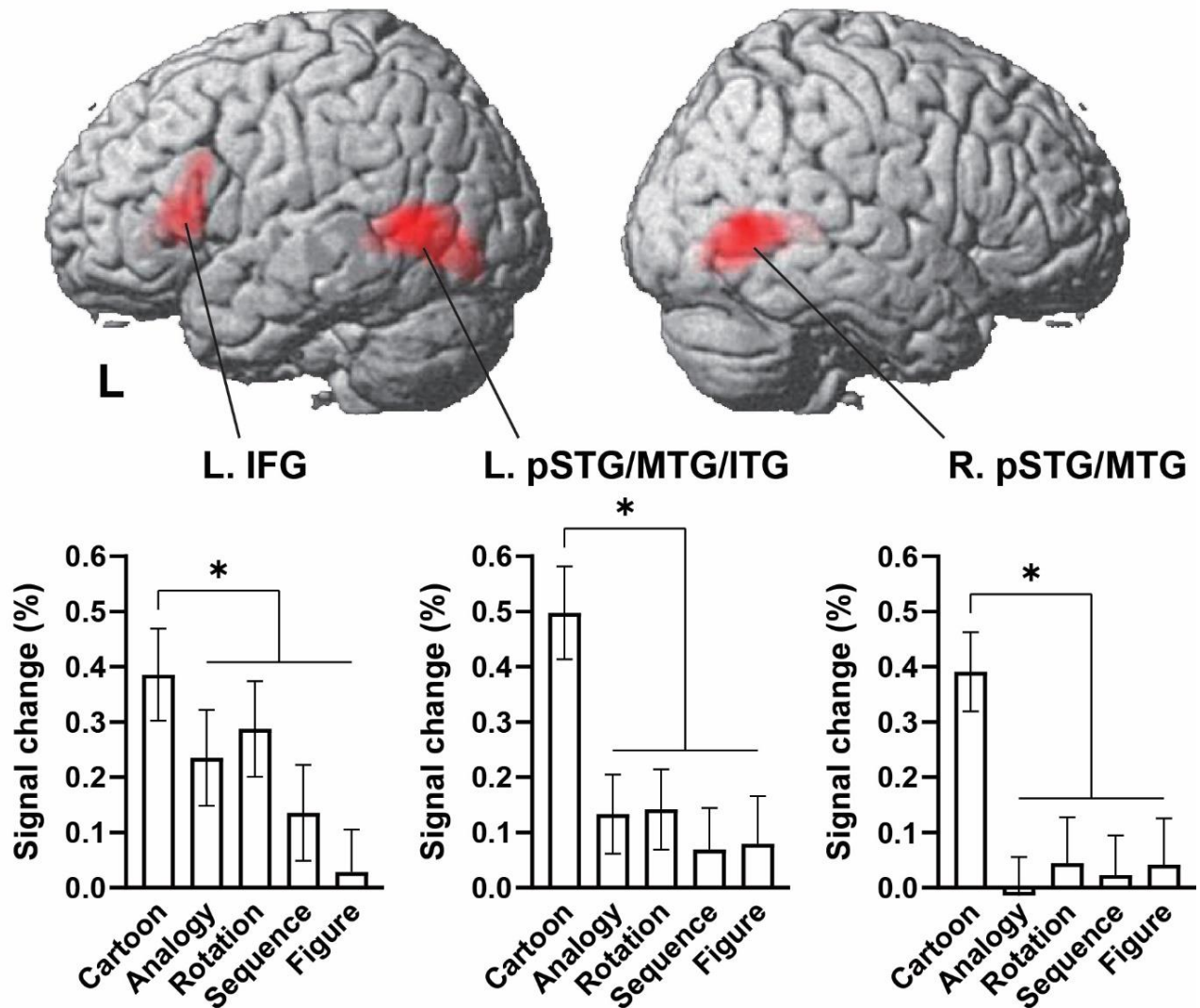


Figure 1. Regions activated in the sign comprehension task (upper half), and enhanced activations in the same regions under the cartoon completion condition of the illustrative mental task (lower half). * $p < 0.05$.

Examination on the use of the Cantonese version of Communication Outcome after Stroke (Can-COAST) scale and the Cantonese version of Carer Communication Outcome after Stroke (Can-Ca COAST) on people with dementia and visual impairment and their caregivers: A pilot study

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Introduction

Many dementia-specific measurements evaluating the effects of interventions measure at impairment level only and from clinicians' perspectives, ignoring the input from the people with dementia (PwD). They rarely measure the impact of communication problems on levels of activity and participation and quality of life. Moreover, they are mostly not readily available to PwD with visual impairment (VI). This research aims to study the feasibility of developing client-centered communication measures for PwD with VI and their caretakers, namely the Cantonese version of Communication Outcome for People with Dementia and Visual Impairment (Can-COPD-VI) and its caretaker version (Can-Ca-COPD-VI), which were adapted respectively from the Cantonese version of Communication Outcome after Stroke (Can-COAST) and its carer version (Can-Ca COAST; Kwok & Wong, 2023).

Methods

Eighteen PwD with VI (Mean age: 80.4 years) and seven of their formal caretakers were recruited from The Hong Kong Society for The Blind Kowloon Home for the Aged Blind. Inclusion criteria included: 1) premorbid fluent Cantonese speakers, 2) being medically diagnosed to have dementia or failing in the Hong Kong Montreal Cognitive Assessment for the Visually Impaired (HKMoCA-VI; Yip et al., submitted), 3) having corrected hearing function, 4) being medically diagnosed to have low vision, 5) being able to comprehend questions and commands, and 6) being aged 60 years or above. Exclusion criteria included: 1) being nonverbal and unable to comprehend questions and 2) having other neuropsychological disorders. Written consent from the participants/family members was obtained prior to task administration.

PwD completed 1) Can-COPD-VI; 2) Cantonese version of the Amsterdam-Nijmegen Everyday Language Test (CANELT) (Wong et al., 2023); 3) category fluency test. Their formal caretakers completed Can-Ca-COPD-VI and the Chinese translated version of Holden Communication Scale (Strøm et al., 2016). Given the presence of visual impairment of PwD, adaptations were made in Can-COPD-VI and Can-Ca-COPD-VI, mainly concerning questions related to reading and writing.

Results

Table 1 illustrates the percentage scores obtained in Can-COPD-VI and Can-Ca-COPD-VI. Correlation between subscales within Can-COPD-VI, and correlation between each subscale and the total score of Can-COPD-VI, were found to be significant. Good internal consistency was found in Can-COPD-VI (Cronbach's alpha = 0.893) and Can-Ca-COPD-VI (Cronbach's alpha = 0.897). Nevertheless, no significant correlations were found between Can-COPD-VI and Can-Ca-COPD-VI, CANELT and semantic fluency test.

Conclusions

Both Can-COPD-VI and Can-Ca-COPD-VI seem to be feasible with good internal consistency. Further investigation into the psychometric properties of Can-COPD-VI and Can-Ca-COPD-VI with a larger sample is suggested. Investigation into extending Can-COPD-VI and Can-Ca-COPD-VI to PwD without visual impairment and their caregivers is also recommended.

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Table 1. Summary of percentage scores of Can-COPD-VI and Can-Ca-COPD-VI

	Can-COPD-VI (Q1-10) (Interactive communication subscale)	Can-COPD-VI (Q11-13) (Overview of communication subscale)	Can-COPD-VI (14-18) (Quality of life subscale)	Can-COP D-VI Total Score	Can-Ca-COPD-VI (Q1-10)(Interactive communication subscale)	Can-Ca-COPD-VI (Q11-13) (Overview of communication subscale)	Can-Ca-COPD-VI (14-18) (Quality of life subscale)	Can-Ca-COP D-VI Total Score
N	18	18	18	18	7	7	7	7
Mean	60.3	68.1	79.4	66.9	79.6	85.7	75.7	79.6
Standard deviation	16.4	25.3	16.6	15.7	12.2	15.0	14.8	10.8

Predicting aphasia severity using multi-modal data

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Introduction

Accurate prediction of aphasia severity provides insight into neurobiological substrates, is essential for developing effective rehabilitation strategies. Despite advancements in neuroimaging, predicting aphasia outcomes remains challenging due to brain complexity. Recently, combining multiple neuroimaging modalities has gained popularity because they offer complementary information for understanding aphasia (Chennuri et al., 2023; Kristinsson et al., 2021). By integrating feature sets derived from different imaging modalities—demographic information (age, months post-stroke, and years of education), structural MRI, resting-state functional MRI, and diffusion tensor imaging (DTI)—using machine learning, this research aims to improve prediction accuracy for aphasia severity as assessed by the Western Aphasia Battery-Revised Aphasia Quotient (WAB-R AQ; Kertesz, 2006).

Methods

77 individuals with left hemisphere stroke were included in the study (mean_age=59.67, SD=10.84; mean_time-post-stroke=74.96 months, SD=76.34 months; mean_WAB-AQ=71.59, SD=23.21). Multimodal data, including demographic information, structural MRI, resting-state fMRI, and DTI, were collected for all individuals.

Feature sets derived from these modalities include: a) percentages of spared tissue in white matter (PSW) calculated using the BCBtoolkit (Foulon et al., 2018); b) percentages of spared tissue in gray matter (PSG) computed for the Automated Anatomical Labelling atlas (Rolls et al., 2020); c) 50*50 resting-state connectivity matrices of brain regions involved in language processing, reduced to 625 values (RS) using the method described in Billot et al. (2022); d) transitivity scores (RS-trans) computed using the Brain Connectivity Toolbox for four networks: Language Network, Dorsal Attention Network, Salient Network, and Default Mode Network (Bullmore & Sporns, 2009); and e) fractional anisotropy values (FA) extracted from DTI data.

This study employs Support Vector Regression (SVR) and Random Forest (RF) models using multimodal data to predict aphasia severity. Fifty-two participants were selected for model training, and an independent group of twenty-five participants for model testing. 10-fold cross-validation was employed on the training dataset for feature selection within each feature set. Following feature selection, models incorporating different combinations of these selected feature sets—such as stacking PSW with RS or FA—were further fine-tuned with the same 10-fold cross-validation on the training set. The selected models were then assessed on an independent testing dataset to evaluate performance based on root-mean-square error (RMSE).

Results

The SVR model that combined PSG and RS derived from fMRI and DTI achieved the lowest mean validation RMSE of 12.14 among combined-modality models. The best single-modality SVR model uses RS and has a mean validation RMSE of 16.65. For RF models, the RF model that combined FA and RS derived from fMRI and MRI achieved a mean validation RMSE of 17.14, while the best single-modality RF model with RS had a mean validation RMSE of 19.64 (see Table 1).

Conclusions

Our research shows that different modalities provide complementary information for predicting aphasia severity. Both SVR and RF models using combined modalities outperform single-modality models, with resting-state functional connectivity being a key predictor. These findings align with previous research, indicating that integrating multimodal neuroimaging data enhances understanding of aphasia (Chennuri et al., 2023, Billot et al., 2022).

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Table 1. Model performance evaluation.

Model	Modalities	Feature Sets	Mean Validation RMSE	Test RMSE	Mean Validation MAE	Test MAE
RF	fMRI	RS	19.64	24.20	17.06	22.25
RF	MRI & fMRI	PSG & RS	17.15	20.34	14.97	18.11
SVR	fMRI	RS	16.66	21.54	13.86	17.12
SVR	DTI & fMRI	FA & RS	12.14	21.55	10.01	17.05

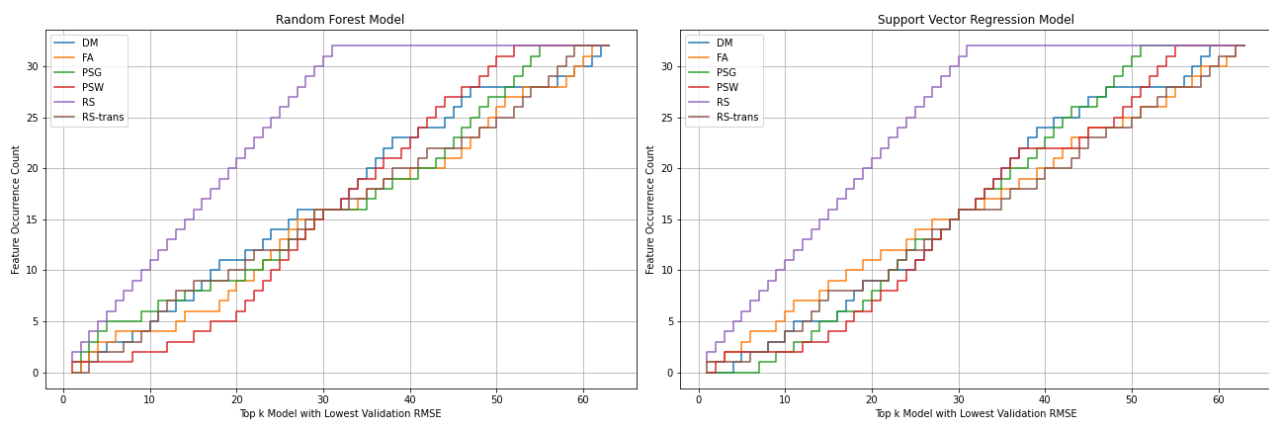


Figure 1. Feature occurrence counts for top models.

Recursive self-feedback enabled self-repaired spontaneous speech in chronic aphasia within real-world settings

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Introduction

Spontaneous speech generation, often impaired in chronic nonfluent aphasia, is essential for natural communication. Treatments aiming to optimize spontaneous speech in real-world settings are critical for improving the quality of life for persons with nonfluent aphasia (PWNA). Traditional treatments frequently rely on models and feedback from external agents, which may not be sustainable in the long term. Preliminary evidence suggests that PWNA can use self-feedback alone, through recursive self-feedback, to improve the production of scripted sentences (Imaezue et al., 2023). This study takes a step further to determine whether PWNA can use recursive self-feedback to improve spontaneous speech which is more cognitively complex than production of scripted sentences. We developed and examined the effects of spontaneous speech with recursive self-feedback, enabling PWNA to self-repair impaired spontaneous speech independently in real-world settings.

Methods

Using a cross-over design, three participants received two treatment conditions at their homes: spontaneous speech with recursive self-feedback and spontaneous speech with speech model. They used a mobile app to practice the recursive self-feedback condition involving iterative self-monitoring and minimization/correction of errors during spontaneous speech response to narrative prompts. The speech model condition provided model responses to prompts from an external source which served as reference frames to guide and help improve the participants' responses. Treatment effects on microlinguistic measures of spontaneous speech were determined through automated transcriptions and analyses of recorded participants' responses to prompts across all assessment and treatment sessions. Statistical analysis was performed at three levels: improvement in participants' production of treated prompts during treatment; improvement in participants' independent production of treated prompts after treatment; and improvement in participants' independent production of untreated prompts after treatment. Improvement in microlinguistic measures of spontaneous speech was used to establish the treatment effects.

Results

Both treatment conditions improved the participants' spontaneous speech over time during treatment. The speech model condition led to better gradual improvement per session over time than the recursive self-feedback condition. Both treatment conditions also led to significant improvements in the participants' production of the treated prompts after treatment, with the recursive self-feedback condition showing a broader generalization to independent production of untreated prompts post-treatment.

Conclusions

Recursive self-feedback is a promising technique for improving spontaneous speech in PWNA, offering a simple, flexible, and independent or follow-up treatment option. This technique can potentially reduce barriers to aphasia care, including the need for continuous external feedback and support, thus enhancing ecological validity and applicability in diverse linguistic contexts.

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Acknowledgments

I thank the participants for their patience and dedication in taking part in the study. I thank Dr. Mira Goral for her comments and feedback during the development of the study.

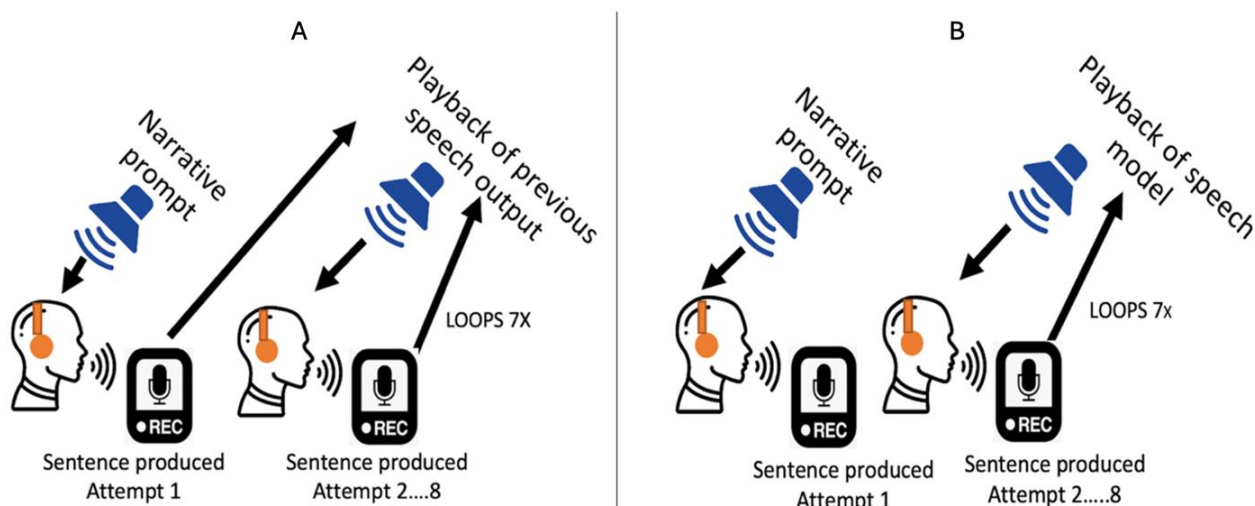


Figure 1. Treatment conditions: the left panel (A) is a schema of spontaneous speech with recursive self-feedback and the right panel (B) is that of spontaneous speech with speech model.

Table 1. Results of general linear mixed effects group analysis of microlinguistic outcomes during both treatment conditions. Note. WPM = words per minute

	Microlinguistic Outcomes	Estimate	Std. Error	z value	p value
Intercept	Number of words	3.9202233	0.0505396	77.57	<.001***
	Number of distinct words	3.4674853	0.0326030	106.355	<.001***
	Speaking rate (WPM)	4.2635000	0.0985900	43.245	<.001***
	Number of open class words	3.2574414	0.0469059	69.446	<.001***
	Number of closed class words	3.2008943	0.0793636	40.332	<.001***
Treatment	Number of words	0.1013443	0.0087632	11.56	<.001***
	Number of distinct words	0.0445628	0.0316099	1.410	0.159
	Speaking rate (WPM)	0.1015027	0.0431444	2.353	0.0186 *
	Number of open class words	0.0883934	0.0164704	5.367	<.001***
	Number of closed class words	0.1081037	0.0095892	11.274	<.001***
Session	Number of words	0.0198556	0.0018349	10.82	<.001***
	Number of distinct words	0.0187903	0.0027880	6.740	<.001***
	Speaking rate (WPM)	0.0243303	0.0034177	7.119	<.001***
	Number of open class words	0.0232038	0.0025149	9.226	<.001***
	Number of closed class words	0.0155302	0.0013917	11.159	<.001***
Treatment*Session	Number of words	- 0.0071108	0.0005093	-13.96	<.001***
	Number of distinct words	- 0.0051641	0.0006628	-7.791	<.001***
	Speaking rate (WPM)	- 0.0064302	0.0004385	-14.663	<.001***
	Number of open class words	- 0.0070237	0.0007449	-9.429	<.001***
	Number of closed class words	- 0.0069565	0.0007279	-9.557	<.001***

The effect of semantic and phonological naming treatment for people with aphasia in the early stage after stroke

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Introduction

In the early post-stroke stage, there is little research on the effects of naming treatment for people with aphasia (Dignam et al., 2024), because of the rapid changes in symptoms and the large effects of spontaneous recovery. On the other hand, in the chronic stage, there are many reports of naming treatment effects using Semantic Feature Analysis (SFA; Boyle & Coelho, 1995) and Phonological Component Analysis (PCA; Leonard et al., 2008). However, the technique of first retrieving semantic features and phonological information is stressful and inappropriate for participants with word-finding difficulty in acute stage. In this study, we investigated the effects of naming treatment using the twofold choice task of semantic features and phonological information to reduce the participants' stress in the early stage after stroke and to examine its relationship with underlying individual patterns of language impairment.

Methods

Two types of naming treatment, semantic naming treatment with choice task (SNTC) and phonological naming treatment with choice task (PNTC), were administered using an alternating treatment design with a baseline (BL) period in nine participants with acute post-stroke aphasia. Depending on the severity of their aphasia, participants were asked to name pictures during the BL period. Items with a correct response rate of 50% or less were divided into treatment items for SNTC, PNTC, and non-treatment items. We assigned the order of SNTC and PNTC by block randomization. Probe naming was performed pre- and post-session. We used a visual method to estimate the change in naming accuracy between the BL period and the first three sessions of the treatment (T1) period. We calculated the nonoverlap of all pairs for the effect size.

Results

Correct naming by eight participants increased in the T1 period compared to the BL period (one in SNTC only, three in PNTC only, and four in both). On the following day, correct naming by eight participants increased in the T1 period (pre-session) compared to the BL period (two in SNTC only and six in PNTC only). Participants with an increase in correct naming in SNTC only showed good comprehension of word meanings, repetition of words, reading kanji/kana words, and reading a single kana character aloud in the initial language test. However, many of the participants whose correct naming increased only in PNTC manifested poor semantic comprehension in reading kanji words and a single kana character.

Conclusions

Naming treatments using a choice task for semantic features and phonological information also seemed to be effective in the early stage after stroke. PNTC showed immediate and

sustained effects when both semantic and phonological functions were impaired in the participants. SNTC also showed a sustained effect if both semantic and phonological impairment was mild. These naming treatments in the early stage after stroke may be positioned as a bridging therapy to SFA and PCA, although it is undeniable that both naming treatments may influence each other when carried out on the same day.

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The development of a prototype Japanese Sign Language naming test

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Introduction

Differences in vocabulary and grammar between spoken and signed languages pose challenges in translating aphasia tests from spoken to signed languages (Pickell, Klima, & Hickok, et al., 2005). A modified aphasia test for sign language has been developed in the US to address linguistic disparities (Salk Institute, 2007), but no equivalent test exists in Japan. Developing an aphasia test tailored to Japanese Sign Language is essential for effective assessment of aphasia symptoms in the deaf community. This study reports on the development of a prototype Japanese Sign Language naming test.

Methods

Participants. A total of 23 deaf individuals (9 women, 14 men) residing in Niigata (n = 10), Chiba (n = 6), and Osaka (n = 7) prefectures participated in the study. The mean participant age was 49.5 years (standard deviation [SD] = 12.3 years, range = 33–67 years). All participants experienced deafness before 9 years of age, and none had a history of brain injury. Of participants, 8 reported complete absence of hearing and 15 had hearing thresholds of 45–120 dB. The mean participant education level was 13.9 years (SD = 1.8 years, range = 12–16 years).

Materials. A set of 22 signs drawn from levels 3–5 of Japan's National Sign Language Examination and incorporating 10 common everyday vocabulary categories was selected for the naming test (Table 1). Half the sign list featured one-handed signs and the other half used two-handed signs. The sign selection process involved consultation with four experts, including a deaf sign linguist, to ensure that it avoided graphic signs, minimized regional and age-related variations, and excluded finger-spelling, among other criteria. Stimuli were presented using black-and-white line illustrations.

Procedure. Naming test using the selected nouns was performed without time limit. Standard sign language expressions, as defined by a sign language dictionary, were deemed correct in the naming test. The Mini-Mental State Examination (MMSE) and Raven's Colored Progressive Matrices (RCPM) were administered in advance in sign language.

Results

The mean scores were 27.6 for the MMSE (SD = 1.4, range = 25–30), 34.1 for the RCPM (SD = 2.2, range = 28–36), and 20.4 for the naming test (SD = 1.8, range = 15–22). There was no significant correlation between age and naming test scores, nor between educational

history and naming test scores. After controlling for age and educational history, the correlation between naming test scores and MMSE scores did not reach significance. No significant differences in naming test performance were observed among groups categorized by time of deafness onset, age at sign language acquisition, occupation, current employment status, and performance for one-handed vs two-handed signs. Among the signs examined, 20 out of the 22 demonstrated correct response rates exceeding 80%, with the exceptions being "bread" and "rock."

Conclusions

Our sign list generally achieved high accuracy while meeting iconographic and handedness criteria, as seen in previous studies. Further validation across diverse populations is needed.

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Table 1. The naming test sign list

Handedness	No.	Sign	Category	National Sign Language Examination levels	The number of correct answers
One-handed	1	CHICKEN	Animal	Level 4	19
	2	BREAD	Food	Level 3	18
	3	STAR	Nature	Level 5	23
	4	TEACHER	Person	Level 5	23
	5	POLICE FFICER	Person	Level 3	23
	6	SQUID	Animal	Level 4	21
	7	PINE	Plant	Level 5	20
	8	RICE	Food	Level 3	22
	9	WHITE	Color	Level 3	23
	10	BLUE	Color	Level 5	23
	11	STRAWBERRY	Food	Level 4	23
Two-handed	1	TORTOISE	Animal	Level 4	23
	2	CASTLE	Building	Level 3	23
	3	SHOES	Everyday item	Level 4	20
	4	MEDICINE	Everyday item	Level 3	22
	5	ROCK	Nature	Level 5	16
	6	CAKE	Food	Level 5	21
	7	GIFT	Other	Level 4	21
	8	ELEVATOR	Vehicle	Level 3	20
	9	TATAMI※	Everyday item	Level 4	22
	10	PEACH	Food	Level 3	21
	11	BAMBOO	Plant	Level 4	22

※Straw and rush mats

Reduced Long-Range Temporal Correlations in BOLD time-series reflect language and mood improvements following Intensive Language-Action Therapy (ILAT) in chronic post-stroke aphasia patients

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Introduction

Intensive Language-Action Therapy (ILAT) is a well-established treatment for chronic post-stroke aphasia, focusing on behaviorally relevant verbal communication in social contexts. This approach provides a neuroscience-based alternative to traditional methods that emphasize isolated linguistic skills (Berthier & Pulvermüller, 2011; DiFrancesco et al., 2012; Pulvermüller et al., 2001). Stroke patients exhibit significantly altered BOLD signals - often attenuated and slower - compared to healthy individuals, complicating the accurate measurement of therapy-related brain activity changes with traditional fMRI methods (Amemiya et al., 2010; Mazzetto-Betty et al., 2010). This study employs Long-Range Temporal Correlations (LRTC), a measure of a signal's self-similarity over time and a sensitive biomarker for learning-related neuroplasticity (Jäger et al., 2023), to investigate ILAT-induced functional reorganization in brain regions associated with language and cognitive processing.

Methods

Sixteen chronic stroke patients underwent fMRI before and after two weeks of ILAT. Language function and emotional well-being were assessed using the Aachen Aphasia Test (AAT) and the Montgomery-Åsberg Depression Rating Scale (MADRS). During fMRI, language function was evaluated through a passive reading paradigm. Detrended Fluctuation Analysis (DFA) measured LRTC across Regions of Interest (ROI) derived from the Automated Anatomical Labeling (AAL) atlas. The ROI analyses included 4 integrated (2 perisylvian frontal and temporal regions in both hemispheres), focused (13 perisylvian language-related ROIs on both sides), and whole brain (all 116 AAL ROIs) approaches. A 2x2x2 repeated measures ANOVA (time: pre, post; hemisphere: left, right; ROI: frontal, temporal) was conducted, adjusting for age and treatment intensity. Further analyses explored correlations between changes in LRTC and behavioral outcomes across integrated, focused and whole-brain ROIs.

Results

The integrated ROI analysis showed a significant effect for ROI ($F = 5.99$, $p = 0.029$), with lower LRTC in frontal compared to temporal ROIs. Additionally, there was a significant time $\times$ age interaction ($F = 5.97$, $p = 0.03$). Changes in LRTC were significantly negatively correlated with improvements in language and emotional well-being (depression) across both hemispheres. Focused ROI analyses revealed significant negative correlations specifically in right perisylvian areas (Figure 1). Whole brain ROI analysis found additional significant strong correlations in bilateral memory and domain-general networks.

Conclusions

In chronic post-stroke aphasia patients, LRTC were lower in frontal regions compared to temporal regions across both hemispheres. Younger patients experienced greater reductions in LRTC during therapy than older patients. ROI analyses indicated that decreases in LRTC following ILAT correlated with significant improvements in clinical language scores and reductions in depressive symptoms. These changes were primarily observed in focal perisylvian regions of the right hemisphere and, to a lesser extent, in the left hemisphere. The lack of focal ROI effects in the left hemisphere might be due to weaker signals from damaged areas, leading to fewer voxels and a reduced signal-to-noise ratio. The strongest correlations between language improvements and LRTC decrease were seen in bilateral domain-general and memory areas, including the hippocampus, supplementary motor area, thalamus, and putamen. These findings suggest a synergistic relationship between mood and language improvements, particularly in right hemisphere perisylvian areas.

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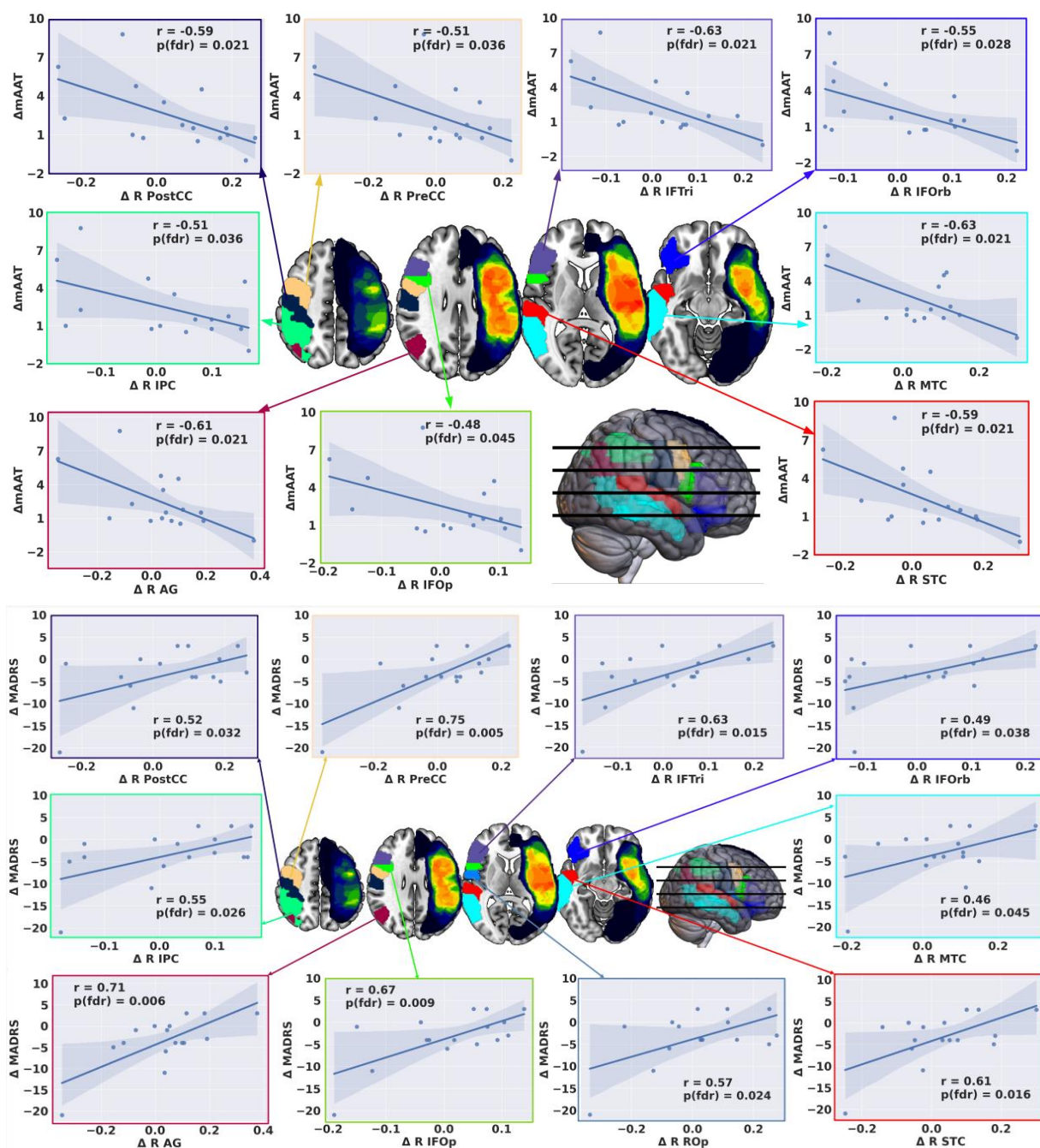


Figure 1. A) Behavioral correlations in right hemisphere language-related subregions: a) Correlation between Δ HE & Δ mAAT, where greater negative correlations mean that greater decreases in LRTC are associated with better language outcome; b) Correlation between Δ HE & Δ MADRS, where greater positive correlations mean that greater decreases in LRTC are associated with better mood outcome. This figure illustrates the outcomes of exploratory one-tailed correlational analyses within pre-defined language-related AAL subregions of the right hemisphere. Significant, multiple comparison-corrected negative correlations were observed. Regions showing correlations include: angular gyrus (AG, magenta), inferior frontal gyrus – opercular part (IFOp, green), orbital part (IFOrb, blue), and triangular part (IFTri, purple), inferior parietal cortex (IPC, light green), middle temporal cortex (MTC, cyan), postcentral cortex (PostCC, dark blue), precentral cortex (PreCC, beige), and superior temporal cortex (STC, red). Additional correlation in the rolandic operculum (ROp) is noted in b).

Aging-related differences in serial position effects and serial clustering strategies in a verbal learning task

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Introduction

The serial position effects (SPEs) refer to the tendency to remember the beginning (primacy) and the end (recency) of a word list better than the middle (Atkinson & Shiffrin, 1968). Previous literature reported that older adults showed lower recall accuracy in recent portions than younger adults, observing the aging effects on the SPEs (Griffin et al., 2016).

Clustering behaviors have been reported as a recall strategy through qualitative analysis, mostly focusing on semantic components of the clustering strategy. More recently, serial aspects of clustering information have been analyzed to recall words in the order presented (Gongvatana et al., 2007). Previous studies showed that older adults have greater difficulty remembering information in sequential order than younger adults (Golomb et al., 2008).

The current study investigated whether aging effects emerged in recall accuracy as a function of SPE and time intervals (immediate vs. delayed recall). Additionally, we examined whether the serial clustering ratio (SCR) differed between young and older groups when the time intervals (immediate vs. delay) were manipulated.

Methods

Participants. Forty Korean-speaking individuals participated in this study, consisting of 20 younger (Mean Age: 24.35, education: 15.20 yrs) and 20 older (Mean Age: 70.90, education: 13.55 yrs) adults. All participants scored within the normal range (age- and education-adjusted scores $\geq 16\%$ ile) of the Korean-Mini Mental State Examination (K-MMSE; Kang, 2006).

Task. The Seoul Verbal Learning Test (SVLT; Kang et al., 2012) was administered. Participants were asked to recall 12 words across three immediate trials and one delayed trial after a 20-minute interval.

Data analysis. Dependent variables are recall accuracy (%) and the SCR, calculated by dividing the total number of words recalled by the number of times a recalled word is followed by its subsequent word (Hasse-Sousa et al., 2023). Independent variables include time points (immediate vs. delay), SPEs (primacy, middle, recency), and groups (young vs old).

Results

The three-way interaction was significant for recall accuracy (%) [$F(2,76)=5.186$, $p=.008$]. As post-hoc analyses, the two-way mixed ANOVAs (group x SPEs) were performed for each time interval. The group x SPE interaction was significant only in the immediate recall condition ($p<.001$). The older group showed worse performance in the middle than in primacy and recency positions, indicating that the older group showed greater SPE effects than young adults [Figure 1(a)]. For the SCR, only the main effect for the group was significant ($p=.012$) (young > old) [Figure 2(b)].

Conclusions

The SPEs emerged more clearly in older adults under the immediate recall condition. These findings are consistent with the hypothesis that the SPEs are pronounced when the information to be recalled exceeds one's capacity (Murdoch, 1962). Our results suggest that the SPE effects became more salient as memory capacity decreases with age. In contrast,

young adults exhibited a step-wise decrease (primacy>middle>recency) in recall performance rather than SPE effects, indicating that the two groups may employ different memory strategies. For the SCR, the young group clearly employed serial clustering strategies across the time intervals. More studies are needed to link memory recall performance with the mnemonic strategies as people age.

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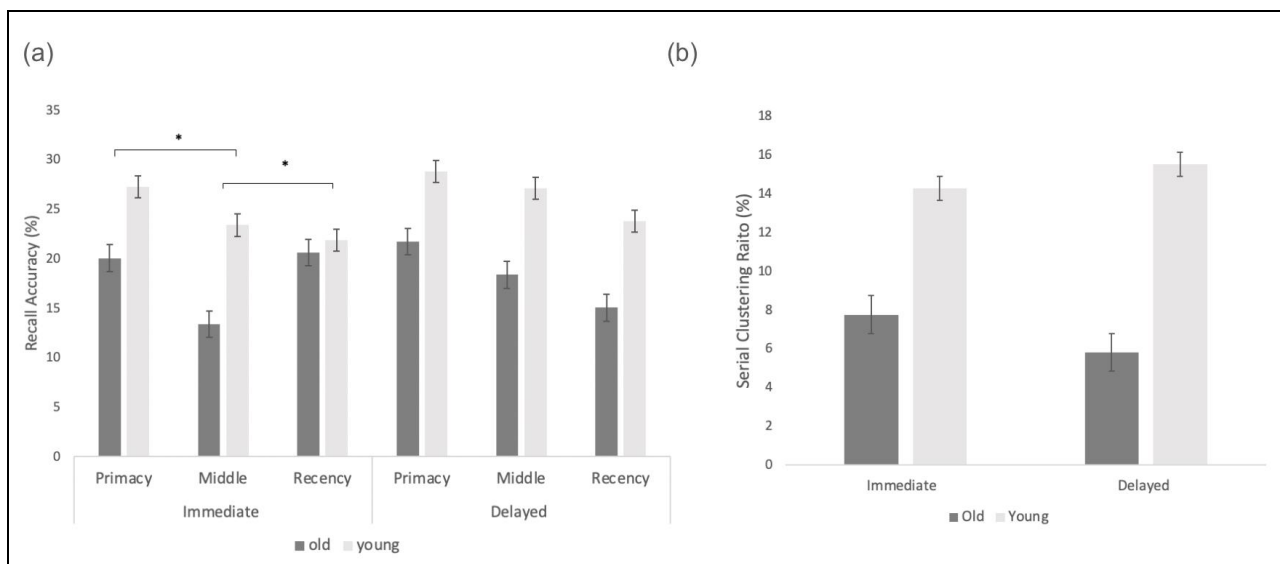


Figure 1. Recall accuracy and serial clustering ratio between young and older groups for each time interval (immediate vs. delay): (a) Recall Accuracy (%) and (b) Serial Clustering Ratio.

Longitudinal investigation of naming accuracy in a case of bilingual logopenic primary progressive aphasia: Contribution of psycholinguistic properties

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Introduction

Although more than half of the world's population speaks multiple languages, our current understanding of primary progressive aphasia (PPA) is mostly based on data from monolingual English speakers (García et al., 2023). The global rise in bilingual populations, coupled with the increased incidence of neurodegenerative diseases, underscores the significance of studying PPA syndromes in bilingual individuals (Fabbro, 2001). Naming impairment is often an early and prominent characteristic of logopenic variant of PPA (lvPPA) and it can serve as a reliable indicator of language deterioration (Gorno-Tempini et al., 2011). To date, only a small body of literature has investigated naming impairment in bilingual lvPPA (for review, see Malcolm et al., 2019). While the insights gained from these investigations are important, no previous study has probed whether word-level naming deterioration is consistent across languages, or how psycholinguistic properties might differentially impact naming performance in the first (L1) versus second (L2) languages for bilingual individuals. This longitudinal study examined naming performance in a Chinese(L1)-English(L2) bilingual woman with lvPPA over two years. It also investigated the impact of psycholinguistic factors on naming accuracy and decline in both languages over time.

Methods

Data for this study were obtained from DementiaBank (Lanzi et al., 2023). BYR, a 78-year-old woman diagnosed with lvPPA, was a balanced Chinese(L1)-English(L2) bilingual. She was evaluated four years post-diagnosis (Filley et al., 2006). A modified version of the Boston Naming Test (mBNT) was administered over a two-year period to assess naming ability in both languages. Psycholinguistic properties for each mBNT item were extracted, including frequency, familiarity, age of acquisition (AoA), word length, valence, and arousal. Paired-sample *t*-tests, correlation analyses, and forward stepwise regression analyses were performed to investigate naming differences between the two languages, examine word-level naming associations, and identify factors influencing accuracy and naming decline.

Results

Comparison of naming accuracy over two years revealed significant differences across languages. At both time points, BYR consistently demonstrated higher naming accuracy in English compared to Chinese, while a significant decline from Year 1 to Year 2 was only observed in Chinese (Figure 1). Correlation analyses indicated a weak association between naming performance in Chinese and English that was not significant at Year 2 (Year 1: $r = .29$, $p = .05$; Year 2: $r = .23$, $p = .13$). Familiarity predicted naming accuracy in Chinese at both timepoints. For English, word length and AoA were significant predictors during the first year, whereas in the second year, only word length was a significant predictor of naming accuracy (Table 1). AoA predicted naming decline in Chinese, while valence and arousal influenced naming deterioration in English (Table 1).

Conclusions

This study documented two-year longitudinal decline in naming accuracy in a Chinese-English bilingual individual with IvPPA. Although overall naming accuracy declined in both languages, performance in Chinese (L1) was significantly more impaired compared to English (L2). The psycholinguistic properties of words affected naming accuracy and decline differently in English and Chinese, reflecting cross-linguistic differences in progression of naming impairment.

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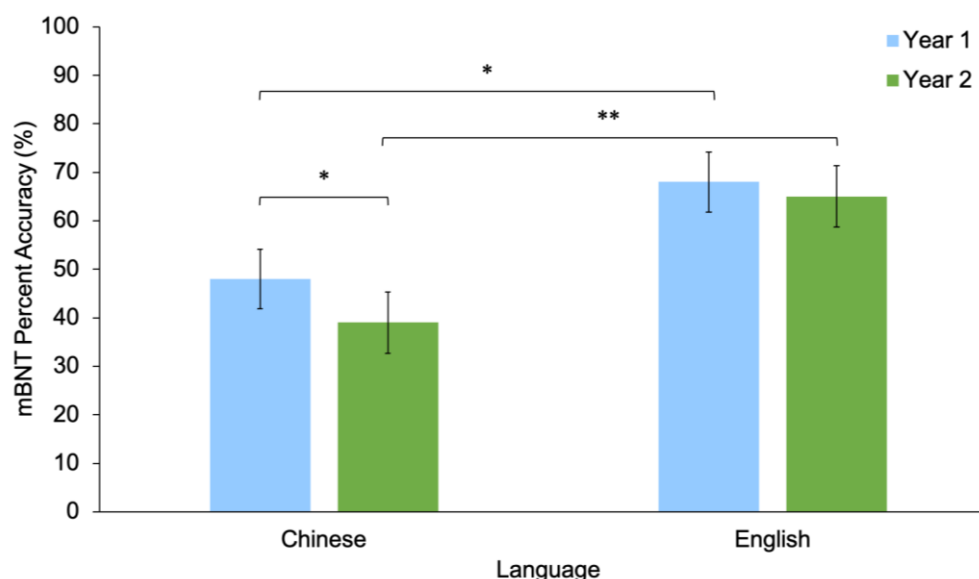


Figure 15. Participant's (BYR) naming accuracy in chinese and english in Year 1 and Year 2

Note. Mbnt = modified boston naming test. Asterisks denote significant differences at * $p < .05$, and ** $p < .01$.

Table 1. Results of forward stepwise linear regressions showing the contribution of psycholinguistic variables to the naming accuracy and decline from Year 1 to Year 2 in Chinese and English

Language	Period	Predictor	β	p
Chinese (L1)	Year 1	Familiarity	.68	< .001 ^{***}
	Year 2	Familiarity	.45	.037 [*]
	Decline (Year 2 - Year 1)	Age of acquisition	.54	.01 [*]
English (L2)	Year 1	Word length	-.44	.002 ^{**}
		Age of acquisition	-.33	.018 [*]
	Year 2	Word length	-.57	< .001 ^{***}
		Valence	-.37	.014 [*]
	Decline (Year 2 - Year 1)	Arousal	-.33	.029 [*]

Note. Frequency was included in the analysis but did not reach statistical significance at $p < .05$; Naming accuracy in Chinese for Year 1 $R^2 = .47$; Naming accuracy in Chinese for Year 2 $R^2 = .20$; Naming decline in Chinese $R^2 = .29$; Naming accuracy in English for Year 1 $R^2 = .38$; Naming accuracy in English for Year 2 $R^2 = .32$; Naming decline in English $R^2 = .20$; Asterisks denote significant effects at ^{*} $p < .05$, ^{**} $p < .01$, and ^{***} $p < .001$.

Feasibility and compliance of ecological momentary assessments to measure stress in people with aphasia: Preliminary analyses

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Introduction

People with aphasia (PWA) report higher levels of stress than people without aphasia¹. Stress can have adverse effects on physical and mental health and may lead to harmful changes in the body's neurological functioning. Moreover, the perception of stress is a dynamic construct and considerable fluctuations in symptom severity occur.²

Ecological Momentary Assessments (EMA) have been increasingly used in healthcare research, but its application specifically to PWA has yet to be explored. EMAs study behavior by repeatedly collecting data in an individual's natural environment. This may be done by sending individuals notifications across a set time-period to answer specific prompts related to the behaviors in question. EMAs may be particularly useful for aphasia research because they can assess dynamic, real-world changes in symptom severity— which may vary significantly day-to-day.³ EMAs are useful and feasible in other clinical research,⁴ are cost-effective⁵, have been used to examine symptoms in people with traumatic brain injuries⁶, and have been a reliable indicator of subjective stress perceptions.⁷

The study presents essential information concerning the feasibility and compliance of EMA implementation to explore variations in stress for PWA.

Methods

Sixteen participants were drawn from an ongoing study exploring stress in PWA. Participants were eligible if they had aphasia from stroke, between the ages of 18-85, had no other evidence of neurological disorder, and had access to a smart phone device. Participants were sent text messages with a weblink to answer five prompts regarding stress severity one time a day for ten consecutive days. Text messages were sent via Twilio. See Table 1 for the EMA prompts.

Feasibility was calculated by the number of screened participants overall, by eligibility, and refusal status. Reasons for participant ineligibility and refusal were documented. Compliance was measured by calculating the number of EMA's completed out of the ten delivered EMAs across all participants.

Results

93.75% percent of enrolled participants in the larger study enrolled in the EMA portion (n = 15 of 16). Among those enrolled, 100% were retained through day ten. Compliance was 96%. Participants' general stress across the ten days ranged from 1 – 4 (1-5 scale). Participants greatest severity of stress during a communication setting across the 1 – 5 days ranged from 1 – 5 (1-5 scale). Stress severity ratings during a communication event elicited an increase of .25 ($p < .001$) in perceived stress compared to general stress for the day (see Figure 1).

Conclusions

We found evidence for the preliminary feasibility and compliance of EMA implementation for people with aphasia. Current research examining chronic stress and the development of therapeutic interventions can be expanded upon using EMA technologies.

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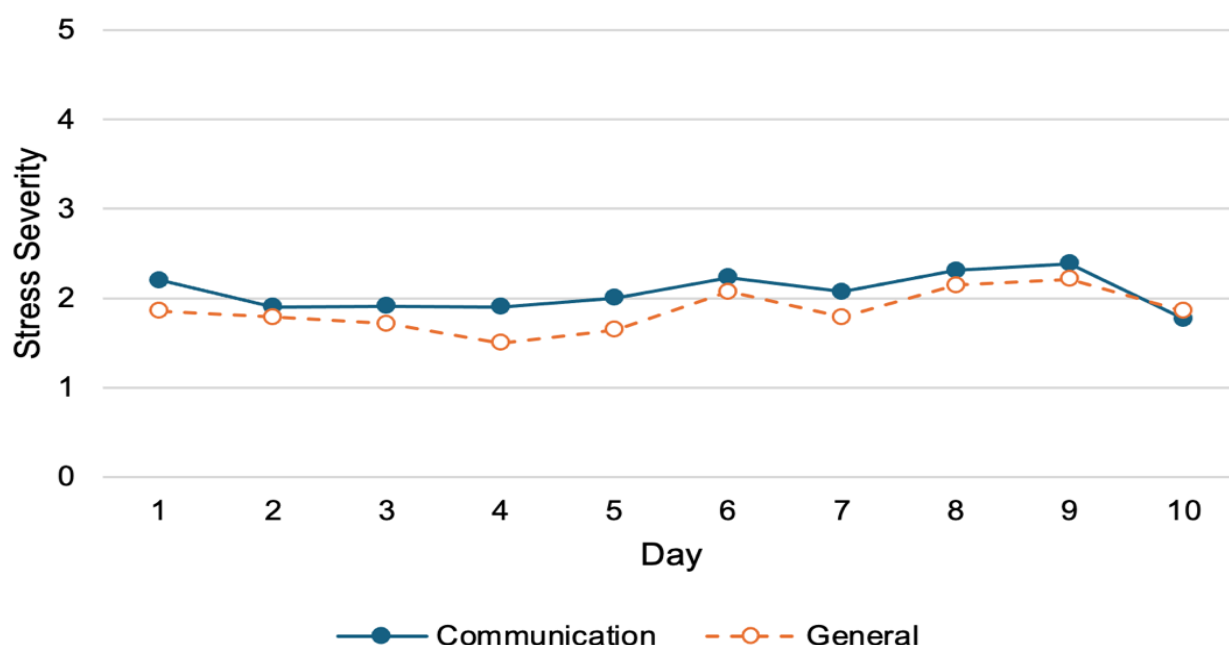


Figure 1. Trajectory of general and communicative stress perceptions.
Note. Longitudinal collection and variability in perceived stress across 10 days. Shown are mean perceived stress severities for general stress and stress during communication. 1 = low stress, 5 = high stress.

Table 1. EMA Prompts.

Prompt	Response options
1. Rate your severity of stress today	Likert Scale 1 - 5
2. Did you participate in communication today?	Yes, No
3. How would you describe the communication event(s)? Select all that apply.	1) communicated in community (e.g., bank, store) 2) communicated with small group of people 3) communicated in a detailed conversation 4) communicated in fast-moving conversation 5) communicated with people you know 6) communicated with people you don't know 7) communicated over the phone 8) communicated in a long conversation 9) other (specify in text box)
4. Of these, which do you consider the most stressful aspect of the communication event(s)?	Select one response from selected above
5. Rate your severity of stress during this communication event	Likert Scale 1 – 5

Analyzing the linguistic characteristics of the Cantonese Aphasia Battery (CAB) naming test items

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Introduction

The Cantonese Aphasia Battery (CAB), especially its naming test, is instrumental in diagnosing language impairments among Cantonese-speaking aphasic patients (Yiu, 1992). Originating from methodologies adapted from the Western Aphasia Battery (Kertesz, 1982), CAB has been tailored specifically for the linguistic and cultural context of Cantonese speakers. This study aims to uncover and describe the linguistic characteristics of the CAB naming test items by conducting a comprehensive analysis involving quantitative data on word frequency and phonological neighborhood density from normal adult Cantonese speakers, along with a qualitative exploration of linguistic structure. This analysis will provide insights that may prompt discussions about potential refinements to the test.

Methods

Quantitative Review. This component will involve analyzing word frequency data from the Hong Kong Cantonese Corpus (HKCanCor) to evaluate the commonality of words in everyday use (Luke & Wong, 2015). Phonological neighborhood density will also be assessed using data from the Cifu database (Lai & Winterstein, 2020), considering its potential impact on word retrieval difficulties.

Qualitative Review. This analysis will extend to exploring the morphosyntactic complexity, transparency and morphemic productivity of compound words used in the CAB naming test. Transparency refers to how clearly the meaning of a compound can be inferred from its parts, while morphemic productivity examines the frequency and diversity of morpheme usage across the language.

Results

This study will employ an integrated approach, combining quantitative and qualitative analyses to thoroughly assess the linguistic attributes of the CAB naming test items. By examining factors such as word frequency, phonological neighborhood density, morphosyntactic complexity, transparency, and morphemic productivity simultaneously, we will provide a detailed view of the elements that may influence word retrieval in aphasic patients. The findings will be presented in a comprehensive visual format to depict how each linguistic factor contributes to retrieval challenges, thereby highlighting items that might warrant further discussion regarding refinement.

Conclusions

The analysis of the CAB naming test items is expected to significantly deepen our understanding of its linguistic components and their potential challenges for aphasic patients. By uncovering and detailing these characteristics, this study will inform discussions about possible enhancements. This could lead to improved diagnostic accuracy and potentially influence future adaptations of the CAB naming test, contributing to better clinical outcomes and more effective therapeutic strategies.

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Characteristics of Japanese agrammatic speech in terms of case particles and predicates

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Introduction

In agrammatic speech, symptoms that reflect the nature of the individual language occur along with common language symptoms. In Japanese, grammatical relations are not indicated by word order but by case particles, and there is no agreement between subject and predicate as in Indo-European languages. For example, the Japanese case particles (“ga”, “wo” or “ni”) acts as a case-marker by attaching to the noun, and predicates are characterized by the attaching of multiple auxiliaries and particles to the verb (ex. otokonoko(Noun)-ga onnanoko(Noun)-ni oikake(Verb)-rare(passive auxiliary) -tei(aspect)-ru(tense) : a boy is chased by a girl.). We analyzed agrammatic speech in terms of case particles and predicate structure, and compared it with non-agrammatic speech.

Methods

Subjects were 5 cases of agrammatic Broca's aphasia due to left frontal lobe lesions, 5 cases of non-agrammatic aphasia involved 3 cases of Anomia and 2 cases of Conduction aphasia due to left temporal/parietal lobe lesions, and 10 healthy people as control. All subjects with aphasia underwent the standard language test of aphasia (SLTA), and Japanese syntactic test of aphasia-revised (STA-R; Fujita and Miyake, 2016). The naming score in each subject with aphasia was above 90%. All cases in Broca's aphasia were decided agrammatic by STA-R. All subjects were asked to describe 4 cartoon test of SLTA. We recorded and transcribed their narrative speech production.

Case particles were classified into structural case particles (nominative case particle “ga” and accusative case particle “wo”) and adjuncts. The incidence of omission and substitution was recorded. For predicate structure, auxiliary verbs and particles combined with verbs were classified as structural auxiliaries (voice) and non-structural auxiliaries (mood, aspect, tense). The number of occurrences in the predicate was counted.

Results

The case particle error appeared only in agrammatic Broca aphasia. In the agrammatic Broca aphasia, omission/substitution of case particles appeared more frequently in structural case particles than in adjuncts. In all cases in agrammatic Broca's aphasia and non-agrammatic aphasia, the auxiliary verb was not omitted or substituted. Structural auxiliary verbs appeared in non -agrammatic aphasia, but not in agrammatic Broca's aphasia. The incidence of non-structural auxiliary verbs was significantly lower in agrammatic Broca's aphasia than in non-agrammatic aphasia.

Conclusions

Notable features of Japanese agrammatic speech were the omission and substitution of structural case particles and simplification of the predicate structure. To express case relations, word order is used in English, while case particles are used in Japanese.

Therefore, the omission or substitution of case particles in Japanese is not only an error in the assignment of grammatical morphemes, but also indicates the possibility that the generation of sentence structure is difficult.

As for the predicate structure, no auxiliary verbs such as tense were omitted, but no voices related to the sentence structure appeared. This suggests that the properties of Japanese auxiliary verbs and English grammatical morphemes differ in the way they indicate tense, and that tense is less likely to be impaired in Japanese agrammatic speech than voice, which is related to structure.

Articulatory-based phonemic paraphasia in conduction aphasia: An impairment in phoneme-to-articulation conversion uncovered through crossed aphasia

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Introduction

Phonemic paraphasia, a common characteristic of conduction aphasia, has traditionally been attributed to dysfunction in phonological representations. However, the presence of *conduite d'approche* leading to a correct response indicates maintenance of an intact phonological representation. In line with this, an alternative hypothesis for phonemic paraphasia posits that phonemic paraphasias can also arise from difficulties in converting phonemes into the corresponding articulatory maneuvers. Ardila (1992) labeled the latter form of paraphasias as verbal apraxia with characteristics of segmentary ideomotor apraxia, specifically articulatory-based phonemic paraphasia. To our best knowledge, detailed case studies supporting this theory have been lacking. Here we present the case of a 61-year-old right-handed man with right temporo-parietal infarction, exhibiting crossed aphasia characterized by typical conduction aphasia symptoms. He showed frequent *conduite d'approche* leading to a correct response, and demonstrates the ability to accurately trace the corresponding phonetic symbol, while facing articulation difficulties, even the smallest unit of speech.

Methods

To confirm the presence of articulatory-based phonemic paraphasias in conduction aphasia, we consider the following conditions to be met: 1) Frequent occurrence of phonemic paraphasias without the presence of other types of paraphasias; 2) The absence of distorted articulation and/or syllable segmentation, distinguishing it from apraxia of speech caused by motor control impairment; 3) Maintenance of an intact phonological representation; 4) phonemic paraphasias or no response in the repetition of the smallest linguistic unit. We investigated these four conditions in the patient by comparing oral and written outputs using the same stimuli.

Results

He speaks relatively fluent speech with intact comprehension, frequent phonemic paraphasias, and significant difficulties in oral repetition, in the absence of distortion, syllable segmentation, or prosody impairment, all consistent with a diagnosis of conduction aphasia. His paraphasias are primarily phonemic in nature. Additionally, his performance on tasks involving one mora and non-word repetition is notably better when written to dictation compared to oral repetition ($p < 0.001$ for both). Notably, his ability to write one mora using Hiragana phonetic symbols is flawless. Similarly, his performance in word naming tasks is better when writing than when naming orally ($p < 0.05$). These results suggest that his phonological representations are almost intact.

Conclusions

This unique phenomenon was believed to result from an unusual separation of language functions in crossed aphasia – specifically, a disconnection between phonological

representations in the right temporo-parietal cortex and speech articulation engrams in the left hemisphere. In this case of conduction aphasia, articulatory-based phonemic paraphasias can be interpreted as an inability to convert phonemes into the appropriate articulatory maneuvers, rather than being attributed to phonological representation dysfunction or apraxia of speech. We believe that this type of phonemic paraphasias exist in individuals with typical conduction aphasia. To investigate the presence of articulatory-based phonemic paraphasias, we consider three methods available in order from simplest to most challenging: frequent conduite d'approche leading to a correct response, phonemic paraphasias or no response in the repetition of the smallest linguistic unit, and preserved orthographic representation, particularly in non-words.

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Investigating the cognitive and perceptual effects of healthy aging on semantic memory: An fNIRS pilot study

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Introduction

Semantic memory, which involves the storage and retrieval of knowledge about concepts, meanings, and relationships, is a critical component of cognitive functioning and plays a crucial role in various everyday activities, such as language comprehension, decision-making, and problem-solving (Kumar, 2020). Past research on the effects of healthy aging on cognition has led to the proposal of the Default-Executive Coupling Hypothesis of Aging (DECHA; Spreng & Turner, 2019). This hypothesis proposes that, as we age, the internally-directed Default Mode Network (DMN), which is associated with the storing of prior knowledge, and the externally-directed Executive Control Network (ECN), which is implicated in the integration of cognitive and perceptual processes, become increasingly coupled during goal-directed cognition due to declining perceptual skills and an increased reliance on semantic knowledge (Spreng & Turner, 2019). While evidence supporting the DECHA has been found in a variety of cognitive domains, there is a lack of research investigating this hypothesis in semantic memory. Thus, the purpose of this study is to investigate the DECHA in the domain of semantic memory using tasks that will assess semantic knowledge and perceptual skills.

Methods

Ten healthy younger (18-35) and ten healthy older (55-90) adults will be recruited (n=20). They will participate in two tasks that rely on semantic knowledge and perceptual skills, an adaptive semantic matching task (Wilson & Yen, 2018) and an adaptive Gabor patch discrimination task. The tasks will be adaptive in that the difficulty of each trial will be adjusted to achieve a consistent accuracy level of ~80% on an individual basis to ensure an appropriate level of challenge to the participant and adequate engagement of the target processes. Functional Near-Infrared Spectroscopy (fNIRS), a non-invasive neuroimaging technique, will be used to investigate the involvement of a region of the DMN, the medial prefrontal cortex (mPFC), and a region of the ECN, the dorsolateral prefrontal cortex (dlPFC) during the adaptive semantic and perceptual tasks.

Anticipated Results

The following is the current state of the study: the tasks have been designed and recruitment and data collection is currently underway. Data collection will be completed by 8/20/2024. The anticipated results of this study are: (1) older adults will perform better on the adaptive semantic matching task, reflecting their superior semantic knowledge, and younger adults will perform better on the adaptive Gabor patch discrimination task, reflecting their superior perceptual abilities and (2) older adults will engage in a greater degree of default-executive coupling than younger adults, as indicated by increased concurrent activation of the mPFC with the dlPFC, during the adaptive semantic matching task and the adaptive Gabor discrimination task.

Anticipated Conclusions

The findings from this study are expected to provide support for the of DECHA in semantic memory. During tasks that rely on semantic knowledge, older adults will engage in adaptive default-executive coupling that facilitates successful task performance. Conversely, during tasks that rely on perceptual abilities, older adults will engage in maladaptive default-executive coupling that inhibits task performance, as their reliance on prior knowledge may be distracting or irrelevant in this context.

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Story telling and event segmentation in aphasia

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Introduction

People who have graduated from speech language therapy and/or have been considered recovered from aphasia often continue to experience communication difficulties.¹ The cognitive-linguistic deficits of these recovered people with aphasia are not being fully captured by the currently available assessments. In a previous double case study, we showed that these deficits were easier to detect in when participants were asked to retell unfamiliar stories, compared to retelling familiar stories, following prior work TBI.² These same individuals also showed deficits in a non-verbal event segmentation task³, suggesting a more general impairment in the ability to recognize event boundaries. Our current work explores familiar vs. novel story retelling and its relationship to event segmentation in a larger cohort of people with aphasia.

Methods

We examined 23 people ages 30-80 (mean=57.7, standard deviation=12.19), who had aphasia as the result of a single left-hemisphere stroke (11 females, 12 males; 15 white/non-Hispanic, 3 white/Hispanic, 5 black/non-Hispanic, WAB AQ between 60.2-93.6). Two familiar stories (Cinderella and Goldilocks and the Three Bears) and two unfamiliar stories (Pigeon Impossible and Snack Attack) were administered and elicited narratives were analyzed using Story Grammar, which is a measure of narrative discourse that allows for identification of story elements necessary to build a complete story within the given context.⁴ The same narratives were collected from 20 controls without a history of neurological or developmental deficits to serve as the norm participants' narratives were compared to during the analysis stage. Both people with aphasia and control participants also watched three videos (gardening, putting up a tent, doing laundry), pressing the space bar at event boundaries.

Results

For both familiar and unfamiliar stories, controls recalled more events than people with aphasia (familiar: 24.6 vs. 19.6, $p=.006$; unfamiliar: 21.1 vs. 14.0, $p=.000$), with a marginally significant interaction in which the difference between familiar and unfamiliar storytelling was greater in patients than in controls ($p=.088$). However, the sample was quite heterogeneous. Intact and impaired performance on the storytelling tasks was defined using a Crawford-Howell modified t-test for each person with aphasia, against the control sample, with a $p<.05$ indicating impaired performance and a $p>.1$ indicating intact performance. With this classification, eight people with aphasia were unimpaired on both familiar and unfamiliar storytelling tasks ten were impaired on both, with only two patients in our sample demonstrating the pattern where they were not impaired on familiar story telling but were impaired on unfamiliar storytelling. In contrast, all participants with aphasia showed impairments on the event segmentation task. Event segmentation was measured with segmentation agreement, and the event segmentation agreement for each of the people with aphasia with the control sample (range: -.06 - .14) was significant lower than the segmentation agreement for the individuals in the control sample with each other (.22 - .44).

Conclusions

The results are consistent with prior results that unfamiliar story telling is a more sensitive measure of cognitive-linguistic deficits in patients with aphasia, though there is heterogeneity in the sample. Event segmentation ability appears impaired across the whole sample.

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Investigating the relationship between white matter integrity and linguistic and non-linguistic cognition in individuals with chronic aphasia

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Introduction

The use of diffusion imaging (DTI) to study white matter integrity in people with aphasia (PWA) and its relation to behavior is growing. Studies have reported (a) relationships between the arcuate fasciculus (AF) and numerous language functions³ and recovery¹⁰, (b) inferior fronto-occipital fasciculus (IFOF) and semantics⁹, (c) inferior longitudinal fasciculus (ILF) and comprehension¹¹, (d) superior longitudinal fasciculus (SLF) and spontaneous speech and comprehension⁸, and (e) uncinate fasciculus (UF) and comprehension¹¹ and memory⁶. Many existing studies focus on a particular tract or behavior of interest, with little overlap in assessments, leading to difficulty drawing significant conclusions about the population. Expanding this body of literature we investigated relationships between white matter tract integrity across all language tracts and linguistic and non-linguistic cognition in PWA.

Methods

DTI data was collected for 28 individuals (3 Female) with post-stroke chronic aphasia (mean age=57.67, range=18-81, mean WAB-R AQ=77.6, range=31.5-98.6). Participants completed the BNT⁴, three-picture PAPT,² RBANS Language and Attention Subtests⁷, and WAB-R Spontaneous Speech, Auditory Verbal Comprehension, Repetition, and Naming and Word Finding subtests⁵. Non-linguistic tasks included the Ravens Matrices from the WAB-R and the RBANS Attention subtest, whereas the rest were used as measures of linguistic cognition. DTI images were preprocessed with FSL 6.0.4. TOPUP and EDDY functions to correct for movement and distortions. Then in DSI Studio images were reconstructed using Generalized Q-sampling Imaging and the ICBM152_adult template, and atlas-based tracking was completed using the ICBM152_adult atlas. Fractional anisotropy (FA) values for 10 tracts (bilateral AF, IFOF, ILF, SLF, & UF) were extracted and manually compared with values from a previous study¹ to confirm similar trends across tracts. Regression models adjusted for lesion volume were used to determine relationships between FA values across tracts of interest and scores on behavioral tasks using the lm function in R Studio.

Results

Statistical results are outlined in Table 1. Significant associations were found between WAB-R AQ and all WAB-R language subtest scores and left AF, IFOF, ILF, SLF and UF integrity, BNT and bilateral AF and left SLF integrity, RBANS Language index scores and left AF and bilateral IFOF integrity, PAPT performance and left AF, IFOF, and ILF integrity, Ravens Matrices performance and right IFOF, ILF, and SLF integrity, and RBANS Attention index scores and left AF integrity. For most significant associations, higher FA values were associated with higher behavioral scores, except the right AF and the BNT, which showed higher FA values associated with lower BNT scores.

Conclusions

Results of this study replicate previous results, and offer novel findings in the DTI literature on aphasia. Novel findings include the association between left SLF and ILF integrity and

repetition, naming and measures of aphasia severity, left AF integrity and repetition, and evidence of bilateral tract involvement in non-linguistic cognition (AF integrity associated with attention performance, and right IFOF, ILF, and SLF integrity associated with problem solving). These results are interpreted as preliminary findings, as analyses will be re-run using a Principal Component Analysis (PCA) when data collection for the project is complete to minimize false-positive associations.

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Table 1. Significant results from analyses of FA values and behavioral scores

Task	Tract	FA			FA + lesion volume		
		Coefficient	t value	P	Coefficient	t value	P
WAB-R AQ	Left AF	171.00	3.787	0.000814***	185.1	2.809	0.00997**
	Left IFOF	149.73	2.282	0.0309*	111.2	1.442	0.1627
	Left ILF	174.44	2.411	0.0233*	142.9	1.775	0.0892°
	Left SLF	234.76	2.885	0.00777**	285.4	2.846	0.00915**
	Left UF	97.41	2.001	0.05595*	49.15	0.848	0.405351
WAB-R Spontaneous Speech	Left AF	2.1898	3.557	0.00147**	2.184	2.791	0.0104*
	Left IFOF	1.8595	2.096	0.046*	1.341	1.468	0.156
	Left ILF	1.9686	1.977	0.0587*	1.601	1.665	0.109
	Left SLF	2.211	1.89	0.07°	2.672	2.112	0.0458*
	Left UF	1.4965	2.364	0.0258*	0.7775	1.145	0.2395
WAB-R Auditory Verbal Comprehension	Left AF	1.50139	3.725	0.000954***	1.645	3.046	0.00573**
	Left IFOF	1.4495	2.538	0.01749*	1.234	1.978	0.06005°
	Left ILF	1.7548	2.825	0.00896**	1.585	2.483	0.0208*
	Left SLF	1.5183	1.96	0.0607°	1.926	2.163	0.0412*
	Left UF	1.0442	2.507	0.0187*	0.6674	1.411	0.172
WAB-R Repetition	Left AF	2.1862	3.565	0.00144**	2.197	2.531	0.0187*
	Left IFOF	2.1275	2.473	0.0203*	1.654	1.694	0.104
	Left ILF	2.45071	2.58	0.0159*	1.976	1.929	0.0661°
	Left SLF	2.4093	2.094	0.0461*	2.761	1.995	0.058*
	Left UF	1.3418	2.084	0.0472*	0.6628	0.891	0.3824
WAB-R Naming and Word Finding	Left AF	2.4542	4.074	0.000385***	2.380	3.05	0.00568**
	Left IFOF	2.3501	2.698	0.0121*	1.793	1.989	0.0587*
	Left ILF	2.41903	2.446	0.0215*	1.853	1.919	0.0674°
	Left SLF	3.1098	2.759	0.0105*	3.922	3.406	0.00242**
	Left UF	1.6539	2.587	0.0156*	0.8635	1.251	0.22337
BNT	Left AF	2.0801	2.005	0.0569*	2.720	1.860	0.077°
	Right AF	-6.162	-2.275	0.03253*	-6.639	-2.578	0.01753*
	Left SLF	2.9032	1.714	0.100°	4.927	2.295	0.0322*
RBANS Language	Left AF	1.14926	2.736	0.0136*	1.455	2.519	0.0221*
	Left IFOF	0.9505	1.745	0.098°	0.8462	1.314	0.206
	Right IFOF	2.2356	1.959	0.0658°	2.342	2.093	0.0516*
PAPT	Left AF	0.28141	1.753	0.0929°	0.3754	1.579	0.129
	Left IFOF	0.3521	1.741	0.095°	0.3744	1.497	0.149
	Left ILF	0.4632	2.037	0.0533*	0.4711	1.800	0.0863°
Ravens Matrices	Right IFOF	2.8132	1.976	0.0621°	3.053	2.043	0.056*
	Right ILF	3.5446	2.665	0.0149*	3.568	2.547	0.0202*
	Right SLF	4.225	3.168	0.00483**	4.570	3.216	0.00479
RBANS Attention	Left AF	112.57	2.036	0.05593*	150.3	1.885	0.0757°
*Statistically significant at $P < 0.05$ °Marginally significant $0.05 < x < 0.1$ **Statistically significant at $P < 0.001$ ***Statistically significant at $P < 0.0001$							

Comparing semantic network differences in the animal fluency task between normal aging and Alzheimer's dementia

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Introduction

The animal fluency task is widely used to evaluate the semantic retrieval abilities of individuals with Alzheimer's Disease (AD) as a measure of verbal fluency. Qualitative analyses of semantic retrieval deficits in AD have gained considerable attention to better understand the features of these impairments. As part of this effort, network science methodologies have been applied to delineate differences in semantic connections across diverse clinical populations, such as typical aging, Parkinson's disease, and AD (Arias-Trejo et al., 2021). Analyses of semantic network make it possible to visualize and quantify the connections and efficiency using nodes and edges (Kenett & Faust, 2019).

The current study investigates how the semantic network deteriorates for individuals with AD compared to Normal Aging (NA) using Semantic Network Analysis (SemNA; Christensen & Kenett, 2021).

Methods

Participants. English-speaking individuals participated in the study and were divided into two groups: AD (n = 20) from the DementiaBank Pittsburgh Corpus (Becker et al., 1994) and NA (n = 20). The groups showed no significant differences in age ($t(32.513) = 1.581, p = .123$) or education ($t(36.879) = 1.909, p = .0644$), but differed significantly (AD < NA) in Mini-Mental State Examination (MMSE) scores ($t(27.389) = -8.651, p < .001$).

Task. Participants were asked to list as many 'animal' category words as possible in one minute (Rofes et al., 2020).

Data analysis. We analyzed the group differences in 3 variables: (1) Average Shortest Path Length (ASPL), which quantifies the minimum steps required to connect two nodes. (2) Clustering Coefficient (CC), which indicates the connectivity among the neighboring nodes. (3) The maximum modularity measure (Q) assesses the network's interconnectedness through sub-categories. We used independent sample t-tests on each network measure to examine the group differences.

Results

In comparison to the NA group, the AD group exhibits a longer ASPL ($t(1998) = -12.594, p < .001$), meaning the AD group needs more lines on average to travel between nodes. The AD group also has a lower CC ($t(1998) = 6.565, p < .001$), indicating lower clustering among nodes. Additionally, the AD group shows a higher Q ($t(1998) = -5.827, p < .001$), suggesting that they have stronger intra-cluster connections but weaker inter-cluster connections. These results are summarized in Figure 1 and Table 1.

Conclusions

The current study examined differences in semantic networks associated with the animal fluency task between NA and AD groups. The AD group demonstrated longer ASPL, indicating more steps required to travel to another node, which leads to decreased efficiency in activating the semantic network (Cosgrove et al., 2021). Lower CC in the AD group

suggests that their semantic nodes are relatively weakly connected compared to NA. Furthermore, Q was higher in the AD group, indicating their inability to divide clusters (e.g., animals) into smaller, well-defined subclusters (e.g., farm animals). This is related to a network's flexibility (Kenett et al., 2018). The higher Q values in AD suggest that individuals with AD are impaired in cognitive flexibility. The current results highlight that semantic network analysis contributes to providing a fine-grained understanding of semantic impairments in AD.

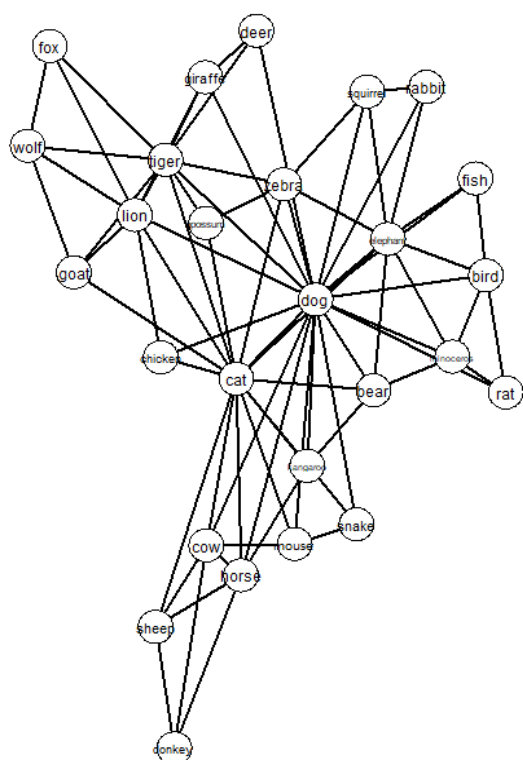
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Acknowledgments

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Normal Aging



Alzheimer Dementia

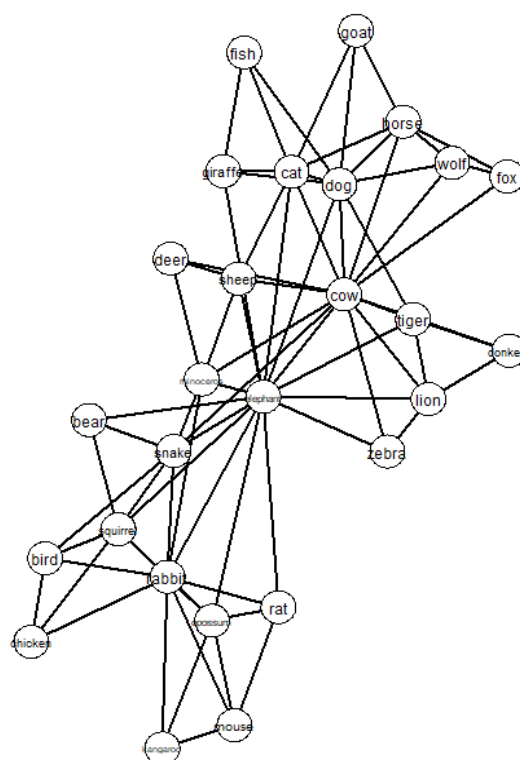


Figure 16. Semantic network comparisons using the semantic network and fluency utility between normal aging (left) and dementia (right): nodes (circles) represent each lexical item from the ‘animal’ category, and edges (lines) indicate the similarity or co-occurrence of the items.

Table 1. Descriptive statistics on each variable from SemNA analysis

Variables	NA mean(SD)	AD mean(SD)	Direction	<i>p</i> -value
ASPL	1.62(0.041)	1.648(0.055)	NA < AD	<i>p</i><.001
CC	0.757(0.012)	0.752(0.02)	NA > AD	<i>p</i><.001
Q	0.209(0.033)	0.218(0.034)	NA < AD	<i>p</i><.001

Note: SemNA=Semantic Network Analysis; ASPL=Average Shortest Path Length; CC=Clustering Coefficient; Q=maximum modularity coefficient. NA=Normal Aging, AD=Alzheimer’s Dementia.

Listening effort and prefrontal cortex activation during discourse comprehension: A preliminary fNIRS study

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Introduction

Listening effort (LE) refers to the cognitive and attentional resources allocated to auditory processing, crucial for discourse comprehension, especially in challenging environments (Pichora-Fuller et al., 2016). As acoustic signals degrade, LE increases, demanding more resources and reducing the capacity for other processes. LE has been behaviorally measured by evaluating auditory discourse comprehension abilities. Recently, LE has been reflected in neurophysiological measures such as hemoglobin changes in the prefrontal cortex (PFC) using functional near-infrared spectroscopy (fNIRS), particularly in the left PFC (Ayasse & Wingfield, 2018).

Some studies have reported that increased oxyhemoglobin in PFC during auditory processing under noisy conditions indicates increased LE (Li et al., 2023). However, other studies suggest that oxyhemoglobin level increases in quiet conditions rather than in noise, proposing that reduced LE in quiet conditions may allow more cognitive resources to be allocated to higher cognitive task, thereby leading to an increase in oxyhemoglobin levels (Peelle, 2018).

The present study investigated behavioral performance and hemodynamic changes during discourse comprehension tasks (DCT) by varying the noise levels.

Methods

Participants. Eight young adults participated (mean_age: 26.6 ± 5.7 , mean_education: 18.0 ± 1.4), all within normal hearing thresholds ($< 26\text{dB HL}$). Additional data will be collected.

Material. DCT comprised 4 passages from the Language Scale for School-Aged Children (LSSC; Lee, Heo, & Jang, 2020). The passages were presented, half in white noise (signal-to-noise ratio of 0) and half in quiet conditions. After each passage, participants answered 5-6 questions. Control tasks were administered using brown noise.

Experimental Procedures. Each experimental unit consisted of four 48-second blocks: rest - DCT - rest - control. We used a 15-channel fNIRS (NIRSIT LITE; OBELAB Inc., Seoul, Korea) to record real-time changes in oxy- and deoxy-hemoglobin (ΔHbO_2 and ΔHbR) in the upper, lower, and central regions of the prefrontal cortex.

Data analysis. To compare differences between noise and quiet conditions, one-way repeated ANOVAs were conducted for behavioral and hemodynamic analysis. Accuracy(%) on the DCT and ΔHbO_2 and ΔHbR (mm x mm) during listening to passages were analyzed.

Results

Accuracy(%) was significantly lower in noise compared to the quiet conditions [$F(1, 7)=18.6$, $p=.004$]. ΔHbO_2 was significantly higher in the quiet than noise conditions, specifically in the upper left PFC [$F(1, 7)=15.7$, $p=.005$]. No significant results were observed in ΔHbR .

Descriptive and ANOVA statistics are detailed in Table 1, and hemodynamic responses are depicted in Figure 1.

Conclusions

This study found that both DCT accuracy and ΔHbO_2 increased under quiet conditions compared to noise ones. These findings are consistent with previous research suggesting that quiet conditions with reduced LE potentially allow greater cognitive resources to be available for processing higher cognitive tasks (Peelle, 2018). Greater consumption of cognitive resources in quiet conditions to perform the DCT is possibly reflected in an increase in ΔHbO_2 , leading to better accuracy. These effects were pronounced in the upper left PFC, underscoring its crucial role in managing LE and performing higher levels of linguistic processing (Lang et al., 2021).

This preliminary study on young, normal-hearing adults provides insights into the interconnections between hemodynamic responses and LE, laying the groundwork for future research on older or clinical populations.

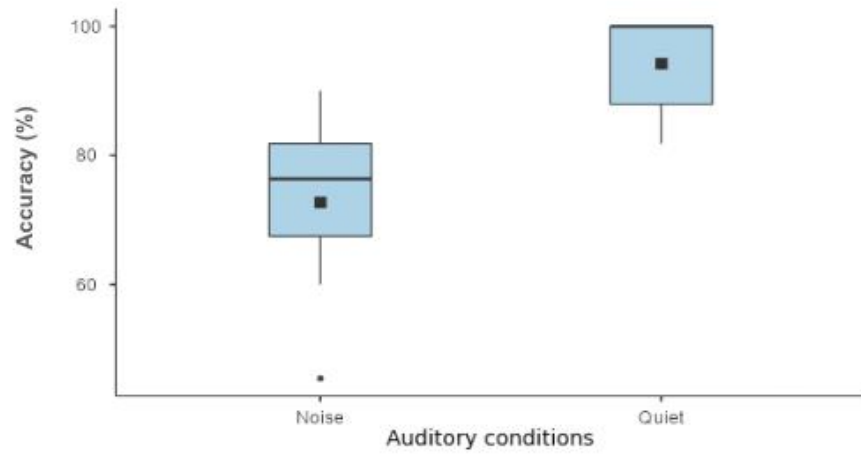
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a



b

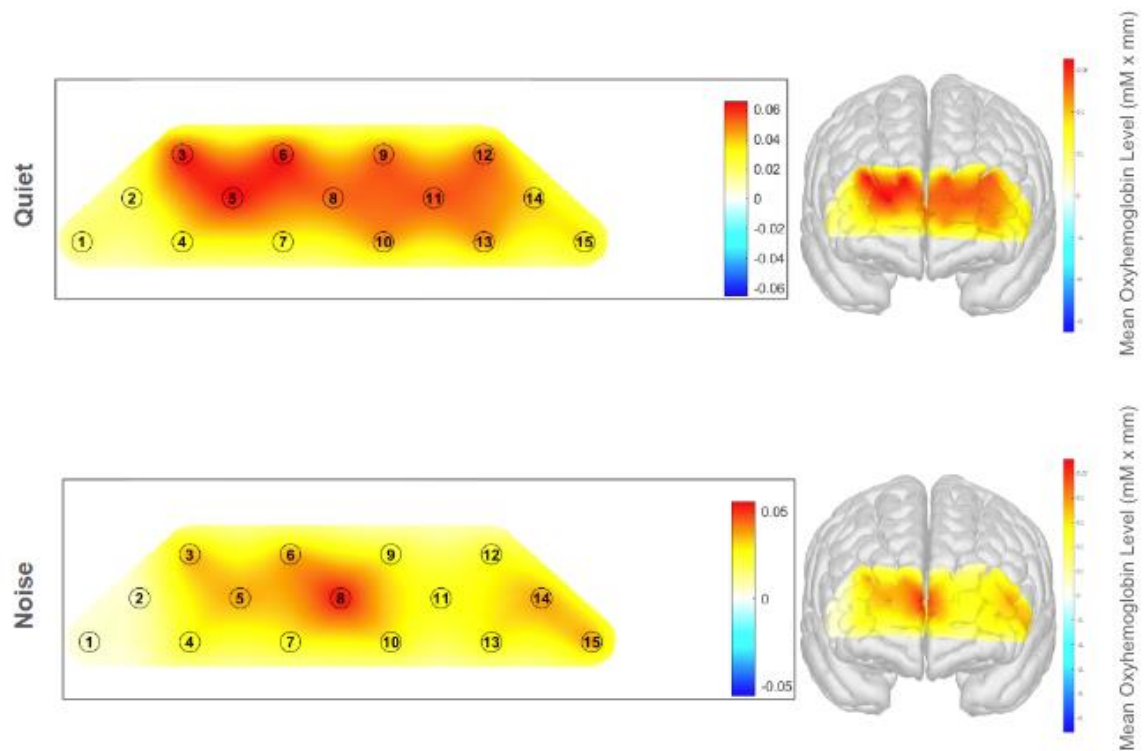


Figure 1. (a) Accuracy (%) in discourse comprehension task and (b) oxyhemodynamic changes in the prefrontal cortex between the auditory conditions (noise vs. quiet).

Table 1. Descriptive and inferential statistics of hemodynamic measures during the discourse comprehension task between the auditory conditions (noise vs. quiet).

Region	Variables	Noise	Quiet	<i>F</i>	<i>p</i> -value
Lateral Left	ΔHbO2	0.068(0.135)	0.073(0.163)	0.03	<i>p</i> =.867
	ΔHbR	0.002(0.415)	-0.019(0.071)	0.88	<i>p</i> =.380
Lateral Right	ΔHbO2	-0.016(0.077)	0.009(0.154)	0.31	<i>p</i> =.593
	ΔHbR	-0.001(0.039)	-0.035(0.091)	2.04	<i>p</i> =.196
Upper Left	ΔHbO2	0.076(0.091)	0.160(0.115)	15.70	<i>p</i>=.005
	ΔHbR	-0.004(0.024)	-0.034(0.043)	4.31	<i>p</i> =.007
Upper Right	ΔHbO2	0.099(0.116)	0.177(0.180)	2.68	<i>p</i> =.145
	ΔHbR	-0.035 (0.036)	-0.047 (0.066)	0.31	<i>p</i> =.593
Lower Left	ΔHbO2	0.047(0.083)	0.084(0.080)	3.33	<i>p</i> =.111
	ΔHbR	-0.007(0.024)	-0.019(0.030)	2.15	<i>p</i> =.186
Lower Right	ΔHbO2	0.042(0.094)	0.049(0.109)	0.03	<i>p</i> =.861
	ΔHbR	-0.024(0.040)	-0.017(0.030)	0.48	<i>p</i> =.513
Center	ΔHbO2	0.042(0.050)	0.034(0.046)	0.72	<i>p</i> =.425
	ΔHbR	0.042(0.050)	0.034(0.046)	0.41	<i>p</i> =.543

Differential patterns of semantic clustering in the verbal learning process in individuals with Alzheimer's disease

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Introduction

The Verbal Learning Test (VLT) is a word recall test with different semantic categories featuring time intervals between immediate (IMM) and delayed (DEL) recall. Semantic clustering is an effective reorganization strategy to improve learning and memory (Ford et al., 2020; McLaughlin et al., 2014). Specifically, the Ratio of Semantic Clustering (RSC) is used as a qualitative analysis to examine semantic processing. The decline of RSC between the time intervals indicates memory impairments (Gaines et al., 2006). This study investigates the difference in the accuracy and RSC between time intervals (IMM vs. DEL) in VLT for Alzheimer's disease (AD), older and young adults. Additionally, we explored correlations between accuracy and RSC by time interval for each group.

Methods

Participants. Eighty Korean-speaking individuals participated in this study, divided into three groups: (1) 8 individuals with AD (Age=80.88, Education=2.44yrs), (2) 42 older adults (Age=74.43, Education=10.89yrs), and (3) 30 young adults (Age=29, Education=14.6yrs). The AD was diagnosed by a neurologist following the criteria of NINCDS-ADRDA (McKhann et al., 1984). Young and older adults performed within the normal range ($\geq 16\%$ ile) on the Korean Mini-Mental State Examination (K-MMSE; Kang et al., 2006).

Task. Participants performed Seoul VLT (SVLT; Kang et al., 2012), which consists of IMM and DEL recall tasks. During the IMM, participants recalled as many words as possible from a set of 12 words, which comprised three semantic categories across three trials. For the DEL, after a 20-minute interval, they recalled the same words without any cues.

Data analysis. Dependent variables included accuracy and RSC. The RSC score was calculated by dividing the number of semantic clustering used by the total number of correctly recalled words (Gaines et al., 2006).

Results

Paired t-test results revealed that the AD recalled significantly fewer words in DEL compared to IMM ($p < .001$), whereas the young adults showed the opposite pattern ($p = .01$). For the RSC, the young adults showed significantly higher RSC in the DEL than the IMM ($p = .01$). However, the older adults had no significant differences (Figure 1).

Pearson correlation coefficients revealed that except for the RSC of DEL, the accuracy of the IMM and DEL was positively correlated with the RSC in young adults ($r = .569^{**}$, $r = .488^{**}$, $r = .386^{*}$). However, only the RSC of DEL was positively correlated with the accuracy of IMM and DEL ($r = .549^{**}$, $r = .5^{**}$) in older adults (Table 1).

Conclusions

The AD showed reduced accuracy and RSC in DEL, consistent with previous studies reporting decreased memory over time in AD (Greenway et al., 2006). The accuracy and RSC in the older adults didn't differ across time intervals. Interestingly, the young adults showed increased accuracy and RSC in DEL compared to IMM, with a significant correlation

between accuracy and RSC. The results demonstrated that semantic clustering enhanced better recall in time-delayed conditions in young adults. This ability to develop strategies may decrease with age, leading to a decline in memory. These findings highlight that the RSC analyses may elicit age-related differences in semantic clustering strategies. Furthermore, it appears that this strategy is clearly diminished in the clinical stage.

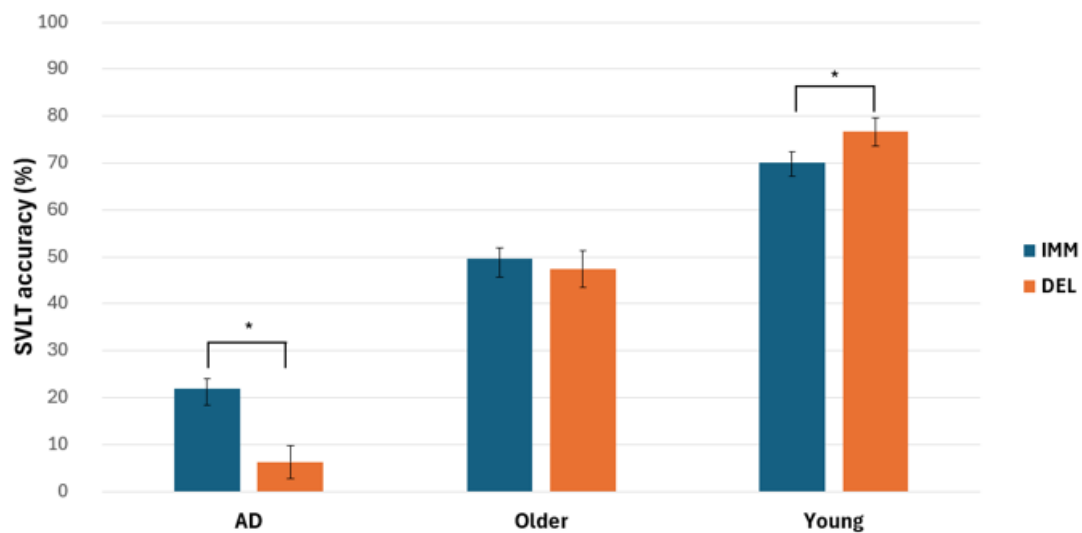
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(A)



(B)

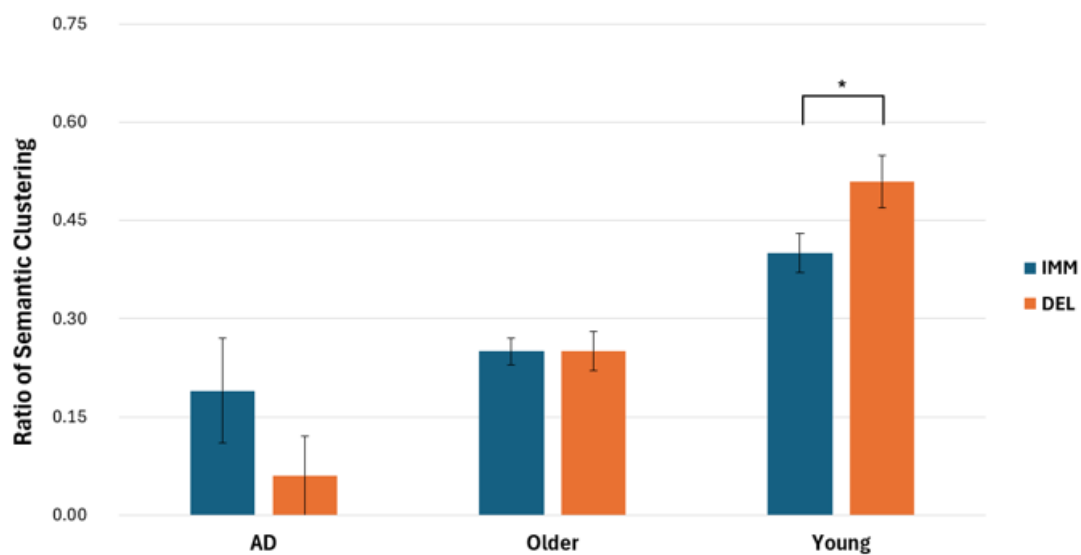


Figure 1. Performance on Seoul Verbal Learning Test (SVLT) in immediate and delayed recall conditions for each group; (A) SVLT accuracy, (B) Ratio of Semantic Clustering.

Table 1. Pearson correlation coefficients among SVLT tasks performance and Semantic clustering strategy.

	SVLT-immediate accuracy	SVLT-delayed accuracy
AD		
RSC-immediate	-.526	-.126
RSC-delayed	.216	.434
Older adults		
RSC-immediate	.268	-.003
RSC-delayed	.549**	.500**
Young adults		
RSC-immediate	.569**	.488**
RSC-delayed	.350	.386*

Note. SVLT=Seoul Verbal Learning Test (Kang & Na, 2003); AD=Alzheimer's Disease; RSC=Ratio of Semantic Clustering

* p <.05, ** p <.01

Differential prefrontal cortex activation during semantic, phonemic and action verbal fluency tasks: A preliminary fNIRS study

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Introduction

Verbal fluency tasks (VFTs) assess word retrieval, executive function, and prefrontal lobe function (Hermann et al., 2003). Semantic verbal fluency (SVF) and phonemic verbal fluency (PVF) are most widely administered. Due to verb-retrieval difficulties even in healthy aging populations, action verbal fluency (AVF) has gained recognition. Neuroimaging studies using functional near-infrared spectroscopy (fNIRS) have reported that VFT involves activation of the prefrontal cortex (PFC) (Huang et al., 2015). Examining neurological changes in the PFC has clinical significance, as the PFC contributes to linguistic-cognitive processing in all age cohorts. Previous research has demonstrated differential behavioral performance and hemodynamic responses in the PFC between SVF and PVF, yet AVF remains understudied. We aimed to compare the three task types behaviorally and neurophysiologically and explore associations between the two outcome measures.

Methods

Participants. Ten healthy young adults (Age: 26.33 ± 5.54 , Education: 17.55 ± 1.13 , Gender: five females, five males) participated and were screened through the Health Screening Questionnaire (Christensen et al., 1991). More data is to be collected.

Verbal Fluency Tasks (VFTs). VFTs included (1) SVF (animal, fruit/vegetable), (2) PVF (/k/, /s/), and (3) AVF (verbs). Participants generated as many words as possible that belonged to each category within 30 seconds.

Experimental procedures. We included two semantic blocks, two phonemic blocks, and one action verb block. Each block started with a 30s rest, followed by a 30s control task (vowel repetition), and ended with a VFT. Task administration and hemodynamic measurement proceeded concurrently. A 15-channel fNIRS (NIRSIT LITE; OBELAB Inc., Seoul, Korea) was used to obtain oxy- and deoxy-hemoglobin changes (ΔHbO_2 , ΔHbR) from the PFC.

Data analysis. We compared the mean number of correct responses across the VFTs in behavioral analyses, along with ΔHbO_2 and ΔHbR (mm x mM) in neurophysiological analyses.

Results

One-way repeated ANOVAs showed a significant main effect of task on the mean number of correct responses (PVF > AVF, $p=.017$; PVF > SVF, $p=.007$) and ΔHbO_2 in the lateral right region (PVF > AVF, $p=.013$). Pearson correlation analyses revealed marginally negative correlations between the mean number of correct responses in PVF and ΔHbO_2 in the upper left ($r=-.612$, $p=.060$) and lower left ($r=-.604$, $p=.065$) regions. Conversely, there was a marginally positive correlation between the mean number of correct responses in AVF

and ΔHbO_2 in the lateral left region ($r=-.598$, $p=.068$). No significant results are observed in ΔHbR . Results are detailed in Table 1 and Figure 1.

Conclusions

The results demonstrated significant performance differences among verbal fluency tasks, with PVF outperforming SVF and AVF. The hemodynamic responses unveiled task-specific differences, particularly evident in the lateral right region, associated with the observed behavioral outcomes. Additionally, weak but notable correlations between ΔHbO_2 in the left PFC and performance in PVF and AVF tasks highlighted the task- and region-specific dynamics of verbal fluency. This preliminary research on younger adults provides insights on the role of PFC related to word retrieval, and lays foundation for further comparison studies with older adults.

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Table 1. Descriptive and inferential statistics of the participants' behavioral performance and brain activation during each verbal fluency task.

Region	Variables	SVF	PVF	AVF	F	p-value
NA	Number of correct words	13.300 (2.496)	16.900 (2.065)	11.760 (3.560)	11.200	<.001
Lateral Left	ΔHbO_2	0.020 (0.098)	0.029 (0.060)	-0.035 (0.135)	1.023	0.759
	ΔHbR	-0.026 (0.051)	-0.011 (0.041)	-0.026 (0.053)	0.525	0.600
Lateral Right	ΔHbO_2	0.134 (0.107)	0.122 (0.095)	0.024 (0.090)	8.186	0.020
	ΔHbR	-0.057 (0.059)	-0.045 (0.050)	-0.030 (0.060)	1.148	0.339
Upper Left	ΔHbO_2	0.010 (0.047)	-0.002 (0.044)	-0.038 (0.059)	3.341	0.350
	ΔHbR	-0.010 (0.033)	-0.009 (0.031)	0.010 (0.034)	3.033	0.073
Upper Right	ΔHbO_2	0.015 (0.069)	0.004 (0.057)	-0.039 (0.060)	3.032	0.367
	ΔHbR	-0.021 (0.042)	-0.011 (0.025)	-0.003 (0.040)	1.269	0.305
Lower Left	ΔHbO_2	0.000 (0.054)	-0.002 (0.055)	-0.030 (0.101)	0.525	0.600
	ΔHbR	-0.012 (0.058)	-0.0147 (0.040)	0.004 (0.044)	0.979	0.395
Lower Right	ΔHbO_2	0.016 (0.047)	0.020 (0.082)	-0.023 (0.104)	1.233	0.944
	ΔHbR	-0.006 (0.057)	-0.007 (0.039)	0.001 (0.038)	0.254	0.778
Center	ΔHbO_2	-0.003 (0.054)	-0.027 (0.047)	-0.056 (0.086)	1.679	0.870
	ΔHbR	-0.004 (0.056)	-0.007 (0.046)	0.002 (0.044)	0.150	0.862

Note. Mean(Standard Deviation); SVF=semantic verbal fluency task; PVF=phonemic verbal fluency task; AVF=action verb fluency task; ΔHbO_2 (mm x mM)=oxyhemoglobin changes; ΔHbR (mm x mM)=deoxyhemoglobin changes.

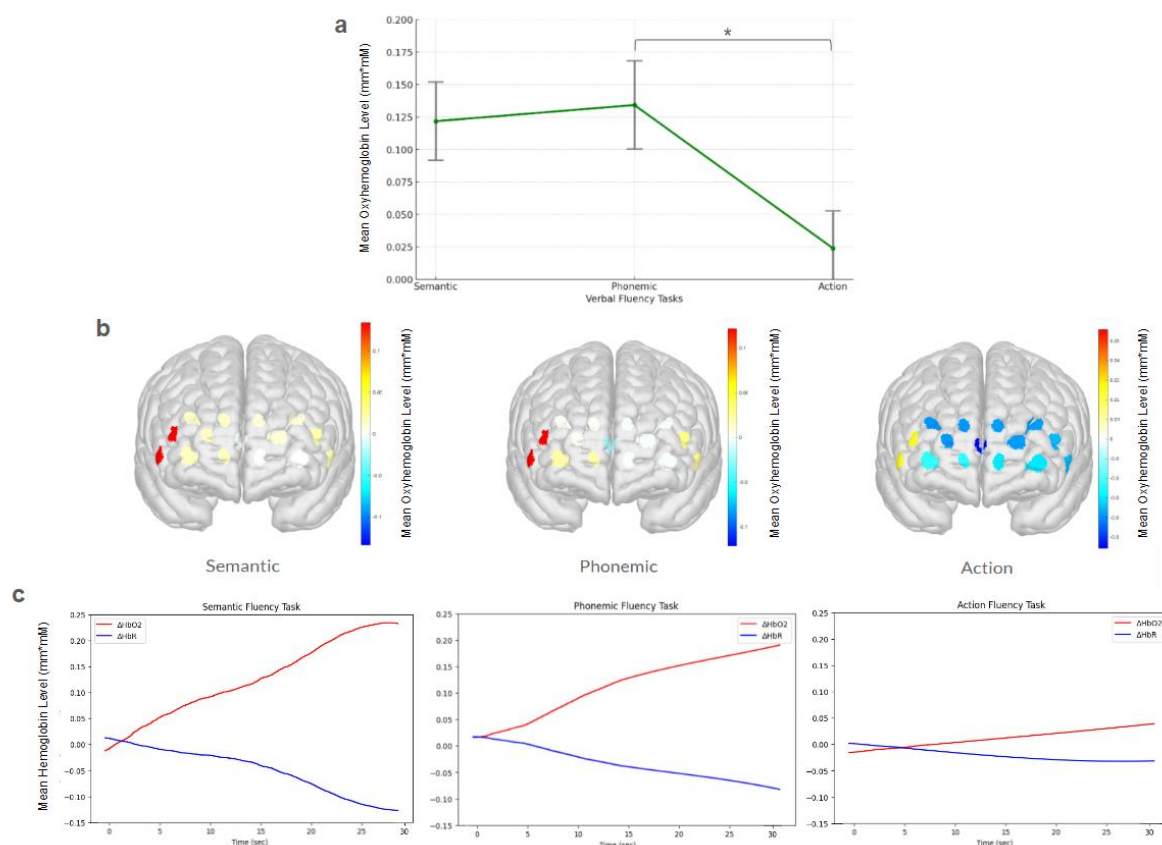


Figure 1. (a) Mean oxyhemoglobin level (ΔHbO_2) in the lateral right PFC during semantic, phonemic, and action VFTs; (b) Brain maps of mean oxyhemoglobin level (ΔHbO_2) during semantic (left), phonemic (middle), and action (right) VFTs; (c) Time-series graphs of mean oxyhemoglobin level (ΔHbO_2 , red) and mean deoxyhemoglobin level (ΔHbR , blue) in the lateral right PFC during semantic (left), phonemic (middle), and action (right) VFTs.

Intensive language action therapy (ILAT) vs. intensive naming therapy (INT): A randomized controlled trial in chronic post-stroke aphasia

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Introduction

Intensive speech-language therapy (SLT) is effective in chronic post-stroke aphasia (PSA) (Pulvermüller et al., 2001; Kurland et al., 2016; Breitenstein et al., 2017; Stahl et al., 2018). However, the impact of factors beyond intensity on SLT efficacy is debated. Intensive Language Action Therapy (ILAT), or Constraint-Induced Aphasia/Language Therapy, combines high intensity with communicative embedding and constraints targeting deficient skills. Some studies indicated that communicative action embedding is crucial (Pulvermüller et al., 2001; Stahl et al., 2016), although a review questioned differences between intensive therapies (Brady et al., 2016). This randomized controlled trial (RCT) compared one group receiving ILAT, training communicative actions like requesting, suggesting and repair activities (Pulvermüller & Roth 1991; Difrancesco et al., 2012) and one receiving intensive naming therapy (INT), focusing on conventional, non-communicative language use in naming and picture-pointing exercises. Therapy amount, intensity, materials, and utterances were matched between groups.

Methods

44 chronic PSA patients (>1-year post-stroke) were randomly assigned to ILAT (n=23) or INT (n=21). Groups were matched for age, time post-onset, education, and lesion size. Both therapies were administered for 20 hours over 2 weeks (10 h/w) in group settings (1 therapist, 2-3 patients). Identical therapy materials and utterances were used, counterbalanced across groups. Language abilities were assessed before (T1) and after therapy (T2) using the Aachen Aphasia Test (AAT, Huber et al. 1983). Secondary measures included the Amsterdam Nijmegen Everyday Language Test (ANELT, Blomert 1995) and the Action Communication Test (ACT, Stahl et al. 2017). The Becks Depression Inventory (BDI, Beck et al. 1961) was also administered. Repeated measures ANOVAs, ANCOVAs, and t-tests determined significance.

Results

The clinical language test results (mean AAT across 4 subtests) revealed a significant interaction between therapy type (ILAT vs INT) and time (pre vs post therapy) (df=43, F=7.61, p=0.009). Planned comparisons showed significant AAT score improvements for the ILAT group (t=-4.92, p<0.001) but not for INT (p>0.8). ANCOVA revealed no significant effects of age and education (all p's>0.15). BDI scores trended towards an interaction

between time and therapy type ($df=43$, $F=3.95$, $p=0.053$) with clearly significant depressive symptom improvements in the ILAT group ($t=-4.33$, $p<0.001$), but not for INT ($p>0.57$). The ACT ($df=43$, $F=8.46$, $p=0.006$) and ANELT ($df=40$, $F=8.84$, $p=0.005$) showed general improvement without significant interaction effects (ACT: $p>0.39$, ANELT: $p>0.13$).

Conclusions

This RCT demonstrates that, while therapy intensity is crucial for SLT success in chronic PSA, it is not the sole determinant. Over 2 weeks, language performance significantly improved with Intensive Language Action Therapy (ILAT) but not with intensive naming and comprehension exercises (INT). Factors like age, time since onset, education, lesion size, or training materials likely did not confound the results. Depression inventory results suggest ILAT, but not INT, significantly improves depressive symptoms, indicating better mental health and quality of life with communicative aphasia therapy. Thus, embedding language into social-communicative interaction appears to be an important factor determining the success of SLT in chronic PSA.

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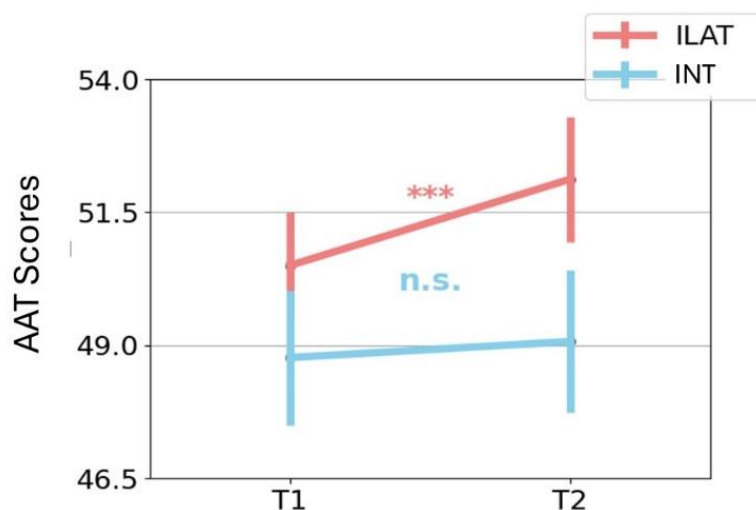


Figure 17. Aachner aphasia test (AAT) scores before (T1) and after (T2) therapy for patients participating in ILAT or INT.

Differences in drawing quantity, essential element occurrence, and its appropriateness between people with aphasia and healthy controls

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Introduction

Drawing is a crucial means of AAC for people with aphasia (PWA). It has been reported that drawings produced with PWA are more difficult to understand compared to those produced by Healthy Controls (HC) (Gainotti et al. 1983). Additionally, objects can be categorized into realistically drawn objects (RO) and symbolically drawn objects (SO), and we have reported differences in their identifiability (komori et al. 2023). However, the reasons for the observed differences in identifiability remain unclear.

This study aims to examine the quantity of drawings, the presence of essential elements, and their appropriateness in RO and SO among PWA and HC, to clarify the causes of lower identifiability in PWA.

Methods

Participants. 19PWA and 18HC.

Materials. We prepared 20 objects (10 ROs and 10 SOs) (average imageability (SD) 6.18 (0.23), familiarity 6.40 (0.36)). A total of 725 drawings were analyzed.

1. The quantity of drawing was defined as the proportion of strokes (black pixels rate). The drawings were digitized at 300 dpi, converted to black and white, and trimmed to their maximum dimensions. A Python script was then used to calculate the black pixel rate.

2. The 'essential elements' were defined as the elements that were commonly drawn by five healthy individuals. The presence of them in the participants' drawings was evaluated by two evaluators.

3. The appropriateness of the depicted essential elements was rated on a seven-point scale (1 = not appropriate at all to 7 = very appropriate) by two evaluators.

The differences in black pixel rate, the occurrence of essential elements, and appropriateness of elements among groups (PWA and HC) and between types of drawings (RO and SO) were analyzed using two-way ANOVA. The significance level was set at 5%.

Results

1. The quantity of drawing; No main effects or interactions were observed for any factors (Group: $F(1,35)=0$, $P=0.991$, $MSE=0.004$; Type of object: $F(1,35)=0.97$, $P=0.75$, $MSE=0.217$; Interaction: $F(1,35)=1.159$, $P=0.289$, $MSE=2.601$) (figure1A).

2. The occurrence rate of essential elements; An interaction was observed ($F(1,35)=4.525$, $P=0.041$, $MSE=4.525$) (figure1B).

3. The appropriateness of the depicted essential elements; The main effects were observed for both factor (Group: $F(1, 35)=14.469$, $P=0.001$, $MSE=14.469$; Type of object; $F(1,35)=21.327$, $P=0.001$, $MSE=7.99$). An interaction was not observed ($F(1,35)=0.026$, $P=0.873$, $MSE=0.01$)(figure1C).

Conclusions

Although PWA produced a similar quantity of drawings as HC, they included fewer essential elements, especially in RO, and the appropriateness of the depicted elements was lower. PWA often incorporated non-essential elements which contributed to the overall quantity of their drawings that is comparable to that of the HCs. This suggests that PWA can depict the elements they can recall. Especially RO, the drawer must recall and incorporate the elements on their attempts. Our results suggest that PWA may have difficulty to recall the essential elements. The low appropriateness in PWA indicates that they can recall the general semantic features of the object however, they failed to recall more detailed ones. To increase identifiability in drawings, PWAs are required to draw essential elements and improve their appropriateness.

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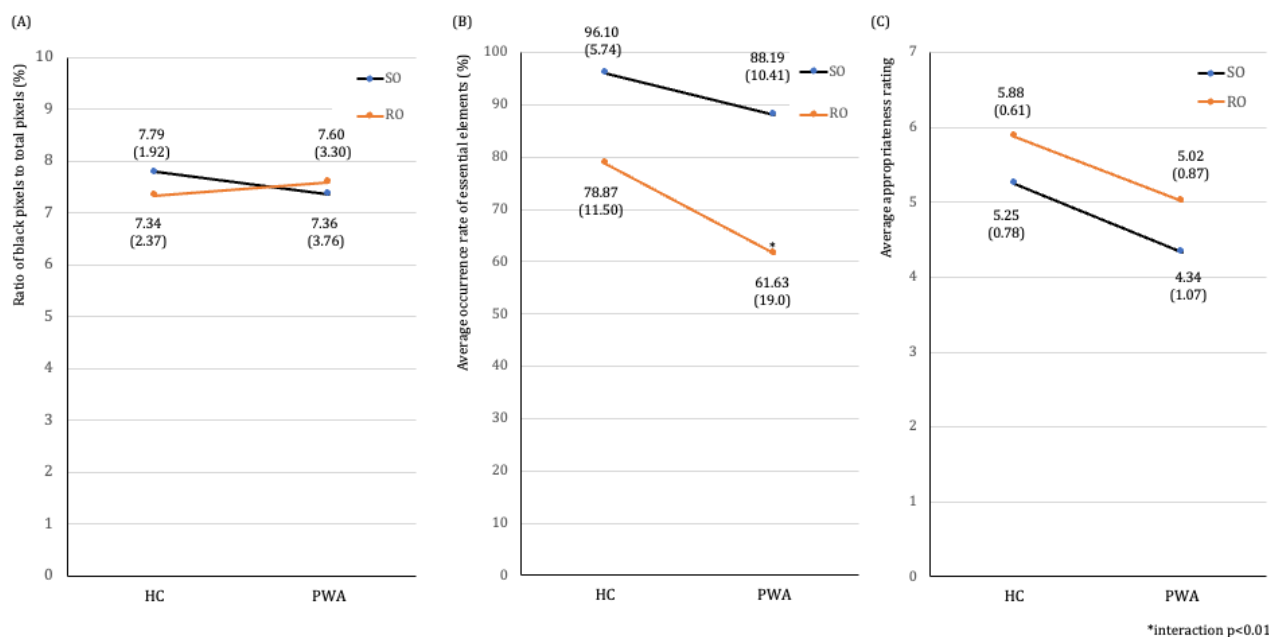


Figure 1. Differences in drawing quantity, essential element occurrence, and its appropriateness in PWA and HC.

A. The average rate of quantity of drawing (SD): 7.79% (1.92) for HC's SO, 7.34% (2.37) for RO, 7.60% (3.30) for PWA's RO, and 7.36% (3.76) for SO. No main effects or interactions were observed for any factors (Group factor: $F(1,35)=0$, $P=0.991$, $MSE=0.004$; Type of object factor: $F(1,35)=0.97$, $P=0.75$, $MSE=0.217$; Interaction: $F(1,35)=1.159$, $P=0.289$, $MSE=2.601$).

B. The occurrence rate of essential elements (SD): 96.10% (5.74) for HC's SO, 78.87% (11.5) for RO, 88.19% (10.41) for PWA's SO, 61.63% (19.0) for RO. An interaction between the factors was observed ($F(1,35)=4.525$, $P=0.041$, $MSE=4.525$). Additionally, the main effects were observed for both factor (Group factor: $F(1, 35)=12.487$, $P=0.001$, $MSE=0.293$; Type of object factor; $F(1,35)=20.906$, $P<0.001$, $MSE=0.886$).

C. The appropriateness of the depicted essential elements (SD): 5.25 (0.78) for HC's SO, 5.88 (0.61) for RO, 4.34(1.07) for PWA's SO, 5.02 (0.87) for RO. The main effects were observed for both factor (Group

Breaking language barriers: Lessons from advancements in rehabilitation of Chinese aphasia and related neurogenic populations

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Introduction

The majority of published aphasia treatment studies have primarily focused on English speakers. This symposium aims to highlight the significance of recent advancements in Chinese aphasia rehabilitation. Specifically, given the limited investigations that specifically examine culturally and linguistically specific interventions for Chinese speakers with aphasia and related neurogenic conditions, a series of recent intervention studies conducted in the Hong Kong and Mainland China that have addressed this gap and will be reported and discussed. These studies not only share insights into the necessary considerations when adopting or modifying existing treatment protocols published in English but also initiate a broader discussion on how researchers from other non-mainstream languages can enhance their work. By highlighting these advancements in Chinese aphasia rehabilitation, this symposium aims to promote cross-cultural collaborations and facilitate the development of effective interventions in non-English languages.

Structure

Presentation 1. Intensive and Comprehensive Aphasia Program (ICAP) and Gesture-Verbal Therapy (GVT) for Cantonese speakers (Cherie Wong¹ [presenter], Anthony Kong¹, Ada Chu¹, Annie Hu¹, Chloe Wong¹)

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Behavioral interventions have garnered extensive evidence from numerous studies regarding the advantages for post-stroke aphasia (Cherney & Carpenter, 2022). Intensive and Comprehensive Aphasia Program (ICAP), being a relatively new service delivery model, addresses the foci of restoring language function and enhancing life participation (Rose et al., 2013). Gesture plus Verbal Treatment (GVT) has exhibited the potential to improve communication by enhancing word retrieval and promoting gesture use (Raymer et al., 2006; Zhang & Liao, 2024). Considering there is a paucity of ICAP and GVT study involved Cantonese-speaking people with aphasia (Kong & Tse, 2018); an ICAP model that infused evidence-based aphasia practice in the Hong Kong Chinese context through in-person and tele-therapy has been developed and validated. GVT was also modified with culturally specific items for examination and hence, fill in the current knowledge gap. Preliminary results of ICAP study demonstrated notable improvements on word and beyond-word level language abilities, and positive changes in communication confidence. Meanwhile, GVT indicated significant improvements in word retrieval abilities.

Presentation 2. Individualized neuromodulation using tACS to promote network changes with language facilitation in Chinese aphasia (Chester Cheung¹ [presenter], Anthony Kong¹, Mehdi Bakhtiar¹, Guang Ouyang¹, Chloe Chan¹, Ada Yick¹)

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Post-stroke aphasia is an acquired language disorder caused by disrupted language network due to a stroke lesion (Kiran et al., 2019). Transcranial alternating current stimulation (tACS) is an emerging non-invasive technique which demonstrates potentials to entrain intrinsic neuronal oscillation and modulate connectivity between brain regions (Elyamany et al., 2021; Herrmann et al., 2013), which is theoretically beneficial to the recovery of disrupted functional network in aphasia (Fridriksson & Hillis, 2021). To date, applications of tACS on PSA is scarce. Most of the studies used one-size-fit-all stimulation protocol (e.g., Keator et al., 2023), which yielded suboptimal results due to the high interpersonal variations of aphasic brain network. The present ongoing study aimed to explore the feasibility of utilizing network analysis during speech-production EEG to indicate individualized stimulation target and test its effects on language outcomes in people with aphasia (PWA). In particular, a novel computational method to rank each edge from individual's network graph was proposed; this allowed for objective data-driven target selection. Preliminary double-blinded sham-controlled single-session clinical trial over 5 PWA demonstrated that 30 minutes of 7 Hz dual-site phase-synchronizing tACS using the proposed individualized targeting method successfully induced greater immediate changes in EEG network and language performance than sham stimulation. Exploratory analysis suggested that both stimulation location and phase relationship between target sites play a role in promoting network change.

Presentation 3. TMS in native Mandarin speakers with sub-acute post-stroke aphasia (Haozheng Li^{1,2} [presenter], Ruiping Hu^{1,2}, Anthony Kong³, Peng Yuan², Dongxiang Fang^{1,2}, Qing Yang^{1,2}, Jie Zhang^{1,2})

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Transcranial magnetic stimulation (TMS) has emerged as one of the most frequently used non-invasive neuroregulation technologies in recent years (Zhang et al., 2021). TMS can improve overall language function in speakers with aphasia by inhibiting the homotopic area of the right Broca's region (Arheix-Parras et al., 2021). TMS treatment for chronic post-stroke aphasia has been classified as Level B in an evidence-based guideline (Lefaucheur et al., 2020); however, its application in people with subacute aphasia remains uncommon. In a recent study conducted by the NORTHSTAR Study Group (Zumbansen et al., 2022), it was discovered that TMS treatment showed significantly higher efficacy in subacute aphasia compared to sham stimulation. Additionally, the study found that TMS treatment outperformed treatment for those with chronic aphasia. First, this session will provide a summary of the results from a systematic review that included 14 randomized double-blind controlled trials. The review indicated that TMS was more effective in treating subacute aphasia and demonstrated a high level of safety. Subsequently, a TMS intervention on anomia was conducted with 27 Mandarin-speaking individuals in Mainland China who had subacute aphasia. The intervention resulted in a significant improvement in their naming function. The utilization of functional near-infrared spectroscopy (fNIRS) technology to scan hotspot areas in the left hemisphere during naming tasks revealed a notable increase in cortical activation and functional connectivity of language-related areas. These findings

indicate the potential for a new individualized target selection approach for subacute post-stroke aphasia. Ongoing examinations are currently employing diffusion tensor imaging (DTI) technology to track the termination points of fiber tracts in the subacute phase post-stroke, with an aim to identify individualized TMS intervention targets for post-stroke aphasia.

Presentation 4. Cognitive Stimulation Therapy (CST) for Chinese individuals with dementia and aphasia (Winsy Wong¹ [presenter], Anthony Kong², Gloria Wong³, Jacky Choy², Ruizhi Dai⁴, Heidi Fung²)

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Cognitive Stimulation Therapy (CST) is an evidence-based therapy targeting cognitive function. It consists of cognitive activities which do not involve practice of specific cognitive modalities (Clare et al., 2003). This session focuses on introducing the cultural adaptation of the CST program to be conducted in Cantonese-speakers with acquired neurogenic communication disorders in Hong Kong. First, the interactions between the facilitator and participants with dementia in 140 virtual CST sessions taking place during the COVID-19 pandemic were captured and analyzed quantitatively via the Verbal and Nonverbal Interactions Scale for Caregivers (VNVIS-CG; Williams & Parker, 2012; Coleman et al., 2022). Verbal acts/strategies demonstrated by the facilitator, which promoted the verbal output of the participants with dementia and effectively resolved communication breakdown during virtual CST sessions, were identified. In another study, a group of 68 individuals diagnosed with mild or moderate dementia participated in a comprehensive CST program consisting of 14 sessions. Correlations between global coherence in personal narratives and episodic memory following the CST training was observed. There was also a significant improvement of informativeness in the participants' spoken discourse, which was sustained over time. Overall, participants showed greater improvement in their ability to describe sequential pictures compared to personal narratives. The CST program also showed potential in delaying the decline of verbal short-term memory but did not enhance episodic memory. Interestingly, participants' level of engagement in communication acted as a predictor for informativeness. The implications of the above-mentioned findings for enhancing CST treatment outcomes and facilitator training will be discussed.

Interest to the Academy

The symposium will feature a comprehensive discussion on recent intervention studies conducted in Hong Kong and Mainland China, which hold great significance for the field of aphasiology. These studies serve as valuable contributions to the existing research, offering insights into the crucial factors to consider when adopting or modifying treatment protocols originally published in English. By shedding light on these considerations, the symposium aims to expedite the development of effective interventions tailored to non-English languages. Furthermore, the curated presentations in this symposium have the potential to foster cross-cultural collaborations among researchers, fostering a deeper understanding of aphasia and enhancing its treatment approaches in non-English speaking populations. Ultimately, this symposium serves as a platform for advancing the field of aphasiology by addressing the specific needs and challenges faced by individuals with aphasia in diverse linguistic and cultural contexts.

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Exploring the impact of aphasia severity on employment, social participation and quality of life

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Introduction

Aphasia is a communication disorder associated with impairments in spoken language, understanding reading and writing that impacts upon daily activities, social participation and quality of life. Individuals with aphasia face difficulties in returning to work or obtaining employment due to communication impairment. Previous studies reported that the onset of aphasia negatively impacts on employment status along with other conditions, such as age, education levels, depression, impaired mobility, non-linguistic cognitive dysfunctions, social environmental barriers (Tanaka et al., 2011; Wang et al., 2014). Moreover, some studies pointed out decreased social participation along with aphasia severity (Dalemans et al., 2010). We aimed to investigate the impact of the severity of aphasia on socio-occupational outcomes and quality of life.

Methods

A cohort of 136 individuals with aphasia following cerebrovascular diseases was recruited and investigated in a cross-sectional study. For employment status, we included individuals under 65 years of age after 18 months of onset of aphasia. For social participation levels and quality of life, we included individuals after 6 months of onset of aphasia.

Participants were given following questionnaires; quality of life was assessed by the Japanese version of the Stroke and Aphasia Quality of Life Scale-39 (SAQOL-39), and the social participation and the environmental factors as barriers was assessed by the Japanese version of the Community Integration Questionnaire and the Japanese version 2 of the Craig Hospital Inventory of Environmental Factors, respectively. We explored predictors such as aphasia severity, cognitive functions, motor paralysis, depression, apathy, as influential factors for employment, social participation and quality of life.

Results

Results of multiple logistic regression analysis revealed that aphasia severity had the most significant impact on employment. As the severity of aphasia increases, engaging in employment including part-time job, becomes more challenging. Additionally, results of multiple linear regression analysis showed aphasia severity as well as social environmental barriers negatively affected quality of life. On the other hand, lower mobility, male gender and younger age were related to reduced the degree of social participation.

Conclusions

Aphasia severity significantly affects not only occupational engagement but also quality of life in individuals with aphasia. These findings shed light on potential treatment options during acute phases of stroke, linguistic rehabilitation and occupational support for individuals with aphasia.

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An adult case of developmental dyslexia due to poor visual cognition

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Introduction

According to the International Dyslexia Association (2002), dyslexia is a specific learning disability of reading and writing characterized by deficits in phonological component of language indicating a decrease in accuracy and fluency in decoding (converting letters to sounds). However, it has been reported that developmental dyslexia result from not only phonological dysfunction but also rapid naming difficulties and visual cognition impairment (Peterson and Pennington, 2015). Moreover, the symptoms of dyslexia may differ among different languages (Miles, 2000). We Japanese have a unique orthographic system including the logographic Kanji (Chinese characters) as well as the phonographic Kana. Here, we report an adult case presenting with atypical dyslexia as a specific difficulty in writing Kanji character due to visual cognitive impairment, together with a slight difficulty in reading.

Methods

The case is a right-handed man in his 30s, with 12 years of education. In his childhood, he could hardly write Kana and could not write Kanji, and he could barely manage to read a book. Despite being extremely diligent and studying very hard, he was unable to gain admission to university. After graduating from high school, he worked various part-time jobs. Recently, he made mistakes even in simple sorting tasks at the warehouse due to his dyslexia, especially when in a hurry. He had also difficulty in recognizing the faces of his colleagues, and eventually he resigned from his job. He was referred to our hospital since he desired to obtain a disability certificate, which would enable him to engage in welfare employment. We investigated his difficulties and the underlying mechanisms in detail.

Results

As shown in Table 1, his visual perception was impaired. He could not recognize any objects in overlapping figures and could not even trace the shapes with his fingers, although his intellectual ability in WAIS-IV was spared. He showed poor construction ability in Rey-Osterrieth Complex Figure Test and consecutively his visual memory was impaired. On the contrary, auditory reversed repetition in irregular words was well spared, indicating preserved phonological ability. He showed a slight difficulty in RAN (rapid automatic naming) but could read words and sentences with sufficient speed in STRAW-R (Standardized Test for Assessing the Reading and Writing Attainment of Japanese Children and Adolescents). On the other hand, his Kanji writing was poor at an elementary school level, and some letters of both Kana and Kanji were written as mirror images, while his writing of the alphabet was relatively preserved.

Conclusions

This case presented with developmental dyslexia almost limited to Kanji writing rather than dyslexia itself, without phonological deficits. Poor visual perception and memory resulted in difficulty with learning to write Kanji. It was suggested that writing Kanji is a more vulnerable aspect of dyslexia in Japanese and it does not necessarily require phonological ability.

Dyslexia manifests different symptoms depending on the languages due to variations in the cognitive functions required for reading and writing.

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Table 1. Neuropsychological assessments

WAIS-IV	FIQ	93
	Verbal comprehension	112
	Perceptual reasoning	93
	Working memory	109
	Processing speed	63
WMS-R	Verbal memory	110
	Visual memory	60
	General memory	96
	Attention/concentration	99
	Delayed recall	68
Rey-Osterrieth Complex Figure Test	Copy	32/36
	3-min delayed recall	12/36
Visual Perception Test for Agnosia	Impaired in perception of overlapping figures	

Cognitive control modulates sentence comprehension differently in individuals with moderate aphasia: Preliminary evidence from a conflict adaptation paradigm

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Introduction

Persons with aphasia may use semantic cues instead of syntax to understand sentences. Thus, for sentences like "The cop was handcuffed by the robber", where the syntactic information contradicts semantics, they might choose the reverse interpretation (i.e., cop handcuffing robber). Modulations in cognitive control—the mental capacity required to detect and resolve conflicts—can influence the interpretation of such sentences in neurotypical adults.¹ We employed a cross-task conflict adaptation paradigm to investigate if cognitive control can similarly modulate sentence comprehension in individuals with aphasia.

Methods

For this ongoing study, we recruited two participants with chronic post-stroke aphasia and moderate comprehension deficits: P1 (male, 59 years old, WAB-Comprehension=7.7, AQ=39.6) and P2 (female, 74 years old, WAB-Comprehension=8.3, AQ=68.6). They completed cognitive control background testing followed by a conflict adaptation experiment with interleaved auditory Stroop and sentence-to-picture matching trials. On Stroop trials, participants identified the gender of the speaker (male or female) saying "boy" or "girl". On sentence trials, participants chose the picture (out of four) that best matched the heard sentence. Sentences were syntactically correct but varied in semantic plausibility (e.g., Congruent: "The robber was handcuffed by the cop" vs. Incongruent: "The cop was handcuffed by the robber"). We crossed previous Stroop congruency with sentence congruency, resulting in four experimental conditions: (i) congruent Stroop followed by congruent sentence, (ii) incongruent Stroop followed by congruent sentence, (iii) congruent Stroop followed by incongruent sentence, (iv) incongruent Stroop followed by incongruent sentence. We used mixed-effect models to assess whether previous Stroop congruency predicted sentence accuracy. We hypothesized that Stroop congruency would modulate the comprehension of incongruent, but not congruent, sentences, as only incongruent sentences involve conflict and require cognitive control.

Results

Background testing showed differences in cognitive control abilities between participants: P1 had worse cognitive control (conflict scores for Stroop: P1=14.29, P2=-14, and auditory Stroop: P1=66.67, P2=-13.85). Descriptive statistics for the conflict adaptation task are presented in Table 1. P1 performed above chance on congruent sentences, irrespective of previous Stroop ($\beta=0.15, SE=0.27, z=0.57, p=.57$). He performed below chance on incongruent sentences preceded by a congruent Stroop (selecting the semantically more plausible but syntactically incorrect interpretation), but at chance when these sentences were preceded by an incongruent Stroop. There was a marginal effect of Stroop congruency ($\beta=0.60, SE=0.34, z=1.76, p=.08$), such that P1 was more likely to choose the correct interpretation when previous Stroop was incongruent than congruent, consistent with conflict adaptation. P2 performed above chance level on congruent sentences and there was no Stroop congruency effect ($\beta=0.14, SE=0.38, z=0.37, p=.71$). For incongruent sentences, she

was at chance when previous Stroop was congruent but above chance when it was incongruent. However, the Stroop congruency effect was not significant ($\beta=0.13, SE=0.36, z=0.36, p=.72$).

Conclusions

Our findings tentatively suggest that cognitive control could impact sentence comprehension in individuals with moderate aphasia. Numerically, both participants performed better when incongruent sentences were preceded by an incongruent than congruent Stroop. The effect was marginally significant for P1 and not significant for P2, suggesting individual variability. Additional participants in the case series can clarify who might benefit from cognitive control modulation.

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Table 1. Mean accuracy with standard deviations in brackets for different experimental conditions.

Condition	Accuracy (SD)	
	P1	P2
(i) Congruent Stroop-Congruent Sentence	0.48↑ (0.51)	0.70↑ (0.47)
(ii) Incongruent Stroop-Congruent Sentence	0.53↑ (0.51)	0.75↑ (0.44)
(iii) Congruent Stroop-Incongruent Sentence	0.15↓ (0.36)	0.50* (0.51)
(iv) Incongruent Stroop-Incongruent Sentence	0.30* (0.46)	0.55↑ (0.51)

Note: Chance levels were calculated using a binomial test with alpha .05 and 33% probability threshold of success. ↑ = above, ↓ = below, * = at chance.

Theory of Mind deficits in people with aphasia following left-hemisphere stroke: Prevalence and relationship with aphasia severity

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Introduction

Theory of Mind (ToM) deficits have been associated with right-hemisphere stroke, but their prevalence in left-hemisphere stroke is not well-defined (Surian & Siegal, 2001). A few studies have suggested that ToM functioning is spared in people with aphasia (PWA) and thus, functioning is not reliant on proponents of language (Varley & Siegal, 2000; Varley et al., 2001). However, this evidence is derived from single case studies, and thus have limited generalization. This study investigates a) how prevalent ToM deficits in PWA are, and b) whether performance on ToM tasks is associated with aphasia severity.

Methods

36 PWA following a left-hemisphere stroke, (mean age= 57, range= 20-81; mean WAB-R AQ= 89, range= 31.5-100) completed two nonverbal false belief tasks, classified as reality-unknown (RUK) and reality-known (RK) (Biervoye et al., 2018). False Belief (FB) and True Belief (TB) trials were conducted, paired with Memory Control (MC), and Filler (F) trials, to account for potential processing issues of input information. To answer our first question, we utilized the decision tree and cut-off scores provided by Biervoye and colleagues to discover if ToM was impaired or spared. To answer our second question, we ran linear regression models looking at overall percentage accuracy across tasks as a function of aphasia severity (measured with WAB-R AQ), age, and total lesion volume.

Results

5/36 participants (13%) exhibited impairments in the RUK task, and 10/37 (27%) for the RK task. Raw scores and relative normative data are reported in Table 1. Regression models showed a) no significant relationship between WAB-R AQ and performance on both ToM tasks (RUK estimate=0.00, p-value=0.1284; RK estimate=0.001694, p-value=0.328858; R), b) a significant relationship between age and performance on the RUK task (RUK estimate=-0.004760, p-value=0.0463), with higher age associated with lower scores (Figure 1a), c) a trending relationship between lesion volume and performance on the RUK task (RUK estimate=-4.542e-07, p-value= 0.0674) (Figure 1b), with higher lesion volume associated with lower performance on RUK tasks. To further explore the relationship between age and ToM accuracy, we looked at the interaction between age and attention skills, as measured with the Repeatable Battery for Neuropsychological Status (RBANS) attention index. This interaction was significant (estimate=0.00, p-value: 0.04770).

Conclusions

ToM deficits are prevalent in PWA, as illustrated in Table 1, which contrasts existing findings in current literature. Performance on ToM tasks appear to not be related to aphasia severity, although age and stroke severity influence outcomes, as older participants and those with higher lesion volumes performed worse, which could be predictors for ToM deficits. Additionally, older participants' performance on ToM tasks seems to be affected by attentional abilities, with higher percentage accuracy associated with better scores on the RBANS attention index. These findings in conjunction support that ToM deficits are prevalent in PWA, and are not affected by language impairments but instead, may be influenced by other concomitant deficits. As ToM plays an integral role in social cognition,

these findings are clinically significant, as clinicians should consider this in treatment planning to maximize quality of life following stroke.

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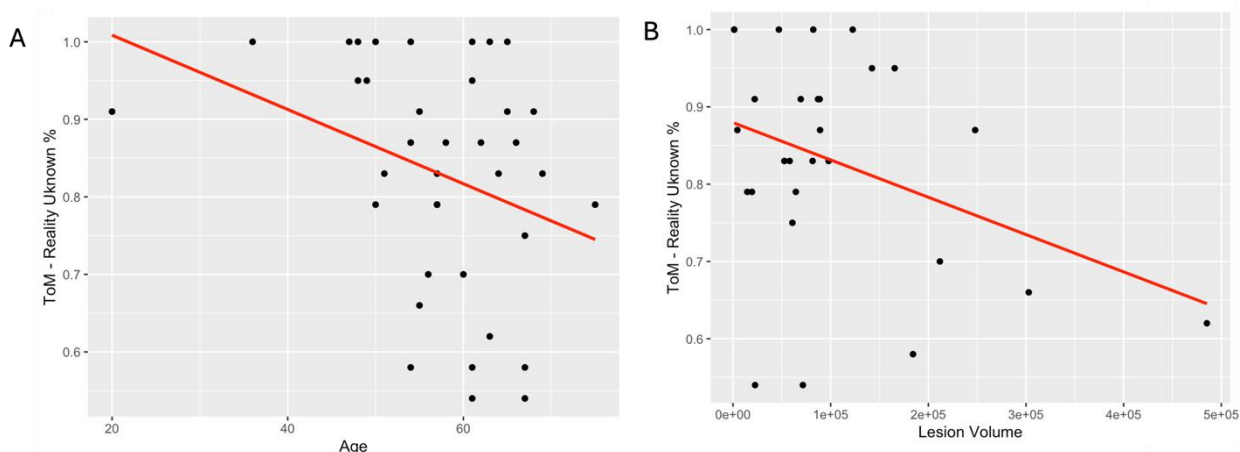


Figure 1. Figure 1a illustrates the relationship between performance on RUK ToM tasks with Age. Figure 1b illustrates the relationship between performance on RUK ToM tasks with lesion volume.

Table 1: Participants' demographic information and raw scores compared to age matched controls for both the RUK and RK task. Participants highlighted are impaired. Age-matched norms illustrate initially the cut-off score to determine a deficit, following the mean score for the participant's age group.

Demographics			ToM RUK Data			Age-matched Norms		
Participant	Age	WAB-R AQ	FB/8	TB/4	MC/F/12	FB	TB	MC/F
P03	55	31.5	2	4	10	6.85/4	3.79/2	11.79/10
P13	67	92.8	1	4	9	6.48/3	3.63/2	11.88/10
P15	54	85.7	0	4	10	6.85/4	3.79/2	11.79/10
P27	57	61.7	4	4	12	6.85/4	3.79/2	11.79/10
P32	60	97.2	2	4	11	6.85/4	3.79/2	11.79/10
P01	55	95.2	7	4	11	6.85/4	3.79/2	11.79/10
P02	61	42.8	5	2	7	6.85/4	3.79/2	11.79/10
P04	58	93	5	4	12	6.85/4	3.79/2	11.79/10
P05	63	96.8	8	4	12	6.85/4	3.79/2	11.79/10
P06	50	94.9	5	3	11	6.85/4	3.79/2	11.79/10
P07	56	46.7	4	3	10	6.85/4	3.79/2	11.79/10
P08	69	89	5	4	11	6.48/3	3.63/2	11.88/10
P09	63	93	1	2	12	6.85/4	3.79/2	11.79/10
P10	67	84.2	7	1	5	6.48/3	3.63/2	11.88/10
P11	66	99.6	6	3	12	6.48/3	3.63/2	11.88/10
P12	80	94	8	4	12	6.48/3	3.63/2	11.88/10
P14	49	72.2	7	4	12	7.5/5	3.90/2	11.9/10
P16	54	92.7	8	4	12	6.85/4	3.79/2	11.79/10
P17	64	85.3	6	4	10	6.85/4	3.79/2	11.79/10
P18	20	79.8	6	4	12	7.32/5	3.94/2	12.0/10
P19	57	90	6	4	9	6.85/4	3.79/2	11.79/10
P20	47	96.8	8	4	12	7.5/5	3.90/2	11.9/10
P21	65	94.6	7	4	11	6.48/3	3.63/2	11.88/10
P22	75	54	7	2	10	6.48/3	3.63/2	11.88/10
P23	36	100	8	4	12	7.5/5	3.90/2	11.9/10
P24	54	66.3	5	4	12	6.85/4	3.79/2	11.79/10
P25	67	80.1	2	4	12	6.48/3	3.63/2	11.88/10
P26	57	61.7	4	4	12	6.85/4	3.79/2	11.79/10
P28	61	65.9	8	4	12	6.85/4	3.79/2	11.79/10
P29	68	96	8	3	11	6.48/3	3.63/2	11.88/10
P30	62	92.9	8	3	10	6.85/4	3.79/2	11.79/10
P31	60	97.2	2	4	11	6.85/4	3.79/2	11.79/10
P33	51	81	5	4	11	6.85/4	3.79/2	11.79/10
P34	48	43.1	7	4	12	7.5/5	3.90/2	11.9/10
P35	48	95.4	8	4	12	7.5/5	3.90/2	11.9/10
P36	61	79.9	3	3	7	6.85/4	3.79/2	11.79/10

Demographics			ToM RK Data			Age-matched Norms		
Participant	Age	WAB-R AQ	FB/8	TB/9	MC/F/16	FB	TB	MC/F
P02	61	42.8	4	7	11	7.88/6	8.94/7	15.93/14
P07	56	46.7	3	9	11	7.88/6	8.94/7	15.93/14
P08	69	89	0	9	16	7.85/6	8.93/7	15.77/14
P09	63	93	1	9	16	7.88/6	8.94/7	15.93/14
P13	67	92.8	2	9	16	7.85/6	8.93/7	15.77/14
P14	49	72.2	4	9	16	7.87/6	9.0/7	15.96/14
P19	57	90	3	9	15	7.88/6	8.94/7	15.93/14
P22	75	54	3	9	15	7.85/6	8.93/7	15.77/14
P34	48	43.1	0	9	16	7.87/6	9.0/7	15.96/14
P36	61	79.9	0	9	16	7.88/6	8.94/7	15.93/14
P01	55	95.2	7	9	16	7.88/6	8.94/7	15.93/14
P03	55	31.5	7	9	16	7.88/6	8.94/7	15.93/14
P04	58	93	6	9	16	7.88/6	8.94/7	15.93/14
P05	63	96.3	8	9	16	7.88/6	8.94/7	15.93/14
P06	50	94.9	8	7	14	7.88/6	8.94/7	15.93/14
P10	67	84.2	2	2	4	7.85/6	8.93/7	15.77/14
P11	66	99.6	8	9	16	7.85/6	8.93/7	15.77/14
P12	50	94	8	9	15	7.88/6	8.94/7	15.93/14
P15	54	85.7	6	9	16	7.88/6	8.94/7	15.93/14
P16	54	92.7	8	8	15	7.88/6	8.94/7	15.93/14
P17	64	85.3	7	9	16	7.88/6	8.94/7	15.93/14
P18	20	79.9	7	9	14	7.94/6	8.97/7	15.94/14
P20	47	96.8	8	9	16	7.87/6	9.0/7	15.96/14
P21	65	94.6	8	9	16	7.85/6	8.93/7	15.77/14
P23	35	100	8	9	16	7.87/6	9.0/7	15.96/14
P24	54	66.3	7	9	14	7.88/6	8.94/7	15.93/14
P25	67	80.1	7	9	14	7.85/6	8.93/7	15.77/14
P26	57	61.7	7	9	16	7.88/6	8.94/7	15.93/14
P27	57	98.1	6	9	15	7.88/6	8.94/7	15.93/14
P28	61	65.9	6	9	15	7.88/6	8.94/7	15.93/14
P29	68	96	8	9	16	7.85/6	8.93/7	15.77/14
P30	62	92.9	0	0	1	7.88/6	8.94/7	15.93/14
P31	60	97.2	0	9	16	7.88/6	8.94/7	15.93/14
P32	65	71.2	7	9	16	7.85/6	8.93/7	15.77/14
P33	51	81	6	9	16	7.88/6	8.94/7	15.93/14
P35	48	95.4	8	9	16	7.87/6	9.0/7	15.96/14

WAB-R AQ: Western Aphasia Battery – Revised Aphasia Quotient; FB- raw scores for false belief task, calculated out of 8; TB- true belief tasks, 4 trials for RUK, 9 trials for RK; MC/F- Memory Control and Filler tasks, 12 trials for RUK, 16 for RK (account for issues with processing input information and utilization of superficial strategy for tasks).

Dual route account of writing-to-dictation in Chinese

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Introduction

The dual route framework suggested that the conversion of phonological codes into orthographic codes in the writing process can be achieved via the lexical and non-lexical routes. The current study investigated the cognitive mechanisms involved in the lexical route by examining the factors that predicted the accuracy and response times (RTs) of Chinese writing-to-dictation. A major group of characters exists in Chinese called phonetic compounds, which are composed by combining semantic radicals that give clues to meanings and phonetic radicals that give clues to sound. One frequently asked question about Chinese lexical processing concerns the role of semantic radicals. While it is believed that the semantic features associated with semantic radicals are processed during the decoding and encoding processes, the issue that transparent semantic radicals also tend to have high combinability potentially confound such believe. To address this, a big data design was used.

Methods

A total of 30 participants (age between 22 to 24 years; gender-balanced) were recruited. They were tested individually in a quiet room using a writing-to-dictation task that consists of 3050 randomly ordered traditional Chinese phonetic compound characters. They were instructed to perform each trial as accurately and as quickly as possible. In each trial, a disyllabic word context of the target character was given to avoid confusion (e.g., “「背包」嘅「背」字” [the ‘back’ in ‘backpack’]). No feedback on accuracy was given.

Results

Results of Linear mixed-effect model indicated significant predictions of accuracy by word frequency, character frequency, semantic radical combinability, phonetic radical combinability, Age of Acquisition, number of strokes, phonetic regularity and semantic radical transparency. Similarly, RT was significantly predicted by word frequency, character frequency, semantic (but not phonetic) radical combinability, homophone density, Age of Acquisition, number of strokes, phonetic regularity and semantic radical transparency. In addition, in both the accuracy and RT models, the interactions between character frequency and phonetic regularity are significant as well, suggesting that phonetic regularity only affects accuracy and RT in the low frequency condition.

Conclusions

The results generally supported the dual route account of writing-to-dictation in Chinese (e.g. Weekes et al., 2006; Lau, 2021). Specifically, the significance of both semantic radical combinability and semantic radical transparency in predicting accuracy and RT confirms that semantic radicals contributed to writing-to-dictation in Chinese at both form and functional levels. In other words, it confirms that semantic features associated with semantic radicals are processed in the lexical-semantic route of Chinese writing-to-dictation.

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Using structural priming as an aphasia treatment: The role of lexical-syntactic Interactions

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Introduction

In natural speech, speakers constantly select and assemble words and syntax to communicate in sentences. Despite pervasive sentence production deficits in persons with aphasia (PWA), few effective treatments exist, and little is known about what learning mechanisms are essential in maximizing recovery. Mounting evidence suggests that both typical and impaired speakers learn to produce different sentences through prior experience of syntactic structures, or *structural priming* (Messenger, 2022; Lee et al., 2023). Shared abstract syntax between primes and targets is thought to drive implicit rule-based learning, independent of lexical-semantic content (Chang et al., 2012). Others also suggest that verb overlap between primes and targets boosts priming due to spreading lemma-to-syntax activation (e.g., Hartsuiker et al., 2008). No study has yet investigated how such lexical (verb)-syntax pairings influence trajectories of language re-learning in aphasia. We investigated (a) whether structural priming treatment creates lasting and generalizable recovery of sentence production in PWA and (b) which learning condition (same verb vs. different verb priming) is an essential treatment component.

Methods

16 PWA and 16 controls completed two treatment phases with each targeting passive or dative sentences. In each phase, they completed baseline testing, three sessions of either same or different verb priming training, and an immediate (1-day) and delayed (1-week) post-testing. Oral reading-based structural priming training was used (Bock & Griffin 2000; Lee & Man, 2017). The critical manipulation between training conditions was whether the verb was repeated or not between primes and targets (e.g., prime: the doctor was chased/pushed by the cop – target: the boxer was chased by the child). The orders of target sentences and training conditions were counterbalanced across participants. At baseline and post-testing, sentence production and completion probes were administered to assess improvement and maintenance of trained and untrained (unexposed) target sentences.

Results

In sentence production, PWA and controls improved significantly at both immediate ($z = 7.494, p < .001$) and delayed post-testing ($z = 2.602, p < .001$). Interestingly, PWA showed *greater* improvement when the verbs in primes and targets were different, while controls showed the opposite pattern at immediate ($z = 3.146, p < .001$) and at delayed post-testing, albeit marginally ($z = 1.828, p = .07$). In sentence completion, controls performed at ceiling. PWA improved at both immediate and delayed post-testing (z s $> 4, p$ s $< .001$) with marginally larger effects following different verb training (z s $< 1.7, p$ s $= .09$). Finally, training

effects generalized to untrained stimuli: comparable improvements were found between trained and untrained target stimuli in all probe measures ($ps > .05$).

Conclusions

Structural priming treatment is effective for sentence production deficits, creating enduring and generalizable improvements in PWA. Unlike controls, PWA generally showed greater improvement and maintenance effects when primes and targets do not share lexical head (verb). These findings suggest that lexically-independent syntactic priming is essential to robust and enduring recovery of sentence production in PWA (Chang et al., 2012; Bock & Griffin, 2000). We will discuss how these novel findings can advance aphasia rehabilitation and cognitive theories of language (re)-learning.

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Role of multiple white matter tracts on severity of poststroke aphasia

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Introduction

This study aims to investigate the relationship between multiple white matter tracts and language impairment in post-stroke aphasia. Beyond the traditionally examined arcuate fasciculus (AF), we investigated association between integrities of 42 white matter tracts reconstructed automatically and language performance.

Methods

A retrospective study was conducted on 66 patients with left hemispheric stroke. We collected demographic data, clinical information, diffusion tensor imaging (DTI) data, and the Korean version of Western Aphasia Battery (K-WAB). Automated multiple white matter tract reconstruction was performed using the Tracts Constrained by Underlying Anatomy (TRACULA), and Fractional anisotropy (FA) values from 42 tracts were extracted. Multiple linear regression analysis was conducted using FA values of white matter tracts with significant correlations to language scores and demographic data as independent variables to predict language scores. Simple linear regression was conducted to investigate the influence of the AF's FA value on language results.

Results

Multiple linear regression results are shown in Table 1. The significant variables for predicting aphasia quotient (AQ) were the FAs of the left AF, left extreme capsule, and left fornix (adjusted $R^2 = 0.425$). A simple linear regression highlighted the FA value of AF alone contributing an adjusted R^2 of 0.320. In language detail evaluation, fluency was influenced by FA of left AF and left extreme capsule (adjusted $R^2 = 0.343$). For comprehension, FA of left AF and left fornix played a role (adjusted $R^2 = 0.316$). Repetition was impacted by FA of left AF (adjusted $R^2 = 0.285$), and naming by FA of left AF and left extreme capsule (adjusted $R^2 = 0.390$). Simple linear regression revealed that the FA value of AF alone showed adjusted R^2 values of 0.217 to 0.280 in predicting language sub-assessment domains.

Conclusions

Analyzing integrity of multiple white matter tracts is more informative than relying solely on AF for prediction and understanding of aphasia severity after stroke.

Acknowledgments

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Table 1. Multiple linear regression results

Model	Dependent variables	Independent variables	Standardised β	Adjusted R^2	P value	VIF
Model 1 (multiple tract)	Fluency			0.343		
		Left AF	0.455		<0.001**	1.105
		Left extreme capsule	0.279		0.011*	1.105
	Compre-henSion			0.316		
		Left AF	0.478		<0.001**	1.003
		Left fornix	0.304		0.005**	1.003
	Repetition			0.285		
		Left AF	0.544		<0.001**	1.000
	Naming			0.390		
		Left AF	0.449		<0.001**	1.105
		Left extreme capsule	0.338		0.002**	1.105
	AQ			0.425		
		Left AF	0.491		<0.001**	1.108
		Left extreme capsule	0.258		0.012*	1.106
		Left fornix	0.225		0.021*	1.004
Model 2 (AF)	Fluency			0.279		
		Left AF	0.539		<0.001**	1.000
	Compre-Hension			0.217		
		Left AF	0.478		<0.001**	1.000
	Repetition			0.278		
		Left AF	0.537		<0.001**	1.000
	Naming			0.280		
		Left AF	0.540		<0.001**	1.000
	AQ			0.320		
		Left AF	0.574		<0.001**	1.000

Psycholinguistic norms and face-naming times for photographs of celebrities in Cantonese

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Introduction

Recently, databases of psycholinguistic norms of face naming have emerged (e.g., Bonin et al., 2008; Marful et al., 2018; Lima et al., 2021), providing resources for testing theories of lexical processing of different name categories. As psycholinguistic norms for celebrity naming are highly constrained by geographic context and cultural specificities (Marful et al., 2018), the current study aims to collect norms for celebrity faces in Cantonese which are currently unavailable.

Methods

Thirty healthy native Cantonese speakers aged between 45 and 60 years old, with balanced gender, were recruited in a pilot study. Sixteen of them were invited to participate in a divergent naming task to give as name names as possible they could think of upon presentation of each of 11 occupational categories. For each category, the exemplars produced by at least 25% of the participants were selected as targets and the corresponding photos were obtained from the internet.

The remaining participants were invited to name the randomly ordered target celebrity photos in the naming experiment. In the rating tasks, they were instructed to rate the age-of-acquisition (AoA) and face-name-agreement using 5-point Likert scales. Frequency of occurrence of each celebrity name in the Hong Kong Corpus of Chinese NewsPaper (Leung & Lau, 2010) was obtained. H-index of each celebrity photo, as a function of number of different names elicited and corresponding weights, was calculated.

Results

Altogether, 112 celebrity names were selected based on the divergent naming task. Results of Pearson's correlation indicated strong association among H-index, AoA, face-name-agreement rating, and log-transformed frequency ($p < .05$).

Conclusions

Results of the pilot data were consistent with patterns reported in previous studies (e.g. Bonin et al., 2008) suggested the representativeness of the selected celebrity items. Data collection will be continued till August this year. In addition to face-name agreement, and age-of-acquisition, this study will also obtain the number of associative names individuals can generate with each face. Behavioral data on naming, including latency and the occurrence of tip-of-tongue (ToT) will also be collected. Finally, two patients with anomia will be recruited, and their naming performance on the same set of pictures will be compared against the normative data. This will provide valuable clinical implications when selecting stimuli for assessment and treatment of individuals with acquired language problems.

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Human judgments of AI images generated using patient-specific text prompts

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Introduction

Images serve as essential stimuli in aphasia assessment and treatment. However, most images used in clinic or research are extracted from standard search engines (e.g., Google Images) or created by humans, which can be time-consuming and challenging for individuals with aphasia to understand (Brown & Thiessen, 2018). Artificial Intelligence (AI) technology offers a promising solution to these issues by allowing for specific text prompts to generate patient-friendly images (Pierce, 2024). This study investigated to what extent AI-generated images using pre-defined text prompts (1) matched with the target word, and (2) were patient friendly based on human judgments.

Methods

A total of 10 nouns and 10 verbs were randomly selected from the International Picture Naming Project database (Szekely et al., 2004). Images for each word were generated four times from Dalle-3 using each of the following text prompts (see example pictures in Figure 1): (1) a general prompt (i.e., “give me an illustration of a *bear*” or “give me an illustration of *kicking*”), and (2) a patient-specific prompt (i.e., “give me an illustration of a *bear*. The picture needs to be patient-friendly for adults with brain injury, meaning it is clear and easy to understand”). In total, 160 images were generated.

Then, thirty MTurk workers based in the U.S. completed an online survey, which asked them to (1) judge whether each image matched with the target word with yes, no, or cannot determine, and (2) rate how patient-friendly each image was on a 1 (not patient-friendly at all) – 5 (very patient-friendly) Likert scale. Definition of “patient-friendly” was provided in the survey.

Two mixed-effects models were conducted to estimate (1) judgment response (yes or no), and (2) rating scale for the matched images (1 – 5). Fixed effects were word category (noun vs. verb), prompt type (general vs. patient-specific) and their two-way interaction. By-subject and by-item random slopes were included to account for additional data variances.

Results

Table 1 reports the average judgment responses and ratings for noun and verb images using each prompt type. For the judgment response, there was no significant simple effect of word category or prompt type (p -values $> .05$), indicating that human judgments of whether an AI-generated image matched with its target word did not vary by word category or the type of text prompt.

For the rating scale, there was a significant simple effect of prompt type ($\beta = -1.12$, $SE = .20$, $p < .01$). Post-hoc pairwise comparisons showed lower ratings for general than patient-specific prompts for both nouns and verbs. These findings suggest that human ratings of images generated with patient-specific prompts were higher than those generated with general prompts. However, there was no significant difference between nouns and verbs.

Conclusions

AI images generated using patient-specific text prompts were more patient friendly than those generated with general prompts. These images well matched with the target word for

both nouns and verbs. Findings indicate that text-to-image AI can be a valuable tool in the development of picture stimuli in aphasia assessment and treatment.

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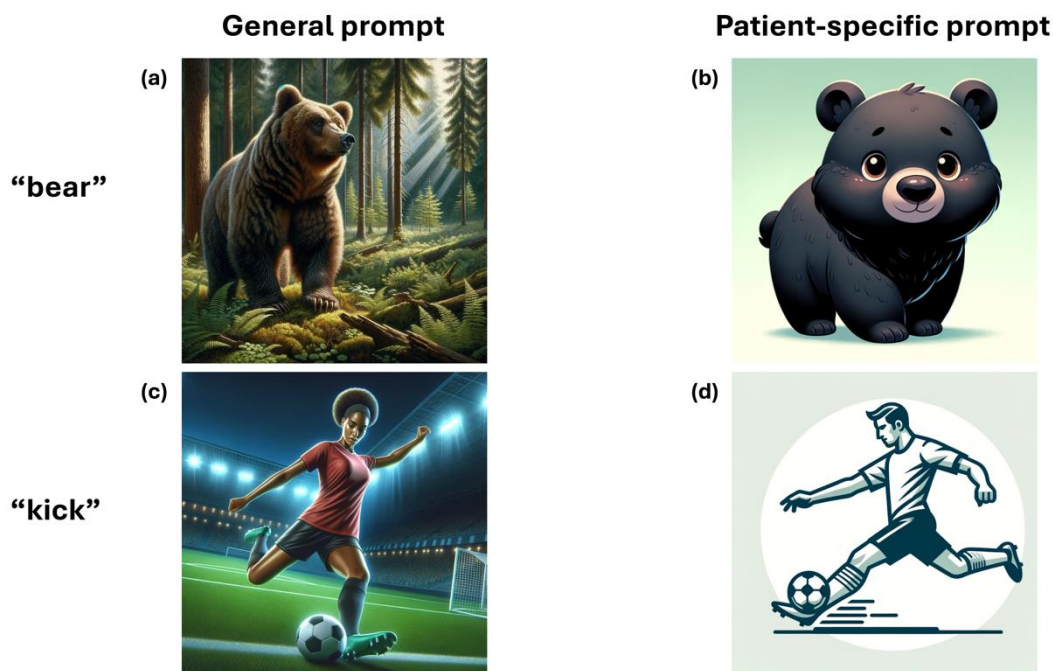


Figure 18. Example ai-generated images for the words “bear” and “kicking” using general (a and c) and patient-specific (b and d) prompts.

Table 1. Average judgment response and rating scale for noun and verb images using general vs. patient-specific prompts.

Word Category	Prompt type	Judgment (% of Yes)	Rating Scale (1 – 5)
Nouns	<i>General</i>	96.9	4.05
	<i>Patient-specific</i>	97.4	4.46
Verbs	<i>General</i>	93.8	3.94
	<i>Patient-specific</i>	90.1	4.34

The neuropsychological characteristics of verbal and non-verbal cognitive function in post-stroke aphasia patients

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Introduction

Post-stroke aphasia (PSA) patients are often accompanied by different degrees of phonological, lexical, semantic, syntactic, and grammatical impairments. Due to the impaired language function, non-verbal cognitive impairment is easy to be masked. However, the current cognitive assessment scales used for PSA patients solely concentrate on specific aspects with limited coverage, and the standardization level in diagnostic procedures is low. Thus, this study aims to fully evaluate the characteristics of language processing pathway and non-verbal cognitive performance, clarify the relationship between verbal and non-verbal cognitive impairment in PSA patients according to the cognitive neuropsychology theory.

Methods

A total of 122 stroke patients with aphasia were recruited into this prospective study. Verbal and non-verbal cognitive functions were evaluated by the Loewenstein Occupational Therapy Cognitive Assessment (LOTCA) and the Chinese Aphasia Language Battery (CALB), respectively. PSA patients were subdivided into the Fluent and the Non-fluent aphasia group. The CALB and LOTCA scores were compared between the PSA subdivisions. Partial correlation analyses between the subscores of CALB and LOTCA were also performed. Moreover, the LOTCA total score was used as the dependent variable, and the language items related to the LOTCA in the partial correlation analysis were included as independent variables to conduct multiple linear regression analysis. According to the results, a multiple linear regression model was constructed and the goodness-of-fit test and significance test were conducted.

Results

This study showed the cognitive performance of PSA patients had different correlations with different nodes in the language processing pathway in terms of speech analysis ability, lexical processing ability, semantic processing ability, and syntactic structure conversion ability ($r > 0$, $P < 0.0005$). Among them, phonetics decoding ($\beta = 0.586$, $P = 0.008$), low-frequency word extraction ($\beta = 0.335$, $p = 0.023$), verb argument structure ($\beta = 0.498$, $p = 0.042$), comprehension ($\beta = 0.395$, $P < 0.001$) and naming ($\beta = 0.231$, $p = 0.049$) significantly positively predicted LOTCA total score. Compared with Fluent aphasics, the scores for phonetics decoding ($p = 0.044$), phonetics input-output ($p = 0.001$), speech vocabulary production ($p = 0.007$), noun category classification ($p = 0.001$) and noun degree of life ($p = 0.001$) ability were significantly worse in Non-fluent aphasics than in fluent aphasics. Furthermore, Non-fluent PSA patients had worse cognitive performance in terms of LOTCA score ($p = 0.002$), orientation ($p = 0.013$), visual perception (< 0.0001), motor praxis ($p = 0.013$), and thinking operation ($p = 0.014$).

Conclusions

Based on the cognitive neuropsychological theory, this study found that PSA patients have extensive impairments in language pathways including pronunciation, vocabulary, semantics, syntax, and grammar. In addition, PSA patients have more extensive and severe non-verbal cognitive impairment, and cognitive decline is positively correlated with linguistic impairment, especially in patients with non-fluent aphasia. In the future, personalized and comprehensive rehabilitation programs should be formulated according to the characteristics of verbal and non-verbal cognitive impairment in stroke patients with different types of aphasia.

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Table 1. Correlations between LOTCA and CALB scores (A) and effect of CALB on LOTCA total score (B) in PSA patients

A		LOTCA total score	Orientation	VP	SP	MP	VMO	TO	Attention
Speech analysis ability									
Phonetics decoding	r	0.584*	0.561*	0.372*	0.528*	0.363*	0.306	0.478*	0.045
Tone decoding	r	0.386*	0.458*	0.158	0.403*	0.084	0.179	0.357*	0.060
Phonetics input to output	r	0.553*	0.483*	0.331*	0.450*	0.563*	0.324*	0.403*	0.008
Vocabulary processing ability									
Auditory vocabulary comprehension	r	0.610*	0.513*	0.508*	0.485*	0.366*	0.390*	0.500*	0.080
Phonetic vocabulary production	r	0.445*	0.283	0.335*	0.579*	0.334*	0.327*	0.198	0.139
Low-frequency word extraction	r	0.550*	0.513*	0.369*	0.495*	0.365*	0.314	0.422*	-0.018
Semantic processing ability									
Noun category classification	r	0.597*	0.394*	0.499*	0.645*	0.415*	0.444*	0.348*	0.194
Noun degree of life	r	0.624*	0.444*	0.479*	0.653*	0.423*	0.444*	0.394*	0.205
Semantic relevance	r	0.240	0.308	0.152	0.204	-0.017	0.132	0.230	-0.029
Verb argument structure	r	0.565*	0.500*	0.414*	0.553*	0.298	0.366*	0.411*	0.041
Syntactic structure conversion ability									
Typical word-order sentence	r	0.523*	0.437*	0.381*	0.602*	0.162	0.320*	0.405*	0.179
Non-typical word order sentence	r	0.355*	0.253	0.221	0.485*	0.004	0.254	0.320*	0.166

Abbreviations: PSA, post-stroke aphasia. LOTCA, Loewenstein Occupational Therapy Cognitive Assessment. CALB, Chinese Aphasia Language Battery. VP, visual perception. SP, spatial perception. MP, motor praxis. VMO, visuomotor organization. TO, thinking operation. *, P≤0.0005.

B		B(95%CI)	β	t	P-value	F	Adjusted R ²
						14.713*	0.555
Phonetics decoding		0.98	0.586	2.715	0.008		
Tone decoding		-1.40	-0.448	-2.580	0.011		
Low-frequency word extraction		1.49	0.355	2.304	0.023		
Verb argument structure		1.07	0.498	2.057	0.042		
Constant		48.97		6.039	<0.001		

Abbreviations: PSA, post-stroke aphasia. LOTCA, Loewenstein Occupational Therapy Cognitive Assessment. CALB, Chinese Aphasia Language Battery. *, P≤0.0001.

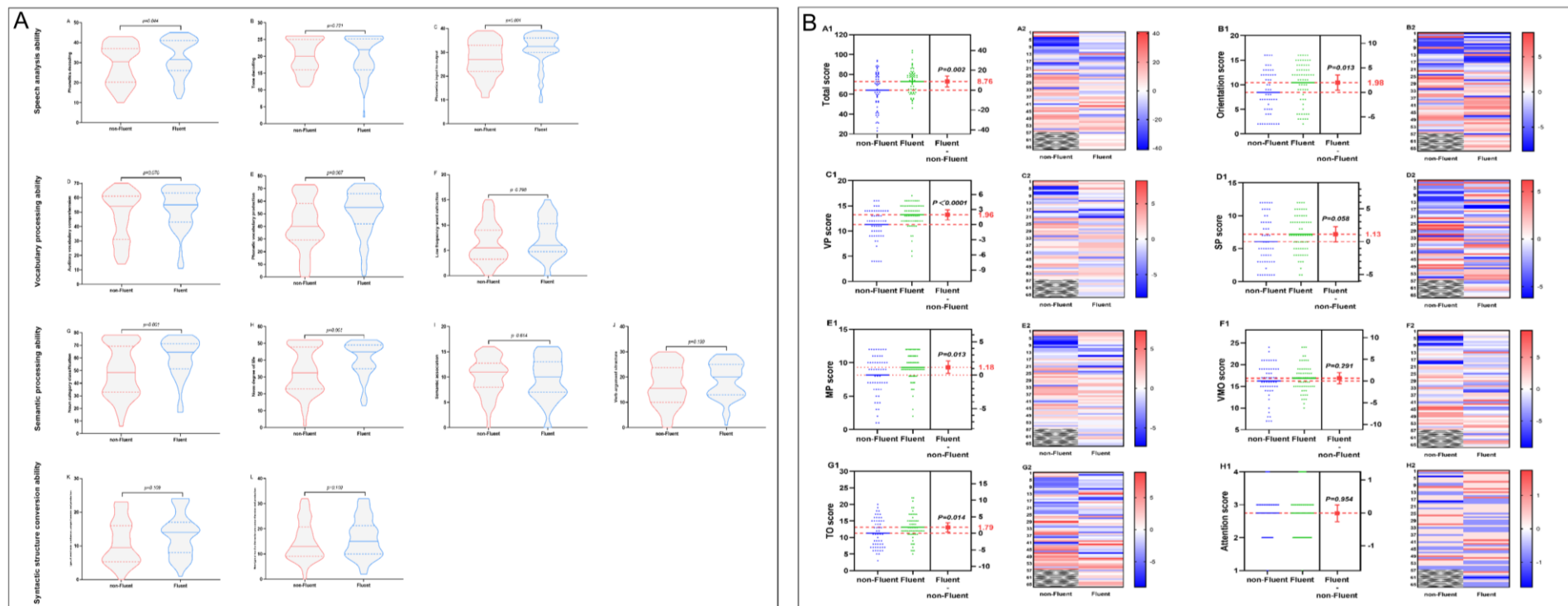


Figure 1. The characteristics of linguistic function (A) and cognitive function (B) between Fluent and Non-fluent PSA patients. Abbreviations: PSA, post-stroke aphasia. LOTCA, Loewenstein occupational therapy cognitive assessment. VP, visual perception. SP, spatial perception. MP, motor praxis. VMO, visuomotor organization. TO, thinking operation.

Exploring prefrontal hemodynamic changes associated with verbal memory encoding and recall process: A preliminary fNIRS study

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Introduction

The verbal encoding and recall process is often measured using verbal learning tasks (Goldstein & Hersen, 2000). Neurophysiological studies using functional near-Infrared spectroscopy (fNIRS) have shown an initial increase in oxyhemoglobin in the prefrontal cortex (PFC), followed by a decrease over repetitive trials (León-Carrión et al., 2010). This hemodynamic change is associated with neural repetition suppression (NRS), a reduction in neural activity upon repeated stimulus presentation (Grill-Spector et al., 2006). NRS occurs in various task types and varies with the degree of repetition. However, the impact of verbal encoding frequency on NRS is not fully understood. This study investigated whether verbal learning performance improves over time and whether these outcomes are associated with hemodynamic changes in the PFC.

Methods

Participants. Ten healthy young adults (mean_age: 26.2 ± 5.2 , mean_education: 17.7 ± 0.4), screened using the Health Screening Questionnaire (Christensen et al., 1991), participated in the study.

Verbal Learning Test. The Korean version of the California Verbal Learning Test was used (K-CVLT; Kim, 1999). Participants were instructed to encode and recall a 16-item list over a total of five trials.

Experimental Procedures. Each word in the verbal learning test was visually presented for 3-second, with a 1-second interstimulus interval using Microsoft PowerPoint, followed by a 30-second recall and a 30-second rest period. Changes in oxyhemoglobin (ΔHbO_2) and deoxyhemoglobin (ΔHbR) during recall were obtained using a 15-channel fNIRS device (NIRSIT Lite; OBELAB Inc., Seoul, Korea). A 2-minute baseline block was conducted before encoding and used for baseline correction.

Data analysis. Dependent variables included 1) word recall accuracy (%) across 5 trials, 2) ΔHbO_2 and ΔHbR across channels between Trial 1 and Trial 5. In each trial, correlation coefficients were calculated among word recall accuracy with ΔHbO_2 and ΔHbR .

Results

For word recall accuracy, a one-way repeated ANOVA showed a significant main effect of trials ($F(4,36)=10.292$, $p<.001$; Trial 1 < Trial 4, $p=.009$; Trial 1 < Trial 5, $p=.018$). For the hemodynamic results, two-way repeated ANOVAs (15 channels x 2 trials) showed significant main effects of trials for ΔHbO_2 ($F(1,9)=9.493$, $p=.013$; Trial 1 > Trial 5) and ΔHbR ($F(1,9)=9.909$, $p=.012$; Trial 1 < Trial 5). Accuracy in Trial 5 was negatively correlated with ΔHbO_2 in channels 4 ($r=-.651$, $p=.042$) and 7 ($r=-.769$, $p=.009$) in Trial 1. Conversely, there

was a positive correlation between the accuracy in Trial 5 and ΔHbR in channels 5($r=.647$, $p=.043$) and 7($r=.806$, $p=.005$) in Trial 1. Detailed statistics and hemodynamic responses are presented in Table 1 and Figure 1, respectively.

Conclusions

The increase in recall accuracy with learning trials signifies successful learning. The decrease in ΔHbO_2 and the increase in ΔHbR at Trial 5 compared to Trial 1 support NRS, indicating neural activity decreases as learning trials progress. The correlation between recall accuracy in Trial 5 and hemodynamic responses in Trial 1 suggests that high-performing individuals exhibit neural efficiency by consuming less energy (Neubauer et al., 2009). This study potentially contributes to better understanding of the relationship between hemodynamic responses and behavioral performance during verbal memory learning.

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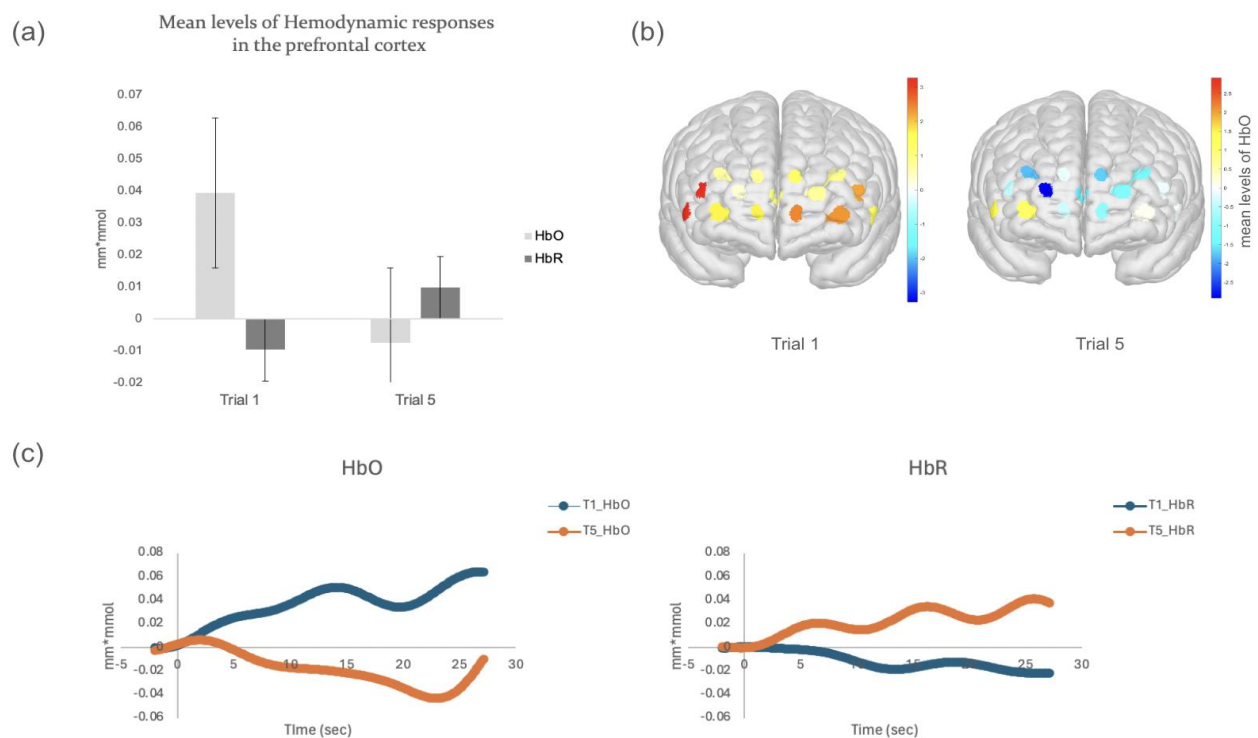


Figure 1. (a) Mean levels of HbO and HbR changes, (b) Activation map in the prefrontal cortex and (c) Time series graphs for group-level of HbO and HbR between Trial 1 and Trial 5

Table 1. Descriptive statistics for Word Recall Accuracy (%)

Trial Number	Mean of Word Recall Accuracy (SD)
Trial 1	70.00 (5.08)
Trial 2	76.87 (5.82)
Trial 3	85.62 (4.93)
Tria 4	91.87 (3.73)
Trial 5	93.12 (2.86)

Connection with the language network affects object representation in the ventral visual pathway: Evidence from functional and diffusion imaging with patients

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Introduction

Object knowledge representation enables human understanding of and rich interactions with the world. The current consensus is that object knowledge is grounded in the corresponding cortical regions for which such knowledge is acquired, with higher-order ventral visual cortex (ventral occipital temporal cortex, VOTC) representing the shape and color knowledge of objects (see reviews in Barsalou, Simmons, Barbey, & Wilson, 2003; Martin, 2016). Recent study has identified an additional types of object representation – those derived from language -- in the dorsal anterior temporal lobe (dATL) (see Bi (2021) for review). Regions representing these two types of knowledge are functionally connected during the resting state (Xiaoying Wang et al., 2020), but whether the connection between the two systems is critically involved in object representation within either systems and/or object knowledge behavior remain unknown. We here test this question using lesion models, combining diffusion imaging (for white matter structural integrity), fMRI (for functional neural knowledge representation), and neuropsychological assessments (for behavioral integrity) in patients.

Methods

To obtain unbiased results, grey-matter (GM) and white-matter (WM) masks of interest were defined in matched healthy controls (N = 35) and the patients' data (N = 33) were analyzed in the corresponding masks (see Figure 1A). For the functionality in the visual cortex, using fMRI experiment where the participants received color knowledge of common objects, we functionally localized the cluster representing object color knowledge within the VOTC in healthy individuals, and tested the patients' fMRI neural representation strengths in this VOTC-color-knowledge mask. For the WM connections, we obtained diffusion imaging data, implemented probabilistic tractography to map the WM connections between the language and visual perceptual cortical regions in healthy individuals, and subsequently quantified the WM integrity (FA values) within the WM tract masks for each stroke patient. We then tested the causal relationship between the WM integrity of these tracts and the functional neural representation of object color knowledge in VOTC, and between the two neural structures and object color knowledge behavior (both verbal and nonverbal).

Results

The impairment of the LdATL-VOTC connection has a significant causal effect on the neural representation of object color in VOTC (see Figure 1B), and these effects could not be fully explained by potential deficits in the visual perception pathway. The effects of the LdATL-VOTC connection also significantly correlated with object color behavior regardless of task modalities (verbal or nonverbal, see Figure 1C), and is above and beyond the effects of the related cognitive processes (object recognition and color patch recognition). These two lines of results remained robust when we controlled for a wide range of potential confounding variables, including the broader effects of lesions, patient post-onset duration and cases with special etiologies.

Conclusions

Our results show that the LdATL-VOTC connection plays a crucial role in the object knowledge representation in the VOTC, and more strongly explain the related behavior than VOTC knowledge representation. That is, in humans knowledge behavior may arise from bridging the sensory derived representation in VOTC and the language derived representation in dATL.

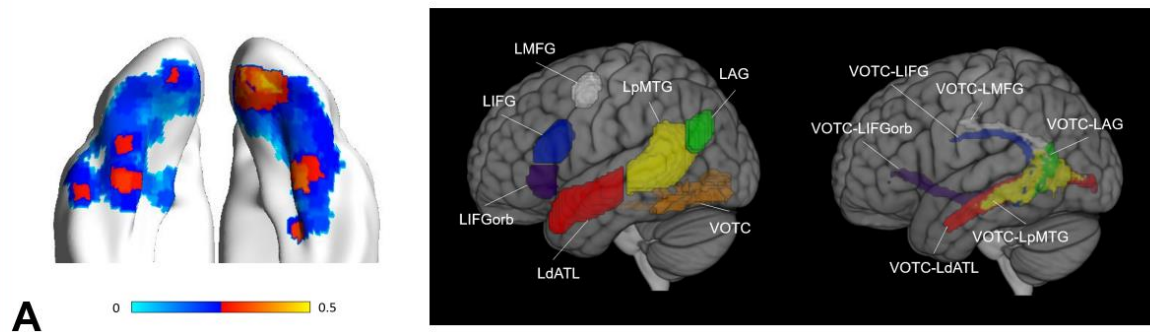
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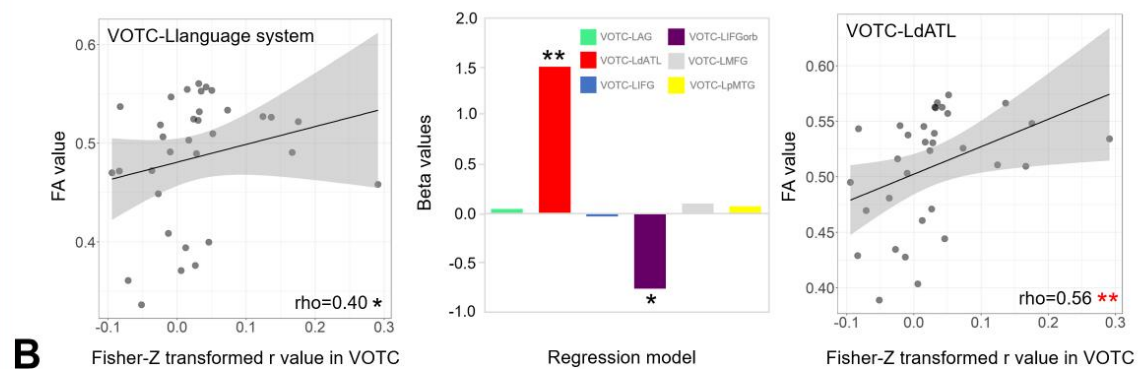
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GM and WM masks of interest in healthy controls



VOTC object color neural representation in patients: Effects of the WM tract integrity



Object color behavior in patients: Effects of the WM tract integrity

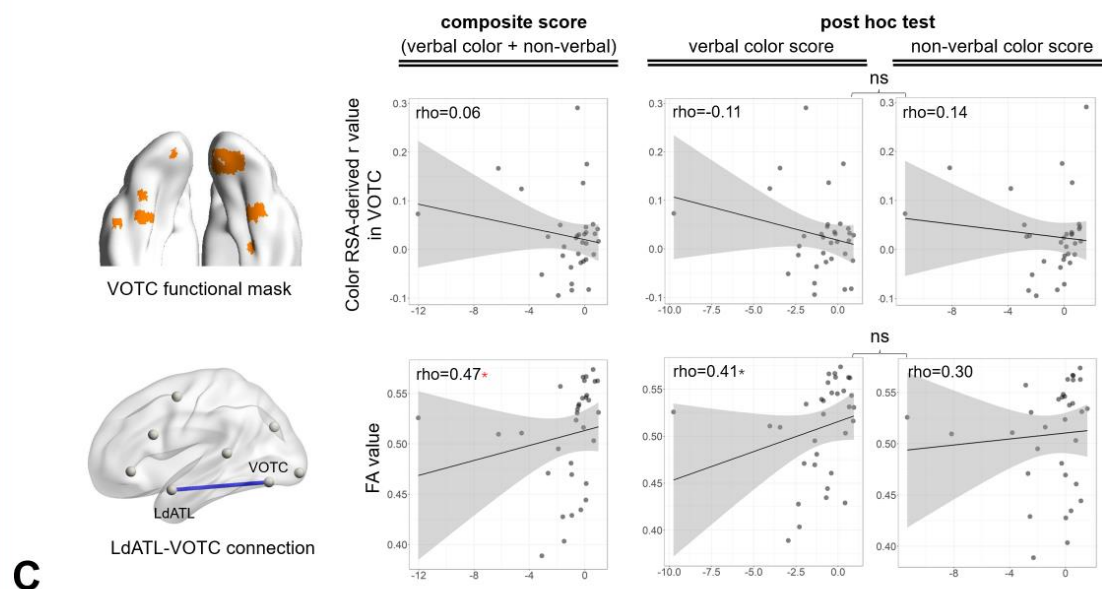


Figure 19. The results of the causal relationship between the WM integrity of these tracts and the functional neural representation of object color knowledge in VOTC, and between the two neural structures and object color knowledge behavior.

Table 1. Demographic data of stroke patients and healthy controls

	Patients group (n = 33)			Controls group (n = 35)			Statistics(t)	P-value
	mean	sd	range	mean	sd	range		
Age (years)	51.55	10.02	30-65	50.23	9.94	31-65	0.54	0.59
Gender (M/F)	25/8			21/14			-1.64	0.11
Education (years)	11.18	3.26	5-16	11.71	2.79	7-16	-0.72	0.47
MMSE (scores)	25.88	4.53	12-30	28.86	1.09	26-30	-3.68	0.001
Handedness (R/L)	33/0			35/0				
Time post stroke (months)	30.09	55.51	3-252	-			-	-
Lesion site (L/R/Bilateral)	18/11/4			-			-	
Lesion volume	44951	55361	852-236545	-			-	-

M = male; F = female; R = right-handed; L = left-hand

Language-specific impairments in Parkinson's disease: A cross-linguistic study

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Introduction

Parkinson's disease (PD) is characterized by both motor and non-motor symptoms, including language impairment (Auclair-Ouellet et al., 2017). Cross-linguistic studies elucidate language-specific patterns of impairment in PD, offering insights into linguistic deficits (Pinto et al., 2017). The Cookie Theft Picture Description Task is widely used to measure language function through various linguistic features (Andrade et al., 2023). This study compares French and English speakers' performance on the Cookie Theft task, focusing on action-verb usage, speech rate, lexical diversity, syntactic complexity, and pauses. Understanding these aspects may inform tailored interventions and enhance comprehension of the cognitive and neural mechanisms underlying PD-related language deficits (Calvo et al., 2018). We aim to examine the interplay between language performance metrics, disease severity, and cognitive impairment, shedding light on the language-specific characteristics of PD and their clinical implications.

Methods

Thirty-six PD patients (18 French, 18 English speakers) completed the Cookie Theft task in their respective languages. Transcripts were analyzed for action verbs, speech rate, lexical diversity (Type-Token Ratio [TTR]), syntactic complexity (Mean Length of Utterance [MLU]), and pauses (silent and filled). Cognitive function was assessed using the Montreal Cognitive Assessment (MoCA), and disease severity was measured using the Unified Parkinson's Disease Rating Scale (UPDRS). Pearson's correlations examined associations between variables, and regression analyses assessed the predictive value of linguistic features on MoCA and UPDRS scores, controlling for potential confounds.

Results

Descriptive analyses indicated comparable mean scores for UPDRS and MoCA between English and French speakers. For French speakers, significant negative correlations were found between UPDRS scores and both action verbs ($r = -0.470, p < 0.05$) and speech rate ($r = -0.724, p < 0.05$), indicating that greater disease severity was associated with reduced action verb usage and slower speech rates. Additionally, a significant positive correlation was found between action verbs and speech rate ($r = 0.574, p < .001$). Significant negative correlations were observed between speech rate and TTR ($r = -0.705, p < 0.05$) and between TTR and MoCA scores ($r = -0.470, p < 0.05$). Regression analyses indicated that speech rate significantly predicted UPDRS scores ($p < 0.05$). For English speakers, a significant negative correlation was found between age and MoCA scores ($r = -0.571, p < 0.05$), and significant positive correlations between MLU and filled pauses ($r = 0.614, p < 0.05$) and negative correlation between MLU and silent pauses ($r = -0.484, p < 0.05$). None of the other correlations found for the French speakers emerged in this group.

Conclusions

This cross-linguistic study revealed language-specific impairments in PD patients, with notable differences between French and English speakers despite comparable UPDRS and MoCA scores. In French speakers, disease severity was linked to linguistic measures, with greater severity associated with reduced action verb usage and slower speech rates, potentially reflecting motor-related impairments. Conversely, in English speakers, linguistic measures such as utterance length and pause frequency showed significant relationships, suggesting that PD-related cognitive and motor impairments may influence language production differently across languages. These findings highlight the importance of language-specific assessment and interventions in PD, as different linguistic profiles may emerge across languages. Further research is needed to understand these differences and develop tailored strategies for managing language deficits in PD patients.

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Table 1. Descriptive statistics of clinical and linguistic measures in Anglophone and Francophone PD patients.

Variable	Anglophones (<i>n</i> = 18) <i>M</i> (<i>SD</i>)	Francophones (<i>n</i> = 18) <i>M</i> (<i>SD</i>)
Age	68.61 (5.76)	67.50 (6.54)
Sex	50% male	78 % male
MoCA	24.86 (3.83)	24.11 (3.92)
UPDRS	40.11 (21.62)	44.78 (23.71)
Action Verbs	11.72 (2.74)	9.44 (2.98)
Speech Rate	132.56 (28.02)	122.50 (28.48)
TTR	53.63 (6.02)	60.76 (8.17)
MLU	10.11 (4.42)	8.85 (2.79)
Silent Pauses	2.83 (2.04)	1.94 (2.18)
Filled Pauses	2.94 (2.26)	4.61 (3.5)

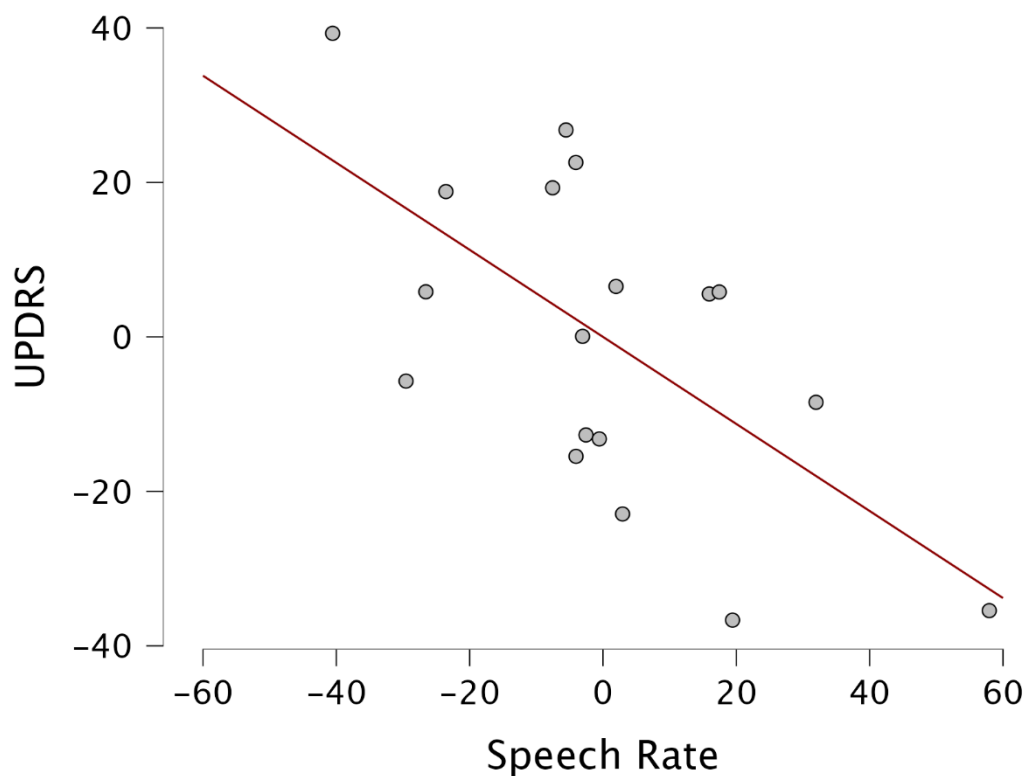


Figure 1. Relationship between speech rate and UPDRS scores in French speakers.

Neurocognitive patterns of verb production deficit therapy: A single case with logopenic variant Primary Progressive Aphasia

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Introduction

Primary Progressive Aphasia (PPA) is a neurodegenerative syndrome characterized by progressive deterioration of language. In a recent meta-analysis (Cotelli et al., 2020), 50 studies examined behavioral treatments for PPA; however, no prior studies have determined neural changes from pre- to post-treatment and tested for generalization effects across different contexts. This study determined word retrieval difficulties in an individual with logopenic variant PPA (lvPPA) and identified behavioral and neural changes after Verb Network Strengthening Treatment (VNeST; Edmonds et al., 2009).

Methods

Using a single-subject multiple baseline experimental design, we examined treatment effects in lvPPA and investigated which brain areas are used during task-based and resting-state functional magnetic resonance imaging (fMRI/rs-fMRI). A 58-year-old male lvPPA underwent a VNeST of three-argument verbs over 13 weeks totaling 52 hours and completed the adaptive language mapping fMRI paradigm (Wilson et al., 2018) and rs-fMRI, capturing neural changes of verb-thematic networks before and after therapy. We examined the generalization from verb naming to other contexts (one- and two-argument verbs and noun production, sentence generation, and connected speech) as well as self-reported emotional experiences.

Results

The Quick Aphasia Battery (QAB) assessments revealed difficulties in word finding, repetition, and sentence processing, and a structural MRI of the brain shows left lateralized temporoparietal atrophy, consistent with lvPPA diagnoses. The participant generally improved verb naming and increased performance by approximately 47% on the treated items ($ES.h = 0.9$) but not on untreated items ($ES.h = -0.2$). Moreover, the participant showed at least a 20% performance increase on the Picture Naming and Repetition sections of the QAB from pre- to post-therapy. The connected speech aphasic features identified using APROCSA were reduced indicating that EB's overall communication abilities improved due to VNeST by eliciting nouns and verbs as co-units. Functional imaging results showed that at the macro level, language organization was similar to healthy controls (Wilson et al., 2018) as well as pre- to post-therapy. Lastly, pre to post self-reported emotional experiences and improvements in perceived communicative ability were observed.

Conclusions

Taken together, these findings allow us to form evidence-based, effective treatment suggestions for individuals with PPA, better understand how the brain processes language, and compensate for their impairment. Finally, naming skills across nouns and verbs are critical to detect and treat, and the study indicates that the verb-thematic network is strengthened in lvPPA through forming substantive connections between the neural substrate for each agent-patient pair and the verb itself, and related verbs and their thematic pairs.

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Lexical retrieval delays in brain tumour patients: Nouns and finite verbs in the past and present tense

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Introduction

The glioma language profile encompasses a global decline of linguistic processing abilities in contrast to selective impairments typically observed post-stroke (Zyryanov et al., 2022). Diminished global functioning in these patients may manifest as slowed responding on linguistic tasks pre- and post-operatively, despite relatively spared accuracy (Mooijman et al., 2021; Moritz-Gasser et al., 2012; Ras et al., 2020). Standard aphasia assessments of error-based impairments may thus fail to capture (often self-reported) word-finding difficulties that do not necessarily translate into linguistic errors (Brownsett et al., 2019; Satoer et al., 2012). However, lexical retrieval abilities in glioma patients requires investigation with more complex morphosyntactic production tasks. In post-stroke aphasia verb production is often more impaired than noun production, particularly in frontal patients (Aggujaro et al., 2006). Moreover, frontal and temporal patients exhibit greater difficulties with reference to the past relative to the present (Bastiaanse, 2008; Jonkers & de Bruin, 2009). The current study aimed to examine whether these dissociations extend to performance (speed and accuracy) in glioma patients during object naming and action naming with finite verbs (ANFV) in the past and present tense.

Methods

Three patients (RS, GD and MW) undergoing awake craniotomy for the excision of suspected low-grade gliomas in the perisylvian regions (frontal, temporal and parietal) were recruited. Picture naming tasks (object naming, past/present ANFV) of the English Verb and Noun Test for Perioperative testing (VAN-POP; Ohlerth et al., 2020) were adapted for use as speeded naming tasks, measuring both accuracy and verbal response times. Patients were assessed preoperatively and postoperatively (at one and three months); performance was compared with healthy age and education level-matched control groups.

Results

At three months postoperatively, all patients were impaired on at least 2/3 tasks in terms of speed but not accuracy, either in relation to healthy controls and/or their preoperative baseline (see Figure 1 for an illustrative case). In the frontal patient (RS), retrieval speed was more impaired on ANFV compared to object naming, while temporal and parietal patients showed no dissociation (Table 1). Notably, in all cases, retrieval speed was more impaired for past compared to present tense ANFV, in relation to baseline or healthy control performance. Although accuracy was not impaired for any task, some errors were evident, but only for ANFV tasks. Retrieval impairments did not correlate with standard aphasia assessment, which found patients to be clinically unimpaired.

Conclusions

Speeded naming tasks may offer higher sensitivity to capture lexical retrieval impairments in glioma than standard error-based clinical assessment. The frontal patient demonstrated greater difficulties for verb over noun retrieval, aligning with evidence from post-stroke aphasia (Aggujaro et al., 2006). Greater difficulties with reference to the past compared to present are also evident in glioma patients, regardless of lesion location. This pattern of impairment is potentially elucidated by time reference theories (Bastiaanse et al., 2011), and suggests that past tense ANFV is the more optimal subset for identifying verb retrieval delays. Improving perioperative assessment requires incorporation of reaction time measures into routine clinical assessment, particularly for tasks requiring more complex grammatical production.

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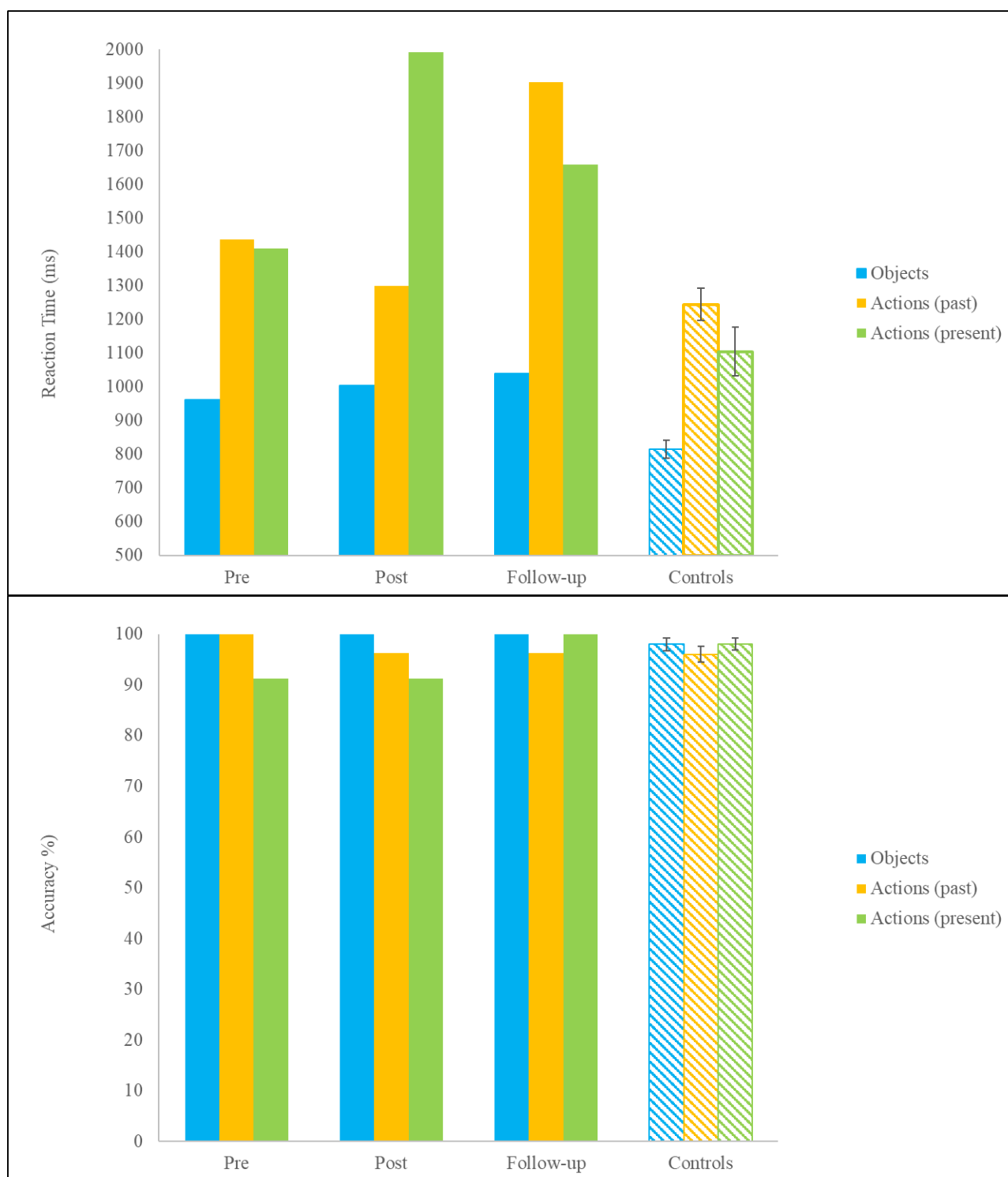


Figure 1. Patient RS's pre-, post-operative and follow-up performance vs. control group performance on VAN-POP tasks. Top: reaction time scores for object naming, past ANFV and present tense ANFV. Bottom: accuracy scores for object naming, past tense ANFV and present tense ANFV. Control performance is displayed in corresponding colour-coded patterned bars.

Table 1. Dissociations in reaction time performance on VAN-POP tasks at follow-up relative to control performance. *z*, patient's score represented as a standardised *z*-score; *X/Y* first/second task per comparison; *z* (*x-y*), differences in *z*-scores between tasks *X* and *Y*; *r*, Pearson correlation coefficient for relationship between tasks *X/Y* in control sample; *t*, *t*-test statistic; *df*, degrees of freedom; *p*, uncorrected *p*-value; *pcorr*, Bonferroni corrected *p*-value. Significant *p*-values are marked with an asterisk (*). A revised standardised difference test (Crawford & Garthwaite, 2005) for testing for dissociation of impairment on two tasks relative to control population.

		Case's score	Comparison	Difference	<i>X and Y correlation in control sample</i>	<i>Sig. test^a</i>				<i>Estimate of the control population exhibiting a difference more extreme than the case</i>
Case		<i>z</i>	Tasks <i>X</i> vs. <i>Y</i>	<i>z</i> _(<i>x-y</i>)	<i>r</i>	<i>t</i>	<i>df</i>	<i>p</i>	<i>p</i> _{corr.}	%
RS	Object naming	4.133	ANFV (past) – Object naming	2.77	.875	3.349	4	.01*	.04*	1.43
	ANFV (past)	6.889	ANFV (present) – Object naming	.326	.688	0.300	4	.39	1.17	38.95
	ANFV (present)	3.807	ANFV (past) - ANFV (present)	3.09	.900	3.953	4	.008*	.02*	.84
MW	Object naming	2.364	ANFV (past) – Object naming	.95	.791	1.039	4	.18	.54	17.87
	ANFV (past)	3.314	ANFV (present) – Object naming	1.43	.564	1.113	4	.16	.49	16.41
	ANFV (present)	0.936	ANFV (past) - ANFV (present)	2.38	.946	4.062	4	.008*	.02*	.77

Domain-general serial order working memory impairment in non-fluent primary progressive aphasia: A multiple case study

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Introduction

Non-fluent primary progressive aphasia (nfPPA), a fronto-temporal neurodegenerative condition, has been associated with verbal working memory (WM) deficits, in line with the verbal nature of this condition (e.g., Hardy et al., 2016). More surprisingly, some studies suggest that WM deficits may be of similar severity in other modalities including visual WM (Eikelboom et al., 2018). Based on neuroimaging and neurostimulation studies of serial order WM (e.g., Guidali et al., 2019), the present study tested the hypothesis that the co-occurring verbal and visual WM deficits may reflect impairment of shared serial order retention processes, as opposed to modality-specific item retention processes.

Methods

Four patients with nfPPA (DG, BM, CJ, BA; age range: 75-81 years; neuroanatomical findings: left anterior temporal volume loss for BA, and bilateral frontal atrophy for the other patients) were presented with short-term probe recognition tasks, in which sequences of four nonwords or unfamiliar faces were presented. For each stimulus modality, retention of either item or serial order information was tested. In the item condition, a single probe stimulus was presented after the memory list and the patients had to decide whether it had been in the list or not. Half of the probes were negative, differing minimally at the phonological (verbal modality) or face feature (visual modality) level from one of the memory items. In the serial order condition, the probe consisted in two items being represented in the same or in a different order and the patients had to decide whether they were in the same order as in the list. The item and order conditions were presented in blocks, preceded by practice trials, ensuring that participants knew in advance which information would be probed. Control data were collected in 24 age-matched healthy participants.

Results

For patient DG, Bayesian difference (BSDif) tests revealed impairment for serial order WM in both verbal and visuo-spatial modalities, while item WM was mildly decreased in the verbal modality and perfectly preserved in the visual modality (see Figure 1). For patient BM, BSDif tests showed a more global impairment for item and order WM tasks in both modalities, except for non-significant impairment in the visual item WM task. Regarding patient CJ, BSDif tests showed selective serial order WM impairment and this most strongly in the verbal modality, with perfectly preserved performance in the item verbal WM task (Bayesian dissociation test : $p=0.014$). Finally, for patient BA, overall verbal WM impairment was observed, BSDif tests revealing pronounced impairment for both item and serial order WM tasks, while performance was preserved for visual item WM and mildly impaired for visual serial order WM. Note that the four patients showed the same performance on a parallel set of the tasks, confirming the stability of their profiles.

Conclusions

Common WM impairment in verbal and visual modalities was restricted to serial order aspects of information, with furthermore a dissociation between preserved visual item but impaired verbal item WM. The results reveal domain-general serial order WM impairment in nfAPP, whose implications for intervention strategies we will discuss.

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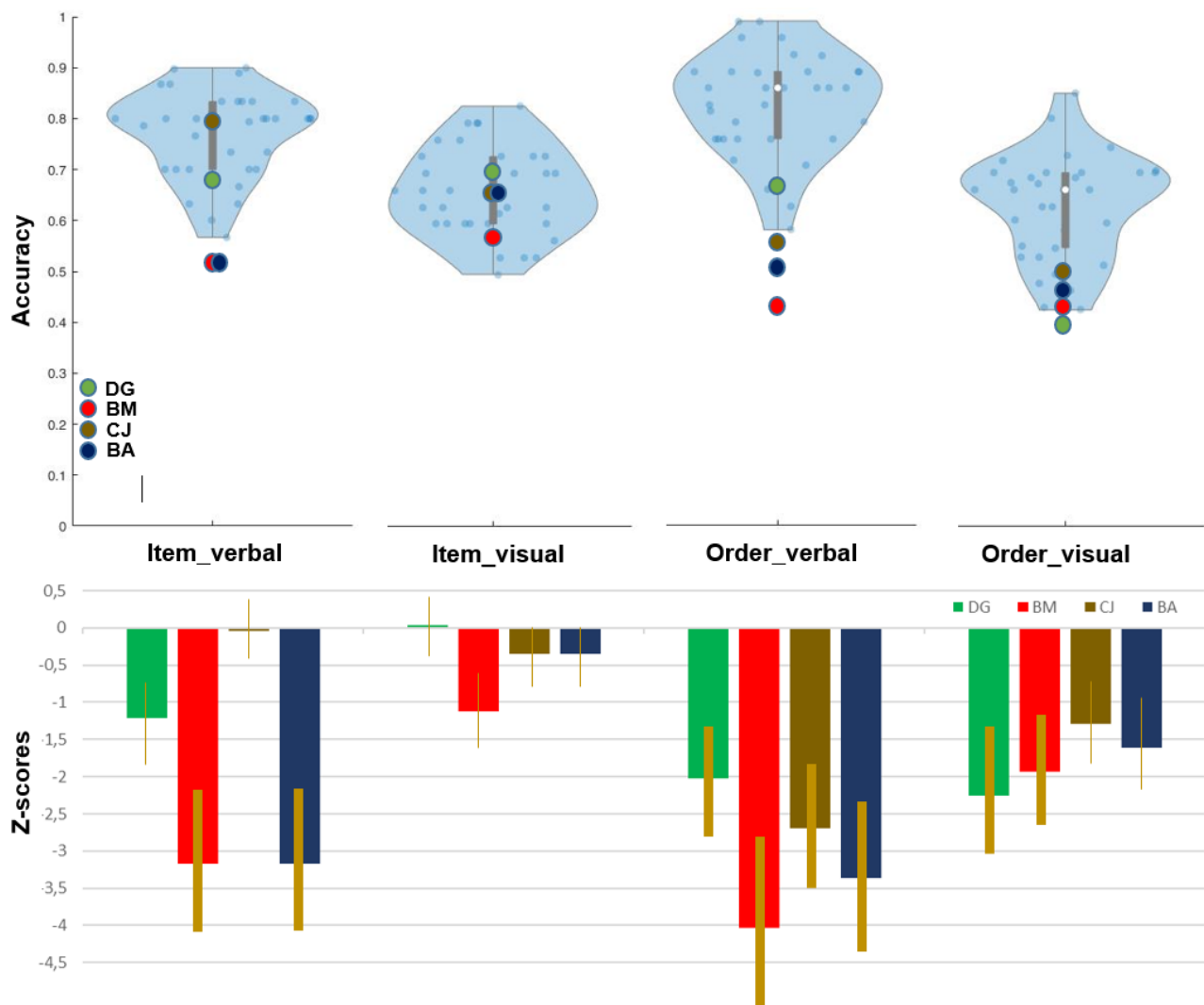


Figure 1. Performance for patients DG, BM, CJ and BA on item and serial order WM tasks in verbal and visual modalities, relative to controls. Upper panel: the colored dots represent patients' accuracies overlaid on the violin plots of accuracies of the control group as a function of WM modality and condition. Lower panel: the bars indicate Z-scores of patient performance relative to controls; the lines on the bars delineate the Bayesian credible intervals of the Z-scores, with strong lines indicating performance significantly different from controls ($p < .05$).

From theory to practice: Implementing aphasia-friendly communication in healthcare

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Introduction

Aphasia, a language disorder often resulting from stroke or brain injury, poses significant challenges to effective communication for individuals affected, persons with aphasia (PWA). In healthcare settings, successful communication between providers and patients with aphasia is crucial for ensuring quality care and patient satisfaction. While research has explored various communication strategies for aphasia, there remains a need to identify practical approaches tailored specifically for healthcare providers. This abstract proposes an investigation into aphasia-friendly communication strategies aimed at enhancing interactions between healthcare providers and individuals with aphasia.

Aphasia-friendly strategies empower patients, even beyond clinics (Godlove & Kiran, 2017). Teletherapy offers promising avenues, especially for underserved populations (Dial et al., 2019). Tablet-based rehabilitation enhances therapeutic interventions (Gallée et al., 2020). Successful implementation relies on staff involvement and education (Jensen et al., 2015; Pound & Jensen, 2018). Nurses' early identification aids in prompt therapy (Poslawsky et al., 2010). Inclusive communication strategies can improve patient satisfaction (Hersh et al., 2016). Tailored CPT for nurses enhances hospital accessibility (Heard & Horsted, 2022). Additionally, computer applications hold potential in aphasia rehabilitation, with a focus on functional and participatory goals (van de Sandt-Koenderman, 2011).

Methods

This study employed a mixed-methods approach to explore aphasia-friendly communication strategies for healthcare providers. Qualitative data were gathered through semi-structured interviews with healthcare professionals experienced in treating individuals with aphasia. These interviews aimed to elucidate current practices, challenges faced, and perceived effectiveness of communication strategies. Quantitative data were collected through surveys distributed to individuals with aphasia, assessing their preferences and experiences regarding communication with healthcare providers.

Results

Qualitative analysis of interviews revealed several key themes regarding communication strategies utilized by healthcare providers. These included the importance of simplifying language, utilizing visual aids, and employing patience and empathy during interactions. Additionally, participants highlighted the value of training and education in aphasia communication for healthcare professionals. Survey results from individuals with aphasia identified specific communication techniques, such as using gestures and allowing sufficient time for comprehension, as particularly beneficial. Moreover, respondents expressed a desire for increased awareness and understanding of aphasia among healthcare providers.

Conclusions

The findings of this study underscore the importance of implementing aphasia-friendly communication strategies in healthcare settings. By adopting approaches such as

simplifying language, utilizing visual aids, and demonstrating patience and empathy, healthcare providers can enhance communication effectiveness and promote patient-centered care for individuals with aphasia. Furthermore, the results highlight the need for ongoing education and training initiatives to equip healthcare professionals with the necessary skills and knowledge to effectively communicate with individuals with aphasia. Future research should focus on the development and evaluation of training programs aimed at enhancing aphasia communication competence among healthcare providers.

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Acknowledgments

This submission is part of a scientific paper.

Assessing dyslexia in Slovenian-speaking children, adolescents and adults

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Introduction

Developmental dyslexia (DD) is the most common learning disability characterized by symptoms affecting reading and spelling. The most prevailing among the theories trying to explain the symptoms is the *phonological theory*, which states that dyslexia results from a phonological coding deficit (Ramus et al., 2006). This means that individuals with dyslexia have difficulties with decoding and identifying phonological properties of speech input, as well as accessing phonological representations in the brain (Shaywitz & Shaywitz, 2005). The abstract presents a linguistically-informed dyslexia assessment protocol for Slovenian-speaking children, adolescents and adults diagnosed with DD and preliminary data from two children.

Dyslexia assessment entails **reading-** and **writing- variables** (*word, pseudoword and text reading, spelling, phonological awareness, orthographic knowledge, phonological memory, rapid automatized naming (RAN), vocabulary*) and **cognitive-related variables** (*verbal and non-verbal IQ, working memory, abstraction and processing speed*) (Reis et. al., 2020). Cross-linguistically, dyslexic individuals show impairments in all domains except IQ tests. Assessments targeting morphological, syntactic, lexical and pragmatic skills (Landerl et al, 2013) highlight delayed morphosyntactic skills (Koster et al., 2005) and delayed vocabulary learning (Cappelli, 2022). Individuals struggle with segmenting morphologically complex words (decomposing *sing-er* -> *sing* + *er*) and with detecting the stem of multimorphemic words, consequently affecting comprehension (Casalis et al., 2004).

Methods

Up to now, we recruited two participants aged 12 to perform evaluation tests: a girl with reading difficulties (RD) but no confirmed diagnosis; a boy without RD – control. By the time of the conference, we will have assessed at least 10 more participants in each group (dyslexia vs. controls).

Evaluation tests.

1. Reading assessment: timed text reading (reading speed, accuracy).
2. Phonological awareness (see Table 1 for tasks)
3. Morphological awareness
4. Lexical Retrieval (RAN)
5. Spelling
6. Working memory
7. Semantic fluency

Results

Considerable differences were observed in **reading assessment**: in 30 seconds, the child with RD read 54 words, while the control read 88. Completion times for RAN, phonological, and morphological tasks also differ considerably (see Graph 1 and Table 1). **RAN**: RD took 47 seconds compared to control's 39 seconds. **Phonological awareness**: RD took 550 seconds vs. control's 367 seconds for the whole battery. **Morphological awareness**: RD took 630 seconds compared to control's 466 seconds. RD made 10 errors reading 52

pseudowords, while the control made none, and had 6 errors in pseudoword phoneme removal compared to control's one error.

Conclusions

Preliminary results show differences between the two children, likely reflecting the general population. Phonological and morphological awareness domains are considerably impaired, with the greatest differences reflected in *processing time*, indicating delays in word decomposition. This is additionally supported by the time differences in RAN and the fact that the child with RD made most errors in tasks concerning pseudowords, which are not listed in the mental lexicon, thus requiring segmentation. The results align with the *phonological theory*, which includes a *double deficit hypothesis* (Wolf & Bowers, 1999), identifying phonological awareness and RAN as key cognitive markers of DD, predicting reading speed even in transparent orthographies, such as Slovenian.

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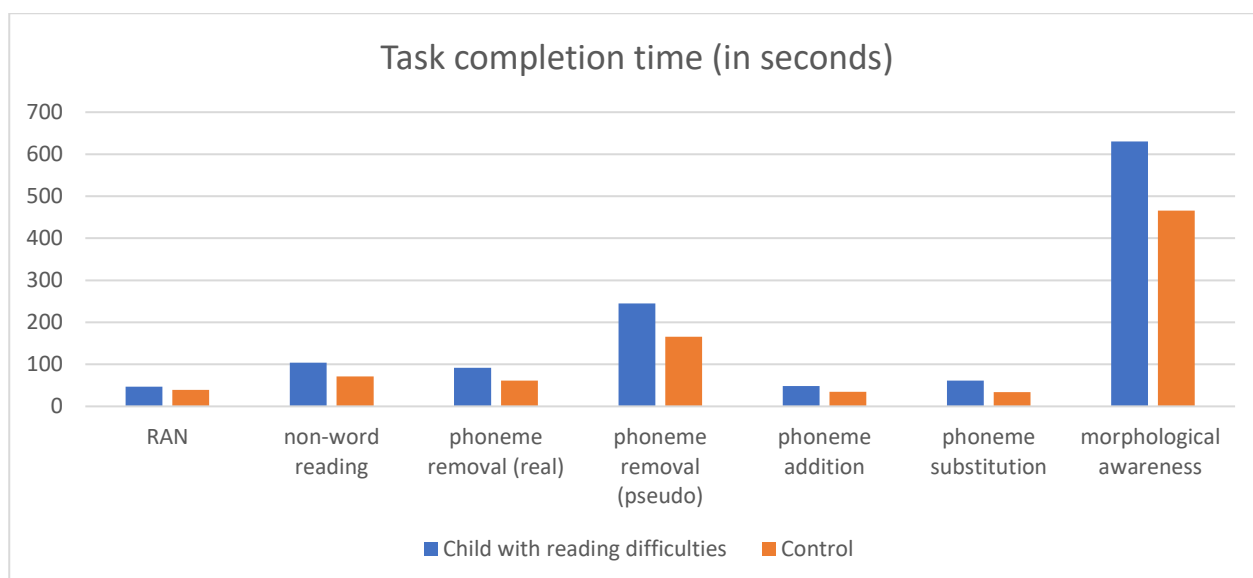


Figure 20. Figure shows time for completion of tasks in seconds.

Table 1. Table shows time for completion of tasks in seconds.

Evaluation task	Time for completion (seconds)	
	<i>Child with RD</i>	<i>Control</i>
rapid automatized naming (RAN)	47	39
non-word reading	104	71
phoneme removal (real words) [e.g. <i>dlan</i> 'palm' without // -> <i>dan</i> 'day']	92	61
phoneme removal (pseudowords) [e.g. <i>*skupul</i> without /k/ <i>supul</i>]	245	166
phoneme addition [osa 'wasp' add /k/ -> <i>kosa</i> 'skythe']	48	35
phoneme substitution [<i>naga</i> 'naked' – <i>žoga</i> 'ball' exchange /n/ and /ž/ -> <i>žaga</i> 'saw', <i>noga</i> 'foot']	61	34
morphological awareness battery [formation of diminutives, agentive and process nouns, pluralization]	630	466
Total	1227	872

Lexical vs. grammatical aspect markers in Chinese aphasia

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Introduction

Usage-based approaches to language are casting new light on aphasic speech. According to one such theory, the ProGram theory (Boye & Harder, 2012), the grammatical-lexical distinction is a conventionalized means for prioritizing parts of complex linguistic messages. Lexical items have the potential to be discourse primary (i.e. attentionally foregrounded), while grammatical items are conventionalized and entrenched as discourse secondary (i.e. attentionally backgrounded). Hence, only the former can be focalized, addressed in subsequent discourse, and modified (Boye & Harder, 2012; Boye et al., 2023; Martínez-Ferreiro et al., 2020).

A growing number of cross-linguistic empirical studies support the ProGram theory. Our aim is to test the theory on a typologically different language and a new set of linguistic elements, the Chinese aspect markers.

Four markers were selected: resultative *wán*, progressive *zài*, durative *zhe*, and perfective *le*. These markers were classified as grammatical or lexical based on native speakers' responses to the focus and addressability tests (Sun & Boye, 2019). Perfective *le* and durative *zhe* were classified as grammatical, as they cannot be focused or addressed independently. Progressive *zài* and resultative *wán* passed the focus test, and were therefore classified as lexical.

If these classifications are significant for the description of agrammatic Mandarin Chinese, *le* and *zhe* are as grammatical particles expected to be underproduced in agrammatic speech, whereas the proportion of the lexical particles *zài* and *wán* will not differ from that found in the speech of controls.

Methods

Six Mandarin Chinese participants (5 male; mean age: 51.17 y. o.; SD: 9.04) with chronic agrammatic aphasia (PWAs) were asked to describe three pictures adapted to Chinese speakers (Pak-Hin & Law, 2004; Ho, 2007): the cookie theft picture (BDAE; Goodglass & Kaplan, 1983), the picnic scene (WAB; Kertesz, 1982), and the living room scene (Cantonese WAB; Yiu, 1992). Patients' performance was compared to that of a control group (NBDs).

Only unambiguous instances of the four aspect markers were included in the analysis. Since the length of the speech samples varied across participants and groups, production was compared in terms of proportions. Fisher's exact was used for statistical analysis.

Results

Out of 1873 words, PWAs produced six instances of *le* and three instances of *zhe*. In the control group, out of 2978 words, there were 35 instances of *le* and 79 instances of *zhe*. Proportions of these grammatical markers were significantly lower in the PWA group ($p = .0011$, and $p < .00001$, respectively).

Regarding lexical markers, PWAs produced a total of 23 cases of *zài*, and only one instance of *wán*. The NBDs produced 26 cases of *zài*, and (like the PWAs) only one instance of *wán*. The proportions of *zài* and *wán* produced by PWA did not differ from those produced by the NBDs ($p = .2411$, and $p = 1$, respectively).

Conclusions

The results confirm our hypotheses and show that a classification of Chinese aspectual markers based on the ProGram theory is significant for the description of agrammatic speech.

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Understanding the relationship between naming and verbal learning in the three primary progressive aphasia variants

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Introduction

Primary progressive aphasia (PPA) is a known neurodegenerative syndrome primarily affecting language functions (Gorno-Tempini et al., 2011). Three variants—semantic (svPPA), nonfluent (nfvPPA), and logopenic (lvPPA)—are distinguished by clinical profiles, atrophy patterns, and underlying pathology. Increasingly, it is recognized that PPA also impacts other cognitive domains such as memory, learning, and executive functions (see Coemans et al., 2022 for a meta-analysis of executive function impairments in PPA). In fact, we and others have found that baseline measures, and verbal learning in particular, are related to treatment outcomes in PPA (de Aguiar et al., 2020; McConathey et al., 2017). However, the relationship between verbal learning and naming impairments, one of the most common features of language impairments, is poorly documented in PPA. Understanding verbal learning and memory impairments in the three PPA variants, and their relation to naming abilities, will inform rehabilitation efforts for improving naming.

Methods

Forty-seven participants (24 individuals with lvPPA (12 F), 13 with nfvPPA (5 F), and 10 with svPPA (7 F)), matched for age, time post-onset, overall severity and language severity underwent neurocognitive assessment. We evaluated naming derived from the short version of the Boston Naming Test (BNT) and the Hopkins Action Naming Assessment (HANA), and memory and learning derived from the Rey Auditory Verbal Learning Test (RAVLT). We performed two types of models: Type 1 models examined each outcome measure with variant diagnosis as the predictor. Type 2 models included four models that used diagnosis and verbal learning measures as predictors, with naming as the dependent variable.

Results

The analysis revealed significant main effects of PPA variant on learning and naming measures. Individuals with nfvPPA also performed significantly better in naming (combined nouns and verbs score) compared to both lvPPA and svPPA and individuals with lvPPA perform better than those with svPPA. For all learning measures (RAVLT 1–immediate recall, RAVLT total–sum of 5 trials, RAVLT 7–recall after interference, and RAVLT 8–delayed recall), individuals with nfvPPA outperformed both lvPPA and svPPA, with no significant difference between lvPPA and svPPA (see Table 1 and Figure 1). Furthermore, naming was significantly associated with verbal learning, specifically with immediate recall and total learning measures (see Table 1).

Conclusions

This study highlights the interaction between naming and verbal learning across the three PPA variants. Specifically, all variants were different in naming measures with nfvPPA performing better than the rest: nfvPPA>lvPP>svPPA. Furthermore, individuals with nfvPPA outperform those with lvPPA and svPPA in verbal learning. The superior learning performance of nfvPPA individuals and the significant association between RAVLT scores

and naming performance may explain their better naming outcomes and their more favorable response to treatment, as noted in many studies (de Aguiar et al., 2020). These findings underscore the importance of considering cognitive profiles other than language, such as learning and recall abilities, in assessing PPA and determining treatment. Further research exploring cognitive domain interactions and neuronal underpinnings could inform tailored interventions for PPA individuals.

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Table 1. Summary of type 1 and type 2 models of regression analysis for naming and learning outcomes by PPA variant.

Type 1	Model Fit			Coefficients		
	F (df1, df2)	p	Adjusted R ²	lvPPA	nfvPPA	svPPA
i. Immediate recall (RAVLT 1 score)	6.5471 (2, 41)	p=0.0034	0.2051	p<0.0001	p=0.0019	p=0.7341
ii. Total learning (RAVLT total score)	10.832 (2, 41)	p=0.0002	0.3138	p<0.0001	p<0.0001	p=0.9660
iii. Recall after interference (RAVLT 7 score)	13.764 (2, 41)	p<0.0001	0.3725	p<0.0001	p<0.0001	p=0.2770
iv. Delayed recall (RAVLT 8 score)	14.941 (2, 41)	p<0.0001	0.3934	p<0.0001	p<0.0001	p=0.4459
v. Naming (Combined naming score)	20.14 (2, 43)	p<0.0001	0.4597	p<0.0001	p=0.0339	p<0.0001

Type 2	F (df1, df2)	p	Adjusted R ² *	lvPPA	nfvPPA	svPPA	RAVLT score
v. a) Naming ~ Variant * RAVLT 1	9.823 (5, 37)	p<0.0001	0.5123 (+0.0526)	p<0.0001	p=0.0141	p=0.0102	p=0.0130
v. b) Naming ~ Variant * RAVLT total	9.199 (5, 37)	p<0.0001	0.4939 (+0.0342)	p<0.0001	p=0.5291	p=0.0085	p=0.0670
v. c) Naming ~ Variant * RAVLT 7	8.527 (5, 37)	p<0.0001	0.4726 (+0.0129)	p<0.0001	p=0.9421	p=0.0082	p=0.1598
v. d) Naming ~ Variant * RAVLT 8	9.036 (5, 37)	p<0.0001	0.4889 (+0.0292)	p<0.0001	p=0.8852	p=0.0005	p=0.1227

Reference group is lvPPA.
Type 1 models show the regression results for all outcomes with variants as predictors. Type 2 models show the regression results for naming with variants, learning and their interaction as predictors.
*Adjusted R² presented in the Model type 2 panel represent the model adjusted R² and the added explained variance compared to the relevant type 1 model.

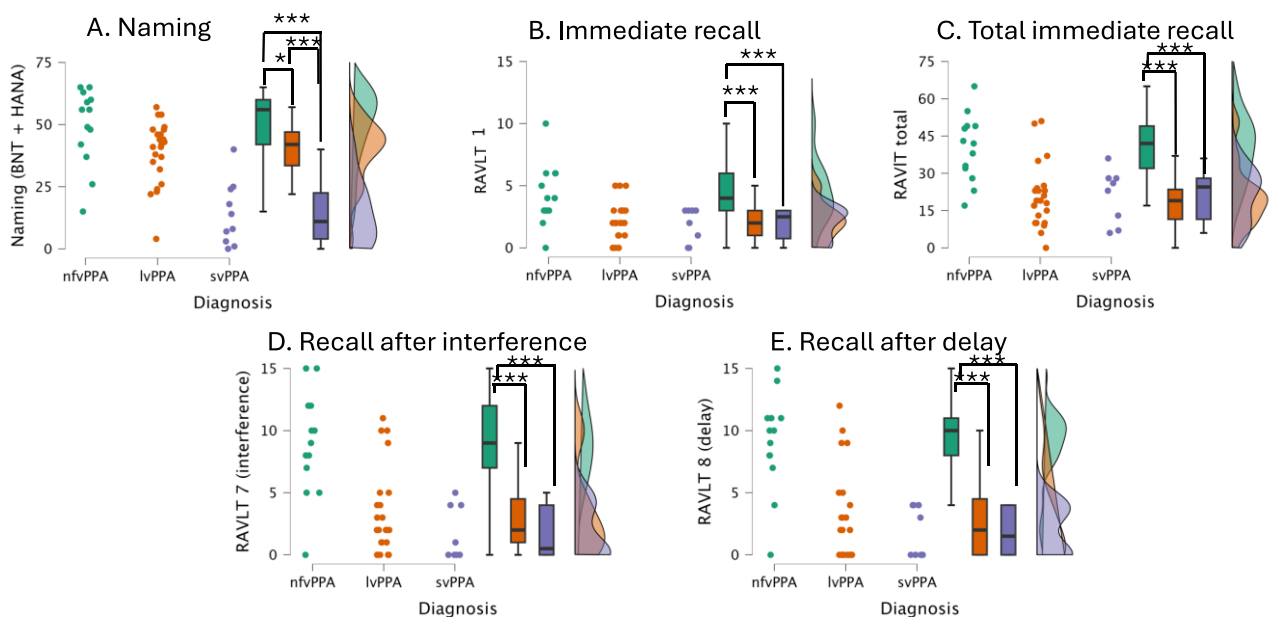


Figure 1. Plots representing the individual performances and the different outcome measures per PPA variant.

Drivers of depression in post-stroke aphasia

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Introduction

Approximately one third of stroke survivors suffer from post-stroke depression (PSD) (Hackett et al., 2005). PSD reduces quality of life (Villa et al., 2018) and is associated with increased risk of mortality (Cai et al., 2019). Previous studies have often focused on the acute/subacute phases of recovery. Reviews have identified several predictors of PSD, including stroke severity, physical disability, cognitive impairment, history of psychiatric disorders, and lack of social support (Ayerbe et al., 2013; Ladwig et al., 2023). Studies have also explored relationships between lesion location and PSD, but the results are conflicting. Individuals with aphasia are often excluded from studies of PSD due to language comprehension concerns (Medeiros et al., 2020), so it is unclear if prior findings generalize to this population. To address this gap, we first examine relationships between demographic factors, different types of disability and impairment, and symptoms of depression in adults with chronic left-hemisphere stroke. We then investigate associations between lesion location and damage to specific white matter connections and PSD.

Methods

Participants were 93 individuals with left-hemisphere stroke, primarily in the chronic phase, and 70 matched controls. Participants completed the Beck Depression Inventory-II (BDI-II) to evaluate severity of depressive symptoms. Stroke survivors also completed the Stroke Impact Scale 3.0 (SIS) to assess disability and health-related quality of life. SIS items were parcelized into physical, cognitive, social, and recovery scores (Vellone et al., 2015). An ordinal regression (Model 1) compared BDI-II total scores between stroke survivors and controls, including demographic factors and antidepressant medication status. Another ordinal regression (Model 2) tested BDI-II scores in stroke survivors as a function of the same demographic factors, plus SIS scores, time-since-stroke, and measures of language and motor impairment (Western Aphasia Battery Aphasia Quotient (WAB-AQ), NIH Stroke Scale (NIHSS) total motor score). Multivariate Voxel- (SVR-VLSM) and Connectome-based (CLSM) Lesion-Symptom Mapping were applied to identify lesion locations and disconnections related to BDI-II scores (DeMarco and Turkeltaub, 2018). Significant predictors from the ordinal regressions were regressed out of behavioral and lesion data, and permutation analyses were used to establish feature-wise statistical thresholds and control the family-wise error rate.

Results

As expected, Model 1 demonstrated that stroke survivors had higher depression scores than controls. Age and education were inversely related to BDI-II scores. In Model 2, the SIS Cognitive, Social, and Recovery scores, but not the SIS Physical score or the language and motor impairment measures, predicted depression symptoms. The SVR-VLSM and CLSM analyses did not reveal any significant results associated with PSD symptoms.

Conclusions

The factors related to PSD are somewhat different in chronic left-hemisphere stroke than in other previously examined populations. Cognitive disabilities, social engagement, and self-perceived recovery, but not physical disability, were related to PSD in our sample. Measures of impairment were also not associated with PSD, illustrating the importance of self-reported outcome measures. Contrary to some previous studies, we did not find a relationship between lesion location or specific disconnections and PSD. Examining large-scale network disruptions may reveal more complex lesion-behavior relationships in PSD.

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Table 1. Sample descriptives and model statistics.

	Stroke Mean ($\pm$ SD)	Control Mean ($\pm$ SD)	Model 1 stats (stroke vs. control)	Model 2 stats (stroke only)
Number of Participants	93	70	$\beta = -1.309^{***}$	—
Age	59.43 ($\pm$ 11.61)	60.37 ($\pm$ 11.59)	$\beta = -0.027^*$	$\beta = -0.030$
Education	16.36 ($\pm$ 2.99)	17.19 ($\pm$ 2.54)	$\beta = -0.107^*$	$\beta = -0.089$
Race	40.9 % Black, 59.1 % White	34.3 % Black, 65.7% White	$\beta = -0.473$	$\beta = -0.652$
Gender	41.9 % Female, 58.1 % Male	51.4 % Female, 48.6% Male	$\beta = -0.320$	$\beta = -0.002$
SES Neighborhood Score	9.54 ($\pm$ 0.73)	9.51 ($\pm$ 0.74)	$\beta = 0.328$	$\beta = 0.018$
Time since Stroke (months)	44.40 ($\pm$ 51.37)	—	—	$\beta = 0.006$
Antidepressant Status	13%	16%	$\beta = -0.192$	$\beta = 0.158$
WAB-AQ	77.73 ($\pm$ 22.14)	—	—	$\beta = 0.006$
NIHSS Total Motor Score	1.23 ($\pm$ 1.90)	—	—	$\beta = 0.051$
SIS Cognitive Score	71.81 ($\pm$ 18.87)	—	—	$\beta = -0.033^*$
SIS Social Score	68.28 ($\pm$ 24.92)	—	—	$\beta = -0.028^*$
SIS Recovery Score	67.40 ($\pm$ 18.46)	—	—	$\beta = -0.041^{**}$
SIS Physical Score	73.09 ($\pm$ 24.09)	—	—	$\beta = 0.025$
BDI	7.66 ($\pm$ 6.25)	4.03 ($\pm$ 5.29)	—	—
Overall model fit	—	—	$\chi^2 = 34.77^{***}$	$\chi^2 = 52.31^{***}$
p < 0.05, **p < 0.01, ***p < 0.001				

A case of apraxia of speech with whispering voice

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Introduction

Apraxia of speech is a condition of a speech sound disorder, in which the ability to plan and execute muscle movements to produce sound is impaired, making fluent speech difficult. Some reports suggest that speech abnormalities in apraxia of speech patients are caused by a disorder of the intentional movement in articulation organs including the co-ordination disorder in expiration and/or glottal closure. Several training methods have been reported, including the use of auditory feedback and relearning speech movements, but there are no reports on whispering voice.

We report a case in which a patient improved fluency by speaking in whispering voice.

Methods

A woman in her 70s who came to the hospital with a chief complaint of language disorder, there is no neurological findings without speech dysfunction. Brain MRI, IMP-SPECT, nasopharyngoscopy, neuropsychological test, assessment of motor speech for dysarthria (AMSD), and language evaluation were evaluated and followed for 2 years. Her speech rate was faster in whispering than normal voiced speech.

Results

Follow-up result of Western aphasia battery, ASD, and neuropsychological tests over the two-year period are described in Table 1.

Language comprehension remained good with no change over the two years.

Speech became more spastic and effortful over the two years. Over the course of two years, her speech impediments became progressively more pronounced, with labored trial and error and attempts at self-correction, abnormalities in rhythm, intonation, and difficulty in initiating utterances. Although her speech with both normal and whispering voice showed a decrease in speaking rate, whispering voice was better than normal voice in speaking rate. In addition, maximum phonation time decreased gradually. Neuropsychological test showed a decline in frontal lobe function at two years compared to the initial assessment, but remained within the age average.

Imaging findings showed mild hypoperfusion in bilateral frontal, parietal, and temporal lobes on IMP-SPECT. Brain MRI showed lacune, mild white matter lesions, and microbleeds around the ventricles. Nasopharyngoscopy revealed no paralysis or dystonia of the vocal cords.

Conclusions

The speech disturbance in this case was thought to be apraxia of speech from ruling out muscle weakness or aphasia. Findings of ASD, the coordination of breathing and speech production may be involved. This case is an important finding that suggests a relationship between the pathophysiology of speech apraxia and the mechanism of speech production. The use of whispering voice may be an effective tool in the rehabilitation of patients with apraxia of speech. Further research on the relationship between apraxia of speech and whispering voice is expected in the future.

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Table 1. Follow-up evaluation of aphasia, motor speech, and neuropsychological tests

	Initial evaluation	1 year later evaluation	2 year later evaluation
Western Aphasia Battery			
Spontaneous speech	18/20	14/20	14/20
Assessment of Motor Speech for Dysarthria			
speaking rate	voiced:3.6 word/s	voiced:2.2 word/s	voiced:2.0 word/s
	voiceless:4.6 word/s	voiceless:3.9 word/s	voiceless:2.6 word/s
Maximum Expiratory Time	20.7s	13.7s	10.1s
Maximum Phonation Time	18.7s	5.6s	2.3s
Neuropsychological test			
Trail making test -A	112s		181s
Trail making test -B	139s		315s
Word fluency (Category)	17 words		12 words
Word fluency (letter)	9 words		5 words

Exploring generalization of cerebellar tDCS gains to discourse skills in chronic aphasia

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Introduction

Studies have shown that cerebellar transcranial direct current stimulation (tDCS) can aid in chronic aphasia recovery (DeMarco et al., 2021; Marangolo et al., 2018; Sebastian et al., 2017, 2020). Our prior work showed that stroke participants with aphasia demonstrated post-treatment gains on trained items with generalization to untrained items and functional communication skills with cerebellar tDCS (Kim et al., 2024; Sebastian et al., 2017, 2020). However, it is not clear whether treatment gains would generalize to discourse skills. Thus, we investigated whether cerebellar tDCS coupled with computerized aphasia treatment targeting lexical semantics can improve discourse skills in individuals with chronic aphasia.

Methods

Twenty participants (mean age=66, 2 females) with chronic aphasia (mean time post-onset=42.25 months) due to left hemisphere stroke were included in a randomized, double-blind, sham-controlled, within-subject crossover trial. This study included 2 intervention periods of 15 treatment sessions (3-5 sessions per week) with cerebellar tDCS + computerized aphasia therapy and sham + computerized aphasia therapy, separated by a 2-month wash-out period. Standardized language testing was administered pre- and post-treatment for each period. Discourse skills were assessed via administration of the Cookie Theft picture description from the Boston Diagnostic Aphasia Examination (BDAE, Goodglass et al., 2001). Picture descriptions were scored for number of words, syllables, total Content Units (CU), and syllables/CU according to standardized scoring (Agis et al., 2016; Yorkston & Beukelman, 1980). We investigated change in content (CUs) and change in efficiency (syllables/CUs) of picture description pre-treatment to post-treatment for tDCS and sham conditions. Paired sample t-tests were used to compare change in CU and syllables/CUs between tDCS and sham.

Results

The results showed an increase in CU from pre-treatment to post-treatment in both tDCS (mean change=0.35, SD=2.83) and sham conditions (mean change=0.55, SD=2.93). Similarly, there were gains in efficiency of discourse from pre-treatment to post-treatment in both the tDCS (mean change=-6.14, SD=21.7) and sham group (mean change=-5.37, SD=21.65). Fewer syllables/CU reflects fewer perseverations, circumlocutions, and interjections (e.g., “um”) and greater communicative efficiency. However, there were no significant differences between tDCS and sham conditions for CU [$t(19)=0.19$, $p=0.840$] and syllables/CU [$t(18)=0.10$, $p=0.91$]. Although the changes did not reach statistical significance at the group level, inspection of individual participant data demonstrated that several participants showed marked improvement in communication efficiency post-treatment in both sham and tDCS conditions. Most notable improvements were observed for participants who had BDAE aphasia severity scores of 2. Participants with aphasia severity scores of 1, 3, or 4 showed minimal improvement, suggesting that aphasia severity may play an important role in treatment generalization effects.

Conclusion

The results of this study indicate that there was no generalization of treatment effects to discourse. It is unclear if this is due to low sample size, the computerized treatment utilized, or study design. A larger study (NCT05093673) is underway based on the preliminary results. Studying the generalization effect of word retrieval ability in discourse is crucial as discourse reflects how people with aphasia (PWA) perform their daily communicative activities (Dipper et al., 2021).

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Potential neural mechanisms in aphasia recovery

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Introduction

The mechanisms underlying functional reorganization during recovery from aphasia remain a subject of debate. While there is evidence suggesting that both hemispheres contribute to recovery, the precise roles are not fully understood. This presentation examines the roles of both hemispheres in aphasia recovery by revisiting our previous findings using Single Photon Emission Computed Tomography (SPECT) and incorporating insights from recent functional MRI (fMRI) studies.

Methods and Results

Prospective Study. We studied 20 right-handed adults with aphasia following an acute cerebrovascular accident (CVA) in the left middle cerebral artery territory. Language evaluations were conducted using the Japanese Standard Language Test of Aphasia (SLTA), and SPECT scans were performed at approximately 3.2 and 9.2 months post-onset. A significant correlation was observed between the severity of initial language deficits and initial regional cerebral blood flow (rCBF) in the left hemisphere, but not in the right. Additionally, changes in the left rCBF correlated with improvements in SLTA scores over time, whereas the right hemisphere showed no such correlation.

Retrospective Study. In another cohort of 16 right-handed patients with residual aphasia, we conducted SLTA and SPECT assessments at an average of 82.8 months post-onset. Unlike the prospective study, this retrospective analysis revealed no significant difference in mean left hemispheric CBF between patients with good and poor recovery outcomes at approximately 7 years post-onset. However, those in the good recovery group exhibited higher mean right rCBF in the frontal and thalamic regions, as well as in the left frontal region, compared to the poor recovery group.

Case Study in Pediatric Aphasia. A 9-year-old boy with aphasia was followed from 3 months to 10 years and 5 months post-stroke, with five SLTA assessments and four SPECT scans. This longitudinal case study revealed varying patterns of hemispheric dominance in rCBF. The Broca and supplementary motor areas consistently exhibited right hemisphere dominance, while Wernicke's area showed early left hemisphere dominance that shifted to the right in later stages. In the primary auditory area, right hemisphere dominance only emerged in the late stages of recovery.

Conclusions

These studies collectively suggest that both hemispheres are involved in the long-term recovery from aphasia, with the specific locations of functional reorganization depending on the regions of interest and the stage of recovery. The findings indicate that aphasia recovery involves complex interactions within larger neural networks. Recent fMRI studies support the notion that the involvement of the left and right hemispheres varies with the recovery stage, often working in a complementary manner. In the early stages, a global network

breakdown is typically observed, followed by a normalization of traditional left hemisphere language networks. Depending on individual characteristics, right hemisphere regions and bilateral domain-general regions may be recruited to support recovery. Future research on aphasia recovery should include larger-scale and long-term studies utilizing fMRI, alongside more individualized investigations that account for the variability in recovery among cases.

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Fluency improvement in aphasia through sentence-level training

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Introduction

Verbal expression in persons with aphasia (PWA) is characterized by frequent disfluencies such as lexical repetitions, filled pauses, and self-corrections. Research suggests that disfluencies arise from various underlying deficits such as impaired syntactic encoding processes, lexical retrieval, and/or motor speech abilities (Baqué & Machuca, 2023; Bosshardt, 2002; Clough & Gordon, 2020; Goldberg et al., 2012; Heller & Goldrick, 2014; Pelczarski et al., 2019). Data on speech fluency from aphasia assessments serves as a crucial clinical marker to determine aphasia types and severity and predict prognosis (Cordella et al., 2024). However, existing aphasia treatments prioritize measuring changes in production accuracy, with improved fluency not typically regarded as a primary approach to enhancing language recovery.

To examine the potential connection of fluency and language production, we investigated whether PWA demonstrate improved fluency following sentence production priming training (Lee & Man, 2017; Van Boxtel et al., 2023). Specifically, we explored whether fluency and production accuracy improve in parallel, and if so, which specific types of disfluencies are most responsive to improved sentence encoding abilities.

Methods

Thirty-two PWA and 32 healthy age-matched controls completed a sentence production priming treatment, targeting passive and dative sentences. Before treatment and immediately and one week after treatment, sentence completion probes were taken to measure improvements in the participants' sentence production and fluency. Each sentence response was transcribed and coded for accuracy and the number of disfluencies produced. Then, the disfluencies were classified into filled pauses, self-corrections, or lexical repetitions, following previous studies (Arslan & Göksun, 2022; Maclay & Osgood, 1959).

Results

As the participants improved in their sentence production accuracies, overall numbers of disfluencies decreased in both groups from baseline to immediate post-testing ($z = -3.640$, $p < .001$). This decrease was maintained at delayed post-testing ($z = -3.640$, $p < .001$). The self-corrections declined from baseline to immediate ($z = -2.614$, $p = .009$) and delayed post-testing ($z = -3.567$, $p < .001$); these declines were stronger in PWA than controls ($z_s < -3$, $p_s < .001$). Instances of filled pauses decreased reliably from baseline to immediate post-testing in both groups ($z = -2.587$, $p < .01$) but not to delayed post-testing overall ($z = -1.399$, $p = .16$). Nevertheless, PWA specifically did show a decrease in filled pauses at delayed post-testing ($z = -4.799$, $p < .001$). Only marginal or non-significant changes were shown in lexical repetitions between testing sessions in either group ($p_s \geq .05$).

Conclusions

Speech fluency was effectively improved in PWA (and controls) following sentence production priming training. The overall reduction in disfluencies reflects the impact of

improved sentence production, particularly evident in decreased filled pauses and self-corrections. Given that our training primarily targeted syntactic rather than lexical production, less consistent reductions in lexical repetitions were not unexpected. These findings together suggest that (a) there is a parallel and systematic improvement between sentence encoding processes and speech disfluencies, (b) sentence-level training is effective to facilitate speech fluency in aphasia, and (c) underscore the importance of speech fluency measures in aphasia rehabilitation.

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Prefrontal cortical activation and hemispheric lateralization during cognitive processing in aphasia: An exploratory fNIRS investigation

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Introduction

Persons with aphasia (PWA) present with working memory (WM) deficits that contribute to their language processing impairments (Wright & Shisler, 2005). Evidence from event-related neuroimaging studies have highlighted the role of lateral prefrontal cortex (PFC) in maintenance and manipulation of information during WM processing (D'Esposito et al., 2002). Only a few aphasia studies have been reported using fNIRS. Our objective is to understand the neural mechanisms underlying WM processes and shed light on the relationship between PFC activation and WM cognitive load in PWA.

Methods

A 16-channel fNIRS 2000C Imager (Biopac, Inc) was used to measure hemodynamic responses from 10 PWA and 10 age and sex-matched neurotypical healthy controls (HC). Participants engaged in 1) a visual n-back task of varying cognitive load- 1-back (low) and 2-back (high) to assess WM, and 2) the Raven's Colored Progressive Matrices (RCPM) to evaluate non-verbal problem-solving and reasoning skills. Behavioral performance accuracy was recorded. The hemodynamic response (oxygenation change or Hb-Oxy) was recorded from the 16 PFC optodes grouped into four quadrants, Q1: lateral left, Q2: medial left, Q3: medial right and Q4: lateral right.

Results

1. n-back- Both groups demonstrated significantly shorter average RT during the low load compared to high load condition (PWA: $p = .02$, HC: $p = .01$), alongside higher accuracy rates on low load condition, with statistical significance observed for both PWA ($p = .01$) and HC ($p < .01$). During low load condition, both groups displayed bilateral lateral PFC activations and on the high load condition, HC exhibited increased activation primarily in the left lateral PFC, whereas PWA demonstrated on the right lateral PFC (Table 1). Between groups revealed that during the low load condition, significant differences in Hb-Oxy were noted in Q2, Q3, and Q4 ($p < .001$ for all) except Q1 ($p = .23$) quadrant, and during the high-load significant differences were observed across all four quadrants ($p < .001$). Within each group, significant differences were observed between both tasks on all quadrants ($p < .001$ for all comparisons).

2. RCPM- Average RT was slower for PWA ($3818.9 \pm 475.96\text{ms}$) than HC ($2898.09 \pm 346.02\text{ms}$) and performance accuracy was greater for HC. PWA exhibited increased Hb-Oxy in bilateral lateral PFC regions, whereas HC showed on bilateral medial PFC regions (Figure 1).

Conclusions

Performance differences on the n-back and RCPM tasks suggest compromised WM and problem-solving abilities in PWA. This study revealed a distinctive activation pattern in the right lateral PFC among PWA under increased cognitive load, implying right hemisphere involvement to compensate for left hemisphere lesions. Our finding aligns with previous studies indicating role of lateral PFC in WM processing as n-back requires active monitoring

and manipulation of the incoming information, functions that are primarily governed by the lateral PFC (D'Esposito et al., 2002). On the RCPM, PWA demonstrated decreased performance accuracy and relied more heavily on bilateral lateral PFC regions (Fedorenko et al., 2013). Future fNIRS studies should correlate with lesion site, severity, and type of aphasia, while exploring everyday language-based communication abilities in aphasia.

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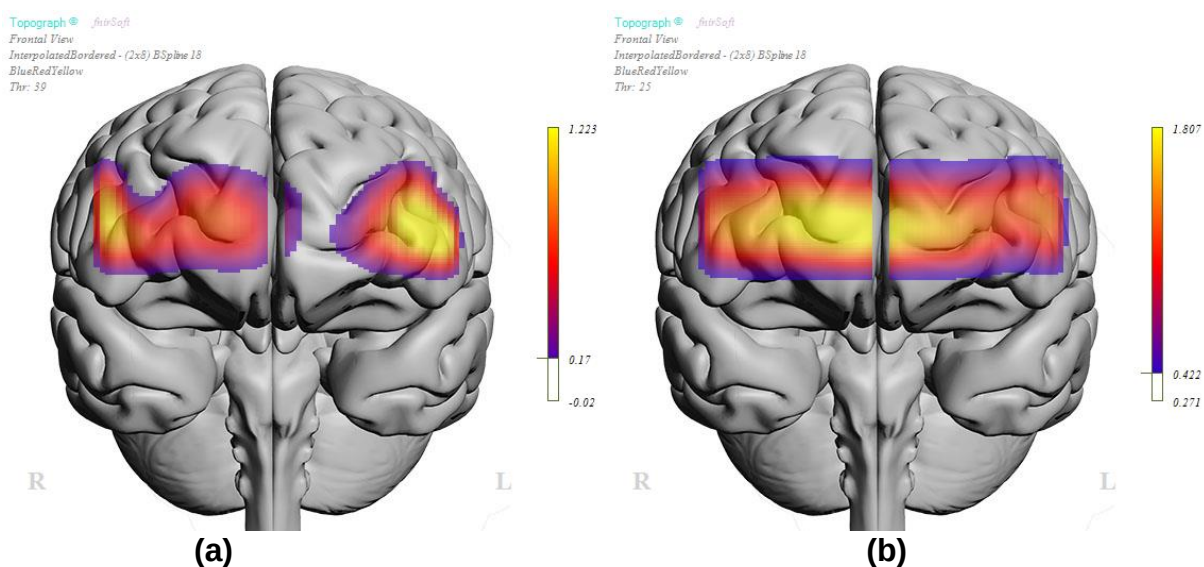


Figure 1: Topographical representation of the PFC activation during: (a) RCPM for persons with aphasia, (b) RCPM for healthy controls.

Table 1. Results from the factorial ANOVA comparisons of oxygenation changes ($\mu\text{mol/l}$) between participant groups, working memory loads, and prefrontal cortical quadrants.

	Persons with aphasia			Healthy controls			Between groups comparisons on tasks (p)	
	1-back	2-back	Within group comparison between tasks (p)	1-back	2-back	Within group comparison between tasks (p)	1-back	2-back
Q1	0.65 ± 0.50	1.61 ± 0.62	<.001	0.62 ± 0.6	2.24 ± 0.92	<.001	.23	<.001
Q2	0.67 ± 0.47	1.87 ± 0.70	<.001	0.90 ± 0.48	1.80 ± 0.75	<.001	<.001	.001
Q3	0.62 ± 0.35	2.10 ± 0.80	<.001	1.04 ± 0.46	1.73 ± 0.71	<.001	<.001	<.001
Q4	0.71 ± 0.45	1.90 ± 0.92	<.001	1.13 ± 0.53	1.80 ± 0.74	<.001	<.001	<.001
Between quadrants (p)	.002	<.001		<.001	<.001		<.001	<.001

Note. Prefrontal quadrants- Q1: lateral left (optodes 1-4), Q2: medial left (optodes 5-8), Q3: medial right (optodes 9-12) and Q4: lateral right (optodes 13-16).

Semantic fluency task as a sensitive tool for detecting clinical stages in three FTD genetic mutations

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Introduction

Frontotemporal dementia (FTD) is an early-onset neurodegenerative condition that includes a variety of clinical and pathological disorders. Investigating its pre-symptomatic phase offers the potential to identify biomarkers and enable early intervention. Alterations in semantic networks have been noted in the early stages of various neurodegenerative diseases. Current studies on pre-symptomatic genetic FTD have not fully explored the qualitative, psycholinguistic information, and semantic networks inherent in their findings. Building on prior research demonstrating alterations in semantic networks among patients with other types of cognitive decline, our investigation extends to pre-symptomatic FTD mutation carriers.

This cross-sectional study aims to evaluate the sensitivity of the semantic verbal fluency (SVF) task as a clinical tool for differentiating pre-symptomatic FTD mutation carriers—progranulin (GRN), chromosome 9 open reading frame 72 (C9orf72), and microtubule-associated protein tau (MAPT)—from genetic controls who belong to families with genetic FTD history.

Methods

We used the SNAFU (Semantic Network and Fluency Utility) Python library to quantify fluency data, including cluster sizes and switches, word frequencies, age-of-acquisition (AoA), intrusions, and perseverations. Generalized linear model (GLM) analyses were conducted with age at onset and education as covariates for group comparisons (controls (85) vs. pre-symptomatic (89) vs. converters (20) vs. symptomatic (29)).

Results

Preliminary results indicated a significant reduction ($p < .03$) in the number of responses in pre-symptomatic C9orf72 mutation carriers compared to controls. Overall, lexical indicators showed significant differences in performance across subgroups, with the number of responses being the most sensitive measure and AoA the least.

Conclusions

This study is the first to demonstrate the potential biomarker role of semantic fluency performance, particularly the number of responses in pre-symptomatic C9orf72 mutation carriers. Investigating longitudinal shifts in qualitative dimensions of semantic fluency performance will provide valuable insights for the development of early diagnostic strategies and interventions in FTD.

Table 1. Semantic fluency performance in controls vs. pre-symptomatic participants.

MUTATION		CONTROLS N=85		PRE-SYMPOMATIC N=89		GLM
	Baseline	mean	SD	mean	SD	P value
MAPT (N=11)	N° responses	23,41	4,09	25,27	5,90	0,74
	N° cluster switches	9,12	2,21	7,91	2,34	0,30
	Avg. cluster size	2,33	0,34	2,98	1,09	0,13
	Avg. word frequency	3,72	0,17	3,69	0,19	0,62
	Avg. word AoA	5,923	0,39	6,05	0,48	0,64
GRN (N=34)	N° responses	22,41	5,17	23,09	4,39	0,82
	N° cluster switches	8,39	2,97	8,82	2,56	0,63
	Avg. cluster size	2,58	1,14	2,44	0,67	0,29
	Avg. word frequency	3,61	0,25	3,61	0,24	0,77
	Avg. word AoA	6,26	0,57	6,16	0,49	0,27
C9orf72 (N=37)	N° responses	28,07	6,32	24,94	4,31	0,03*
	N° cluster switches	11,11	3,25	9,70	2,99	0,08
	Avg. cluster size	2,35	0,48	2,49	0,93	0,35
	Avg. word frequency	3,59	0,23	3,63	0,23	0,39
	Avg. word AoA	6,21	0,33	6,11	0,46	0,23

A historic trend analysis of research pertaining to language and pragmatics after right hemisphere damage: Are we moving in the “right” direction?

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Introduction

Right hemisphere damage (RHD) commonly causes communicative and cognitive impairments, with prevalence estimates ranging from 50-80% (Tompkins, 2012). Communication deficits affect comprehension and production, particularly in discourse and complex communicative contexts (Gajardo-Vidal et al., 2018), can negatively affect social relationships and quality of life (Hewetson et al., 2021), and have been described collectively as apragmatism (Minga et al., 2023). To advance understanding of these communication deficits, the ANCDs RHD EvidenceBased Writing Group conducted a systematic review of 50+ years of research on language and pragmatic deficits following right hemisphere (RH) stroke, the most common etiology of RHD. Whereas broad aims driving this systematic review include identifying typical characteristics of RHD language and pragmatic disorders and patterns of deficit co-occurrence that can guide assessment practices, this proposal reports on historic trends by answering the following:

1. Has the frequency of research output changed across decades?
2. What is the historic pattern of data output by world region and across language domains?
3. Have assessment practices, intervention research frequency or focus, or participant description practices changed across the decades?

Methods

Our PRISMA-guided systematic review searched research published 1970-2022, identifying 10,000+ unduplicated papers. For each review stage, at least two authors independently assessed each record. Exclusionary criteria included: not peer-reviewed, no original data, stroke was not the primary etiology, RHD participants' data could not be isolated, and did not directly address language or pragmatics. Title and abstract reviews yielded 1118 articles. Following full article review, 440 papers remained and were evaluated for methodological quality (Kmet et al., 2004); another 72 articles were excluded. Two authors independently completed data extraction for the remaining 316 articles.

Results

Question 1: Whereas publication numbers increased over the first four decades (n=9 vs. n=105 in 1st vs. 4th decade), this trend reversed recently (n=65). Question 2: More countries generated this research over time (e.g., 4 countries in the 1970s vs. 18 during the most recent time period). Across decades, linguistics was the most researched language domain with extralinguistic abilities least frequently investigated (Figure 1). Question 3: Albeit a trend for increased use over time, RHD communication battery use was documented in only 14% of the papers. Only 7 intervention studies were identified (5 published between 2003-2012). A trend for more comprehensive description of participants was observed (e.g., Table 1 shows more frequent and comprehensive reporting of cognitive abilities). There was nominal improvement in reporting other essential participant characteristics (e.g., in the most recent decade only 23% of studies reported hearing status).

Conclusions

Some historic trends in research pertaining to RHD language and pragmatic disorders are moving in the “right” direction. Nonetheless, some persistent gaps and issues that must be prioritized in future research (e.g., limited use of RHD batteries to establish overall severity; limited investigation of extralinguistic abilities; limited documentation of factors that may influence RHD language and pragmatic profiles). Empirically addressing these topics is germane to improving clinical support for speech-language pathologists who report feeling ill-prepared to address these aforementioned communication changes (Ramsey & Blake, 2020).

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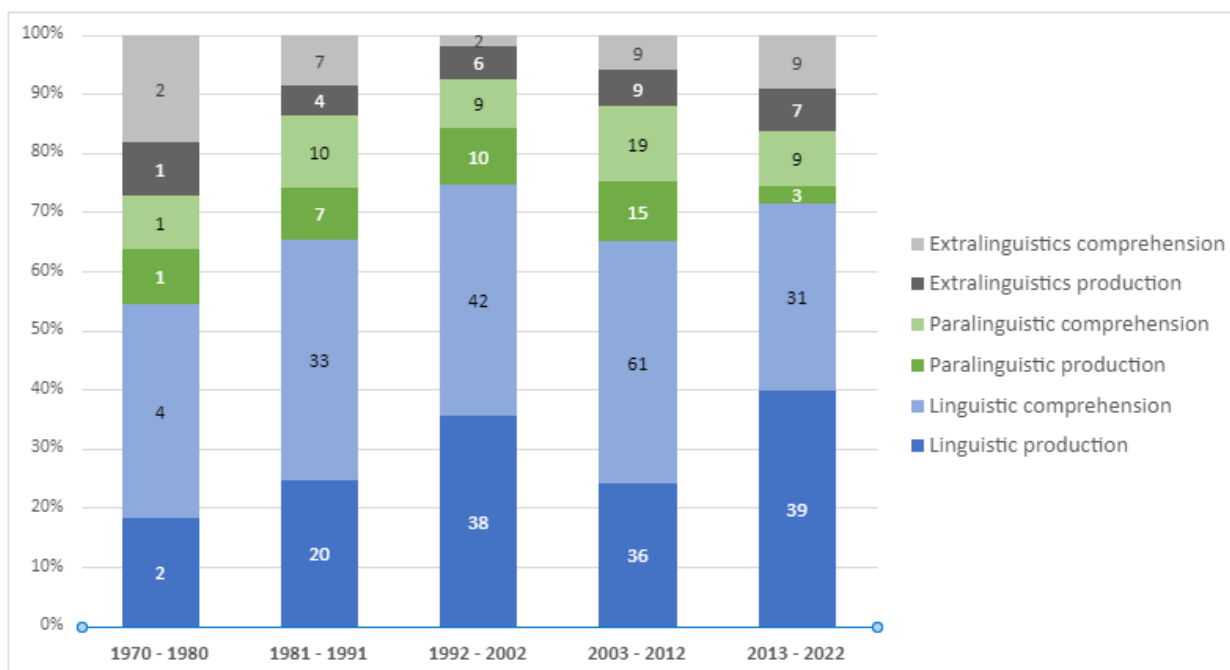


Figure 1. Historic trend in frequency of language domain examined.

Table 1. Historical trend of number of studies reporting on the cognitive abilities of RHD participants.

	1970 - 1980	1981 - 1991	1992 - 2002	2003 - 2012	2013 - 2022
Attention	0	2	10	28	14
Memory	1	8	18	42	21
Executive function	0	3	5	21	17
Awareness	0	3	1	5	4
Neglect	2	13	32	70	30
Visuoperception	1	10	13	30	18

Disconnection in the ventral language system in pure alexia: Follow-up longitudinal diffusion tensor imaging study

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Introduction

There has been highly debated which cortical or white matter regions were involved in pure alexia. One claims that pure alexia comes from a degradation of general visual system that can affect multiple stages of cognitive processing (Farah & Wallace, 1991; Starrfelt, Habekost, & Leff, 2009), on the other hand, the other side said that pure alexia resulted from damage to the specific brain regions that plays a crucial role in reading (Cohen & Dehaene, 2004; Warrington & Shallice, 1980). However, the reading network underlying the pathological mechanism of pure alexia is not yet clearly defined. Here we reported a case with pure alexia and investigated the structural connection changes associated with recovery of reading difficulty.

Methods

We report a 53-year-old female who showed reading difficulty after a left posterior cerebral artery (PCA) territory infarction involving on the left temporo-occipital lobe, medial thalamus and splenium of corpus callosum. She was diagnosed as a pure alexia without agraphia using the Korean version of Western Aphasia Battery (K-WAB).

We longitudinally followed up her language function using K-WAB at < 2 wks, 4 months and 6 months after stroke onset, respectively and diffusion tensor imaging (DTI) using a 3.0T MRI scanner (Siemens Prisma, Erlangen, Germany) were acquired at the same time points. We conducted diffusion tensor tractography (DTT) using DTI studio V3.0.2, and the corpus callosum (CC), arcuate fasciculus (AF), inferior fronto-occipital fasciculus (IFOF) and inferior longitudinal fasciculus (ILF) were reconstructed.

Results

She initially showed a mild type of anomia (aphasia quotient; AQ = 90.69) and recovered to within normal limit afterwards, however, her reading difficulty has lasted more than 3 months (Table 1). She could not read a short sentence comprising more than 2 Eojeol (Korean space unit in the writing system), but writing function remained intact.

The DTT results showed that the damage to the forceps major of CC projecting to the parieto-occipital lobe became more pronounced over time. The dorsal pathway of the language system represented by the AF remained intact and showed no morphological change across time. Meanwhile, the ILF showed remarkable damage in the initial DTT result (Figure 1), but it showed a morphological recovery pattern over time according to language function recovery including reading.

Conclusions

These findings support that pure alexia is caused by disconnection between visual input and brain regions involving in reading. More specifically, change of the ventral language system

linking the occipital lobe and temporal lobe via fusiform gyrus is associated with recovery of pure alexia.

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Table 1. Language assessment results of K-WAB.

Language test	Days from onset	Fluency (20)	Comprehension (10)	Repetition (10)	Naming (10)	Reading (20)	Writing (20)	AQ	LQ
1 st	11	17.5	9.5	10	8.3	8	19.8	90.69	82.6
2 nd	124	20	9.35	10	9.1	16.8	20	96.9	94.6
3 rd	188	20	9.8	10	8.9	19.6	20	97.4	98.1

AQ; aphasia quotient, LQ; language quotient

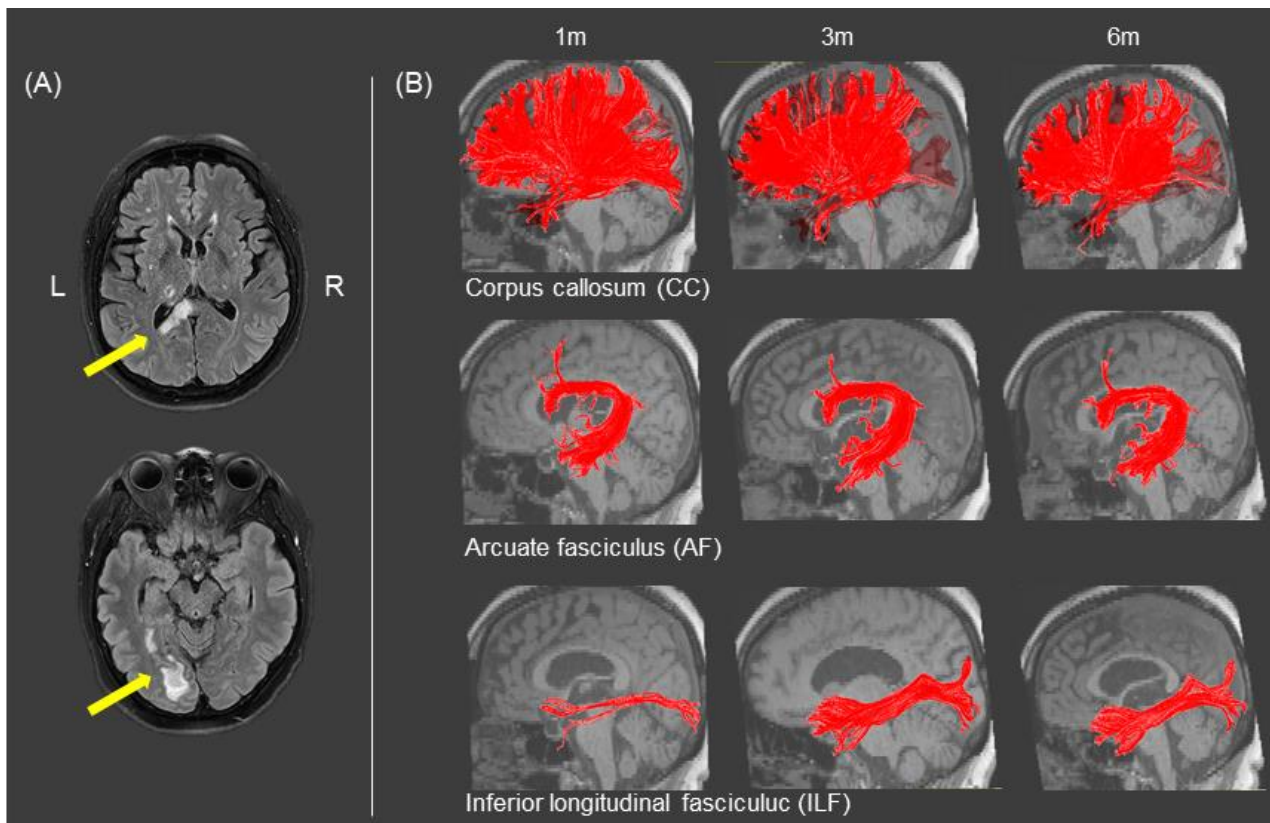


Figure 1. Lesion location and longitudinal follow up of diffusion tensor tractography at three time points.

The boundary between language and non-language: A case of pure kanji (Chinese character) agraphia due to left-dominant posterior cortical atrophy

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Introduction

There are two subtypes of Alzheimer's disease: logopenic variant primary progressive aphasia (lvPPA), in which language symptoms predominate over memory impairment, and posterior cortical atrophy (PCA), in which visual and visuospatial cognitive impairment predominate. Patients with left-dominant PCA may develop language impairment, but whether this differs from lvPPA has not been fully investigated. The purpose of this study is to determine whether the performance of a patient with PCA presenting with pure agraphia differs from that of the patients with three subtypes of PPA (non-fluent variant PPA (nfvPPA), semantic variant PPA (svPPA), and lvPPA), using a novel clock reading and writing test developed to detect constructive disabilities during the progression of diseases in PPA.

Methods

Participants. A patient with PCA and three patients with PPA participated in this research (Table1).

Profile of patient with PCA. A woman visited our hospital because of progressive writing disorders of Kanji (Chinese characters in Japan) for four years. In addition, she complained about having difficulty with mental arithmetic and operating her smartphone. There were no neurologically abnormal findings. Scores of Western Aphasia Battery (WAB) did not reveal any evidence of aphasia, apraxia, or constructional disabilities. She could write numbers easily and could calculate if she was allowed to see. She was able to read aloud correctly both in Kanji and Kana (a Japanese letter different from Kanji), but only had difficulty writing Kanji. She often had to rewrite many times and finally gave up. Even when she could write the letters correctly, she complained of a lack of confidence in stroke order. The neuroimaging examinations suggested that main lesions located in the left superior parietal lobe (SPL) and the intraparietal sulcus (IPS).

DAAD test (Digital-Analog & Analog-Digital conversion test). 1) View a digital clock and draw corresponding clock hands on an analog clock (DA task); 2) View an analog clock and write the digital time representation (AD task). Each test consisted of two sets with 16 items. The test was performed in a DA1-AD1-AD2-DA2 order and accuracy and error types were evaluated according to the scoring system used in our previous report.

Results

In DA tasks, accuracy did not show any difference among all patients (Figure1). On the other hand, in AD tasks, the patient with PCA showed remarkably decreased accuracy compared to all subtypes of patients with PPA. Moreover, in both tasks, the patient with PCA consistently showed the most reversed clock hand errors (e.g. 11:05 for 1:55), while patients with PPA showed several different types of errors, respectively.

Conclusions

The patient with PCA showed clear deficits in AD task compared to patients with PPA, which the error pattern was consistently restricted to the reversed clock hand errors. Recent

studies have suggested that numerical information induces three different semantic concepts: magnitude, ordinality, and cardinality. Among these, magnitude and ordinality are considered to be closely related to SPL/IPS functions, and the errors observed in the present study are thought to be related to the dysfunction of these areas, regardless of language.

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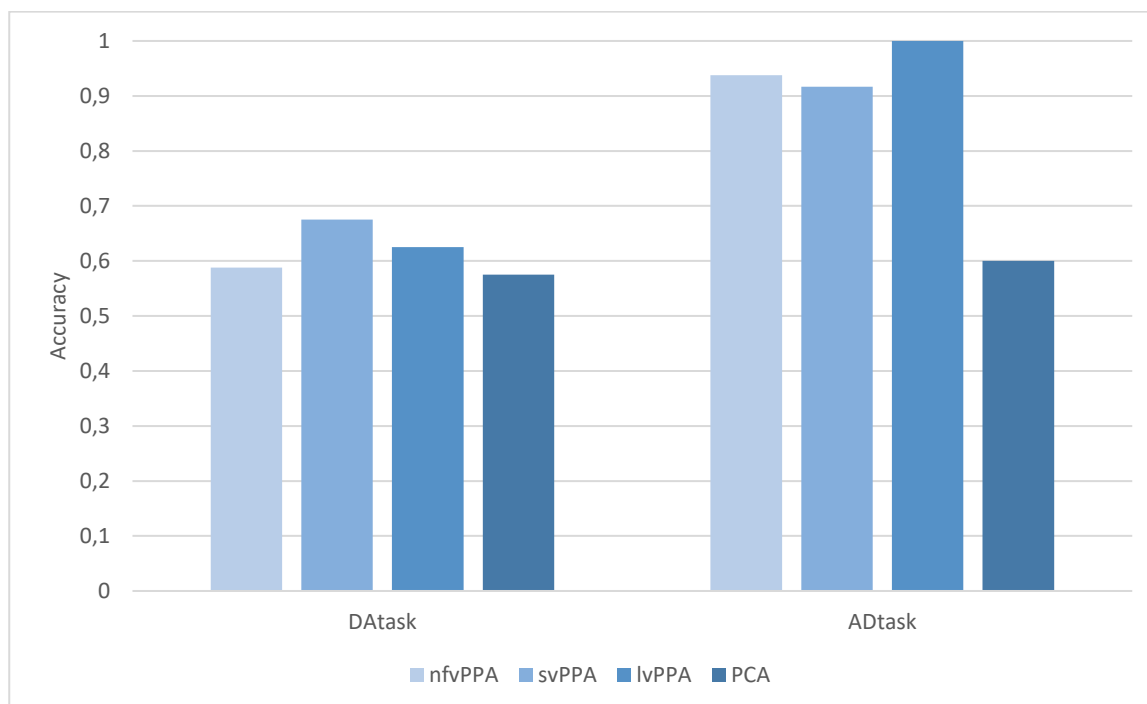


Figure 21. Results of DAAD test (accuracy)

Table 1. Profiles of participants and the results of DAAD test (Error rates)

	nfvPPA	svPPA	lvPPA	PCA
Age / gender	70s / M	50s / F	70s / M	60s / F
WAB AQ	70.2	10.7	73	99.2
WAB CQ	77.2	18.6	63.4	97.5
RCPM	27/36	28/36	25/36	31/36
Reading (Kanji / Kana)	-	-	-	100 / 100
Writing (Kanji / Kana)	-	-	-	76 / 100
DAAD test (Error rates)	Error types: 1)hour hand simplification 2)reversed clock hand 3)isometric hands 4)shift of center point 5)others			
DA task	1)0.2 2)0.1 3)0.5 4)0.1 5)0.1	1)0.5 2)0.3 3)0.1 4)0.1 5)0.1	1)0.1 2)0.3 3)0.1 4)0.2 5)0.4	1)0.1 2)0.7 3)0 4)0.1 5)0.1
AD task	1) only	1) only	-	1)0 2)0.8 3)0.2

Prognostic factors for long-term improvement from stroke-related aphasia with adequate linguistic rehabilitation

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Introduction

Recent studies have reported that age, initial aphasia severity, aphasia subtype, lesion location, lesion volume, stroke severity, and phonology are potential prognostic factors for aphasia after stroke. Among these factors, initial aphasia severity has been proposed to be the most clinically relevant factor. In these reports, however, recovery from aphasia covered no more than one year after onset. This is despite the fact that patients often continue to improve over longer periods. To address these shortcomings, we identified and enrolled patients with aphasia who received adequate linguistic rehabilitation for at least 2 years post-onset and carried out a multivariable regression analysis to determine prognostic factors for long-term improvement.

Methods

The present study included 121 patients with aphasia who received cognitive-based linguistic rehabilitation for at least 2 years post-onset (Table 1). To assess baseline linguistic function, we administered the Standard Language Test of Aphasia (SLTA). Lesion location assessment covered seven regions of interest that surround the left Sylvian fissure and are all related to linguistic function: Broca's area and the precentral gyrus, the supramarginal and postcentral gyrus, the angular gyrus, the superior temporal gyrus that includes Wernicke's area, the middle temporal gyrus, insula, and the basal ganglia. First, we evaluated the influence of each explanatory variable, i.e., demographics (age, gender, and education level), stroke type, lesion volume, seven lesion locations, baseline aphasia severity, and the six baseline linguistic components, using univariate regression analysis. Then, the combined influence of the variables on aphasia outcome was investigated using multivariable regression analysis. A stepwise method was used to identify variables with the greatest influence on aphasia outcome.

Results

Out of a maximum score of 10 on the aphasia assessment, the average baseline aphasia severity score for the 121 patients was 3.2 ± 2.6 and the average aphasia outcome score was 6.2 ± 3.2 . In the univariate regression analysis, four variables had P values of >0.01 (indicating no statistical significance). Gender ($P = 0.32$), education level ($P = 0.28$), stroke type ($P = 0.11$), and lesion in the basal ganglia ($P = 0.04$) were excluded from the multivariable regression model. The stepwise method in the multivariable linear regression model revealed that age at onset, lesion in the left superior temporal gyrus (including Wernicke's area), and baseline linguistic abilities (including aphasia severity and both phonological and semantic functions) were significant predictors of long-term aphasia outcome (Figure 1).

Conclusions

Our study suggests that long-term aphasia outcome for patients who receive adequate linguistic rehabilitation for at least 2 years can be predicted by age at onset, lesion in the left

superior temporal gyrus including Wernicke’s area, and baseline linguistic abilities. Our results were mostly consistent with previous studies in that age, lesion location, and initial linguistic abilities were important for long-term rehabilitation. Furthermore, we found that a younger age at onset was associated with greater recovery of linguistic abilities. Our findings may enhance the accuracy of aphasia prognosis and inform rehabilitation strategies, and they suggest that adequate linguistic rehabilitation may particularly benefit younger individuals with aphasia.

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Acknowledgments

We thank the patients and their caregivers who participated in our study.

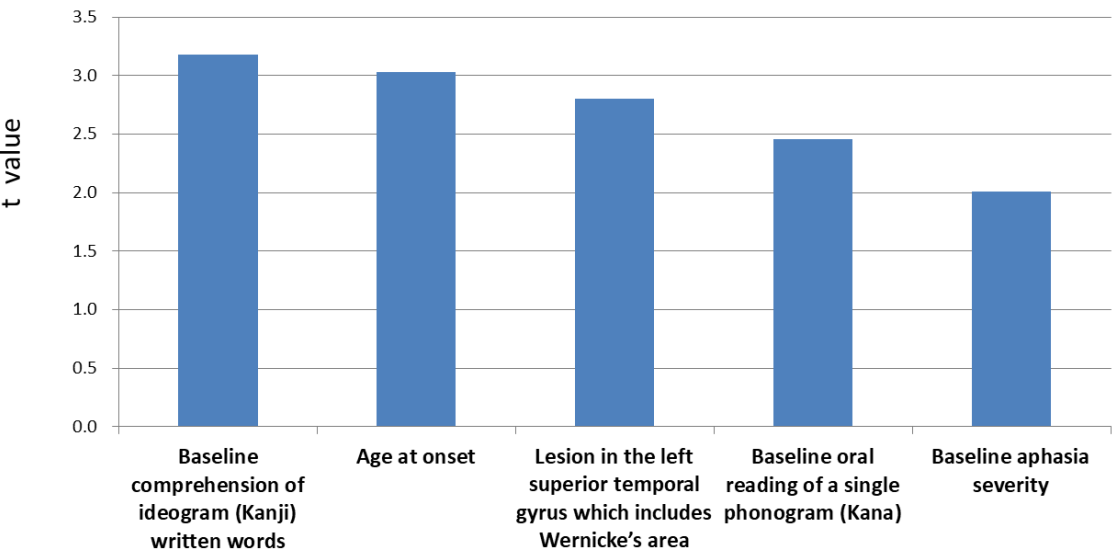


Figure 22. Effects of the five variables that were identified based on the multiple regression analysis.

Table 1. Baseline characteristics of patients (n = 121)

Characteristic	Value
Demographics	
Mean age, years (SD)	54.4 (11.9)
Females, n (%)	28 (23)
Mean rehabilitation start, months post-onset (SD)	2.6 (1.5)
Right handedness, n (%)	121 (100)
Level of education, n (%)	
≥16 years	30 (25)
<16 years	91 (75)
Stroke subtype, n (%)	
Infarction	75 (62)
Intracerebral hemorrhage	46 (38)
Linguistic performance (SLTA)	
Mean baseline aphasia severity, score (SD) (0, worst; 10, best)	3.2 (2.6)

Retention of item and serial order information during verbal short-term memory tests in patients with Broca's aphasia and conduction aphasia

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Introduction

Verbal short-term memory (STM) deficits are very frequently observed in individuals with aphasia, but the differences in deficit characteristics between patients with different aphasia types have not been fully clarified. Serial recall tasks, such as the digit span test, are used to examine recall of items and serial order, but it is not known whether these functions are impaired in isolation or whether each type of aphasia demonstrates different deficit characteristics. The aim of this study was to investigate the characteristics of verbal STM deficits in patients with Broca's aphasia and conduction aphasia through the recall of item and serial order information.

Methods

Participants. The participants included 8 patients with Broca's aphasia and 7 patients with conduction aphasia. In addition, 16 healthy individuals were included as the control group.

Tasks.

1. Item probe recognition task: The item retention ability was examined in this task. A four-word sequence was presented auditorily, followed by two words presented auditorily as a probe. Participants were asked whether the words in the probe were part of the four-word sequence.

2. Serial order probe recognition task: Serial order retention ability was examined in this task. A four-word sequence was presented auditorily, followed by two words presented auditorily as a probe. Participants were asked whether the serial order of the words in both sequences was the same.

3. Serial order reconstruction task: Sequence reconstruction ability was examined in this task. A three-word sequence was presented auditorily to the participants, and they were immediately asked to reconstruct the sequence.

Each task consisted of 32 trials.

Results

Median (IQR: interquartile range) number of incorrect responses (Table 1)

In the item probe recognition task, the performance of both aphasia groups was significantly lower than that of the healthy control group ($p < 0.05$). In the serial order probe recognition task, the performance of the Broca's aphasia group was significantly lower than that of the healthy control group ($p < 0.01$). Comparing the performance in both tasks, the Broca's aphasia group showed significantly lower performance in the serial order retention task than in the item recognition task ($p < 0.05$), but there was no significant difference between the two tests in the conduction aphasia group ($p = 0.43$). In the serial order reconstruction task, the performance of the Broca's aphasia group was significantly lower than that of the control group ($p < 0.01$). In terms of differences in sequence position, the conduction aphasia group showed significantly more errors in the middle position than in the initial position ($p < 0.05$).

Conclusions

Deficits in the retention of item information were observed in patients with Broca's aphasia and conduction aphasia, while deficits in the retention of serial order information were observed only in patient with Broca's aphasia.

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Table 1. Number of incorrect responses in the verbal STM tasks.

	item probe recognition	serial order probe recognition	serial order reconstruction
Median(IQR)			
Broca's aphasia	7.0 (7.0)	12.5 (6.0)	7.0 (8.5)
Conduction aphasia	5.0 (1.0)	6.0 (4.0)	3.0 (5.0)
Healthy control	3.0 (3.3)	2.0 (4.5)	0.0 (1.0)

The contribution of the temporo-frontal extreme capsule fasciculus and the uncinate fasciculus in semantic processing in primary progressive aphasia

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Introduction

There is evidence that impairments in semantic processing are related to damage in the anterior temporal region (Hodges et al., 1992). Traditionally, the anterior temporal region was considered to be linked with the frontal cortex via the Uncinate Fasciculus (UF) and semantic impairments were attributed to this pathway. However, more recent evidence has demonstrated that the UF connects only the most anterior and medial part of the temporal lobe with the orbitofrontal cortex, while the intermediate temporal lobe is connected with ventrolateral frontal cortex (i.e., the language-related cortex) via axons that cross the extreme capsule under the anterior insula, namely the temporo-frontal extreme capsule fasciculus (TFexcF) (Petrides & Pandya, 2009). Evidence from neuroimaging studies (Saur et al., 2008) and recent tractography (Barbeau et al., 2024) suggests that the TFexcF may be the tract associated with semantic processing. The TFexcF connects the middle temporal gyrus, which is a multisensory region that integrates information from both the auditory and the visual processing domains with the inferior frontal gyrus, particularly area 45 (Petrides, 2023).

To resolve this discrepancy, we examined the contribution of these white matter tracts to semantic processing in a group of Primary Progressive Aphasia (PPA) individuals. In this work, we used a newly developed protocol that extracts each tract based on its unique set of cortical terminations (Loh et al., in prep).

Methods

DTI data were collected from 17 PPA patients and, using our new protocol, we extracted the left hemisphere: 1) ventral TFexcF (intermediate temporal cortex to ventrolateral frontal cortex); 2) dorsal TFexcF (intermediate temporal cortex to dorsolateral frontal cortex); and 3) UF (anterior-medial temporal cortex to orbitofrontal cortex). For each tract, mean diffusivity (MD) – a measure of WM integrity - was calculated. Semantic processing, specifically selective semantic retrieval was assessed using a Semantic Fluency task in which participants were asked to produce as many words as possible (in one minute) that belonged to a specific semantic category (Fruits, Animals, Vegetables). The three tracts were evaluated simultaneously, using a multiple linear regression model with Semantic Fluency as the dependent variable, and the MD values for each tract and Age as predictors.

Results

Results are presented in Table 1. As shown, only the ventral TFexcF showed a statistically significant effect, which is also indexed by the large R-squared value. Neither the dorsal TFexcF, nor the UF showed a statistically significant effect.

Conclusions

The current study directly compared for the first time the contribution the dorsal and ventral parts of the TFexcF and the UF in semantic processing in a group of PPA individuals and showed that the ventral TFexcF is the strongest predictor of selective semantic retrieval and

not the UF. These results are in line with independent evidence from healthy control and individuals with cerebrovascular impairments (Saur et al., 2008; Thompson-Schill et al., 2005). Our findings have important implications for understanding of the neural underpinnings of selective semantic retrieval, as well as for rehabilitation purposes, such as neuromodulation treatments in PPA, aiming to stimulate semantic processing areas.

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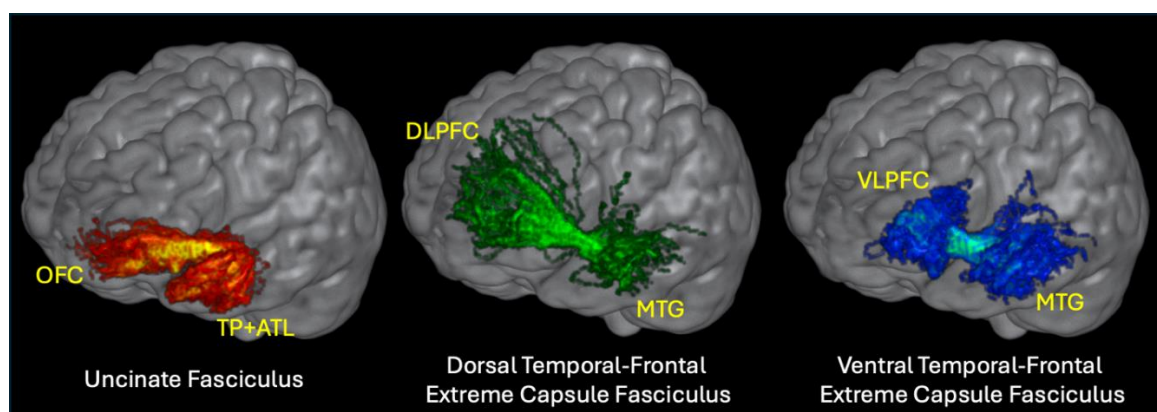


Figure 1. The three tracts of interest: ventral and dorsal Temporo-Frontal Extreme Capsule Fasciculus and Uncinate Fasciculus. OFC = orbitofrontal cortex, TP = temporal pole, ATL = anterior temporal lobe, DLPFC = dorsolateral prefrontal cortex, MTG = middle temporal gyrus, VLPFC = ventrolateral prefrontal cortex.

Table 1. Results of multiple linear regression (* : p-value <.05). R-squared describes the R-squared each variable contributes with when it is added last in the model.

<i>Tract</i>	<i>p-value</i>	<i>R-squared</i>
ventral TFexcF	0.035*	0.191
dorsal TFexcF	0.220	0.056
UF	0.947	0.0002

Using the *computerized Token Test* to assess sentence comprehension skills in Greek aphasia: The role of executive functions

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Introduction

The Token Test (De Renzi & Vignolo, 1962) assesses auditory language comprehension and it has extensively been used in the aphasia literature due to its discriminative power and its sensitivity in determining aphasia severity. Recently, a multilingual digital version of the shortened version of Token task, the *Token Test App*, was developed (Bastiaanse et al., 2016; for Greek: Nerantzini et al., 2020). The application automatically provides accuracy scoring that can be clinically used to demonstrate performance deterioration in aphasia, while avoiding paper-and-pencil drawbacks that are prone to human error and offering the clinicians the opportunity to observe the results remotely. Apart from its clinical use, this task involves cognitive processes, such as verbal working memory (WM) and inhibitory control, as it consists of sentences which vary in terms of number of linguistic units, with increasing levels of structural complexity and WM load. The purpose of the present study is to investigate how executive functions interfere with participants' performance in separate subsections of the task when WM demands are manipulated.

Methods

The participants of the study were 25 Greek-speaking individuals with aphasia (mean age: 49.4; mean years of education: 10) with an average of 6 months post onset, who were recruited from the ANIMUS Rehabilitation Center in Larisa, Greece, and 45 healthy non-brain-damaged participants (mean age: 54.3; mean years of education: 10.2). Participants were asked to point to one or two shapes in a particular sequence specified by the examiner. Instructions were recorded by a Greek native speaker and the recordings were assessed for articulatory and prosodic accuracy.

Results

Although no significant correlations were attested with age or education level (in line with Akinina et al., 2019 for Russian), the auditory comprehension scores of other behavioral measures, such as the BDAE diagnostic score (for Greek: Papathanasiou et al., 2008) and the Northwestern Assessment of Verbs and Sentences (for Greek: Nerantzini et al., 2016) were highly correlated with the token test score, suggesting that language comprehension is highly dependent on syntactic processing skills as well. Additional correlations were found between neuropsychological measures assessing cognitive abilities (e.g., MMSE, Folstein et al., 1975; Digit Span Task-WAIS-III; Wechsler, 1997) and subtests with syntactically more complex structures, denoting the influence of WM on verbal comprehension when cognitive capacities are taxed by task demands. Finally, a high test-retest reliability was obtained across participants, indicating validity and stability of performance (2 weeks in between sessions).

Conclusions

Our results suggest that the *Token Test app* is a suitable measure of language processing, which can be effectively used as an accurate discriminator between participants with aphasia of varying severity levels and healthy adults. Our data support the idea that cognitive abilities directly affect auditory comprehension in people with aphasia. Implications for treatment are also discussed.

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An investigation of domain-general vs. domain-language-specific attention treatments in aphasia

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Introduction

Attention treatment approaches in people with aphasia (PWA) have focused on improving domain-general attention via direct attention training, or on domain-specific training via language-based activities, e.g., Language-Specific Attention Training (L-SAT; Peach, Beck, Gorman & Fisher, 2019). In general, findings from domain-general treatments in PWA showed that they improved on the trained cognitive tasks, albeit with limited generalization to language performance (Rohling, Faust, Beverly, & Demakis, 2009). Research on language specific-attention training, however, showed good generalization to improving functional language outcomes (Peach et al., 2019). These findings are limited due to the paucity of research directly comparing the effectiveness of these different approaches in aphasia.

Another rapidly growing area in attention treatment is that of utilizing neurofeedback (NF), a form of electroencephalography (EEG) biofeedback, with brain-computer interface systems. Play Attention (PA; Unique Logic and Technology, Fletcher, NC) is one such type of NF attention training that utilizes a simple form of neurofeedback via a non-invasive arm transducer.

The purpose of this study is to compare the effectiveness of NF training, i.e., PA, in PWA to that of a domain-specific language training (L-SAT) on cognitive, language, and participation/ecological outcomes in PWA.

We hypothesize that for: 1) attentional skills: the domain-general NF treatment, PA, would yield superior results to that of the domain-specific approach, L-SAT, due to its advantage of providing real-time feedback of one's attention, b) language skills: the L-SAT would result in more favorable outcomes than PA, due to its advantage of having embedded language contexts within the attention training activities, and c) participation/ecological outcomes: would show similar improvement for both treatments.

Methods

The study is a randomized controlled alternating treatment design conducted over a 25-week period: 1) initial assessment, 2) Treatment A, 3) post-Treatment A assessment, 4) washout phase, 5) Treatment B, 6) post-Treatment B assessment, and 7) final one-month post-treatment assessment. Each treatment program consisted of 15 sessions (three 1-hr sessions per week for 5 weeks), for a total of 30 treatment sessions. Four PWA (P1: moderate, P2: very severe, P3 and P4: mild) received the same dosage and intensity of each attention training program. The participants were tested on a battery of eight standardized tests measuring language, cognitive, and participation/ecological outcomes.

Results

Language tests. P1 findings concurred with the prior literature in that domain-specific L-SAT yielded better results than domain-general PA. The other participants had similar results after both treatments.

Attention tests. P1 and P4: findings concurred with the prior literature in that domain-general PA yielded better results than domain-specific L-SAT. P2 and P3 showed minimal improvements after both treatments.

Participation and ecological tests. Minimal improvements were shown after both treatments.

Conclusions

Performance on the language and attention tasks post- each treatment was impacted by the severity profile of the participant. Findings concurred with our hypotheses on language and cognitive outcomes only in the participant with the moderate aphasia profile. Participation/ecological outcomes did not show significant improvements after either treatment likely due to the short duration of the study (5 weeks per treatment).

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Predicting written language performance in primary progressive aphasia: The role of central language processes and psychometric word properties

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Introduction

Written language deficits are one of the earliest symptoms to emerge in primary progressive aphasia (PPA) (Neophytou et al., 2019). Individuals with the logopenic (lvPPA) and nonfluent (nfvPPA) variants show damage to the left perisylvian network that supports sub-lexical phonological processing (Henry et al., 2016). They produce spelling/reading errors that are often phonologically implausible. In lvPPA, lexical-semantic processes may also be impaired to different degrees, resulting in phonologically plausible errors (PPEs) on irregularly spelled words (Sepelyak et al., 2011). To understand patterns of breakdown in written language in PPA, we (1) characterized types of errors made during single-word spelling and reading; (2) examined the role of central language processes on spelling and reading performance; and (3) explored the influence of words' psychometric properties on spelling and reading accuracy.

Methods

In this study, 21 individuals with a confirmed diagnosis of lvPPA ($n=18$) or nfvPPA ($n=3$) and healthy age- and education-matched controls ($n=17$) performed spelling and reading tasks with nonwords, regular, and irregular words from the Arizona Battery for Reading and Spelling (Beeson et al., 2010).

To investigate the relationship between written language and central language processes, we performed a Principal Component Analysis with varimax rotation to derive factors representing phonological abilities, semantics, and phonological-orthographic transcoding skills. These factor scores were entered into multiple linear regressions to determine the degree to which semantic, phonological, and transcoding abilities predicted performance on spelling and reading of real words and nonwords.

The psychometric properties of real word stimuli (frequency, familiarity, age of acquisition (AoA), phonological and orthographic length, #syllables and #letters, phonological, semantic, and orthographic neighborhood, imageability, valence, and arousal) were extracted at the item-level and entered as predictors for spelling and reading accuracy in stepwise linear regression analyses.

Results

Repeated measures ANOVA for spelling and reading revealed significant lexicality (words>nonwords) and regularity (regular words>irregular words) effects in the PPA group, but not for controls. Phonologically implausible errors were most common during spelling of nonwords (20%) and regular words (5%), while PPEs were most common during irregular word spelling (12%). During reading, the most frequent were lexical errors for nonwords (10%), visually/phonologically similar errors for regular words (2%), and PPEs for irregular words (2%).

Nonword spelling performance was significantly predicted by phonological and phonology-orthography transcoding skills (Table 1). Spelling of regular words was predicted by phonology and semantics, but semantics alone predicted spelling of irregular words. Models for reading (nonwords and words) were not significant (Table 1).

The strongest predictor of overall spelling accuracy of real words was word frequency, followed by orthographic neighborhood and number of phonemes (Figure 1). In contrast, AoA and phonological neighborhood predicted overall reading accuracy.

Conclusions

The results of this study demonstrate the differential influence of phonological and semantic abilities on written language performance in PPA. We also observed differences in error types and the influence of psycholinguistic properties by modality (spelling vs. reading). These findings highlight the need to consider central cognitive processes in determining the status of written language profiles in PPA.

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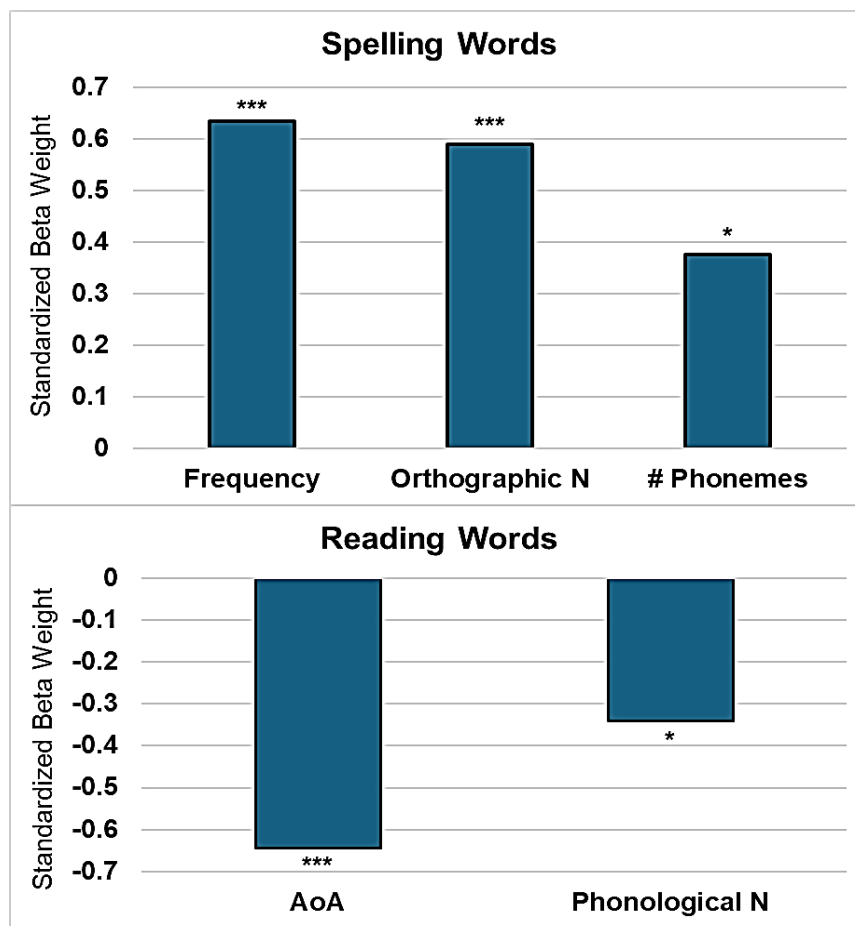
Acknowledgments

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Table 1. Results of multiple linear regression analyses predicting the relative contribution of semantic, phonological, and phonological-orthographic transcoding factors on single-word spelling and reading performance for words and nonwords.

Stimuli (#items)	R ²	df	F	p	Semantics	Phonology	Transcoding
<u>Single-Word Spelling</u>							
Nonwords (20)	0.625	3, 10	5.561	0.017	0.396	0.448*	0.517*
All Words (40)	0.784	3, 6	7.243	0.020	0.778**	0.422	-0.037
Regular Words (20)	0.825	3, 6	9.443	0.011	0.706**	0.581*	0.005
Irregular Words (20)	0.710	3, 10	4.902	0.047	0.782*	0.305	-0.055
<u>Single-Word Reading</u>							
Nonwords (20)	0.400	3, 10	2.223	0.148	0.079	0.156	0.608*
All Words (40)	0.362	3, 10	1.892	0.195	0.196	0.271	0.500
Regular Words (20)	0.157	3, 10	0.622	0.616	-0.079	0.285	0.265
Irregular Words (20)	0.423	3, 10	2.445	0.124	0.296	0.222	0.535*

Values for Semantics, Phonology, and Transcoding are standardized Beta coefficients (β); Significant standardized Beta coefficients are provided in bold, * = $p < 0.05$, ** = $p < 0.01$.



Orthographic N = Orthographic Neighborhood, AoA = Age of Acquisition, Phonological N = Phonological Neighborhood; Significant standardized Beta coefficients * = $p < 0.05$, *** = $p < 0.01$.

Figure 1. Standardized beta weights from stepwise linear regression analyses for psycholinguistic properties that significantly predicted spelling and reading performance.

Acoustic analysis as phonetic basis for phonological paraphasia in persons with aphasia: A preliminary study

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Introduction

Phonological planning deficit is considered to be the cause of phonemic paraphasia in persons with Aphasia. The errors are believed to be because of substitution of incorrect phoneme due to deficit in phoneme selection. However, the cascaded activation model suggests that phonemic paraphasia are the result of partial activation of the target and the competing phoneme that transcends to the lower articulatory level as a phoneme which reflects the acoustic properties of both sounds. Hence, this study aims to understand the existence of a phonetic basis for phonemic paraphasia in adults with Broca's Aphasia in the Tamil language.

Methods

The study recruited five persons diagnosed with Broca's Aphasia in the age range of 50-60 years and five age and gender-matched controls. The participants were assessed using Western Aphasia Battery (WAB) in Tamil language. Confrontation naming task was used as the stimuli to elicit speech samples in affected individuals. All the recordings were done using PRAAT software and the sounds /p/ and /b/ were chosen for analysis since they were the most occurring phonemic paraphasia in the obtained sample.

Results

The burst duration and Voice Onset Time (VOT) of the sounds /p/ and /b/ were compared between the experimental and control groups. Results suggested the presence of an acoustic trail of target sound in the substituted phoneme. This provides evidence for the presence of cascaded activation at the stage of phoneme selection in phonological planning.

Conclusions

Thus, the results of the present study challenge the existing literature on phoneme selection deficit at the planning level as the reason for the occurrence of phonemic paraphasia.

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Revisiting the neural substrates of language processing: Insights from glioma Lesion Symptom Mapping

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Introduction

Traditional views link language comprehension to left posterior temporal and inferior parietal regions, contrasting with frontal regions primarily associated with language production (Broca, 1865; Geschwind, 1972; Hickok & Poeppel, 2007; Wernicke, 1874). Recent evidence challenge these views: cortical thinning in the left anterior temporal lobe (ATL) leads to profound comprehension impairments (Lambon Ralph & Patterson, 2008; Mesulam et al., 2009; Mion et al., 2010), while post-stroke aphasia patients show language production deficits not from inferior frontal gyrus damage but from insula and frontal white matter lesions (Fridriksson et al., 2015; Gajardo-Vidal et al., 2021). To explore these discrepancies between traditional and contemporary data, we employed Multivariate Lesion Symptom Mapping (MLSM) on a large cohort of individuals with left hemisphere gliomas. Although brain tumors are less explored in aphasiology, they offer advantages as they are not biased towards the territory supplied by the middle cerebral artery and, importantly, may be quite small, whereas most stroke patients typically suffer from large lesions. This focality and broader distribution of tumors may lead to improved monitoring of a larger set of cortical areas and, potentially, to results differing from those of stroke studies.

Methods

Retrospective data of 104 individuals with left-hemisphere gliomas were analyzed (mean age = 48.8, sd = 14.7). Four sub-tests of the Aachen Aphasia Test (Huber et al., 1984) were used to evaluate word and sentence processing 7 to 2 days before surgery. Investigated language modalities included production, repetition, and auditory comprehension. Single word tasks included words referring to concrete objects, whereas the sentences described scenes, ranged between 4-12 words and followed canonical word order (SVO).

Results

Our results showed that for both word and sentence comprehension, damage of the left ATL and ventral peri-central regions were associated with lower accuracy. Damage to posterior parts of the left temporal lobe specifically affected sentence comprehension (Fig.1a). Language production followed a similar pattern, with significant voxels for both word and sentence production located in the ATL and peri-central regions, whereas posterior temporal damage just led to significant sentence production deficits (Fig.1b). Damage of pre- and post-central regions affected repetition of both words and sentences. However, ATL lesions

specifically degraded sentence repetition, whereas posterior temporal and inferior parietal areas led to deficits in word repetition only (Fig.1c).

Conclusions

In sum, we found processing hubs relevant for language production, comprehension and repetition at the word and sentence levels in both left inferior peri-central cortex and left ATL. Based on our data, it appears that the sensorimotor cortex and ATL play a crucial role in tasks involving semantic processing relevant for comprehension and production of both words and sentences. However, the same does not apply to the posterior temporal lobe, which had traditionally been associated with comprehension difficulties in post-stroke aphasia. Our findings are in line with the role of the ATL as an amodal hub for semantic processing, serving both comprehension and production at the word and sentence levels. Our findings also highlight that overlap areas for both word and sentence processes across the three modalities are found in pre- and postcentral regions.

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Acknowledgments

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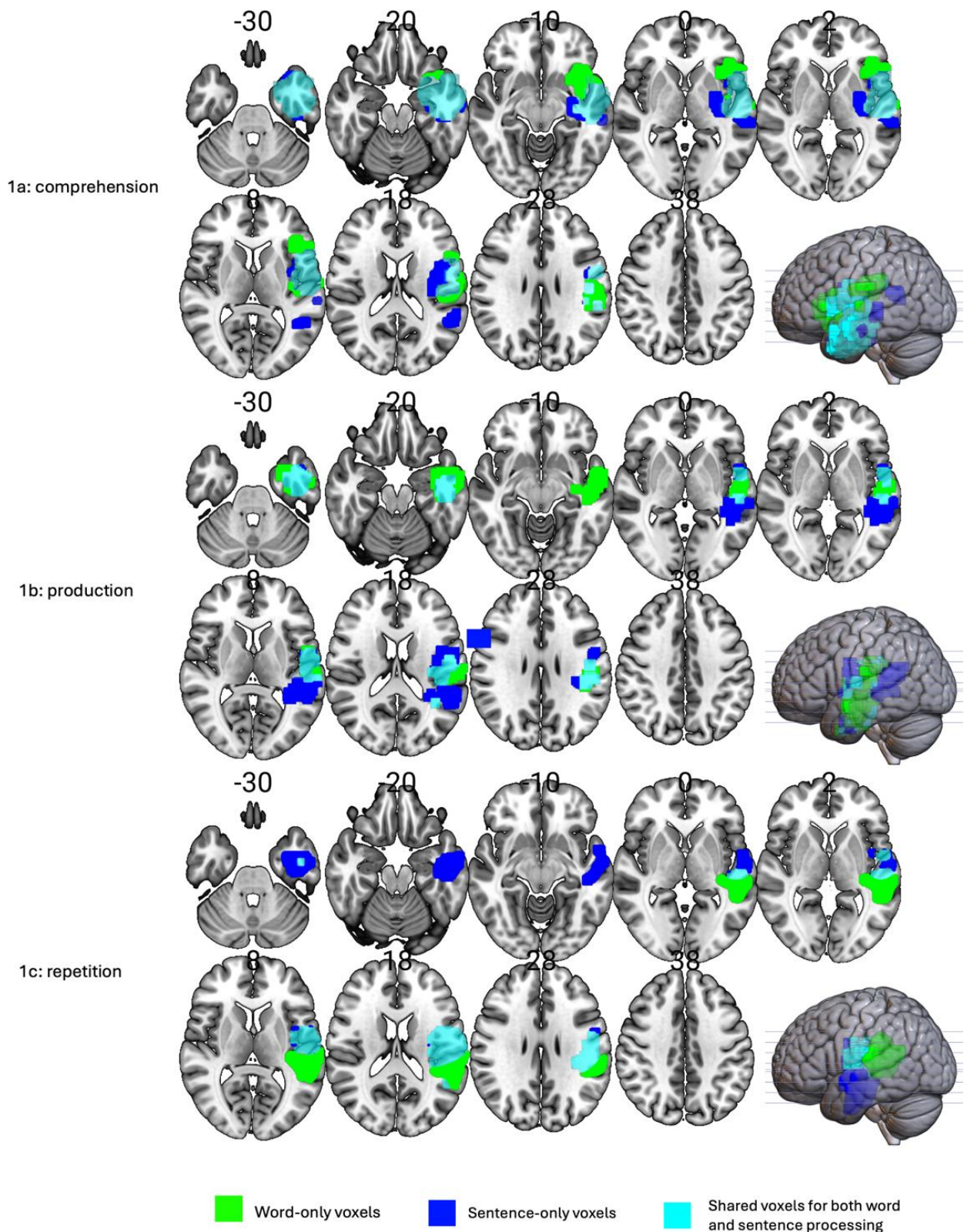


Figure 23. Specificity results of MLSM analysis according to task (green: word, blue: sentence, light blue: shared) and language modality (a: comprehension, b: production, c: repetition). Green voxels were significant for word-level tasks but for sentence-level tasks. Blue voxels were significant for sentence-level but not for word-level tasks.

Correlations between verbal short-term memory and comprehension of syntactically complex sentences: Evidence from people with aphasia

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Introduction

The relevance of verbal short-term memory (vSTM) for sentence comprehension has been discussed controversially. While storage is evidently mandatory for recovering meaning from the non-linear surface of sentences, both general vSTM capacities (Fedorenko & Thompson-Schill, 2014; Papagno & Cecchetto, 2019) and language-specific resources (Caplan & Waters, 1999; Makuuchi, Bahlmann, Anwander, & Friederici, 2009) have been advocated to be pivotal to afford such storage. Here correlational analyses on data of 43 participants with lesion in the extended left hemispheric language network explore the relevance of vSTM for (i) overall sentence comprehension and (ii) relevance of vSTM for the handling of syntactic complexity.

Methods

Data from experimental and clinical assessment of participants were used: **(1) PhoM** assessing vSTM in a simple forced choice task. Participants had to judge whether the last item of a chain of (pseudo)words was identical to any of the preceding items. While the material assesses different dimensions (word/pseudoword; chain lengths; similarity; phonotactic complexity); here only overall performance entered further analyses. Example for 5-item chain, repetition, pseudowords: *tsaus - gaus - jaus - vaus - tsaus*. **(2) SYN** assessing the correct comprehension of complex sentences. Example for double embedding object-first relative clause: “Der Käfer, den der Frosch, der braun ist, zieht, lacht.” English, literally translated: “The bug, *whom the frog^[subj], who brown is, pulls*, laughs.”). Forced choice from 4 pictures (3 distractors for each proposition) was required (Krause et al., 2022). Sentences were identical in lengths, number of propositions, and semantic (im)plausibility but varied regarding argument structure of the relative clause (object-/subject 1st) and embedding depth (no, one, two embeddings). **(3) Clinical tests** digit/ block-span, measure of alertness. **(4) lesion size /site** from neuroimaging were used for exploratory analyses.

Results

Correlational analyses show that performance on vSTM-tasks were relevant predictors for correct sentence-picture-matching, while reaction times only depended on age and lesion size. Notably, increasing syntactic complexity reduced the correlational strength between accuracy of sentence-to-picture matching and vSTM measures. The complementary lesion-behaviour analysis (see figure) yielded different lesion volumes correlating with either the sentence-task or the STM-task (**figure 1, A**). Factoring out vSTM measures lesions in the anterior temporal lobe correlated a larger decrease in accuracy with increasing syntactic complexity (**figure 1, B**).

Conclusions

Regarding the controversy of whether 'domain-general' or language specific resources meet storage requirements during sentence comprehension our results suggest that overall sentence comprehension depends on STM/WM capacity, while increases in syntactic complexity tax another independent cognitive resource. Thus, the results speak for the recruitment of language specific resources independent of STM/WM, when resolving complex syntactic structure. The lesion data highlight a potential role of the anterior temporal lobe during the recovery of meaning from syntactically complex sentences.

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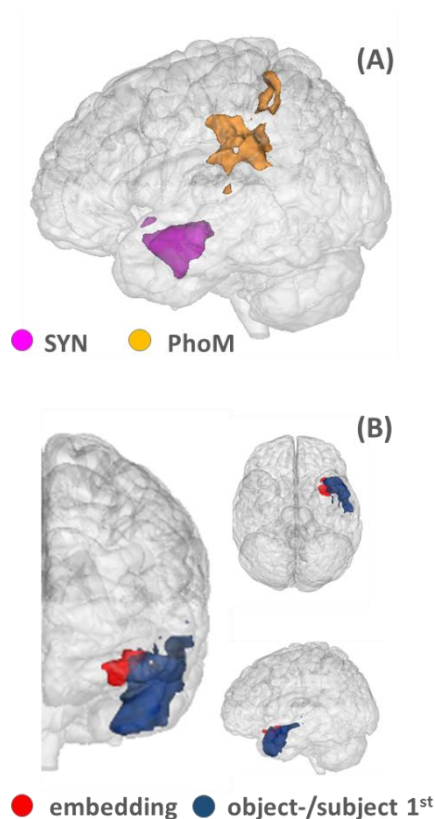


Figure 1. (A) illustrates the volumes in which lesions decreased performance in the sentence-comprehension task (purple) and the experimental vSTM task (orange). (B) Lesions in the anterior temporal lobe correlated with larger decreases in task performance with increasing syntactic complexity.

Preserved Katakana and impaired Hiragana writing in posterior cortical atrophy: A case study - Dissociated dysgraphia in two types of phonograms in Japanese -

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Introduction

The Japanese writing system is characterized by two script types: Kana (phonogram) and Kanji (morphogram). Kana are further divided into Hiragana and Katakana which are regarded as allographs. Children master Hiragana and subsequently learn Katakana during the first grade of elementary school. Each Kana script has 46 characters, as opposed to the over 2000 Kanji characters used in daily life. Kanji and Hiragana are frequently used, while Katakana primarily denotes foreign-origin words. Few reports have described the dissociated impairments in writing between Hiragana and Katakana. Particularly, no reports show higher scores for Katakana than for Hiragana.

Methods

A 68-year-old, right-handed woman was admitted to our hospital following an increase in minor vehicle accidents over the past year. Magnetic resonance imaging revealed predominantly right-sided temporoparietal lobe atrophy, with corresponding hypoperfusion observed in the ^{99m}Tc-ECD single-photon emission computed tomography. Her neurological examination was unremarkable. She was oriented in time and place but showed significant constructional impairments. Her Mini-Mental State Examination score was 25/30. Memory was largely preserved, with no signs of apraxia, topographical disorientation, or prosopagnosia. She was diagnosed with posterior cortical atrophy. Her language functions were evaluated using the Standard Language Test for Aphasia (SLTA), revealing dysgraphia for Kanji and Hiragana with relatively preserved Katakana. All Hiragana and Katakana characters were dictated to focus on the dissociation of writing abilities between them. Additionally, copying tracing, and completing incomplete characters were analyzed to determine how Hiragana errors were made.

Results

Her oral language and reading abilities were proficient as assessed by the SLTA. Both dictation and copying tasks for Kanji demonstrated significant impairment. During the dictation of 46 characters each in Hiragana and Katakana, she accurately wrote 17 and 39 characters, respectively. A prevalent error in Hiragana transcription involved correct initiation followed by premature cessation of writing. Even in a single-stroke character, her hand stopped midway through writing. Furthermore, she wrote 14 Katakana instead of Hiragana during the Hiragana dictation task. Since some Hiragana characters are similar in shape to the corresponding Katakana, she wrote a Katakana first and added a stroke to make it a Hiragana. Her performance in copying and tracing Hiragana was superior to dictation. However, she experienced significant challenges in copying Hiragana, particularly with the directionality and curvature of strokes. The task of adding missing parts to characters

revealed impairments in Hiragana. However, her ability to read and make lexical judgments on Hiragana characters was unimpaired, indicating that the mental representation of Hiragana remained intact, but the motor sequence of writing was disrupted, likely due to kinesthetic route dysfunction.

Conclusions

The study illustrates that Hiragana writing can be differentially impaired in patients with posterior cortical atrophy, with relative preservation of Katakana writing. Kanji is processed mainly through the orthographic route, while Kana engages both the orthographic and phonological routes. Hiragana may additionally be processed through the kinesthetic route due to its simpler structure, fewer numbers, and extensive overlearning (Suzuki, 2022). This suggests a distinct distribution of neurological dysfunction affecting script-dependent writing abilities in such patients

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Syntactic structure, syntactic frequency, and event typicality: The integrated effect on sentence comprehension

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Introduction

The comprehension of passive sentences in people with aphasia (PWA) has been reported to be more impaired than that of active sentences due to syntactic complexity. However, recent research indicates that passive sentences containing verbs commonly used in passive structures are just as accessible as active sentences (Jap et al., 2016; Thompson & Lee, 2009). Furthermore, there is some evidence that the semantic probability of events described may aid in sentence processing (Warren et al., 2017). Thus, this study aims to investigate how syntactic frequency and event typicality, as well as syntactic structure, influence comprehension in Japanese PWA using active and passive sentences.

Methods

Seven individuals with mild-to-moderate aphasia resulting from a cerebrovascular accident in the left cerebral hemisphere participated. All of them were native speakers of Japanese, right-handed, intellectually intact, and had difficulty in understanding passive sentences.

They completed a sentence-to-picture matching task. Half of the 88 items contained “active-bias verbs,” which are used more frequently in active voice than in passive voice (e.g., help, push, etc.), while the other half contained “passive-bias verbs,” which are used more frequently in passive voice (e.g., steal, encourage, etc.). The frequency was determined based on “The Balanced Corpus of Contemporary Written Japanese” developed by National Institute for Japanese Language and Linguistics. Furthermore, familiarity and imageability were matched between active-bias and passive-bias verbs.

Forty-four items were further divided into two categories: typical events (where the agent-theme relationship is considered to be common and fixed. e.g., “A policeman is watching a thief.”) and neutral events (the agent-theme relationship is likely to be alternated equally. e.g., “A girl is watching a boy.”).

Participants were required to select a picture that matched with an aurally presented sentence within ten seconds. The percentage of correct responses for each sentence type was calculated to compare active and passive sentences using active-bias and passive-bias verbs respectively.

Results

The correct answer rate for each sentence type is summarized in Figure 1. In typical events, active sentences with active-bias verbs were comprehended marginally better than passive sentences (active sentences 85.7%, passive sentences 67.5%, $p = 0.06$), but the difference between active and passive sentences was mitigated in passive-bias verbs; that is, passive sentences were comprehended equally well as active sentences (active sentences 84.4%, passive sentences 87.0%, $p = 0.75$).

There was no significant difference between active and passive sentences in neutral events for either active-bias verbs (active sentences 70.1%, passive sentences 68.8%, $p = 0.90$) or passive-bias verbs (active sentences 70.1%, passive sentences 71.4%, $p = 0.90$).

Conclusions

When passive-bias verbs are used to represent events that frequently occur in the real world, comprehension of passive sentences, which are considered syntactically complex, may improve. As some researchers have recently suggested (Gahl & Menn, 2016; Martinez-Ferreiro et al., 2020; Menn & Bastiaanse, 2016), sentence comprehension should be viewed as a dynamic process in which not only linguistic properties but also the speaker's experience with how sentences are used in context play an important role.

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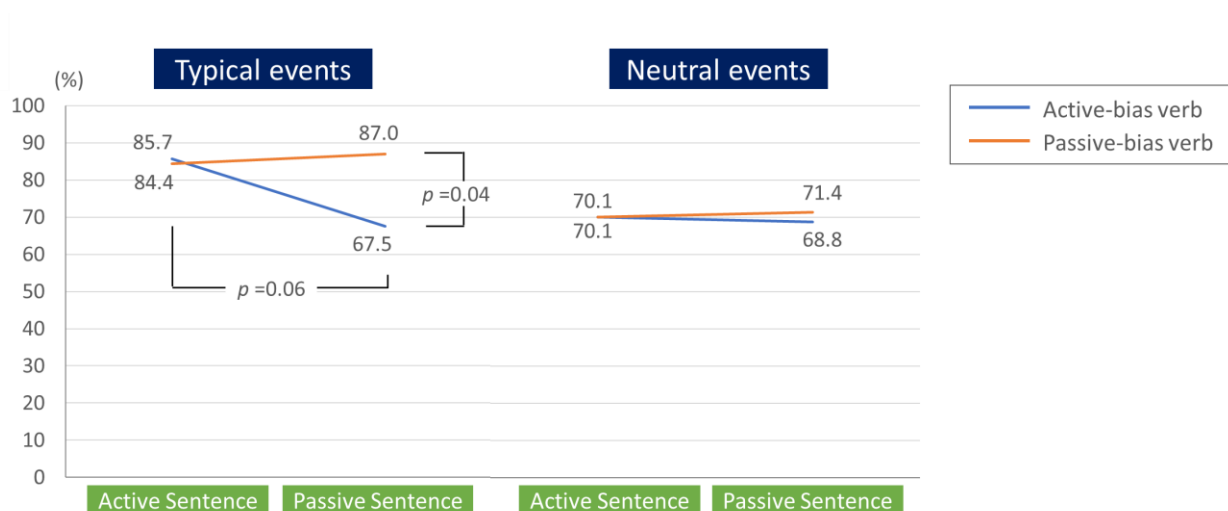


Figure 24. The correct answer rate for each sentence type.

Distinct neural pathways associated with conceptual and lexical verb retrieval priming in aphasia

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Introduction

Several studies have explored the white-matter mechanisms underlying verb retrieval in post-stroke aphasia patients (Dresang et al., 2021); however, the mechanisms behind how verb retrieval can be facilitated by priming nouns (cues) remains to be explored. Language therapies can leverage different types of noun cues to facilitate verb retrieval, such as conceptually (pencil – writing) or lexically (name – writing) related noun cues. Different treatments/cue types benefit different aphasia patients (Parkinson et al., 2009). Characterizing the neural substrates of different cueing mechanisms may translate to precision medicine advancements in prescribing therapy/cueing types based on neuroanatomical profiles. Here we report white matter tracts associated with the effects of conceptually or lexically related priming conditions on verb retrieval accuracy.

Methods

This cross-sectional, observational study included fifteen patients with chronic aphasia due to left-lateralized ischemic stroke and fourteen age-matched controls. The priming task evaluated the impact of three different cue types on verb retrieval ability: a lexically co-occurring noun, a conceptually (semantically) related noun, and a baseline, unrelated noun. To obtain a measure of individual differences for each prime type over the baseline, within-subject condition slopes were extracted from linear mixed effects regression models (Dresang et al., 2021) and used as connectometry outcome measures. Diffusion spectrum imaging (DSI) data were collected in all subjects (257 diffusion samples, TE= 99.2ms, TR= 2490ms, b-value=3975s/mm², in-plane resolution= 2mm, slice thickness= 2mm). Two correlational tractography analyses were run to identify white-matter tracts involved in (1) conceptual priming and (2) lexical priming, each compared to baseline. A multiple regression model identified the local connectome associated with each priming effect, using a deterministic fiber tracking algorithm (Yeh et al., 2013) with a T-score threshold of 3.00 and a fiber length threshold of 30 voxels. Both models included covariates for lesion volume (0 entered for control participants), age, and sex (*table 1*). To determine overlap of tracts identified in both models, a threshold of 1 mm voxel distance was applied.

Results

Both analyses found segments of tracts associated with contemporary neurocognitive dual-stream models of language, including the ventral stream left inferior fronto-occipital fasciculus, but furthermore found anatomically distinct regions associated with each priming condition. Integrity of the left frontal aslant tract was associated with magnitude of lexical priming, while posterior and ventral tracts like the left inferior longitudinal fasciculus was associated with conceptual priming (*figure 1*). In addition, the two priming conditions were associated with non-overlapping portions of corticosubcortical projection pathways implicated in motor functions, as found in previous verb studies.

Conclusions

These findings provide novel evidence that unique white matter tracts are associated with conceptual and lexical verb-retrieval priming. Tracts that were implicated in both priming conditions employed distinct, non-overlapping portions. These findings provide valuable insights that can inform neurorehabilitation strategies for cueing patients with aphasia based on lesion area so they can achieve sentence-level communication. Future research will continue to identify behavioral and neuroanatomical characteristics of individuals most likely to receive facilitation from conceptual-semantic versus lexical cue types, which will help improve the likelihood of successful therapy outcomes.

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Table 1. Data used in connectometry analysis.

Participant ID	Group	Sex	Age	CAT modality T score	Conceptual priming effect (compared to baseline)	Lexical priming effect (compared to baseline)
7001	Control	M	42	n/a	-0.0631087	0.0409794
7002	Control	M	59	n/a	0.01082667	0.00935339
7003	Control	M	74	n/a	-0.0012121	-0.231214
7004	Control	M	52	n/a	0.00658823	0.0022506
7005	Control	M	54	n/a	0.01099176	0.0040421
7006	Control	M	57	n/a	0.01102121	0.01108728
7007	Control	F	72	n/a	-0.0303585	0.01905323
7008	Control	F	64	n/a	0.00664178	0.00134086
7010	Control	M	74	n/a	0.03611423	0.06369138
7011	Control	F	68	n/a	-0.0615912	0.03845647
7012	Control	M	72	n/a	0.00594771	0.00643371
7013	Control	M	65	n/a	0.03495564	0.01828635
7014	Control	F	71	n/a	0.00913206	0.00532139
7015	Control	M	52	n/a	0.00447911	0.00829619
7016	Control	F	69	n/a	0.01101429	0.01547543
7202	Aphasia	M	63	47.83	0.05430945	-0.1885535
7203	Aphasia	F	61	59.67	0.04323522	0.00450516
7204	Aphasia	M	55	56	0.07917116	0.0742683
7205	Aphasia	M	52	48.33	0.04416101	-0.0949905
7207	Aphasia	F	70	59	0.01307328	-0.2889651
7209	Aphasia	M	77	52.83	0.01376363	0.0046458
7210	Aphasia	M	54	51.33	-0.0123403	-0.4499382
7211	Aphasia	M	71	50.33	0.0257229	-0.0015657
7212	Aphasia	M	55	51.17	-0.105058	0.64109921
7213	Aphasia	M	68	49.83	0.03718242	0.01453853
7214	Aphasia	F	53	62	-0.0281049	0.12999231
7215	Aphasia	M	71	53.17	-0.1065156	0.17911257
7216	Aphasia	M	72	42.5	0.01980017	-0.0327807
7217	Aphasia	M	72	58.67	-0.0318635	0.12468729

Notes and abbreviations: CAT Modality Mean T Score: The Comprehensive Aphasia Test- assesses aphasia severity. M-mean. SD- standard deviation. Magnitude of priming effects were computed from subject-level condition slopes extracted from published mixed effects regression models (Dresang et al. 2021).

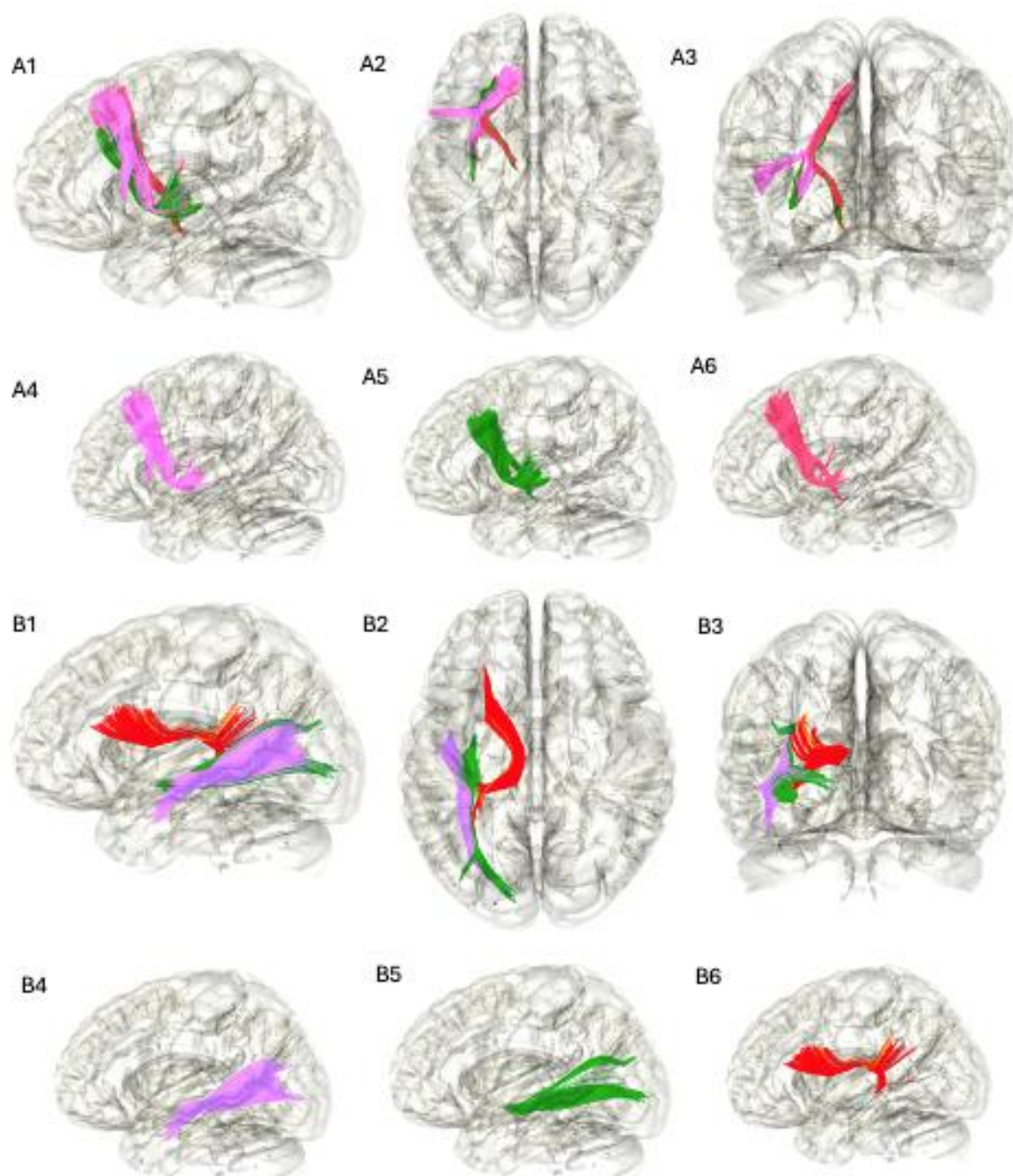


Figure 1. Data used in connectometry analysis.

Transition from deep dysphasia to phonological dysphasia: An analysis of dyslexia symptoms

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Introduction

In cases of deep dysphasia where semantic paraphasias occur during word repetition, surface dyslexia during reading aloud has been sporadically reported (Valdois et al., 1995, Majerus et al., 2001). This study analyzes dyslexia symptoms in a case that transitioned from deep dysphasia to phonological dysphasia.

Methods

To analyze dyslexia symptoms in cases of deep dysphasia, reading tests were administered on the following case 20 months post-onset.

Case (Omori et al., 2023): A 72-year-old right-handed woman experienced aphasia symptoms three days after undergoing craniotomy for the removal of a left trigeminal nerve sheath tumor. Initial CT scans showed low absorption areas in the subcortical left inferior frontal gyrus, insula, and parietal lobe. Initially, she presented semantic paraphasias during repetition, but at 20 months post-onset, these disappeared, and she exhibited formal paraphasias and phonological errors during low-imagery word repetition. Repetition effects related to lexicality and imagery were observed at both times, indicating a transition from deep to phonological aphasia.

Results

The following shows the results 20 months post-onset.

Semantic comprehension (visual). In a noun similarity judgment test (SALA AC6), she scored 42/48 (high-imagery words 24/24, low-imagery words 19/24), demonstrating an imagery effect in the orthographic input pathway ($p < .05$).

Reading aloud (kana). Kana characters which, apart from the nasal, correspond to V or CV morae. She correctly read 61/67 syllable letter. In the TLPA lexical decision test II & III, she scored 33/40 for non-words and 38/40 for words, indicating a lexicality effect. In SALA OR37, she read 37/56 non-words and 28/30 homophonic pseudowords correctly, demonstrating a homophonic pseudoword effect ($p < .01$). However, lexicalization error, semantic dyslexia, and visual misreading were not observed.

Reading aloud (kanji (Fushimi et al., 1999)). She scored 79/120 for kanji words (high-frequency words 46/60, low-frequency words 33/60) and 80/120 for kanji non-words (high-frequency 43/60, low-frequency 37/60). No lexicality effect was observed, but both word and non-word frequency effects were significant ($p < .01$, $p < .05$). Consistency effects were observed in kanji words, with the worst performance for inconsistent, atypical low-frequency words (consistent words 13/20, inconsistent atypical words 6/20: $p < .01$). The primary errors were LARC errors (e.g., “keiba (horse race)”: “kyouba”) and phonological dyslexia (e.g., “doumyaku (artery)”: “douhyaku”), with minimal visual misreading.

Conclusions

The patient exhibited symptoms of both surface and phonological dyslexia. The reading symptoms appeared to arise from partially preserved lexical and non-lexical routes.

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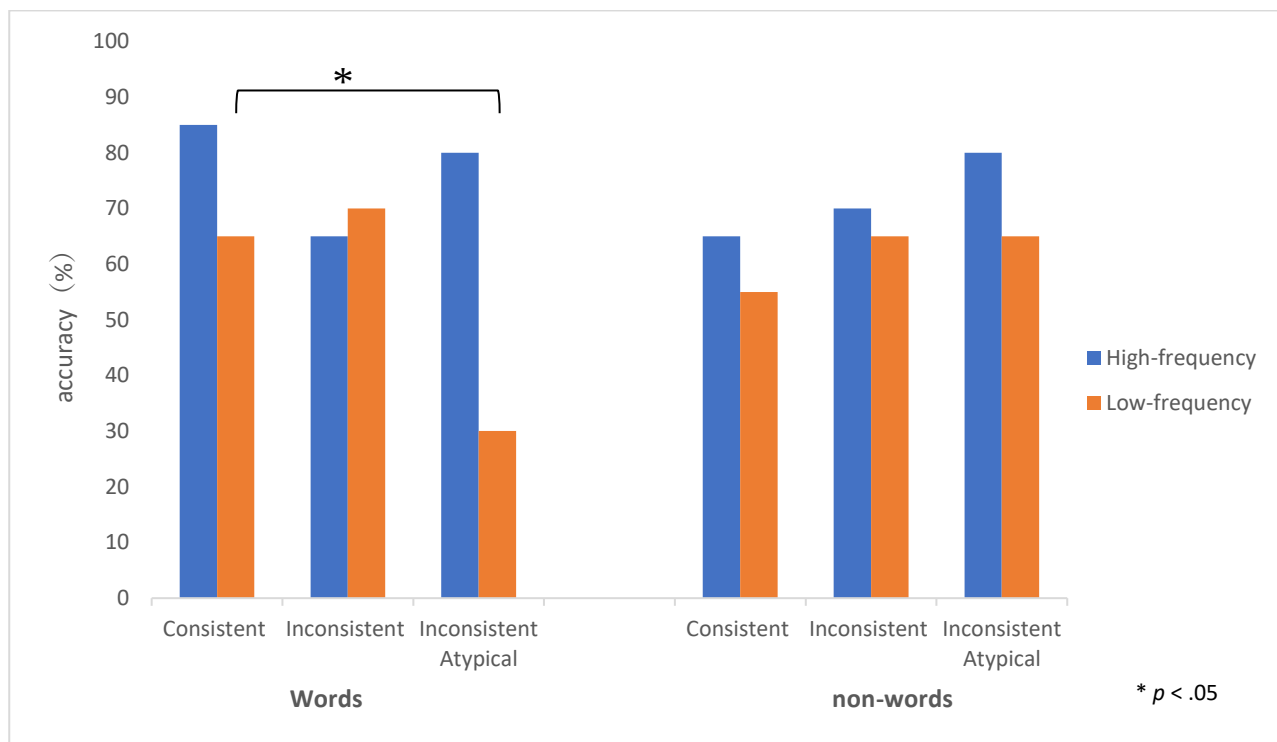


Figure 25. Kanji reading.

Table 1. Incorrect kanji pronunciations.

		Word				Non-word		
		visual	Phono-logical	LARC	other	visual	Phono-logical	other
High-frequency	Consistent	0/3 (0.0%)	3/3 (100.0%)	0/3 (0.0%)	0/3 (0.0%)	1/7 (14.2%)	6/7 (85.7%)	0/7 (0.0%)
	Inconsistent	0/8 (0.0%)	6/8 (75.0%)	2/8 (25.0%)	0/8 (0.0%)	1/6 (16.6%)	4/6 (66.7%)	1/6 (16.6%)
	Inconsistent	0/5 (0.0%)	3/5 (60.0%)	2/5 (40.0%)	0/5 (0.0%)	0/4 (0.0%)	4/4 (100.0%)	0/4 (0.0%)
	Atypical	0/7 (0.0%)	7/7 (100.0%)	0/7 (0.0%)	0/7 (0.0%)	2/9 (22.2%)	3/9 (33.3%)	4/9 (44.4%)
Low-frequency	Consistent	0/7 (0.0%)	7/7 (100.0%)	0/7 (0.0%)	0/7 (0.0%)	2/9 (22.2%)	3/9 (33.3%)	4/9 (44.4%)
	Inconsistent	0/10 (0.0%)	4/10 (40.0%)	4/10 (40.0%)	2/10 (20.0%)	0/7 (0.0%)	6/7 (85.7%)	1/7 (14.3%)
	Inconsistent	0/14 (0.0%)	7/14 (50.0%)	6/14 (42.8%)	1/14 (7.1%)	1/7 (14.2%)	6/7 (85.7%)	0/7 (0.0%)
	Atypical	0/14 (0.0%)	7/14 (50.0%)	6/14 (42.8%)	1/14 (7.1%)	1/7 (14.2%)	6/7 (85.7%)	0/7 (0.0%)

Effects of repeated application of Intensive Language Action Therapy (ILAT) in patients with chronic aphasia

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Introduction

Intensive speech-language therapy with 5 or more hours per week administered for short periods of 2-4 weeks has been shown to be successful in chronic post-stroke aphasia patients, but its application for longer periods is normally not possible due to resource limitations (Berthier et al., 2009; Breitenstein et al., 2017; Kurland et al., 2016; Pulvermüller et al., 2001; Stahl et al., 2018; Stahl et al., 2016). Therefore, long breaks with little or no therapy usually interrupt blocks of intensive therapy. However, it is, at present, unknown whether repeated application of intensive therapy blocks separated by months or years can lead to accumulating benefits. Here, we investigate this issue in 14 persons with aphasia (PWA) using an established intensive method, intensive language action therapy (ILAT) also known as 'Constraint-induced' aphasia/language therapy (Difrancesco et al., 2012; Pulvermüller et al., 2001).

Methods

ILAT was applied to a group of 14 patients with chronic post-stroke aphasia. Following an initial therapy interval of 2–4 weeks and an average break of 20.6 months (SD: 12.7; range: 8–59 m), each PWA participated in a second ILAT interval. The Aachen Aphasia Test (AAT, primary outcome measure, Huber et al., 1984) Action Communication Test (ACT, Stahl et al., 2017) and the Beck's Depression Inventory (BDI, Beck et al., 1961) were administered before and after each therapy block.

Results

A repeated-measures analysis of variance showed a significant time effect for all three tests (AAT: $df=13$, $F=8.27$, $p<0.001$, ACT: $df=12$, $F=12.9$, $p<0.001$, BDI: $df=13$, $F=3.72$, $p=0.019$). The AAT, ACT and BDI all showed significant improvements across the first treatment block (AAT: $p<0.001$, ACT: $p<0.001$, BDI: $p=0.013$), and the language and communication measures also confirmed a further improvement during the second treatment interval (AAT: $p=0.024$, ACT: $p=0.001$, BDI n.s.). No changes were evident during the long waiting period between intensive therapies where no or little therapy was available. Only the results on the ACT indicated an improvement when comparing results after the second to those after the first therapy interval ($p=0.009$). One-sided paired t-tests showed that the improvement during the first therapy session was significantly greater than during the second therapy

session on the AAT ($p=0.038$), whereas improvements on the BDI ($p=0.51$) and ACT ($p=0.53$) did not differ between treatment intervals.

Conclusions

Repeated intervals of intensive therapy with ILAT, separated by a long break, can lead to repeated improvements in language performance of persons with chronic aphasia. Furthermore, a repeated reduction of depressive symptoms was also observed across the first therapy interval, suggesting that the patients' well-being and quality of life also profited, at least from the first therapy donation. Based on these results, a format of delivery of intensive aphasia treatment in blocks interrupted by longer therapy breaks may provide an effective alternative to prolonged low-intensity treatment.

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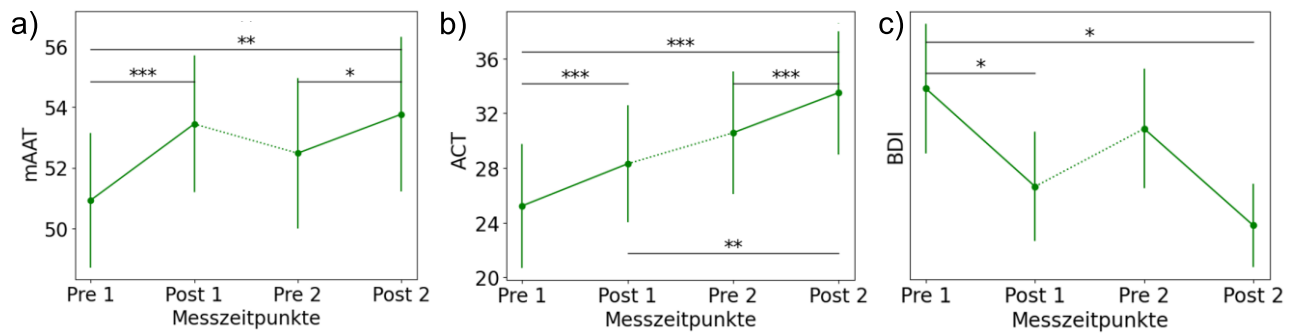


Figure 26. Average scores on a) the Aachen Aphasia Test (AAT), b) the Action Communication Test (ACT), and c) the Beck's Depression Inventory (BDI) for the two ILAT therapy intervals (1, 2), respectively before (Pre) and immediately after (Post).

Dysgraphia in Japanese patients with primary progressive aphasia: Differences between nonfluent/agrammatic and semantic variants

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Introduction

Dysgraphia in primary progressive aphasia (PPA) has not received much attention except for surface dysgraphia, which is a diagnostic feature of semantic variant PPA (svPPA) (Gorno-Tempini et al., 2011). Comprehensive examinations of dysgraphia in PPA could unveil distinct features of language impairment associated with each PPA subtype. Japanese orthography utilizes two types of characters, phonograms (kana) and morphograms (kanji). Each of kana characters has one pronunciation and no meaning, while each of kanji characters has a meaning and more than one pronunciation (Suzuki, 2022). This study addresses this gap by examining dysgraphia characteristics, affected differently based on the region of cerebral dysfunction.

Methods

We included 27 patients diagnosed with nonfluent/agrammatic variant PPA (nfvPPA) (14 patients) or svPPA (13 patients) based on the PPA criteria. Assessments were conducted using the Japanese version of Western Aphasia Battery (WAB), Mini-Mental State Examination (MMSE), and Raven's coloured progressive matrices (RCPM). Additionally, we conducted a detailed evaluation of writing abilities through the dictation task of the Sophia Analysis of Language in Aphasia (SALA)-D39, which included a dictation of 30 kanji and kana (hiragana) words. Data analysis employed chi-square tests and Mann-Whitney U tests ($p=0.05$).

Results

No significant differences in demographic features and MMSE scores were observed between the groups. In the WAB, patients with nfvPPA had significantly lower scores in spontaneous speech, kana word dictation, and the RCPM, while svPPA patients had significantly lower scores in naming and kanji word dictation. In the SALA dictation task, nfvPPA patients had significantly lower kana scores, whereas svPPA patients had lower kanji scores. Phonological paraphasia in kana was observed primarily in nfvPPA. Surface dysgraphia in kanji was observed mainly in svPPA. Common errors observed in both groups included difficulties in kanji character recall.

Conclusions

This study highlights the differences in dysgraphia between nfvPPA and svPPA, which align with the distinct regions of cerebral dysfunction associated with these two subtypes. Specifically, our findings are in accord with previous research of stroke patients, indicating that damage to the left frontal lobe predominantly affects kana writing, while damage to the left temporal lobe predominantly affects kanji writing. Furthermore, kana dysgraphia in nfvPPA and kanji dysgraphia in svPPA reflect different language impairments: syllable selection/sequencing and semantics, respectively. Thus, our results reveal a clear dissociation between impairments in writing kanji and kana in Japanese patients with PPA.

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Improving expressive language fluency in Cantonese-speaking individuals with nonfluent/agrammatic primary progressive aphasia through script intervention using aphasia-friendly text and usage-based scripts

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Introduction

Background. Previous literature proved effectiveness of video-implemented script training for aphasia (VISTA) on improving speech production of patients with nfvPPA (Henry, Hubbard & Grasso et al., 2018). Despite the promising findings reported, ongoing research is needed to better understand how to refine script training and to explore its integration with other therapeutic strategies to optimize support individuals with nfvPPA.

Purpose. This study examines the utility of script intervention using aphasia-friendly text and usage-based script for improving speech production and fluency in Cantonese-speakers with nfvPPA.

Methods

In this mixed design experimental study, script intervention with aphasia-friendly text and usage-based script were implemented in 2 individuals with nfvPPA in two phases through structured treatment sessions and with an audiovisual model. Personalized scripts presented in aphasia-friendly format, larger front size, word and line spacing, to evaluate the potential for enhancing comprehension of written materials while scripts adopted usage-based approach contained a high proportion of trigrams and frequently used words by individuals to examine the potential of usage effect on enhancing fluency and grammatical construction. Primary and secondary outcome measures were accuracy of scripted words, speech rate, mean length of utterance and grammatical errors.

Results

Participants showed significant improvement in scripted word accuracy and speech rate ($p < .05$) for trained topics. Follow-up testing indicated maintenance of gains for trained topics up to 1 month. A greater magnitude of improvement was observed for intervention with usage-based scripts. Performance on standardized tests and language sampling improved at post-treatment revealed generalization to unscripted situations.

Conclusions

This is the first study to document the benefits of script interventions using aphasia-friendly text and usage-based script in nfvPPA. Findings indicate that both aphasia-friendly text and usage-based script are viable strategies to be combined with script intervention for this target population to address the core linguistic (agrammatism) and motoric (MSD) deficits that influence successful communication.

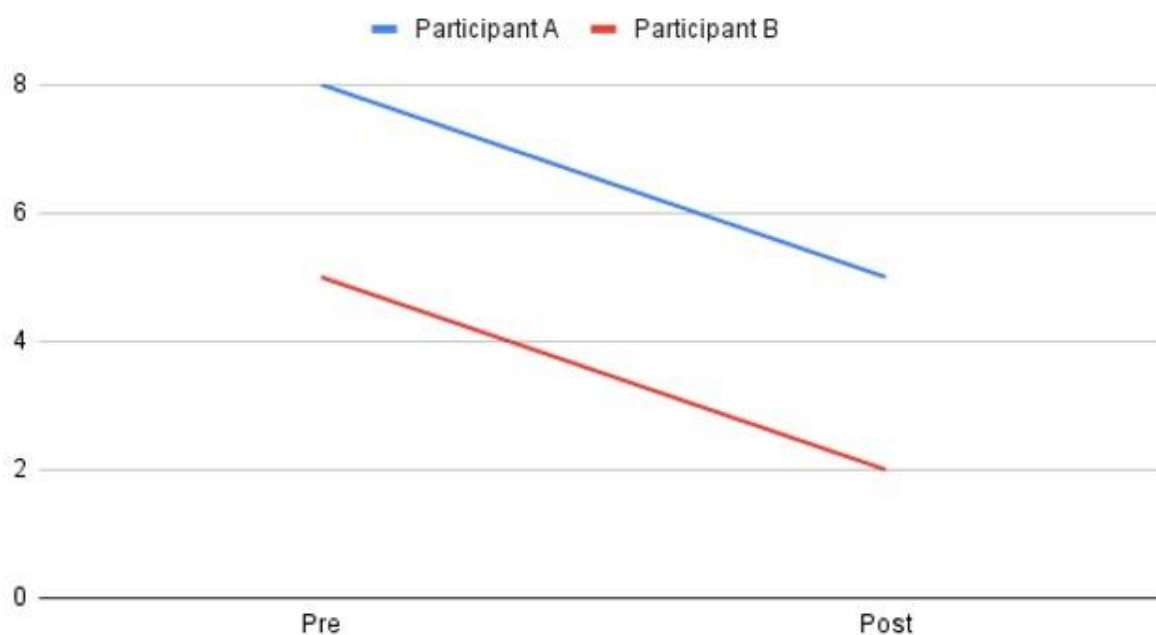
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Number of Grammatical Errors Produced in 10 Sentences



Patient ID	A		B	
Speech and language	Pre	Post	Pre	Post
MoCA				
Visuospatial function	1	0	5	5
Naming	3	3	3	3
Attention	1	2	4	5
Language	1	1	2	2
Abstraction	0	1	2	2
Memory	0	2	4	4
Orientation	6	6	6	6
Overall	12	15	26	27
Translated version of QAB				
Word comprehension	8.75	8.33	10.00	10.00
Sentence comprehension	2.92	4.58	7.92	9.58
Word finding	6.42	6.83	8.00	9.00
Grammatical construction	3.13	3.25	6.25	7.63
Speech motor programming	2.50	2.50	7.50	7.50
Repetition	5.83	6.67	9.17	9.58
Reading	5.42	5.83	7.50	9.17
Overall	4.96	5.36	8.14	8.94
Language Sampling* (MLUm)				
Picture description	2	2	3	3
Procedure description	1	1	2	3
Event recall	2	2	2	3
Storytelling	1	1	3	3
*0: single word, 1: 2 words, 2: 3-4 words, 3:5-7 words, 4:>7 words				

Psycholinguistic norms of action and object pictures in Hong Kong Cantonese – A preliminary report

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Introduction

Large-scale databanks of psycholinguistic norms are getting increasingly common (e.g. Bonin et al., 2018; Stoinski et al., 2023). The compiled databanks not only promote open science, but also allow better selection of stimuli for experiments to examine specific psycholinguistic theories. Due to issues of cultural and language differences, databanks of psycholinguistic norms obtained from single language may not be readily applicable to other languages. In the current study, the psycholinguistic norm of a set of 260 action pictures and 350 object pictures designed to fit the Hong Kong culture with psycholinguistic norms of modal names, naming response time (RT), ratings of visual complexity, picture-name-agreement and familiarity is reported.

Methods

For each of the two picture sets, a naming experiment and three separate rating experiments, namely ratings of visual complexity, familiarity, and name-picture-agreement using Likert scales, were conducted. For each of the naming and rating experiments, 40 undergraduate students (gender-balanced, age between 18 to 21 years) reported to have born in Hong Kong and used Cantonese to communicate since kindergarten, were recruited. Each participant was tested individually in a quiet room. For each trial, one of the randomly ordered target pictures was presented and the participant was required to name using Cantonese or give ratings according to prior instructions illustrated with examples. For each picture item, the percentage of subjects using each name was computed. The name reaching the highest percentage was identified as the modal name. In addition to modal name analysis, H value of each picture item, which is an index sensitive to the number and weight of alternative names, was also calculated using the following formula:

$$H = \sum_{i=1}^k P_i \log_2\left(\frac{1}{P_i}\right)$$

where k refers to the number of different names given to each picture. P_i is the proportion of participants who give a name for each object.

Results

Results of linear regression analyses indicated that for both action and object picture sets, the naming RT was significantly predicted by H-value, familiarity, name-picture-agreement and visual complexity. The total variances (R^2) explained by the action-picture model and the object-picture model are 71.7% and 77.4% respectively.

Conclusions

The two sets of pictures were designed to fit the unique cultural background of Hong Kong. They serve as invaluable resources for designing assessments and treatment for clinical purpose. The naming performance from 10 patients with aphasia using the two sets of pictures will be collected during this summer to explore possible effects of word class on lexical retrieval in Cantonese (e.g. Law et al., 2015).

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Comparative analysis of predicate types on young and older adults in a predicate-final language

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Introduction

Connected speech is commonly used to identify age-related decline in older adults and those with mild cognitive impairments (Boschi et al., 2017; Wright et al., 2011). Although research indicates that certain microlinguistic features, such as grammaticality, are relatively preserved in older adults (Glosser & Deser, 1992), they tend to produce fewer inflectional forms, exhibit less syntactic diversity, and generate simpler syntactic constructions compared to young adults (Marini et al., 2005; Moscoso del Prado Martin, 2016).

The current study utilizes a storytelling task in a predicate-final language to investigate the effects of aging on microlinguistic features, particularly focusing on predicate types, and to examine their relationship with cognitive components. In Korean, comprising of predicates can be considered complete, as the noun phrase in the subject position can be omitted when the verb's arguments are recognizable in the context (Sohn, 2019). Furthermore, Korean accommodates serial predicates, such as serial-verb or auxiliary-verb constructions, which provide additional semantic information (Sohn, 2019). We hypothesize that older adults will produce fewer serial predicates, but more single predicates compared to young adults, and that cognitive components will relate differently according to predicate types.

Methods

Participants. Sixty-four Korean-speaking individuals (32 young and 32 older) participated. They were screened using the Health Screening Questionnaire (Christensen et al., 1991). Older adults additionally completed the Korean version of Mini-Mental State Examination (K-MMSE; Kang, 2006) and immediate recall of Seoul Verbal Learning Test (SVLT-IR) from the Seoul Neuropsychological Screening Battery-2nd Edition (SNSB-II; Kang et al., 2012), and were all within the normal range (age- and education-adjusted >16%ile). Two groups did not differ significantly in education ($p=.895$).

Task. Participants performed the 'Heungbu-Nolbu (Bad Older Brother and Good Younger Brother)' storytelling task, a well-known folktale in Korea, using a series of eight black-and-white drawings (Choi et al., 2022).

Predicate analyses. Analyzed predicate types were: 1) Single Predicate-Adjective(SP-Adj), 2) Single Predicate-Verb(SP-Vb), 3) Do-verb(Do-Vb) consisting of 'noun+do(hata)', 4) Be-Copular(Be-C) consisting of 'noun+be(ita)', 5) Serial Predicate(Serial-P) featuring serial- or auxiliary-verb constructions, and 6) Predicate Complexity(P-Complexity) that measures the complexity of Serial-P (Sung & DeDe, 2018)(See Table 1 for example).

Results

Older adults produced significantly more SP-Vb($p=.038$) but fewer Serial-P than young adults($p=.048$). There were no significant differences between two groups in SP-Adj($p=.375$), Do-Vb($p=.722$), Be-C($p=.076$), and P-complexity($p=.814$)(Figure 1). Furthermore, Pearson's correlation coefficient results for older adults revealed that SP-Vb was significantly positively correlated with K-MMSE($r=.366^*$) and SVLT-IR($r=.470^{**}$),

whereas Do-Vb was significantly negatively correlated with K-MMSE($r=-.358^*$). Moreover, Serial-P was significantly positively correlated with SVLT-IR($r=.361^*$).

Conclusions

Older adults produced more simple predicates but fewer serial predicates compared to young adults, who exhibited the opposite pattern. Specifically, older adults with higher SVLT-IR scores produced more serial predicates, indicating that semantic short-term memory is a significant indicator of their ability to generate serial predicates. This finding is consistent with prior research on English-speaking older adults, which indicates that age-related cognitive decline complicates the production of verbs with complex arguments (Kemper et al., 2003; Altmann & Kemper, 2006). Our findings underscore the importance of investigating language-specific markers, like serial predicates, for early detection of cognitive decline in aging.

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Table 1. Example of predicate analysis

Scene #1 	
It is a scene⁴⁾ in which Nolbu expels²⁾ Heungbu's family in the cold weather. Heungbu and his children are crying while walking⁵⁾. Nolbu is farewelling³⁾ them with a wicked expression and this makes Heungbu's family pitiful¹⁾.	
Types	Korean translation
Be-C ⁴⁾	cangmyen-ita scene-Be-copular
SP-Vb ²⁾	nayccoch-ta expel-Declarative (expel)
Serial-P ⁵⁾	wul-myense / ket-ko / iss-ta cry (1) / walk (1) / be-Auxiliary (1) → P-Complexity ⁶⁾ = 3 (cry while walking being)
Do-Vb ³⁾	paywung-hata farewell-Do-verb (do farewell)
SP-Adj ¹⁾	anthakkap-ta pitiful-Declarative

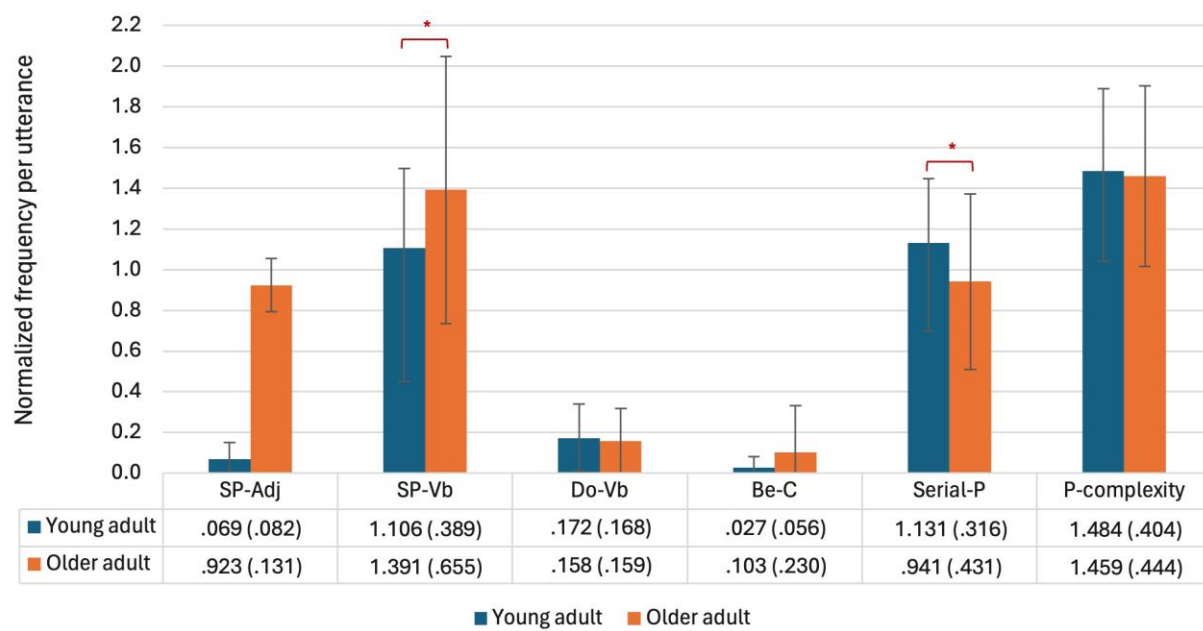


Figure 27. Frequency comparison of predicate types between young and older adults.

Discourse comprehension deficits in non-fluent variant primary progressive aphasia and autism spectrum disorder: Evidence for a continuum of language traits beyond diagnostic boundaries

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Introduction

Non-fluent variant primary progressive aphasia (nfvPPA) is characterized by cortical atrophy primarily in the left inferior frontal gyrus (Mesulam, 2016). The question whether vulnerability of the language network in nfvPPA is related to neurodevelopmental disorders that affect language acquisition processes and make the language network a locus of vulnerability of a later-arising neurodegenerative disease, such as nfvPPA, has recently attracted great interest (Hillis & Kolundzic, 2020; Weintraub et al., 2020). Relevant research has detected common language deficits across PPA and neurodevelopmental disorders (Oswald et al., 2017), however, the way these deficits are manifested in discourse skills of both clinical populations is still underexplored. The current study aims: (a) to compare nfvPPA and children with Autism Spectrum Disorder and co-occurring Specific Language Impairment (henceforth, ASD-SLI) on a listening discourse comprehension task that targeted explicit and implicit comprehension skills, and (b) to identify underlying mechanisms mediating discourse comprehension in each group, including working memory and syntactic comprehension.

Methods

The study included 14 Greek-speaking participants with nfvPPA (age range 53-73; mean age: 64 yrs., *SD*: 5.1) along with eighteen age- and education-matched language-unimpaired adults, and a group of 23 children with ASD-SLI diagnosed by expert clinicians (age range 9-12; mean age: 10;5 y;m, *SD*: 1.3), along with 23 age-matched typically-developing (TD) children. Participants were administered a listening comprehension test (Cain & Oakhill, 1999) that measured inferencing of implicit/knowledge-based and text-based inferencing; and recall of explicit facts. The groups were also assessed on vocabulary, syntactic comprehension and digit span tests.

Results

The nfvPPA patients performed lower than controls in overall discourse comprehension accuracy ($p < .001$) (see Table 1). The patients scored lower than controls in text- and knowledge-based (i.e., implicit) inferencing ($p = .041$ and $p < .001$, respectively) but not in factual (i.e., explicit) comprehension ($p = .124$). The pattern was similar in ASD-SLI children. Overall accuracy was lower than TD children ($p = .003$). Group differences were observed in implicit inferencing ($p = .037$ and $p = .002$, respectively), but not in explicit comprehension ($p = .117$). Mediation analyses showed that nfvPPA patients' implicit inferencing was significantly mediated by syntactic comprehension ($p = .017$, $R^2 = 24.7$), while ASD-SLI's implicit inferencing was mediated by syntactic comprehension ($p = .019$, $R^2 = 34.3$) and digit backward (proxy for working memory) ($p = .04$, $R^2 = 19.7$).

Conclusions

Patients with nfvPPA and ASD-SLI children exhibited qualitatively similar patterns of performance in discourse comprehension, with both groups being impaired in drawing

implicit inferences but not understanding facts. Deficits in these skills were strongly associated with syntactic capacity in patients, and both syntactic capacity and working memory in children. The finding that the two disorders selectively targeted the same domain in language (i.e., implicit inferencing), and that both clinical groups' inferencing performance was regulated by overlapping factors (i.e., syntactic capacity) speak in favor of a common deficit in the architecture of language/cognition in the two disorders. These findings may open new venues of theorizing on the intersection between neurodevelopmental and neurodegenerative conditions affecting language.

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Table 1. Groups' mean accuracy (%) in factual, text- and knowledge-based inferencing comprehension, and mean accuracy (%) collapsing across conditions.

Group	Factual/Explicit comprehension	Text-based/Implicit inferencing	Knowledge-based/Implicit inferencing	Total mean accuracy
nfv-PPA	69.9 (14.4)	69.1 (20.0)	43.5 (14.2)	60.7 (10.1)
Control adults	83.1 (14.3)	86.6 (13.3)	96.4 (5.8)	88.7 (7.3)
ASD-SLI children	50.3 (10.1)	41.3 (14.4)	25.5 (14.4)	39.0 (7.2)
Control children	61.5 (8.6)	53.6 (12.4)	39.9 (12.3)	51.7 (10.7)

Note. nfv-PPA = non-fluent variant primary progressive aphasia; ASD-SLI = Autism Spectrum Disorder with co-occurring Specific Language Impairment

The rationality of mismatch between clinical classification and statistical cluster analysis conclusions: A discussion on the validation of aphasia classification criteria

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Introduction

The Boston Group classification system, or the classical classification system, has been the most influential and frequently used classification system in clinical aphasia diagnosis, with its terminology being widely accepted and applied globally. The classification system has been adopted by standardized aphasia batteries such as the Boston Diagnostic Aphasia Examination (BDAE) and the Western Aphasia Battery (WAB). The validation of the classification criteria was usually conducted by the test developers through comparisons between the clinical classification conclusions and the results of statistical procedures, especially the cluster analysis methods (Kertesz, 1977; Kertesz & Phipps, 1980). However, subsequent studies reported varied agreement rates between the clinical classification and statistical clusters, which ranged from 30% to 88% (e.g. Crary et al., 1992; Yiu et al., 1998; Clough & Gordon, 2020; Landrigan et al., 2021). In addition, the discussion on the classification validity was insufficient in number (Kertesz, 2020).

Methods

The current study purposed to examine and discuss the efficacy of using cluster analysis methods as a validation procedure for aphasia classification criteria under the argument-based validation framework (Kane, 2006, 2013) and built its argument based on Toulmin's structure (illustrated in *Figure 1*). To examine the efficacy of common cluster analysis methods, we used the k-means cluster analysis, hierarchical cluster analysis, and q-type factor analysis to generate data-driven clusters from a dataset of WAB-R (revised version) testing scores collected from 122 Mandarin-speaking non-acute post-stroke aphasic patients. Comparisons were made between clustering classification conclusions and clinical classification conclusions using WAB-R criteria. Eight clusters were expected to be generated from statistical procedures as confirmatory tests. To explore the influence of cluster numbers, the solutions of generating six, eight, and ten clusters were conducted in the k-means and hierarchical cluster analysis. Analysis of cluster attributes and membership was made based on statistical results.

Results

Under the solution of eight clusters, the overall agreement between cluster analysis and clinical classification was moderate. The rate was 62.3% with k-means cluster analysis and 56.6% with hierarchical cluster analysis. The overall agreements increased with the increase of cluster number in hierarchical cluster analysis but did not influence that of k-means cluster analysis (see Table 1). The overall agreement of q-type factor analysis was inferior (20.5%). Attributive analysis suggested the instability of using cluster analysis to validate aphasia classification criteria, as the fundamental differences between the clustering algorithm and the theoretical classifying procedure formed a major conflict in the ways of generating clusters and caused the mismatch.

Conclusions

The results suggested that, although cluster analysis could provide supportive evidence for the classification criteria, the method presented reliability issues when used as the only decisive source for the validation. The mismatch rates did not directly form a critical challenge to the classification criteria. The argument-based validation framework could assist and guide the validation of aphasia tests through solid argumentation. Cross-validation via multiple statistical procedures is recommended as well as the use of more indexes other than the battery items as external indicators for validation to a specific aphasia classification criterion.

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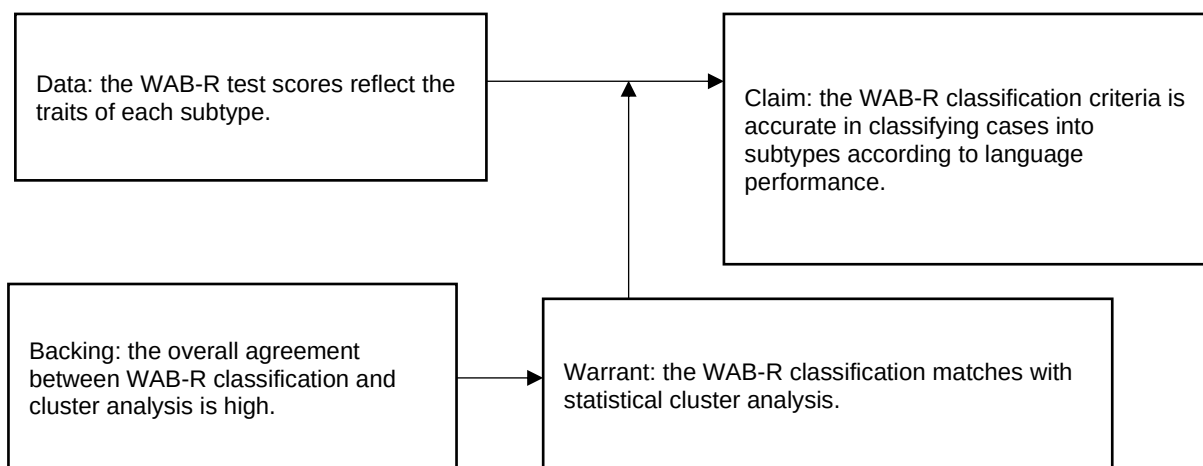


Figure 1. An illustration of Toulmin's argument structure as the basis of the current study.

Table 1. K-means cluster analysis results (using the four scores as clustering variables).

Solution of 6 clusters			Solution of 8 clusters			Solution of 10 clusters		
Cluster type	N	Match rate	Cluster type	N	Match rate	Cluster type	N	Match rate
1 GLO	17	70.6%	1 CON	4	50.0%	1 ANO	11	54.5%
2 TRM	30	33.3%	2 BRO	15	60.0%	2 CON	5	40.0%
3 BRO	23	60.9%	3 TCM	13	46.2%	3 BRO	25	68.0%
4 CON	6	50.0%	4 ANO	17	53.0%	4 TCM	13	30.8%
5 TCM	15	46.7%	5 TCM	21	33.3%	5 TCM	7	42.9%
6 ANO	31	96.8%	6 ANO	22	100%	6 ANO	23	100%
			7 GLO	11	81.8%	7 GLO	11	81.8%
			8 BRO	19	57.9%	8 CON	1	100.0%
						9 WER	8	75.0%
						10 TCM	18	33.3%
Total	76	62.3%		76	62.3%		77	63.1%

Abbreviations: BRO=Broca's aphasia; WER=Wernicke's aphasia; GLO=Global aphasia; ANO=Anomic aphasia; CON=Conduction aphasia; TCM=Transcortical motor aphasia.

STAR- sentence treatment for aphasia recovery: Personalized virtual implicit training

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Introduction

Difficulty producing sentences is common in persons with aphasia (PWA). Yet, available treatment options are limited, and they require explicit re-learning of grammatical rules, which is often challenging for PWA. Additionally, there remains a deficiency of treatments that can be easily delivered virtually. Research suggests that humans learn to produce different types of sentences through experience-based implicit learning, called structural priming (Chang, Griffin, & Bock, 2006; Pickering & Ferreira, 2008). After reading and hearing prime sentences, PWA can produce similar sentence structures more frequently and successfully (Cho-Reyes et al., 2016; Man et al., 2019). Lee and Man (2017) found that implicit priming-based Sentence Treatment for Aphasia (STAR) was effective in creating generalizable and lasting (up to a month) improvement in a single case study. This study examined if the in-person outcomes of STAR (Lee & Man, 2017) could be replicated and extended (a) to virtual delivery, (b) across different target sentences tailored to the severity level of each PWA, and (c) over longer-term (2 month) follow-up.

Methods

Two participants with moderate-to-severe Broca's aphasia (A1, A2) completed baseline, 15 sessions of oral reading structural priming treatment, and 1-month and 2-month follow-up sessions. At baseline, each PWA was tested on a set of target sentences to determine their appropriate target structure. A1 received training on active sentences (e.g., *the girl is chasing the man*), and A2 received training on dative sentences (e.g., *the boy is giving a guitar to the man*). The training was administered through Zoom. In training, the participant orally repeated 2 prime sentences followed by 2 fillers and described a target picture. Daily probes were conducted for trained and untrained target items to assess acquisition, generalization, and maintenance effects. Portions of the Northwestern Assessment of Verbs and Sentences (Thompson 2012) were administered at baseline and post-testing sessions to measure additional generalization effects.

Results

A1 significantly improved on trained (0% to 100%) and untrained (10% to 90%) transitive sentence production, and the improvements were maintained at 1 month (trained 90% and untrained 100%) and 2-month (trained: 90%; untrained 90%) follow-up. Likewise, A2 improved for trained (0% to 60%) and untrained dative sentences (0% to 40%). Additionally, A2 showed generalized improvement on untrained transitive sentences (30% to 85%). The follow-up sessions for A2 are ongoing. Both participants also showed generalized improvements on the Verb Naming Test (A1: 36% to 55%; A2: 73% to 90%) and the Argument Structure Production Test of the NAVS (A1: 31% to 59%; A2: 63% to 90%) indicating generally improved verb retrieval and sentence production abilities.

Conclusions

STAR is a promising and versatile intervention strategy for sentence production difficulties in PWA. STAR can be tailored to each PWA's level of severity, yielding significantly

improved production of trained and untrained sentences for both PWAs. Positive maintenance effects and broader generalization to different types of sentences and verb retrieval were also noted through implicit learning of message-sentence associations. In addition, the treatment was effectively delivered virtually, which is promising for reaching PWAs who have limited access to in-person therapy.

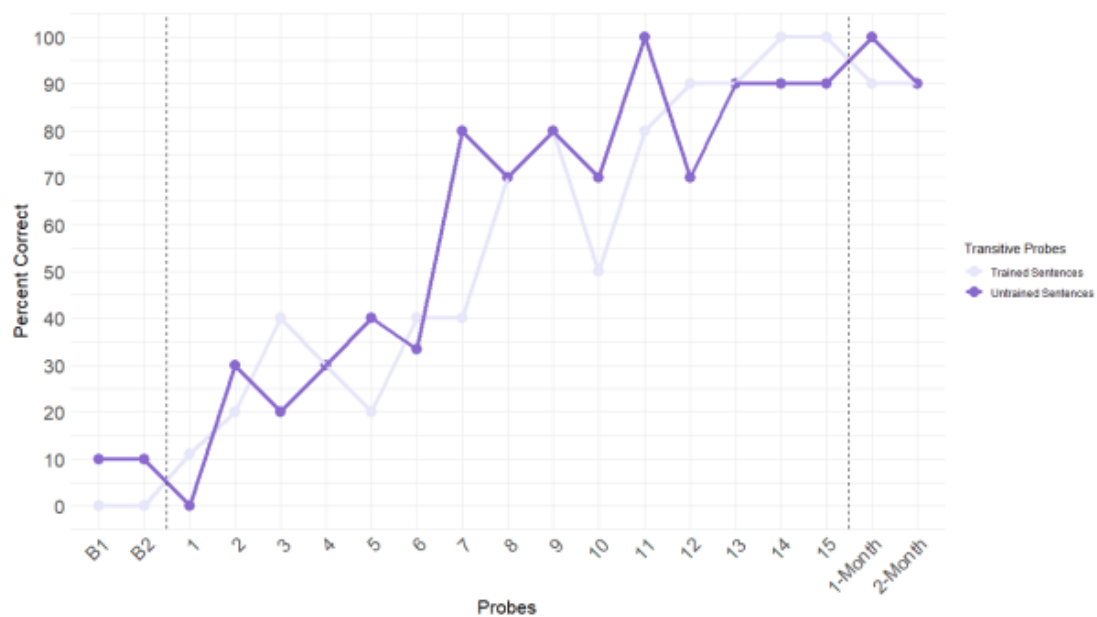
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Participant A1



Participant A2

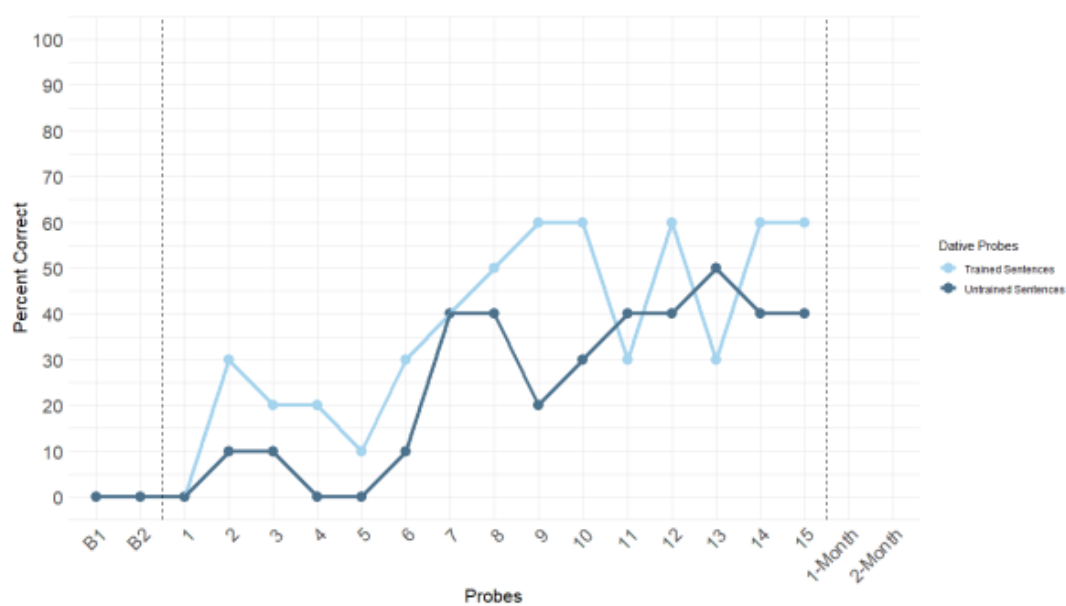


Figure 1. Performance on daily probes for baseline, treatment, and follow-up testing for A1 (top) and A2 (bottom). A1 was trained on transitive sentences and A2 was trained on dative sentences. Follow-up testing data will be collected and reported for A2.

Orthographic processing and disorders in Asian orthographies

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Introduction

The vast majority of research on the cognitive processes that support literacy (reading and writing) and acquired orthographic processing deficits has involved alphabetic orthographies. However, much of the world reads and spells using non-alphabetic orthographies, including many Asian orthographies (Joshi & Aaron, 2005). This symposium provides an overview of the characteristics of three East Asian orthographies (Japanese, Korean and Chinese) followed by reports on acquired dyslexia/dysgraphia. Understanding the similarities and differences between orthographies, orthographic processes and deficit profiles helps identify universal and orthography-specific characteristics, with significant implications for rehabilitation design.

Structure

Presentation 1. Orthographic characteristics of Japanese, Chinese and Korean: Similarities and differences (Ami Sambai, University of Tsukuba)

I will provide an overview focusing on three East Asian languages - Japanese, Chinese and Korean. The three differ from languages with alphabetic orthographies. Importantly, there are also similarities and differences among these three orthographies that can influence reading and spelling processes and the deficits that can arise.

Presentation 2. Acquired dyslexia in Japanese orthography: Symptoms and assessment (Kosei Hashimoto, Meiji University)

Japanese orthography consists of two writing systems, logographic Kanji and phonographic Kana. We created lexical decision and reading-aloud tasks to assess the underlying mechanisms of acquired dyslexia. Task reliability and validity were confirmed with healthy adults. Currently, the tasks are used in clinical assessment, providing valuable information for interpreting Japanese acquired dyslexia.

Presentation 3. Characteristics and recovery of acquired dyslexia and dysgraphia in the Korean orthography (Sung-Bom Pyun, Korea University College of Medicine)

The Korean alphabetic system, Hangeul, differs significantly from Western and other East Asian orthographies with consonants and vowels arranged in syllables within square-like blocks. I will discuss cases/types of acquired dyslexia and dysgraphia in Korean, the recovery process, brain plasticity, and influencing factors.

Presentation 4. The impact of script in Chinese-speaking primary progressive aphasia (Boon Lead Tee, University of California, San Francisco)

Most insights into Primary Progressive Aphasia stem from English speakers. Chinese, with its logographic script and visual complexity, contrasts with English's linear, left-to-right structure. I will report on dysgraphia and dyslexia phenotypes in Chinese-speaking

individuals with different PPA variants, comparing their symptoms with English-speaking PPA.

Presentation 5. Spatiotemporal neural network of sublexical reading in Chinese: An intracranial SEEG study (Zaizhu Han, Beijing Normal University)

Surface dyslexia involves overreliance on the sub-lexical route for reading. To reveal the neural network underlying sublexical processing in Chinese, participants read Chinese words during intracranial SEEG recording. Sublexical effects (regularity, consistency, transparency) were observed, revealing the neural dynamics of surface dyslexia in Chinese.

Interest to the Academy

This symposium includes speakers from different Asian countries (Japan, China, Korea) and different disciplines (neurology, psychology, speech pathology, rehabilitation medicine), reporting on different deficit etiologies (stroke and PPA), employing different research methods (behavioral and neuroimaging). It will provide truly unique opportunities for AoA members to learn about understudied orthographies, deficits and rehabilitation approaches and to interact with aphasia researchers typically under-represented in AoA meetings.

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Validity and reliability of the Fatigue Severity Scale for Aphasia (FSS-A)

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Introduction

Post-stroke fatigue is a pervasive but poorly understood symptom, with an estimated prevalence of between 20% and 85% of stroke survivors (Cumming et al., 2016). This variability is attributed to several factors, including the subjective nature of fatigue experiences and challenges accurately reporting fatigue. Individuals with aphasia face additional obstacles in communicating fatigue symptoms, further complicating the issue. Notably, recent review of post-stroke fatigue research highlights the underrepresentation of persons with aphasia (PWA) in these studies, identifying a critical gap in understanding and addressing their specific needs (Riley et al., 2021).

Central to this issue is the lack of fatigue measurement tools tailored to the unique communication challenges of PWA. Conventional assessments, such as the Fatigue Severity Scale (FSS), rely heavily on language comprehension and responses, limiting accessibility for individuals with language impairments. To address this limitation, the FSS was adapted to enhance its applicability for PWA. Through focus group discussions involving PWA and experienced speech-language pathologists, the Fatigue Severity Scale for Aphasia (FSS-A) was developed. The FSS-A included modifications such as simplifying language, incorporating visual aids, and optimizing response formats to accommodate diverse communication needs (Rembrandt et al., 2023). For this study, we assessed the validity and reliability of the FSS-A.

Methods

Validity and reliability of the FSS-A were evaluated in three groups of English-speaking adults: a healthy control group (n = 202), a post-stroke group (n = 60, 47% reported experiencing language challenges), and an aphasia group (n = 10). Healthy control and post-stroke participants completed the FSS-A, along with other established fatigue measures such as the Fatigue Assessment Scale (FAS; Michielsen et al., 2004), the Multidimensional Fatigue Inventory (MFI; Smets et al., 1995), and the original FSS (Krupp et al., 1989), which were administered through the online data collection tool, Prolific (prolific.com). Aphasia group participants completed testing in-person with a Speech-Language Pathologist and were administered the FSS-A and the original FSS. A subset of control and post-stroke participants and all the aphasia participants completed the FSS-A a second time in a subsequent session to assess test-retest reliability.

Results

Results showed significant positive correlations for all comparisons (see Table 1). Correlations were strong between the FSS-A and other fatigue measures in the healthy and stroke/aphasia groups, indicating good construct validity. Furthermore, alternate form validity was supported by a strong positive correlation between the FSS-A and the original FSS. Test-retest reliability analysis comparing administration of the FSS-A at two different time points yielded consistently strong correlations.

Conclusions

These findings support the FSS-A as a valid and reliable tool for assessing fatigue in PWA, as well as in the broader stroke population. By addressing accessibility barriers posed by conventional measures, the FSS-A facilitates more inclusive research practices and improves the chance that the fatigue experiences of PWA are adequately captured. The development and validation of the FSS-A represents a significant advancement in post-stroke fatigue assessment, promoting equity and inclusivity in stroke research and clinical practice and ultimately enhancing the quality of care for individuals living with stroke-related fatigue.

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Table 1. Results of Pearson correlations assessing validity and reliability of the FSS-A.

	Comparison	Group	dF	r
	FSS-A vs. MFI [construct validity]	Healthy controls	200	.686**
		Stroke/aphasia	58	.745**
	FSS-A vs. FAS [construct validity]	Healthy controls	200	.761**
		Stroke/aphasia	58	.788**
	FSS-A vs. FSS [alternate form validity]	Healthy controls	97	.869**
		Stroke/aphasia	58	.858**
	FSS-A (1) vs. FSS-A (2) [test-retest reliability]	Healthy controls	134	.823**
		Stroke/aphasia	38	.863**
** indicates significance at $p < .001$; FSS-A = Fatigue Severity Scale for Aphasia, FSS = Fatigue Severity Scale, MFI = Multidimensional Fatigue Inventory, FAS = Fatigue Assessment Scale				

Cognitive control involved in resolving semantic interference across individuals with and without left hemisphere stroke-induced aphasia

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Introduction

Monitoring one's speech is necessary for effective communication. Speech monitoring mechanisms may be modulated by semantic context, which can result in interference or facilitation during language production^{1,2}. These diverging effects have been explored in taxonomic and thematic semantic contexts. Taxonomically-related words (e.g., wolf and dog) have been associated with interference, while thematically-related words (e.g., leash and dog) have been associated with facilitation^{3,4}. We propose that an increased effort to monitor language production may be necessary to resolve the semantic interference created by taxonomic contexts. These speech monitoring mechanisms may further be impacted in individuals with aphasia (IWA) due to left hemisphere stroke in whom brain regions typically associated with cognitive control and semantic interference resolution have been damaged, such as the left lateral prefrontal cortex (PFC)⁵. We hypothesize that the medial frontal conflict monitoring system, reflected in the error negativity and previously associated with inner speech monitoring, may aid in resolving taxonomically-induced semantic interference in individuals with lesions involving the left lateral PFC.

Methods

We investigated the effect of left hemisphere stroke-induced lesions on left prefrontal and medial frontal cognitive control mechanisms engaged in resolving semantic interference. In particular, we examined a previously reported left prefrontal EEG component and the error negativity in correct trials, also referred to as the correct response negativity (CRN), a medial frontal EEG correlate of conflict and inner speech monitoring. We recorded scalp EEG in seven IWA (mean age: 61.3 years, SD: 16.3) and 11 age-matched controls (mean age: 63.1 years, SD: 9.3) in a Picture-Word Interference task involving taxonomically-, thematically-, and unrelated auditorily-presented distractor words. Statistical analyses were performed on the surface area under the curve of EEG activity at the lateral frontal electrode F3 and the central electrode Cz.

Results

Individuals with aphasia (IWA) were slower ($p < 0.001$) and made more errors ($p < 0.001$) than controls. Controls were slower ($p < 0.001$) and individuals with aphasia made more errors ($p = 0.041$) in the taxonomic vs. thematic condition. The left lateral PFC negativity was significantly larger in the taxonomically-related vs. unrelated condition from 30-130ms after response onset in controls ($p = 0.048$), but this was not the case for the thematically-related vs. unrelated condition ($p = 0.966$). In IWA, there was no taxonomic effect at this recording site ($p = 0.405$). Contrastively, the medial frontal negativity was significantly larger in the taxonomically-related vs. unrelated condition after response onset (18-118ms) in IWA ($p = 0.042$), but not in controls ($p = 0.541$). No significant difference between thematic and unrelated conditions was observed at this recording site in IWA ($p = 0.073$).

Conclusions

These preliminary results indicate that cognitive control mechanisms supported by the left lateral PFC are involved in resolving semantic interference induced by taxonomically-related contexts in individuals without stroke-induced aphasia. However, in IWA with left hemisphere brain lesions, this left lateral PFC EEG component was absent, indicating possible impairment of the cognitive control mechanisms originating from this brain region. Consequently, the medial frontal monitoring mechanism reflected by the CRN may be engaged to resolve increased semantic interference in IWA with left hemisphere lesions.

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Verbal initiation, selection, strategy, and inhibition in stroke: A brief, novel screening tool

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Introduction

Many stroke-specific screening tools cater to patients with aphasia, meaning those with impaired core language, and more subtle impairments often go undetected. Further, current widely used cognitive screens only minimally assess executive processes impacted in acute stroke. To address this, we introduce a brief (<5minutes) verbal screening tool (the Brief Executive Language Screening Test-Sentence Completion; BELS-SC; Robinson et al., 2021), adapted from the Hayling Sentence Completion Test (HSCT; Burgess & Shallice, 1996), which assesses four executive processes required for spoken language: *initiation*, *selection*, *inhibition*, and *strategy*. Key features of the BELS-SC include **1)** high and low constraint (HC and LC, respectively), sentences to increase selection demands, **2)** repetition of Initiation items in the Inhibition subtest to increase inhibition demands, and **3)** a score for strategy. Here, we aimed to determine the convergent validity of the BELS-SC and compare left and right hemisphere (LHS and RHS, respectively) stroke patients' performance on each component assessed by the BELS-SC.

Methods

Eighty-eight acute to early sub-acute stroke patients (tested within 7 weeks of stroke; N LHS = 29, N RHS = 57, N Bilateral = 2) and 116 healthy age-matched controls completed the BELS-SC as part of a larger neuropsychology battery. Inclusion criteria were first-time stroke confirmed by CT or MRI, >18 years old, and fluency English. Exclusion criteria were Transient Ischaemic Attack, significant psychiatric history, or neurological diagnoses. Convergent validity was evaluated via correlations. Control, LHS, and RHS groups were compared on BELS-SC measures using Kruskal-Wallis tests, and Mann-Whitney U tests for pairwise comparisons. Bonferroni corrections were applied to correct for multiple comparisons.

Results

The BELS-SC Initiation and Inhibition subtests demonstrated good convergent validity with corresponding HSCT subtests ($N = 140$, $r = .36$, $p < .001$ and $N = 147$, $r = .49$, $p < .001$, respectively). RHS were significantly poorer than controls on all BELS-SC components. LHS were significantly poorer than controls on all components except Initiation HC (low selection demand) items. LHS and RHS appeared to be relatively equally impaired on initiation and selection processes; however, RHS showed more profound impairment on inhibition and strategy compared LHS (see Figure 1). This was particularly clear for Inhibition HC items, where RHS were significantly worse than LHS (62% of RHS and 27% of LHS impaired).

Conclusions

The BELS-SC is a valid, brief, bedside screening tool that can capture four key distinct executive processes required for spoken language production. The adaptation of repeating Initiation items in the Inhibition subtest showed to be particularly effective in increasing inhibition demands and detecting more subtle impairment. Further, the current study

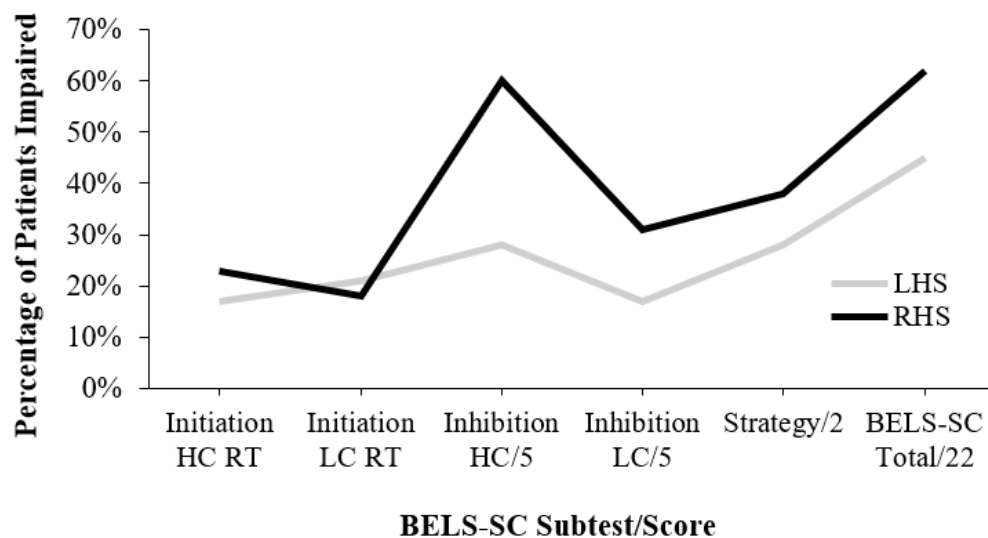
highlights bilateral involvement in executive functions in a group of stroke patients without significant aphasia. The BELS-SC is a useful and practical tool which may aid in detecting executive language deficits and prompting early intervention and rehabilitation post-stroke.

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Note. This figure demonstrates the percentage of LHS and RHS patients who were impaired (i.e., below 5th percentile) on BELS-SC subtests.

Figure 1. Proportion of LHS and RHS groups impaired on BELS-SC subtests.

Language testing during awake brain surgery: Defeating the gold standard?

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Introduction

Forty-five years after the seminal work of Catherine Mateer and George Ojemann^[1], the assessment of language in people with brain tumors has experienced significant advances^[2]. Awake brain surgery consists in applying a short and weak electric current directly to the cortex or subcortical structures, while the patient is asked to perform language tasks^[3]. The goals of this approach are maximizing tumor resection, and minimizing postoperative impairments. In this symposium, Japanese and European researchers will discuss the state-of-the-art in this field with a focus on the rationale and neural correlates of a series of tasks, including the gold standard (i.e., object naming), and new approaches using action naming^[4,5], reading and writing^[6,7], proper names and non-verbal semantics^[8,9], and sentence processing^[10,11]. We will think critically about the gold standard, and showcase new approaches that improve patient outcomes, and enhance our knowledge of how language is represented in the brain.

Structure

Presentation 1. Object and action naming (Adrià Rofes, University of Groningen)

Object naming is the gold standard in awake brain surgery. The task is useful because it assesses lexico-semantic processes, hence, sparing severe damage in language production and comprehension. Newer advances, however, indicate that a combination with action naming may allow the detection of more brain areas relevant to language processing, as well as sparing language processes that are more relevant for everyday language abilities.

Presentation 2. Reading and writing (Kazuya Motomura, Nagoya University)

Reading and writing functions are thought to be primarily associated with the parietal lobes of the language-dominant hemisphere. However, the white matter fibers involved in this function are still unknown. Here, we describe a case of transient alexia and agraphia elicited by intraoperative direct subcortical electrostimulation of a specific white matter tract in a patient who underwent an awake craniotomy for a left inferior parietal lobe glioma.

Presentation 3. Proper names and non-verbal semantics (Guillaume Herbet, Montpellier University Medical Center, Paul Valéry University Montpellier 3)

The intraoperative mapping of ventral white matter connections remains challenging, mainly due to our limited understanding of the underlying processes they convey. Here, we present

data demonstrating that tasks involving non-verbal semantic associations are effective for the bilateral identification and sparing of the inferior fronto-occipital fasciculus. Additionally, common and proper name lexical tasks are well-suited for mapping the left inferior longitudinal fasciculus.

Presentation 4. Sentence processing (Ryuta Kinno, Showa University Fujigaoka Hospital)

Preoperative reorganization explains the near-normal function of sentence processing in patients with brain tumors on standard assessments. However, some patients show agrammatic comprehension on a task that is sensitive to the assessment of syntactic ability. Here, we present this task and discuss the possibility of using it in awake surgery.

Interest to the Academy

Awake brain surgery is a unique setting to understand the representation of language directly in the brain and in a causal manner^[2,3]. This approach has not been reviewed in this conference. However, it is of interest, as it utilizes advances in neuroimaging and cognitive science, including the study of language models and a detailed understanding of brain anatomy. Findings from awake surgery can be applied to other populations, particularly people with mild language impairments.

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White matter differences in two individuals with developmental dysgraphia

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Introduction

Producing written language is a fundamental aspect of daily communication, yet the neural pathways that support it are still not well understood. Functional MRI studies have revealed that spelling requires information transfer within a distributed, left-dominant cortical network (Planton et al., 2013; Purcell et al., 2011). Diffusion MRI (dMRI) studies have shown that left ventral and bilateral dorsal white matter pathways are associated with spelling performance (Banfi et al., 2019; Cheema et al., 2022; Gebauer et al., 2012; Neophytou et al., 2023; Sagi et al., 2024). Recent data suggest that lexical aspects of spelling map to left ventral pathways, while sublexical aspects map to dorsal pathways (Sagi et al., 2024). Here, we evaluated the white matter integrity of dorsal and ventral language-related pathways in two individuals with severe developmental dysgraphia: father (RBT) and son (TBT).

Methods

Participants were both right-handed, ages 56 and 19. Both suffered from severe developmental dysgraphia accompanied by developmental surface dyslexia as documented by standardized testing, but showed typical/superior spoken language, memory and cognitive functions. Their spelling and reading performance were characterized by difficulty with irregular words compared to regular and pseudo-words, indicating a specific developmental difficulty in acquiring or retrieving lexical-orthographic representations.

Microstructural properties of white matter pathways in each participant were compared with matched control groups. Diffusion MRI scans were acquired on a 3T Philips scanner. Data were processed with tensor modeling at the voxel level, coupled with deterministic tractography. Tracts of interest were identified bilaterally using automated segmentation tools; dorsally: the arcuate fasciculus (AF) and superior longitudinal fasciculus-III (SLF-III); ventrally: the inferior longitudinal fasciculus (ILF) and inferior fronto-occipital fasciculus (IFOF). Fractional anisotropy (FA) values were extracted and averaged for each tract. Lateralization indices were calculated over FA values for each tract. FA values and lateralization indices were compared between each participant and their matched control group using a two-tailed Crawford-Howell t-test.

Results

Both father and son showed an overall pattern of reduced FA in certain dorsal and ventral left-hemisphere tracts compared with controls. Specifically, both showed reduced FA in the left ILF. Significant right-biased lateralization indices (vs. controls, $p < 0.05$) were observed in the father in a dorsal tract (SLF-III) and in the son in both dorsal and ventral tracts (AF and ILF).

Conclusions

The reported differences observed between these individuals with developmental dysgraphia and controls are consistent with previous dMRI findings showing associations of both dorsal and ventral streams with spelling. Reduced anisotropy in the left ILF and right-biased lateralization may reflect poor lexical-orthographic spelling processes mediated by

the left ventral stream and greater reliance on the right-hemisphere dorsal pathways for sublexical spelling. These findings shed light on the neural network that supports spelling and have implications for understanding acquired dysgraphia and the relationship between developmental and acquired spelling deficits. Given the close relationships between spelling and reading, further work will be required to distinguish the contribution of the underlying white matter pathways to spelling and reading difficulties, respectively.

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Measuring successful conversations for couples affected by aphasia: Development and cognitive validation of a Patient Reported Outcome Measure (PROM)

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Introduction

Conversation therapies for dyads or couples focus on behaviours that help or hinder participation in a conversation (Simmons-Mackie, Savage, & Worrall, 2014). It remains unclear how best to conceptualise "successful conversation" for people living with aphasia (PWA) and their primary conversation partners (PCP) (Sirman, Beeke, & Cruice, 2017). There is a lack of outcome measures that provide quantifiable information on conversation success, especially from couples' perspectives (Wallace et al., 2020). This research aimed to develop a patient-reported outcome measure (PROM) that gauges the couple's perspectives on the success of their conversation.

Methods

PROM development and validation methods were conducted using the process outlined by Terwee et al., 2018. The preliminary item bank was formed using data from two previous studies: (1) a scoping review of conversation outcome measures for couples with and without aphasia and (2) a focus group study with PWA (n=20) and their PCPs (n=19) to share their experiences of successful conversations. The item bank was used to develop a Measure of Dyadic Conversation in Aphasia (MDCA), comprising a version for people with aphasia and a version for primary conversation partners. The content validity of the MDCA was assessed using cognitive interviews with eight couples (where one member of each couple had aphasia). Analysis of the cognitive interviews followed a five-step process. This involved summarising the content, comparing across respondents to make themes, comparing across groups for advanced themes, and making conclusions to produce final study conclusions (Miller, Chepp, Willson, & Padilla, 2014).

Results

The MDCA has two separate questionnaires, one for the People with aphasia MDCA-A and one for the primary conversation partner- MDCA-CP, and contains the following domains: (1) Working together- interaction, (2) Other ways of communicating- multimodal communication, (3) Familiarity-context and common ground, (4) Managing the impact of aphasia- attitude and mindset, and (5) An optional fifth domain with relationship questions for couples.

The preliminary item bank, MDCA Version 1, contained 37 items for the PWA and 43 items for the PCP, seven items based on questions from existing aphasia PROMs, and 14 relationship questions from couple behaviour therapy PROMs. An overarching general question was also included for overall conversational success for both partners. Following the cognitive interviews, the MDCA items were refined, rephrased and reorganised into domains. This resulted in the MDCA Version 2 containing 35 items for the PWA and 34 items for the PCP. Three items from aphasia PROMs are incorporated into the four main domains for both conversation partners and eight relationship questions for both. The items

reflect the dyadic exchange by measuring the frequency of use of communication and coping strategies that lead to successful conversation experiences.

Conclusions

The MDCA captures dyadic conversation, measuring conversation behaviours and strategies and perceptions/feelings about conversations from the perspective of both people with aphasia and their primary conversation partners. The impact of aphasia on couple relationships is also considered with an optional relationship domain. Future research will evaluate face and content validity from the perspective of aphasia expert researchers and clinicians and refine the measure further before larger-scale psychometric testing.

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Beyond naming: Assessing near and far transfer effects in bilingual aphasia following semantic feature-based treatment

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Introduction

Optimal aphasia rehabilitation extends treatment gains to untrained language skills (Webster et al., 2015). Semantic feature-based treatments (SFT) improve trained and, more modestly, untrained naming (Quique et al., 2019). Grounded in spreading activation theory (Collins & Loftus, 1975; Dell, 1986), SFT proposes to improve word retrieval by activating semantic networks, potentially facilitating: (1) *direct transfer* to untrained words; (2) *near transfer* to tasks tapping similar areas of semantic processing; and (3) *far transfer* to broader language/cognitive skills engaged during SFT (e.g., sentence production, attention). For bilinguals with aphasia (BWA), SFT may activate a shared semantic system (Costa et al., 2006), promoting *cross-language transfer* (direct, near, and/or far) and aligning with evidence that therapy in one language can benefit both (Goral et al., 2023; Peñaloza & Kiran, 2019). Limited research explores the range of SFT-induced transfer, especially for bilinguals (Quique et al., 2019, Oh et al., 2016). This study addresses this gap by examining direct, near, and far transfer following SFT in BWA.

Methods

Forty-eight Spanish-English BWA (mean age: 54.0, SD=15.86; mean months post-stroke: 47.35, SD=82.7) received 40 hours of SFT in English (n=20) or Spanish (n=28). Trained items included 15 words named incorrectly at baseline. Assessments were administered pre and post-treatment. *Direct transfer* was measured by the Boston Naming Test (BNT) and six word sets: (1) trained words (e.g., *dog*); (2) semantically related words (e.g., *cat*); (3) unrelated words (e.g., *book*), and untrained translations of sets 1-3 (e.g., *perro, gato, libro*). *Near transfer* was measured by the Pyramids and Palm Trees Test (PAPT) and subtests from the Psycholinguistic Assessment of Language Processing in Aphasia (PALPA)/its Spanish equivalent (EPLA), including spoken/written word-to-picture matching, auditory/written synonym judgment, and word semantic association. *Far transfer* measures included the Western Aphasia Battery-Revised (WAB-R) and Raven's Coloured Progressive Matrices (RCPM).

Missing data were imputed. Treatment effects were captured using linear mixed-effects models with naming probe accuracy or raw assessment score as the dependent variable, timepoint (pre/post-treatment) as a fixed effect, participant as a random intercept, and correction for multiple comparisons using the Benjamini & Hochberg (1995) procedure.

Results

Table 1 outlines regression results. Significant improvements emerged for all word sets and the BNT in both languages, highlighting *direct transfer* (Figure 1A). Improvement in spoken/written word-to-picture matching scores in both languages and word semantic

association in the trained language indicated *near transfer*. No significant changes were found for auditory/written synonym judgments or the PAPT (Figure 1B). For *far transfer*, WAB-AQ scores improved in both languages, with no significant change for RCPM (Figure 1C).

Conclusions

Gains largely extended from the treated to untreated language, supporting SFT's ability to facilitate comprehensive language recovery. SFT promotes direct transfer to untrained naming and near transfer to semantic processing measures that link conceptual representation and lexical forms, but not those involving purely conceptual semantic processing (e.g., PAPT) or more abstract reasoning (e.g., synonym judgments). Far transfer was limited to overall language function (captured globally by WAB-AQ), with no gains in domain-general cognition, suggesting SFT may not address broader cognitive rehabilitation needs.

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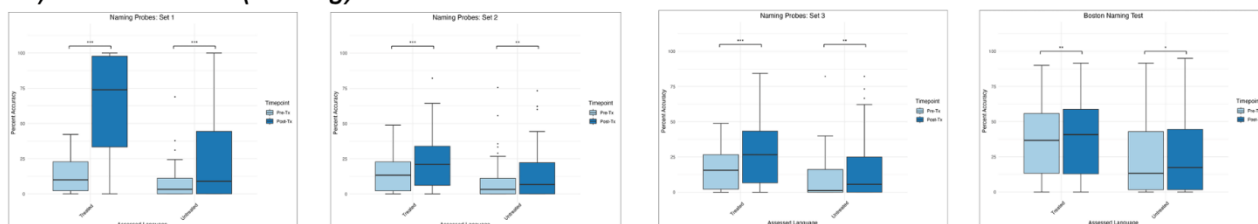
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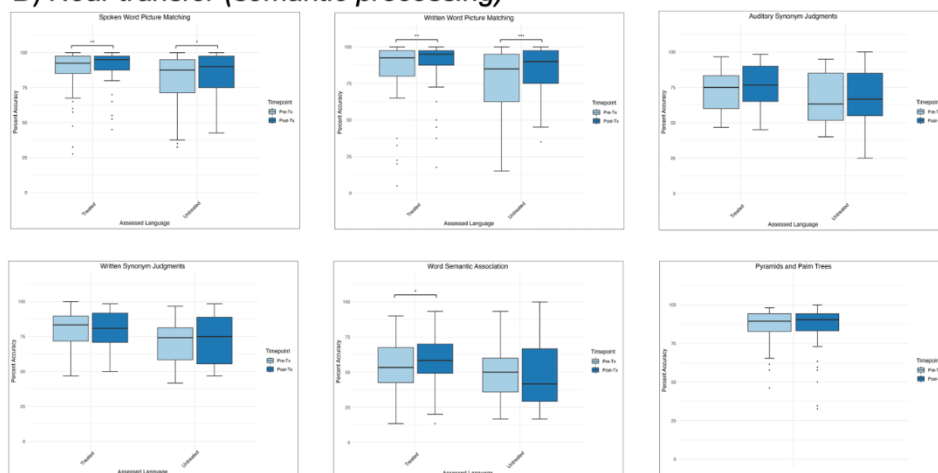
This research was supported by U01 DC014922 awarded to Swathi Kiran. Additionally, Marissa Russell-Meill, Erin Carpenter, Manuel Marte, and Michael Scimeca were partially supported by T32 DC013017. Claudia Peñaloza was supported by grant RYC2021-034561-I funded by MCIN/AEI/10.13039/501100011033 and the European Union NextGenerationEU/PRTR during the conceptualization, analysis, and preparation of this

work. The authors wish to thank the participants and their families for participating in the study.

A) Direct transfer (naming)



B) Near transfer (semantic processing)



C) Far transfer (overall language ability, cognition)

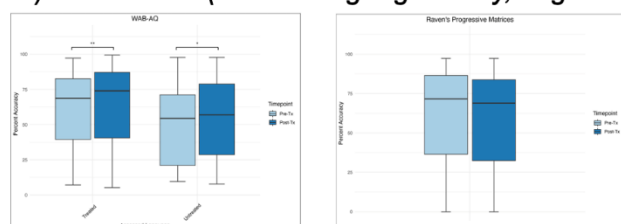


Figure 1. Pre-to-post treatment change on selected assessments.

Note: Figures include observed (unimputed) data. Panel A: Set 1 includes trained words and corresponding untrained translations (e.g., dog-perro). Set 2 includes words semantically related to trained words alongside untrained translations (e.g., cat-gato). Set 3 includes unrelated control words that have minimal semantic overlap with trained words as well as their untrained translations (e.g., apple-manzana). Panel B: Spoken word picture matching=PALPA 47/EPLA 45; written word picture matching=PALPA 48/EPLA 46; auditory synonym judgements=PALPA 49 / EPLA 47; written synonym judgements=PALPA 50/EPLA 48; word semantic association=PALPA 51/EPLA 49. Panel C: WAB-AQ=western aphasia battery-revised aphasia quotient. P-values represent regression results (table 1) and are Benjamini-Hochberg adjusted.

* $p < .05$ (significance threshold). ** $p < .01$. *** $p < .001$.

Table 1. Mixed-effects model results.

Assessment	Language	Term	Estimate	SE	t-value	p-value
Direct Transfer (naming)						
Set 1 (% accuracy)	Trained	(Intercept)	13.10	0.04	3.36	.002**
		Timepoint	50.86	0.05	11.17	<.001***
	Untrained	(Intercept)	8.05	0.03	2.46	.02*
		Timepoint	14.96	0.03	4.62	<.001***
Set 2 (% accuracy)	Trained	(Intercept)	14.49	0.03	5.76	<.001***
		Timepoint	8.59	0.02	4.67	<.001***
	Untrained	(Intercept)	9.91	0.03	3.78	<.001***
		Timepoint	5.69	0.02	3.37	.002**
Set 3 (% accuracy)	Trained	(Intercept)	16.71	0.03	6.16	<.001***
		Timepoint	11.19	0.02	5.45	<.001***
	Untrained	(Intercept)	9.63	0.03	3.40	.002**
		Timepoint	6.30	0.02	3.22	.004**
BNT	Trained	(Intercept)	21.33	2.45	8.71	< .001***
		Timepoint	1.41	0.46	3.04	.005**
	Untrained	(Intercept)	14.90	2.41	6.17	< .001**
		Timepoint	1.07	0.46	2.32	.03*
Near Transfer (semantic processing)						
Spoken Word Picture Matching	Trained	(Intercept)	31.73	1.21	26.22	< .001***
		Timepoint	3.88	1.24	3.14	.004**
	Untrained	(Intercept)	30.06	1.29	23.25	< .001***
		Timepoint	2.809	1.10	2.56	.02*
Written Word Picture Matching	Trained	(Intercept)	30.51	1.55	19.63	< .001***
		Timepoint	2.57	0.90	2.85	.008**
	Untrained	(Intercept)	28.43	1.48	19.23	< .001***
		Timepoint	3.49	0.84	4.15	< .001***
Auditory Synonym Judgments	Trained	(Intercept)	42.42	1.45	29.20	< .001**
		Timepoint	2.55	1.35	1.89	.07
	Untrained	(Intercept)	38.13	1.60	23.83	< .001****
		Timepoint	1.86	1.33	1.39	.19
Written Synonym Judgments	Trained	(Intercept)	45.53	1.36	33.39	< .001***
		Timepoint	0.76	0.76	1.00	0.36
	Untrained	(Intercept)	41.75	1.60	26.03	< .001***
		Timepoint	0.54	1.40	0.39	.75
Word Semantic Association	Trained	(Intercept)	14.70	0.92	16.01	< .001***
		Timepoint	2.08	0.73	2.86	0.008*
	Untrained	(Intercept)	13.92	1.00	13.87	< .001***
		Timepoint	0.00	0.87	0.00	> 0.99
PAPT	Nonverbal	(Intercept)	43.48	1.17	37.14	< .001***
		Timepoint	0.26	0.97	0.27	0.81

		Far Transfer (aphasia severity, nonverbal intelligence)				
WAB-AQ	Trained	(Intercept)	59.42	4.29	13.863	< .001***
		Timepoint	3.25	1.08	3.021	.005**
	Untrained	(Intercept)	50.24	4.18	12.011	< .001***
		Timepoint	3.33	1.30	2.570	.02*
<i>Raven's Progressive Matrices</i>	Nonverbal	(Intercept)	21.75	1.80	12.120	< .001**
		Timepoint	-0.69	1.93	-0.357	0.76

A case of left temporal lobal atrophy in characteristic clinical course

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Introduction

We report on an ambidextrous housewife who in her early 70's, exhibited drawing deficits in addition to a profound agraphia for kanji was subsequently diagnosed as not having semantic dementia.

Methods

Over the whole period of our observation of her, there were two points of detailed evaluation and it is these that have been used in this abstract.

Results

Xy. She noticed that she couldn't recall kanji, even her grandchildren's names and decided to visit our clinic on her own.

X+2y. She complained of an inability to recall words, in addition to being unable to write kanji. General neurological examination was normal. Her behavior was absolutely normal in other ways. Her ability to comprehend spoken and written language remained intact. She exhibited mild difficulty at finding words, some verbal paraphasia and a degree of circumlocution. In confrontation naming, she showed greater difficulty in naming objects and increased verbal paraphasia, although her phonemic cue was effective. Repetition and reading aloud were preserved. She was able to read a simple kanji compounds by meaning and did not show confusion between on- and kun-reading of kanji in oral reading. She had difficulty in writing the simplest kanji that she had learned in her first grade in primary school. Regarding the intrinsic character of drawing, she mostly produced bizarre depictions that were quite unrelated from target concepts. However, she was able to copy the items well with no apparent constitutional disorder being observed. Episodic and semantic memory was preserved. MRI revealed focal atrophy in the left anterior temporal lobe.

X+6y. She exhibited anomia coupled with word comprehension. Although she generally retained a comprehension of spoken language in conversation, she was no longer able to understand or read aloud kanji and kana. In writing she was unable to respond to dictation using kana, but able to copy kana character. During the following 4years, it became more difficult to deduce what the object was that she was attempting to copy. Semantic memory impairment disorder began to appear. From X+3 years, she began to show confusion regarding appropriate coloring and orientation of shapes. Even at this time, she had still not shown any prosopagnosia. MRI revealed that the atrophy in the right temporal lobe had not only extended slightly into the posterior part, but also into the left anterior temporal lobe.

Conclusions

Morphological features are more dependent on visual semantic memory, and visual images in addition to verbal semantic memory must be brought up to explain them. In this case, although the verbal knowledge of the objects was almost preserved, it might be difficult for

her to describe the morphological features of the objects and to draw them because she could not recall the visual image. Although the meaning of the kanji had been understood, agraphia most probably resulted in her inability to recall its visual images. Consequently this prevented her from writing it down.

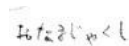
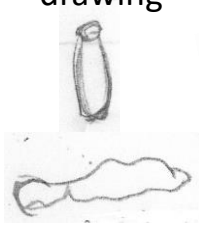
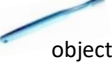
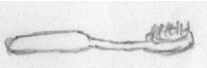
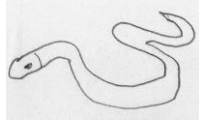
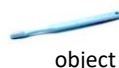
		X+2y			X+6y		
kanji		dictation	cue	copy	dictation	copy	
		雲  親  道 道			impossible	顔 	
kana		おたまじゃくし 		possible	impossible	ね 	
objects		drawing		copy	drawing	copy	
		  object    picture 			impossible	  object    picture 	

Figure 1. Comparison over 4 years regarding the patient's writing and drawing tests.

Effect of lexical, syntactic, and executive function on the conveying narrative meaning in people with aphasia

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Introduction

Although lexical function affects the conveying narrative meaning in people with aphasia (Richardson et al., 2018), other factors have yet to be fully investigated. This study aimed to examine the factors related to the processing of narrative propositions in people with aphasia in terms of lexical, syntactic, and executive functions.

Methods

Participants. The participants were 31 individuals with aphasia (62.1 years old, SD13.5). The aphasia subtypes included 11 Broca's aphasia, 1 transcortical motor aphasia, 8 Wernicke's aphasia, 4 transcortical sensory aphasia, 3 anomic aphasia, 1 conduction aphasia, and 3 atypical aphasia subtypes. The severity of aphasia assessed with the Standard Language Test of Aphasia was moderate in 13 patients and mild in 18 patients.

Procedure. Narrative speech was elicited using 10 scene pictures. The number of main propositions and their accuracy and completeness were analyzed in the conveying meaning. Lexical and syntactic functions were tested using the naming and sentence production tests and executive function using the Color Trails Test. In the naming test, 50 nouns comprising the main propositions of the narratives were used, and the numbers of correct responses, paraphasia, and non-responses were counted. In the sentence production test, 30 sentences (24 non-reversible sentences and 6 reversible sentences) were used, and the number of correct responses and grammatical errors were counted.

Results

1. The numbers of main propositions in the narratives and correct responses in the naming and sentence production tests were significantly correlated (naming: $r = .75$, $p < .01$, sentence: $r = .79$, $p < .01$; *Figure*). The numbers of inaccurate sentences were moderately correlated with correct responses in both the naming and sentence tests (naming: $r = -.47$, $p < .01$; sentence: $r = -.47$, $p < .01$), and the number of incomplete sentences was moderately correlated only with the sentence production performance ($r = -.43$, $p = .02$). Performance on the Color Trails Test, which reflects executive function, was not correlated with any of the indices of propositional production.

2. Multiple Regression Analysis was used to determine the relationship between the conveying meaning in narratives and lexical and syntactic functions. The number of non-responses was significant predictor of the number of main propositions, while for the number of inaccurate sentences, the numbers of paraphasia and grammatical errors, and for the number of incomplete sentences, the number of grammatical errors were significant predictors (*Table*).

Conclusions

Lexical and syntactic functions affect the conveying meaning in the narratives of people with aphasia, but executive functions are not involved. The factors involved in the production of

the main propositions and in their accuracy and completeness differed. This difference suggests that proposition generation and linguistic formulation of narratives in people with aphasia are separately impaired.

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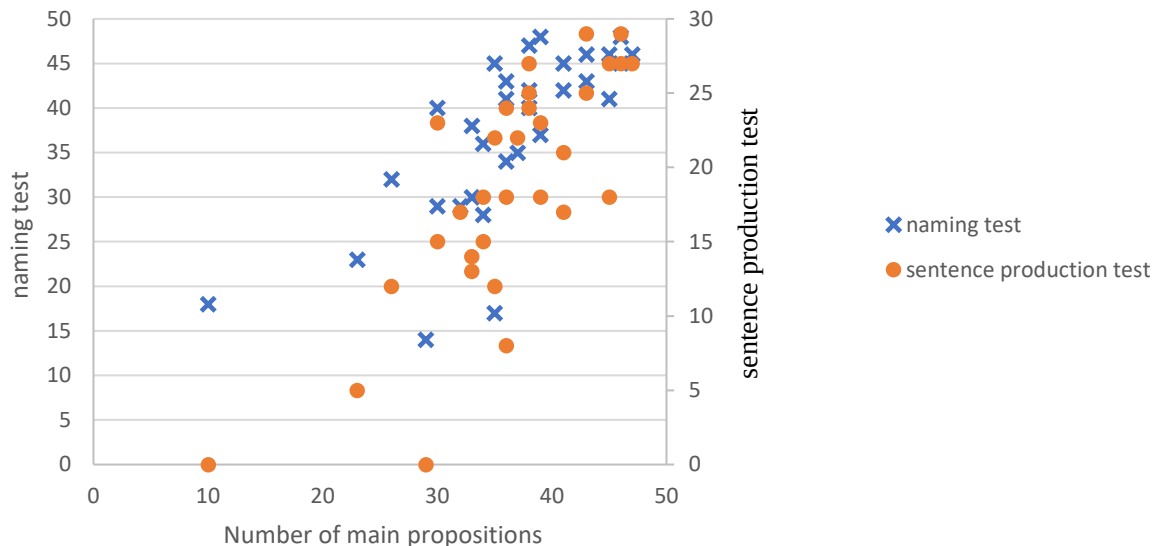


Figure. Correlation between the performance on single naming and single sentence production and the number of main propositions in discourse.

Table. Results of multiple regression analysis predicting the number of main propositions, inaccurate sentences, and incomplete sentences ($n = 31$).

	$B(SE)$	β	p -value	adjusted R^2
Number of main propositions				
Constant	40.3(1.3)		< .01	
Number of non- responses in naming test	-.98(.19)	-.70	< .01	.49**
Number of inaccurate sentences				
Constant	1.31(1.09)		.24	
Number of paraphasia in naming test	.62(.13)	.61	< .01	
Number of grammatical errors in sentence production test	.29(.12)	.32	.02	.55**
Number of incomplete sentences				
Constant	4.9(1.28)		< .01	
Number of grammatical errors in sentence production test	.48(.15)	.52	< .01	.24**

Aphasics' errors in simple multiplication

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Introduction

Calculation in the brain may or may not be dependent on language, according to the specific task (Proios et al., 2021; Semenza & Salillas, 2021). Simple multiplication (tables) is a task that is traditionally considered akin to naming; in math-educated people, the results are recalled from memory rather than calculated. Such task is believed to be mainly sustained in the left inferior parietal lobe (Dehaene & Cohen, 1995). The present investigation addresses for the first time the question of whether and how the performance in simple multiplication may be influenced by aphasia. To this aim, an analysis of substitution errors is conducted, and the results are related to neuroimaging evidence.

Methods

A group of 31 patients with aphasia (4 female; average age=56.9, standard deviation=10.1; average months-post-onset=91.3, standard deviation=100.6) due to left hemisphere lesions performed simple multiplication problems where they had to mentally calculate and type their answer. Response accuracy and reaction times were registered. A classification of the substitution errors was conducted. Errors were classified as *close-far* errors (*close* errors were defined as erroneous responses with a difference <9 from the correct solution), *operand-not operand* (*operand* errors were those within the multiplication table of one of the operands), within not-operand errors, we further divided the errors in *not prime-prime* numbers.

The structural MRIs were obtained, and the lesions were drawn to a binarized mask. First, the lesion voxels localized in the parietal lobe were quantified, and two groups of patients with and without damage in the parietal lobe were generated. The distribution of probabilities for each type of error was observed. Second, the post-stroke lesions maps were related to the proportion of errors of each type, using NiiStat software. Three independent analyses focused on the temporal lobe, the parietal lobe, and the frontal lobe.

Results

For the first analysis, patients with parietal damage committed significantly more errors overall than patients without ($t=2.39$; $p=0.023$). However, the distribution of errors in patients with parietal damage differed from that in patients without, especially for *operand close* errors (i.e. $2 \times 3 = 4$). Patients without parietal damage committed these errors in a higher proportion compared to the rest of the errors ($t = 2.62$; $p=0.014$). Patients with parietal damage had a more homogeneous distribution across error types.

For the brain-behavior analysis, a main significant effect appeared: *prime* and *not prime* erroneous responses were associated with different lesion distributions. Importantly, only the higher probability of *not prime* (excluding *operand*) errors was associated with left parietal lesions. *Prime* errors were associated with left frontal but not with left parietal lesions (Figure 1).

Conclusions

The results showed that the nature of errors depends on the involvement of the parietal lobe in the lesion. An intact parietal lobe, hence preserved “table” representations, seems to be associated with operand-related table results. Damage involving the parietal lobe, instead, is associated with specific non-operand errors: not prime errors. The results also open the question of whether prime errors might derive from right parietal damage.

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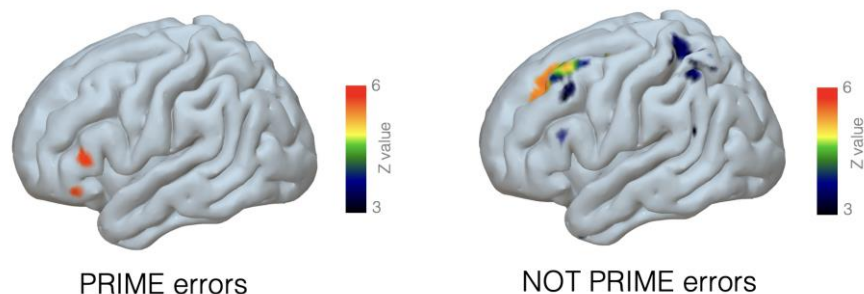


Figure 28. Brain-behavior analysis showed different lesion distributions explaining the higher probability of prime or not prime errors within not operand errors (z-score over threshold FDR corrected). Importantly, prime errors did not associate with left parietal lesions. (note that the probability of each kind of error was weighted by the number of prime numbers within all solution intervals, i.e., lower).

Language-specific dual-task effects in typical aging: A systematic review

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Introduction

This systematic review focuses on speech production in neurotypical older adults when they talk under conditions of distraction. Such dual-task conditions predominate in daily communication, and thus are advocated as an ecologically valid approach to examining age- and stroke-related cognitive-linguistic changes (Salis et al., 2023). In a language-specific dual-task study, spoken language is compared between single- and dual-task conditions in the same individuals. The relative change between dual- and single-tasking in measures of interest is described as the dual-task effect (Plummer & Eskes, 2015). As the first systematic review on language-specific dual-task effects in aging, our aims were to synthesise and appraise literature that used dual-task methods to investigate spoken language production in typically aging older adults.

Methods

Five databases (Web of Science Core Collection, Medline, EMBASE, PsycINFO, LLBA) were searched (inception to January 2024) for eligible studies published in English using comprehensive search terms. Eligible studies had to report data from neurotypical younger and older adults (between-group design) or correlations/regressions of a sample with a wide range of ages or age groups. Additionally, the method of elicitation had to include a language-specific dual-task (as defined earlier). We followed the PRISMA 2020 guidelines (Page et al., 2021) and a Synthesis without Meta-Analysis (Campbell et al., 2020), due to the heterogeneity of measures. Two reviewers worked independently at all stages, including critical appraisal of each study according to the following four categories: Study design, demographic variables, cognitive variables, reliability information.

Results

Figure 1 summarizes the data generation and study inclusion process. From the 225 articles that were deemed eligible for full-text scrutiny, 13 studies culminated in the qualitative synthesis. Table 1 shows details of the included studies which have been divided into two categories: discourse and non-discourse studies.

Across all studies 474 older adults were included, with similar numbers of younger adults. Exceptionally, Rogalski et al. (2021) were the only investigators who did not include a younger control group yet explored aging effects through regression. Collectively, the discourse studies included 378 older adults and across all but one non-discourse study there were 76 older adults. Shumway-Cook et al. (1997) (n=20 older adults) conducted the only non-discourse study to focus on single sentence production under dual-task conditions as opposed to word fluency. Methodologically, all studies across both categories were of low quality.

Conclusions

The linguistic measures used in the discourse studies were typically speech fluency (typically, words per minute) or micro-structure measures (e.g., mean length of utterance, type-token ratio), with one exception of a macro-structure measure, global coherence, in Rogalski et al. (2021). Despite task differences, it appears that speech rate is more

vulnerable to negative effects of dual-task (i.e., dual-task cost) in older than younger adults. Measures of micro-structure appear less vulnerable. Due to the methodological differences and small number of non-discourse studies, it is unclear if dual-task performance in aging is affected at these linguistic levels. Low quality ratings undermined overall confidence in the findings and were chiefly due to under-reporting of demographic and cognitive variables.

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Figure 29. Prisma 2020 flow diagram of identification-inclusion process.

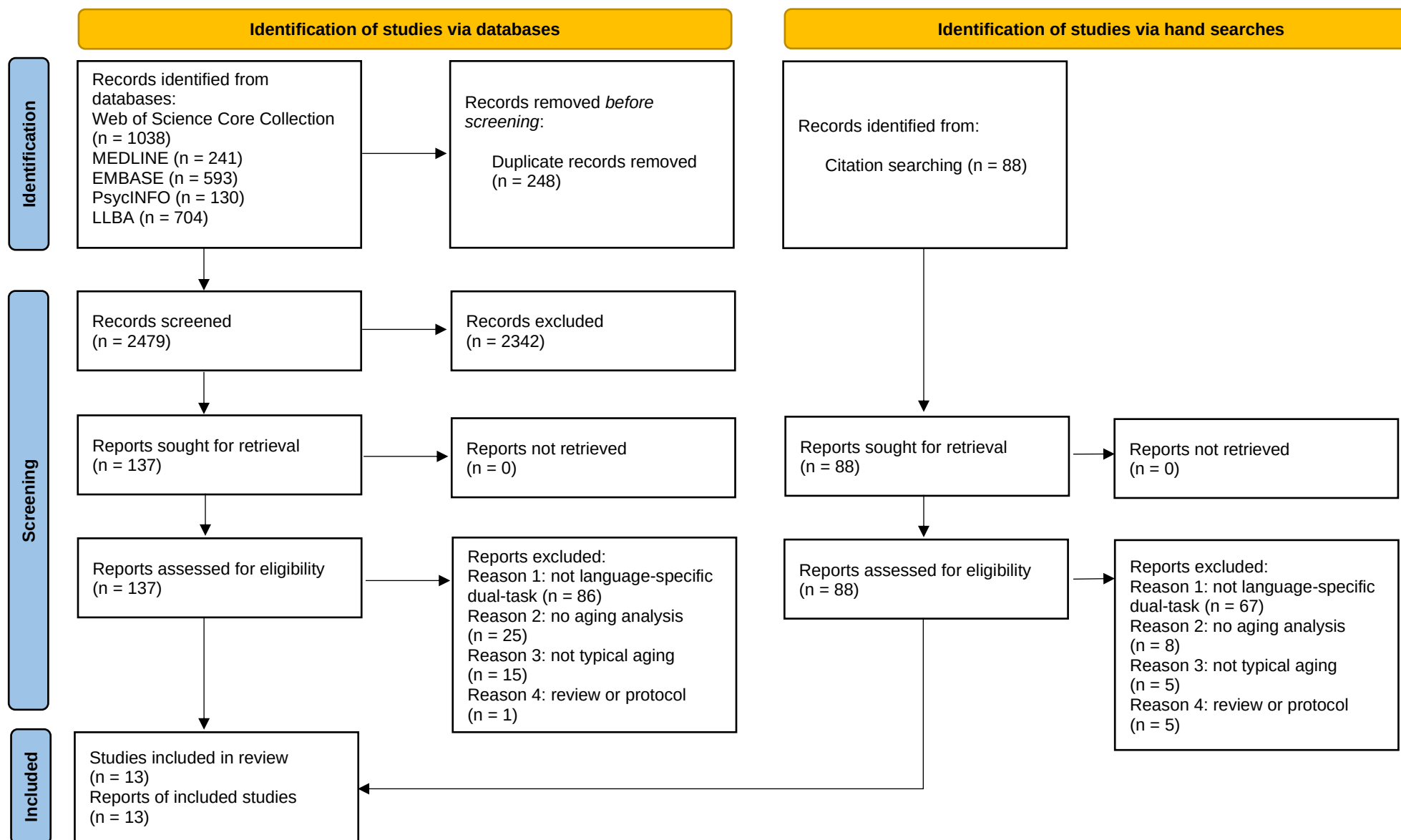


Table 1. Single-dual task comparisons and findings.

Studies	Single-dual task comparisons	Results of aging and dual-task effects on spoken language production
	<i>Discourse studies</i>	
Becic et al. (2010)	Immediate story retelling vs. immediate story retelling while driving in simulator	OA performed worse on the story retelling (fewer propositions) than YA; unclear if there was an interaction between age group and dual-task
Kemper et al. (2003)	Discourse production vs. discourse production while: a) walking; b) complex finger tapping; c) simple finger tapping; d) ignoring concurrent speech; e) ignoring concurrent noise	Age difference in DTC regarding fluency (i.e., mean length of utterance, words per minute) and grammatical complexity measures (i.e., proportion of grammatical sentences). YA experienced larger DTC than OA in mean length of utterance, whereas OA in speech rate. DTC for content measures (i.e., propositional density, type/token ratio)
Kemper et al. (2005)	Discourse production vs. discourse production while: a) walking; b) walking and carrying a bag of groceries	YA > OA for mean length of utterance and words per minute; YA < OA in mean clauses per utterance, morphological complexity; in carrying groceries or climbing steps tasks, OA experienced greater DTCs for 3 of 4 fluency measures (the exception was the % of grammatical sentences) and for walking rate and time-on-task whereas young adults experienced greater DTCs for both complexity measures and for proposition density
Kemper et al. (2009)	Discourse production vs. discourse production while carrying out a visual (on screen) tracking task using trackpad or mouse	YA greater DTC than OA in mean length of utterance, mean clauses per utterance, morphological complexity OA greater DTC than YA in words per minute No DTC differences between YA and OA in propositional density and type/token ratio
Kemper et al. (2010)	Baseline condition and two dual-task conditions which differed in the speed of moving target (either 100% of baseline speed or 150% of baseline speed)	Speech of YA less fluent, less complex, and less informative progressively as dual task demands increased from moderate to demanding, although not propositional density and type/token ratio which varied further in the two dual-task conditions; in OA fluency, grammatical complexity, and linguistic content were resistant to moderate dual task demands, but declined in more demanding dual task conditions
Kemper et al. (2011)	Three dual-task conditions: a) equal emphasis on talking and tracking; b) emphasising talking; c) emphasizing tracking;	For both groups (YA, OA), speech rates in words per min were ordered: emphasis on tracking < equal emphasis < emphasis on talking; YA: morphological complexity and

	emphasis was in the instructions participants received; monetary incentives were given in conditions a and c	mean clauses per utterance were ordered: emphasis on tracking < equal emphasis < emphasis on talking. OA: grammatical complexity did not vary with condition. Varying task priorities did not affect sentence length or propositional content
Kemper et al. (2014)	In baseline condition, participants read aloud a paragraph presented in the centre of the rotor track while ignoring a moving target; in the dual-task condition, participants attempted to track the moving target while reading aloud a paragraph	YA read aloud more rapidly than OA; OA paused longer than YA before reading grammatically complex and propositionally dense sentences
Rogalski et al. (2021)	Discourse production while sitting vs. discourse production task while stationary cycling	Absence of age effects on global coherence
<i>Non-discourse studies</i>		
Goh et al. (2021)	Word fluency (semantic) while standing vs. word fluency while walking for 30 secs (one category only; two alternating category (animal-letter-animal))	OA greater DTC (one category = 24%; two categories = 29.12%) than YA (one category = 9.99%; two categories = 12.64%) (p < .01); greater difficulty in the two category word fluency tasks
Perfect & Rabbit (1993)	Word retrieval (reading aloud or self-initiated after category probe) while completing tone identification (low or how tones) auditorily presented	Interaction between age and dual-task manipulation suggested that OA were slower in the dual-task; word production latencies varied by task demands neutral < easy < hard
Pitts et al. (2023)	Letter fluency (for 10 secs) alone and letter fluency while walking at speeds	Absence of age effects in the three walking speeds
Shumway-Cook et al. (1997)	Number of grammatical sentences produced that conformed to the task requirements while sitting vs. standing on a firm or compliant surface within 30 secs	YA similar to OA
Yogev-Seligmann et al. (2010)	a) Letter fluency while sitting vs. letter fluency while walking (no instruction about task prioritisation) vs. letter fluency (walking priority) vs. letter fluency (fluency priority)	No main effect, no interaction group by prioritisation, no between-group effect

Note. YA = younger adults; OA = older adults; DTC = Dual-task cost (i.e., worse performance in dual- versus single-task)

Treatment of error awareness with motor speech (TEAMS): A pilot study

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Introduction

Error awareness (EA), in the area of motor speech production, is defined as the conscious awareness of the correctness of one's own speech production. EA has long been considered to be a typical characteristic of acquired apraxia of speech (AOS), but further research has shown it to vary considerably across persons with AOS and aphasia (A-AOS) (Wambaugh et al., 2016). Mauszycki and colleagues (2017) found that EA was moderately associated with post-treatment performance in 20 persons with A-AOS. Salomon, Mauszycki, and Wambaugh (in preparation) demonstrated a threshold for EA at which participants showed significant differences in treatment gains throughout treatment and in maintenance probes. It stands that the ability to self-monitor speech production is correlated to the rate at which gains during AOS treatment are achieved as well as the maintenance of those gains. These studies brought EA to light as an important factor in AOS diagnosis and treatment. This study looks to shed more light on EA within the population with AOS. Treatment of Error Awareness in Motor Speech (TEAMS) targets EA in individuals with aphasia and AOS simultaneously. This is the pilot study for this newly developed treatment and is underway currently.

Methods

This study examines whether EA, measured as a correct judgment of speech production accuracy, can be trained or treated through combined mediums of auditory and articulatory feedback mechanisms. A single-case experimental design utilizing multiple baseline designs across participants and behaviors will be employed with three speakers with chronic aphasia and AOS. Correct Judgments of Production (CPJs) is the primary outcome measure being utilized to assess any significant change in EA caused by the treatment. The investigation is designed as a pilot study. Specifically, it is designed to determine if TEAMS is feasible and if the outcomes of TEAMS are statistically and clinically significant.

Results

Participants will be finished with the treatment portion of the study, and the results will be ready to share in time for the conference.

Conclusions

This will be provided upon completion of data analysis but before the conference.

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Production and comprehension of sentence negation in Spanish-speaking people with aphasia

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Introduction

People with aphasia (PWA) experience difficulty producing and comprehending sentences, but relatively little is known about specific difficulty processing sentences with negation (Fyndanis et al., 2023). In this study we examined the comprehension and production of sentence negation in Spanish, a language that has specific morphosyntactic phenomena associated with negation, such as negative concord (Martinez-Ferreiro, 2009). We asked whether Spanish-speaking people with nonfluent aphasia have difficulty comprehending and producing sentences with negation markers and whether the difficulty changes across sentence structures.

Methods

Participants. Eight Spanish speakers participated in the study: four people with nonfluent aphasia and four neurologically healthy people. All participants were native speakers of Spanish with no significant use of other languages. None of the participants had significant apraxia of speech nor significant sensory and cognitive impairment, and none had a previous stroke or significant history of developmental or other acquired conditions. The four participants with aphasia were evaluated by speech-language therapists prior to the study. Their language comprehension was superior to their language production. Their language production was characterized by short utterances, minimal use of grammatical morphemes, slow speech, and anomia.

Tasks & Materials. A negation battery was designed that includes four tasks. A Repetition Task and a Say-the-Opposite Task, administered in six conditions (i.e., six sentence structures). A Sentence-Picture Matching Task, administered in three conditions and An Anagram Task, administered in two (See Table 1). The conditions contrasted sentences comprising subject-verb (SV) vs. subject-verb-object (SVO), sentences in the present tense (PS) vs. in the present progressive tense (PP), and sentences containing negative concord (NC) or not. For each condition, 16 stimuli were created (eight affirmative and eight negative). Thus, the Repetition and Say-the-Opposite tasks had a total of 96 items each; the Sentence-Picture Matching task had a total of 48 items; and the Anagram task had a total of 32 items. Each item was scored as correct or incorrect. Error types (e.g., omission of the negation marker, substituting the verb) were also coded. Response patterns were analyzed for the group and for each person with aphasia.

Results

The results demonstrated that across all tasks, neurologically healthy people performed at ceiling. For the PWA, sentences with negation were more difficult to produce and comprehend than sentences in the affirmative, and the degree of difficulty was modulated

by the task (See Figure 1). In the task that yielded the lowest accuracy (Say-the-Opposite), morphosyntactic complexity interacted with accuracy on the negation sentences (e.g., SVO and PP sentences and the presence of NC resulted in greater differences between items with and without negation compared to SV and PP sentences and the absence of NC).

Conclusions

The results demonstrated that people with nonfluent aphasia do have difficulty producing and comprehending sentences with negation. This difficulty was evident when the sentences presented morphosyntactic difficulty for the participants. Error analysis demonstrated difficulty with including the negation marker and with the placement of the negation marker within the sentence.

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Table 1. Example of sentences in the different conditions used.

Sentence Type	Condition	Examples in affirmative (A) and negative (N)
Predicate	Predicate	<i>El hombre es orgulloso / El hombre no es orgulloso</i> <i>The man is proud / The man is not proud</i>
Subject-Verb ^a	SV	<i>La mamá está estudiando / La mamá no está estudiando</i> <i>The mother is studying / The mother is not studying</i>
Subject-Verb with Negative concord, always/never	SV NC	<i>El chico sonríe siempre / El chico no sonríe nunca</i> <i>The boy always smiles / The boy never smiles</i>
Subject-Verb-Object, present simple ^{ab}	SVO PS	<i>La tía escribe cartas / La tía no escribe cartas</i> <i>The aunt writes letters / The aunt does not write letters</i>
Subject-Verb-Object, present progressive ^{ab}	SVO PP	<i>El papá está cocinando fideos / El papá no está cocinando fideos</i> <i>The father is cooking pasta / The father is not cooking pasta</i>
Subject-Verb-Object with Negative concord, something/nothing	SVO NC	<i>La nena está leyendo algo / La nena no está leyendo nada</i> <i>The girl is reading something / The girl is not reading anything</i>

Note: ^a was used in Sentence-Picture Matching task; ^b was used in Anagram task

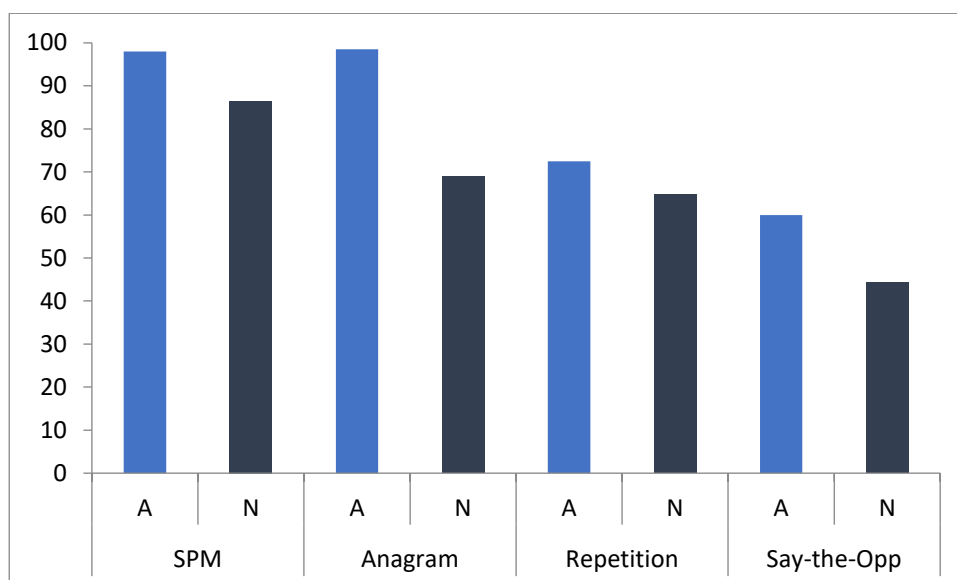


Figure 1. Accuracy by task for the PWA.

Semantic cognition in aphasia and healthy population: Consideration in terms of semantic knowledge type and relatedness strength

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Introduction

Semantic cognition refers to “the representation of acquired knowledge about the world and the controlled, task-oriented use of this knowledge” (Lambon Ralph et al., 2017; Hoffman et al., 2018). Semantic/conceptual knowledge consists of two distinct semantic relations (Mirman et al., 2017): taxonomic relations based on shared features (e.g. horse – sheep, hammer – saw), and thematic relations based on co-occurrence in events or scenarios (e.g. horse – carrot, hammer -nail). Impairment of conceptual knowledge and/or semantic control in neurological patients has been reported (e.g. Jefferies & Lambon Ralph, 2006, Thompson et al., 2017). However, little is known about the relationships between these abilities in both aphasia patients and healthy people.

This study investigates the semantic cognition of persons with aphasia (PWA) and healthy people aged 6 to 99 years old using a semantic association test.

Methods

Participant. Fifty-five stroke aphasia patients with right-handed, aged between 40 and 89 (mean age = 67.2 years, mean years of education = 13.2 years) were 44 persons with fluent aphasia (mean WAB AQ = 80.7, mean RCPM = 27.3) and 11 persons with non-fluent aphasia (mean WAB AQ = 50.9, mean RCPM = 25.1).

Healthy adults consist of 100 university students, 100 employed workers, and 112 elderly people (aged between 65 and 99). A wide range of ages across later life were sampled in 312 adults (mean age = 48.3 years, mean years of education = 14.3 years). To examine semantic cognition from a developmental perspective, we also targeted 360 public elementary school children, aged between 6 to 12 (60 in each grade, 30 in each gender).

Material. The probe words consisted of 20 words each belonging to the biological or the artefact category, with age of acquisition and familiarity controlled. The target words were 20 words each, which have taxonomic or thematic relationships with the probe words. The semantic relatedness strength was dichotomized using ratings from 100 healthy people, aged between 18 and 83, who were not test subjects. Psycholinguistic properties of the words used in each condition are presented in Table 1.

Procedure. Subjects were asked to choose the target that has a taxonomic/ thematic relationship with the probe among four same-category items (e.g. does drum go with xylophone (the target), trumpet, harmonica, guitar?). All items were presented as black-and-white drawings. PWA were asked to respond by pointing. Healthy subjects were asked to circle the appropriate answers on paper.

Results

The mean accuracy rate for all subjects was in the following order: High-thematic relation > High-taxonomic relation > Low-thematic relation > Low-taxonomic relation (Figure 1). There was a significant effect of relatedness strength in the healthy population (adults: $F(3,36)=13.48$, $p = 0.001$, children: $F(3,36)=18.24$, $p < 0.001$). PWA showed effects of both relatedness strength and semantic relation type (relatedness strength: $F(3,36)=37.12$, $p <$

0.000001, semantic type: $F(3,36)=6.84$, $p=0.013$), but the two factors interaction was not significant.

Conclusions

Relatedness strength had an impact on semantic cognition in all groups and highly related semantic knowledge showed endurance against the brain damage. PWA's performance suggests that aphasia causes degraded semantic control and conceptual representation.

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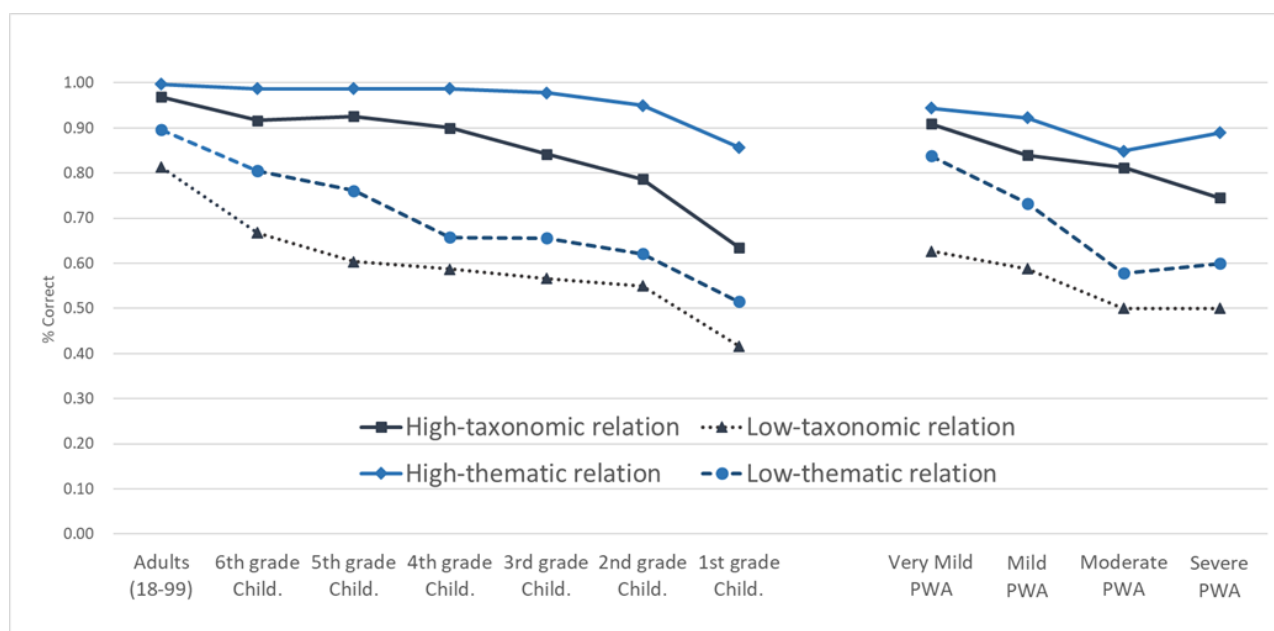
Acknowledgments

We would like to thank Dr. Shinichi Asakawa (Tokyo Woman's Christian University) for computing semantic similarity values of the stimuli using wordVec2.

Table 1. Mean semantic and psycholinguistic properties of words used in semantic association tasks as a function of semantic type and relatedness strength (standard deviations are shown in parentheses).

	High-Taxonomic	Low-Taxonomic	High-Thematic	Low-Thematic
Frequency	2.55(0.50)	2.41 (0.59)	2.70 (0.46)	2.46 (0.39)
Familiarity	5.89 (0.28)	5.93 (0.20)	6.06 (0.20)	5.89 (0.33)
Imageability	6.10 (0.29)	5.98 (0.36)	6.24 (0.23)	6.24 (0.41)
Age of Acquisition	1.82 (1.27)	1.67 (1.05)	1.56 (0.68)	2.09 (1.44)
Typicality	3.53 (0.87)	3.80 (0.51)	3.79 (0.68)	3.93 (0.61)
Probe-target semantic similarity	0.57 (0.15)	0.51 (0.16)	0.37 (0.14)	0.33 (0.17)
Probe-foil semantic similarity	0.38 (0.12)	0.29 (0.07)	0.19 (0.14)	0.21 (0.17)

Note. Word frequency and familiarity values were obtained from Amano & Kondo (1999, 2000). Imageability values were obtained from Sakuma et al. (2005), age of acquisition values from Sakamoto (1984), and semantic typicality from Sato & Asakawa (2010). Semantic similarity values (probe-target/foil) were computed using wordVec2 (Mikolov et al., 2013).



Note. PWA= persons with aphasia, Child.= children

Figure 30. Semantic association performance by healthy population and persons with aphasia (mean accuracy rate).

Preliminary analysis: The role of music listening and baseline alertness on higher-order attentional deficits in aphasia

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Introduction

Attention is frequently impaired in people with aphasia (PWA) and relates to their language deficits. Yet, attention is minimally targeted in aphasia rehabilitation. Listening to music is one potential treatment for attention deficits in aphasia. Previous work demonstrates that different types of music modulate attention in older adults (Dovorany, et al., 2023). This study investigated the potential effect of music listening on attention in PWA. We further explored how aphasia severity affects attention, as well as how baseline differences in attention affect higher-order attentional processes.

Methods

Twenty-six PWA completed the Attention Network Test (ANT), a cued-flanker task, before (T1) and after (T2) listening to either happy music (n=9), sad music (n=9), or silence (n=8) for 10 minutes. Using the ANT, we measured participants' readiness to perceive information (alerting), their ability to shift attention towards relevant information (orienting), and their ability to focus on task specific information and ignore irrelevant information (executive control). Aphasia severity was derived from the WAB-R Aphasia Quotient and categorized as mild or moderate-severe. Baseline differences in attention were quantified using participants' T1 alerting scores and divided into low and high levels of alertness.

Three ANOVAs analyzed how the groups' (happy, sad, silent-control) alerting, orienting, and executive control attention changed from T1 to T2. Aphasia severity was included as a covariate in all three analyses and baseline attention was included as a covariate in the orienting and executive control analyses. Significance was set to $p=.05$ for main effects and $p=.10$ for interactions.

Results

Alerting. Cue and Group interacted ($F(2, 22)=3.42, p=.05$). The silent-control group demonstrated the alerting effect (better performance on cued than non-cued trials) whereas the happy and sad groups did not.

Orienting. Time, Cue, and Group interacted ($F(2, 21)=3.10, p=.066$). The orienting effect (better performance on spatially cued than neutrally cued trials) was not significant at T1 for any group but was significant for the sad group ($p=.01$) at T2 and trended towards significance for the happy group ($p=.07$) at T2. Time, Cue, and Aphasia Severity interacted ($F(1, 21)=3.25, p=.086$). PWA with mild aphasia did not demonstrate the orienting effect at T1 but did at T2. PWA with moderate-severe aphasia did not demonstrate the orienting effect at T1 or T2.

Executive Control. Time, Congruency, and Baseline Alerting interacted ($F(1, 21)=11.08, p=.003$). PWA with lower levels of baseline alertness were not distracted by irrelevant information at T1 but were at T2. PWA with higher levels of alertness were more distracted by irrelevant information at T1 and T2 (similar to controls).

Conclusions

Previous work demonstrates that orienting attention, but not alerting or executive control, is impaired in PWA compared to controls (LaCroix et al., 2020). We preliminarily show that

music listening modulates orienting attention, suggesting music may be a potential low-cost treatment for certain attention deficits in aphasia. Aphasia severity also impacted whether PWA learned to use the spatial cue over time. Baseline differences in alertness also affected higher-order attentional processes; clinicians should therefore evaluate alertness in addition to aphasia severity before targeting higher-order cognitive-linguistic skills.

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How do single-handed gestures differ from two-handed gestures? Implications for multimodal treatment for people with aphasia

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Introduction

Our communication is fundamentally multimodal, involving various modalities such as speech, eye gaze, and facial expression. Research indicates that co-speech gestures are crucial not only because they convey messages that speech alone does not but also because they influence the speaker's cognitive processes (Clough & Duff, 2020). This holds true for individuals with aphasia (PwA) as well. Encouraging PwA to use gestures aids in their communication and assists in word retrieval (e.g., Hogrefe et al., 2013). Based on these findings, a treatment called M-MAT (Multi-Modality Aphasia Therapy), which utilises modalities such as gesture, drawing, and writing has been developed (Rose et al., 2013). Although research suggests that gestures are a valuable resource for PwA (Sekine et al., 2013), many aphasic patients have hemiplegia and can only produce single-handed gestures. However, it is unclear to what extent single-handed gestures differ from two-handed gestures in depicting referents. To address this question, we investigated the differences in gestures between two-handed and single-handed gestures in healthy speakers. By the time of the conference, we plan to increase the number of participants.

Methods

Two healthy native speakers of Japanese (Mage=35) participated. Both were male and right-handed. We selected 117 items from the Japanese version of M-MAT (Kimura et al., 2020), consisting of 68 nouns and 49 verbs. Participants sat in front of a monitor where a target word was displayed with audio, one at a time. They were instructed to depict the target word with gestures within four seconds of the slide being shown. They completed the task under two different conditions: in the two-handed condition, they produced gestures with either or both hands; in the single-handed condition, they used their non-dominant hand.

Results

Using categories from previous studies (e.g., Ortega et al., 2019), we classified gestures into one of the following categories: acting (representing how the referent is manipulated), drawing (depicting the outline), representing (representing the form of an object), personification (incarnating the concept), pointing (pointing to a gesture), or combination (using more than one category). The percentages of gesture categories for each condition are shown in Table 1. Acting was the most used category in both conditions, followed by representing and combination. Participants used more drawing gestures in the single-handed condition than in the two-handed condition. The use of drawing gestures by single-handed gestures was more striking in noun items, as shown in Figure 1. Drawing was not used at all for verb items. Lastly, we counted the number of items where different gesture categories were used between conditions. Out of 117 items, 33% (66 items) involved different gesture categories between the two conditions.

Conclusions

This study showed that single-handed gestures were often used by healthy speakers to draw the outline of objects. Even though many PwA have hemiplegia, they often produce gestures. However, their depiction of referents may be limited due to reliance on single-handed drawing gestures. If drawing gestures do not have communicative effectiveness, speech pathologists need to encourage them to use other gesture techniques to ensure effective communication.

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Table 1. The percentages of gesture categories for each gesture condition.

Gesture categories	Two-handed	Single-handed
Acting	65.1%	62.4%
Drawing	1.4%	5.7%
Representing	13.4%	16.2%
Personification	0.5%	1.0%
Pointing	0.5%	0.0%
Combination	19.1%	14.8%

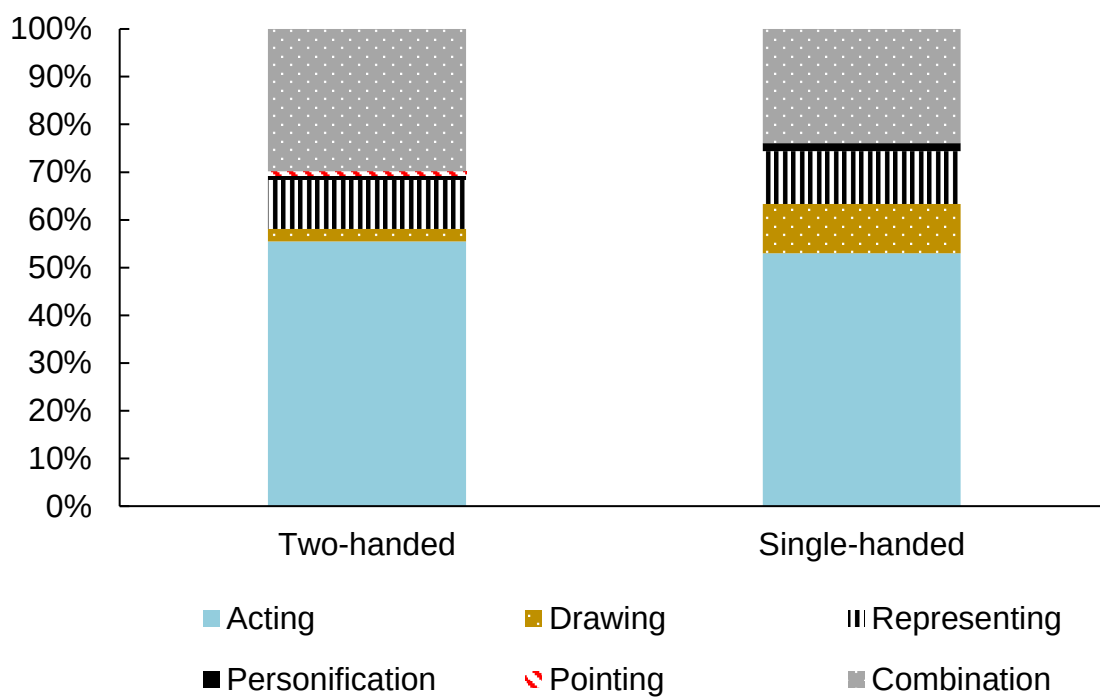


Figure 31. The percentages of gesture categories for each gesture condition in noun items.

Combining smartphone-delivered and clinician-delivered intervention: A plausible model for service delivery?

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Introduction

Substantial research has investigated the treatment of word-finding difficulties in aphasia, using a wide range of tasks (e.g., Abel et al., 2015; Boyle, 2010; Howard et al., 1985; Leonard et al., 2008; Nickels, 2002; Nunn et al., 2023). Although there is ongoing debate regarding the extent to which generalisation occurs, it is clear that treatment-related improvements are usually observed for treated items (Nickels, 2002; Quique et al., 2019). To improve service delivery, many researchers have incorporated technology to facilitate self-practice of traditional therapy tasks (e.g., Des-Roches et al., 2015; Lavoie et al., 2019). However, some therapy tasks are less easily adapted for self-practice by people with aphasia even with technology. For example, while repetition in the presence of picture (RIPP) can be relatively easily implemented as self-practice (e.g., Mason et al., 2011), semantic feature analysis (SFA, Boyle & Coelho, 1995) is more challenging due to the need for feedback and adaptation depending on the participant's response.

Given these challenges, we examined a plausible model for clinical service delivery using two modes of service delivery with two different therapy approaches: a smartphone-based home program using RIPP, and clinician-delivered therapy using SFA.

Methods

We used a single case methodology (Howard et al., 2015) with six people with chronic aphasia who had a predominant difficulty in picture naming. Following background testing, participants were given a set of 300 pictures for naming. 120 items that were difficult to name were selected for treatment and divided into four matched lists (30 each). These lists were randomly allotted to four conditions: smartphone-delivered treatment; clinician-delivered treatment; untreated but probed; and untreated pre-post only.

We had three treatment orders with two participants per order: clinician-delivered treatment (using SFA) followed by smartphone-delivered treatment (using RIPP); smartphone-delivered treatment followed by clinician-delivered treatment; simultaneous provision of both treatment modes.

We analysed the picture naming results using Weighted Statistics (WEST; Howard et al., 2015). To investigate treatment-related improvement, generalisation, and difference in the mode of delivery, we considered both the trend for improvement across the study using WEST-TREND and the difference in the rate of change across the treated and untreated phases using WEST-Rate Of Change.

Results

Of the six participants, four showed significant item-specific improvements in naming following smartphone-delivered treatment (Figure 1; Table 1) with three of these participants also showing improvement with the clinician-delivered treatment. There was no significant difference between the tasks for any participant. No participant showed generalisation to the untreated lists, although two showed an exposure effect.

Conclusions

This study reinforces the potential for technology-based home practice to improve word retrieval through the use of simple tasks. Such technology-based intervention has advantages over pen and paper 'homework' as they allow for (remote) monitoring by clinicians. In addition, we suggest that the success of home practice highlights the critical role of clinicians in providing therapy using more complex tasks and in rapidly and flexibly adapting the intervention dependent on the participant's response and/or need in the clinical environment.

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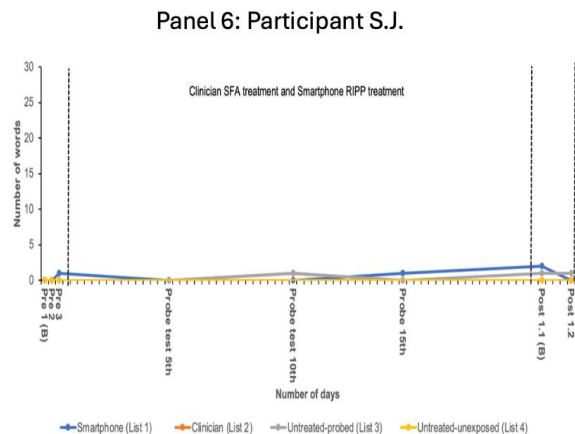
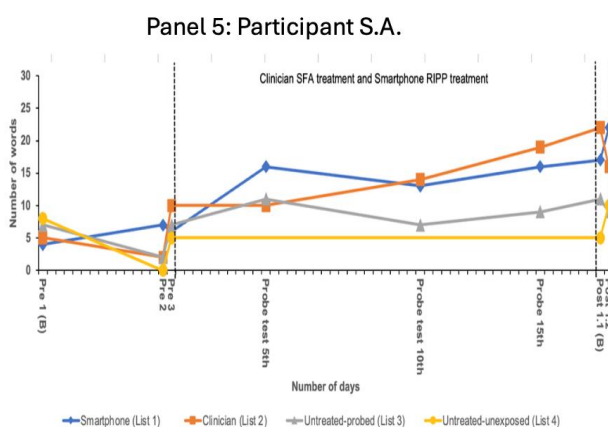
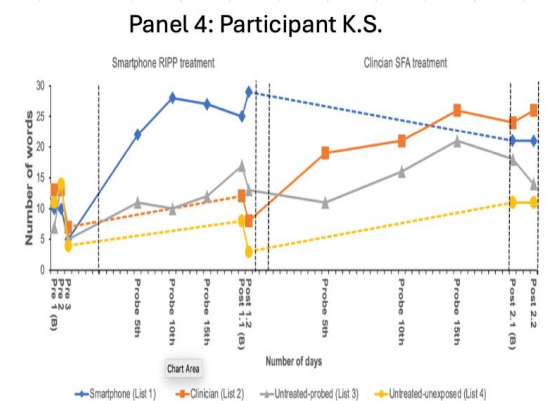
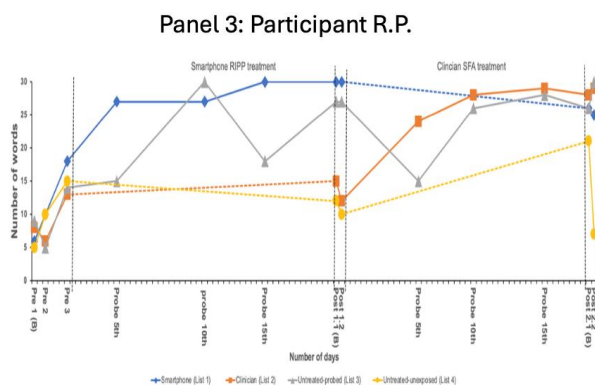
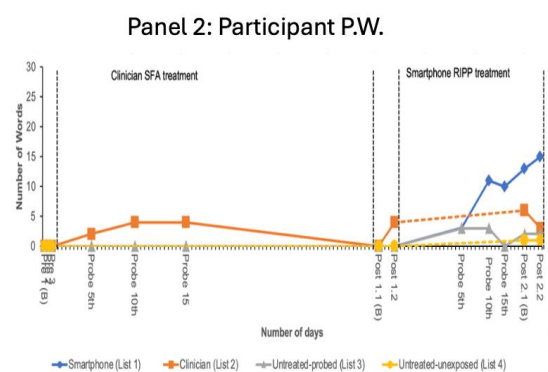
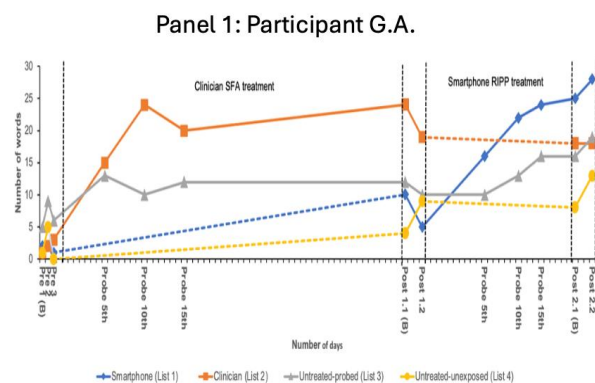


Figure 32 Picture naming results across the study for each of the six participants with aphasia.

Table 1. Results of Weighted Statistics (WEST; Howard et al., 2015) for six participants with aphasia.

	G.A.	P.W.	R.P.	K.S.	S.A.	S.J.
Order of treatment	C, S	C, S	S, C	S, C	S&C	S&C
<i>Treatment-related improvements?</i>						
Smartphone-delivered RIPP treatment	Y	Y	Y	Y	N	N
Clinician-delivered SFA treatment	YY	YY*	Y	Y	N	N
Untreated-probed	N	Y	N	Marginal	Marginal	N
Untreated-unexposed	N	N	N	N	Y	N
<i>Effect of repeated assessment?</i>						
	Y	Y	Y	N	Y	N
<i>Difference between treatments?</i>						
	?C>S	N	N	N	N	N

Notes:

Order of Treatment: S = Smartphone-delivered RIPP treatment; C=Clinician-delivered SFA treatment

Dark green fill: YY= Significant WEST-Trend & ROC, and significantly greater than untreated probed list (p<.05)

Light Green fill: Y = Significant Trend & ROC (p<.05) but not consistently significantly greater than untreated

Orange Highlights: Marginally significant, one or either Trend or ROC = p <.1

* PW showed a significant improvement in naming after phonemic cues, and in repetition but not in strict criterion naming (depicted in Figure 1)

Differential clustering strategies in a verbal fluency task between English- and Korean-speaking individuals with aphasia

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Introduction

Verbal fluency tasks assess the ability to retrieve semantic information by challenging participants to list as many words as possible within a specific category and time limit, requiring strategies like clustering and switching to efficiently produce words. Although previous literature has primarily focused on semantic components of these behaviors (Troyer, 2000), sublexical features may also influence clustering strategies such as alphabetical-order or letter-based activation. For example, the Korean writing system, Hangul, combines alphabetic and syllabic elements, using syllabic blocks to group letters—a feature distinct from purely alphabetic languages like English—transparently binding phonetic representation with structure, potentially leading to greater reliance on letter-based activation.

This study investigated how different clustering strategies are employed by English- and Korean-speaking individuals with aphasia (PWA) due to cross-linguistic differences in alphabetical and syllabic structures. We categorized clustering strategies into three domains: (1) semantic, involving words from animal subcategories (Troyer, 2000); (2) letter, grouping words with the same initial letter; and (3) alphabetical-order, listing items in alphabetical sequence.

Methods

Participants. This study included 50 PWAs, divided into two language groups of 25 each for English and Korean speakers. English-PWA were evaluated using the Western Aphasia Battery-Revised (Kertesz, 2006), while Korean-PWA were assessed with the Korean version of the Western Aphasia Battery-Revised (Kim & Na, 2012). An independent t-test revealed no significant differences between groups in age ($p=.289$), education ($p=.102$), and Aphasia Quotients ($p=.545$).

Animal fluency task. Participants were instructed to list as many animals as possible in one minute.

Data analysis. Clustering strategies were analyzed by computing semantic cluster ratio (SCR), letter cluster ratio (LCR), and alphabetical-order cluster ratio (ACR) (Figure 1a and 1b). We calculated clustering ratios by dividing the sum of cluster scores by the total correct responses (Gaines et al., 2006). Cluster scores were determined by identifying clusters of at least two consecutive items and subtracting one from the total items in each cluster. Hence, higher cluster ratio indicates a greater use of clustering strategies.

Results

English-PWA produced significantly more correct responses ($p=.006$). A two-way mixed ANOVA revealed that Korean-PWA generated an overall higher clustering ratio than the English-PWA group ($p=.003$). A significant main effect for the type of clustering strategies showed $SCR > LCR > ACR$ ($p<.001$). The significant 2-way interaction suggests that the

Korean-PWA group had a significantly higher LCR than the English-PWA group ($p<.001$) (Figure 1c, Table 1). No significant differences were found in ACR and SCR between the groups.

Conclusions

Korean-PWA generated fewer animals but utilized more letter-based clustering strategies compared to English-PWA. This increased use of letter clustering may be attributed to the Korean syllabic blocks, containing at least one initial consonant and a vowel, with a transparent letter binding structure that differs from the purely alphabetic system of English. These features may contribute to the use of more letter-based clustering strategies in semantic verbal fluency tasks. These findings highlight the need to consider cross-linguistic influences on strategy usage in verbal fluency tasks and demonstrate how sublexical features drive performance differences among PWA groups.

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Table 1. Descriptive statistics of clustering strategies for each group.

Variables	English-PWA	Korean-PWA	p-value
Total Number of Correct Responses	10.60(6.02)	6.80(3.01)	$p=.006$
SCR	0.331(0.113)	0.311(0.169)	$p=.609$
LCR	0.012(0.026)	0.313(0.199)	$p<.001$
ACR	0.104(0.122)	0.023(0.052)	$p=.058$

Note. M(SD); SCR=semantic cluster ratio; LCR=letter cluster ratio; ACR=alphabetical-order cluster ratio.

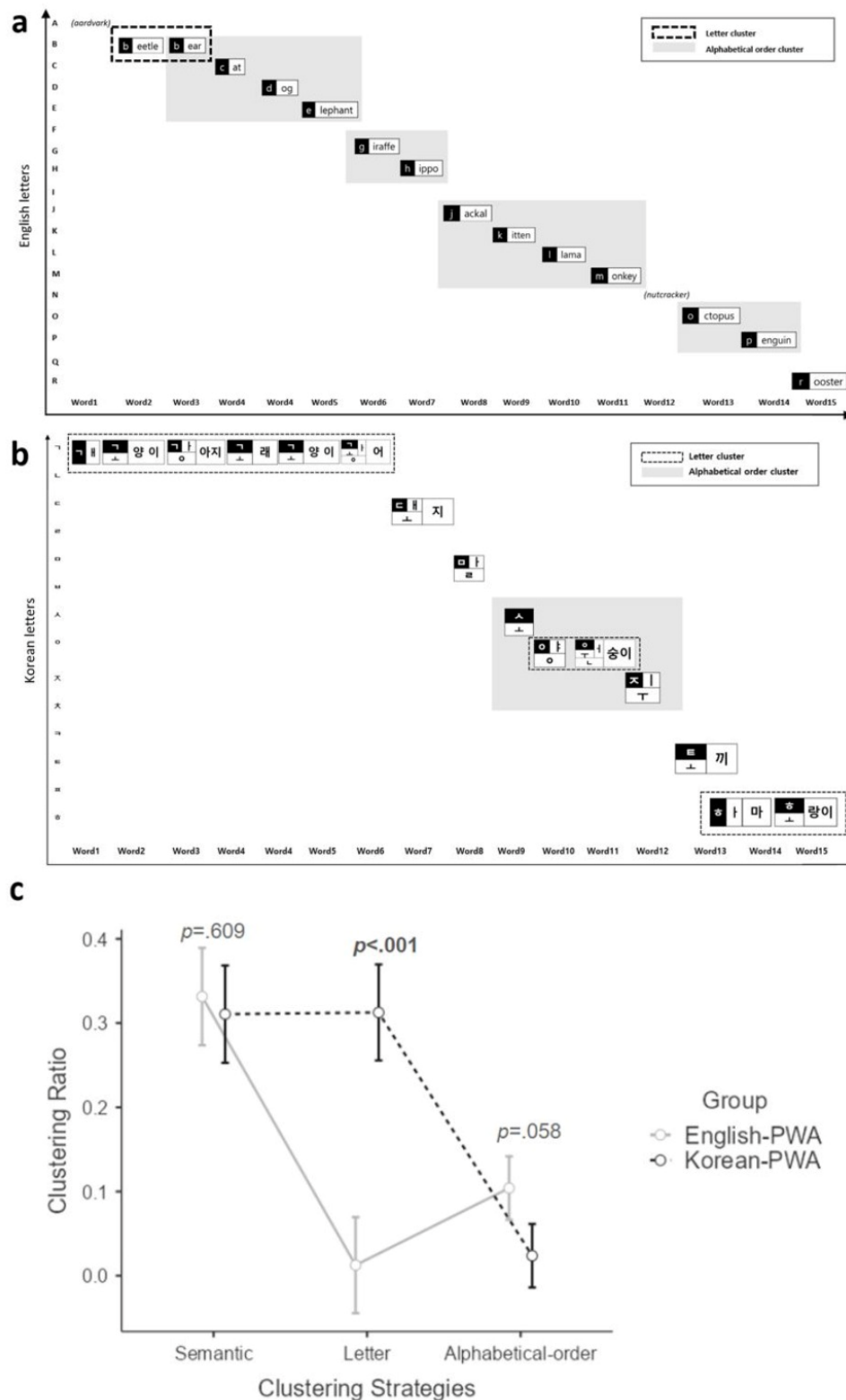


Figure 1. Example of letter and alphabetical-order clusters in animal fluency for (a) a participant in the English-speaking PWA group and (b) a participant in the Korean-speaking PWA group; (c) Clustering ratio across three clustering strategies (semantic, letter, alphabetical-order) for English- and Korean-speaking PWA.

Co-development of quality indicators and implementation priorities for post-stroke aphasia services

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Introduction

Despite the availability of high-quality guidelines (Burton et al., 2023), evidence-practice gaps persist within aphasia services (Shrubsole et al., 2018). There are no agreed quality indicators for post-stroke aphasia services, and it is therefore unknown if care reflects best practice or meets the expectations of service users. We aimed to establish quality indicators and implementation priorities for post-stroke aphasia care.

Methods

Three phases of research were conducted: (1) Guideline review and synthesis, (2) 2-round e-Delphi exercise and (3) Consensus meetings. Best practice recommendations with strong evidence or reported as being important to people with aphasia and their families were identified and synthesised. Clinicians (n=48), researchers (n=34), people with aphasia (n=22) and significant others (n=4) participated in a 2-round e-Delphi exercise and rated the importance of each recommendation. The top ten recommendations were subsequently ranked for importance and feasibility and converted into quality indicators. An expert panel comprising researchers (n=11), clinicians (n=6), people with aphasia (n=3), and significant others (n=1) voted yes or no for the routine measurement of each indicator and voted on implementation priorities.

Results

The expert panel gained consensus on 11 quality indicators: 1-Screening and/or assessment for communication impairment; 2-Valid and reliable standardised assessment of severity of aphasia; 3-Information about aphasia is provided to the PWA; 4-Information about aphasia is provided to the PWAs significant other(s); 5-Information about support is

provided to the PWAs significant other(s); 6-The primary communication partner receives communication partner training; 7-Individualised recommendations for communicating with the person with aphasia are provided to the treating team; 8-Training for staff in supported communication for aphasia; 9-Goal setting is conducted in partnership with the PWA and their significant others;10-The PWA receives person/family centred care; 11-The PWA receives speech and language therapy. Consensus was gained on three implementation priorities relating to: 1-Assessment, 2-Information provision; and 3-Person and family centred care (See Table 1).

Conclusions

Consensus was gained on 11 quality indicators and 3 implementation priorities for post-stroke aphasia services that are based on strong research evidence and are important to stakeholders.

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Table 1. Quality indicators and implementation priorities reaching consensus.

	Ten most important best practice recommendations	Quality indicators
1	The person with suspected aphasia should be assessed by a speech pathologist to determine the presence and severity of aphasia.	1a. A screener and/or assessment is completed to determine if communication impairment (including aphasia) is present. 1b. A valid and reliable standardised assessment is conducted to determine the severity of aphasia.
2	All people with aphasia should be offered information tailored to meet their changing individual needs using relevant language and communication formats. This should include information about the impact of aphasia and treatment options, and use the word 'aphasia'	2. Information about aphasia is provided to the person with aphasia.
3	Carers should be given tailored information and support at all stages of recovery, including connection with appropriate social supports and support organisations.	3a. Information about aphasia is provided to the person with aphasia's significant other(s). 3b. Information about support is provided to the person with aphasia's significant other(s).
4	Aphasia rehabilitation should include communication partner training to family, carers, and frequent communication partners of people with aphasia to improve communication and the communicative environment	4. The primary communication partner of the person with aphasia is provided with communication partner training.
5	All health and social care providers working with people with aphasia across the continuum of care (i.e., acute care to end-of-life) should be educated about aphasia and trained to support communication in aphasia.	5a. Individualised recommendations for communicating with the person with aphasia are provided to the treating team. 5b. There is training for staff in supported communication for aphasia.
6	Recovery goals should be set together with the person with aphasia, their family or carer, and speech pathologist. The goals should be well-defined, specific, and challenging, clearly documented, and reviewed and updated regularly.	6. Goal setting is undertaken in partnership with the person with aphasia and their significant others.
7	Aphasia services should be person and family centred.	7. The person with aphasia receives person/family centred care.
8	People with aphasia should be offered therapy to gain benefits in receptive and expressive language, and communication in everyday environments. This should include people with chronic aphasia who have ongoing goals.	8. The person with aphasia receives speech and language therapy.

Top 3 implementation priorities

1	The person with suspected aphasia should be assessed by a speech pathologist to determine the presence and severity of aphasia.
2	All people with aphasia should be offered information tailored to meet their changing individual needs using relevant language and communication formats. This should include information about the impact of aphasia and treatment options, and use the word 'aphasia'
3	Aphasia services should be person and family centred.

Early primary progressive aphasia atrophy asymmetry as a predictor of neuropathological diagnosis

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Introduction

Primary progressive aphasia (PPA) is a neurodegenerative dementia syndrome involving a progressive loss of language function. It is commonly accepted that language is predominantly processed in the left hemisphere of the brain. Greater atrophy occurs in the left rather than right hemisphere in participants with language deficits such as PPA¹. However, previous work has suggested that atrophy patterns may differ depending on the underlying pathology causing PPA². This study aims to further elucidate quantitative neurophysiological change that occurs in PPA groups defined by underlying pathologies.

Methods

Cortical thickness values of 35 left- and right-hemisphere regions-of-interests (ROIs) obtained from the first available structural scans of 44 PPA participants who came to autopsy³. Thirty participants had an autopsy-confirmed diagnosis of Alzheimer's Disease (AD) and 14 had Frontotemporal Lobar Degeneration (FTLD)-TDP-C. Left and right ROIs were vectorized and correlation values between the left and right hemisphere vectors were then calculated as a measure of hemispheric asymmetry (lower correlation indicating higher asymmetry) using R. Laterality values were then calculated between the left and right hemisphere to clarify the directionality of the asymmetric atrophy.

Results

The results of our analysis indicate a generalized degree of hemispheric asymmetry in the PPA group, as well as varying degrees of hemispheric asymmetry between PPA disease subtypes. Greater asymmetry was found in both the AD and the FTLD TDP-C groups than in a group of 35 age-matched healthy participants. The FTLD TDP-C group had a correlation value of 0.49, proving to be more asymmetric in comparison with the AD group correlation value of 0.84. The laterality indices showed all asymmetry in the PPA subtypes as leftward leaning, with the TDP-C group showing greater specificity for language centers.

Conclusions

In the early stages of PPA, the underlying neuropathology influences atrophy asymmetry, suggesting that some neuropathologies may show a greater preference for the language network than others. To further investigate these differences, laterality indexes and correlation values will be calculated for subcortical data.

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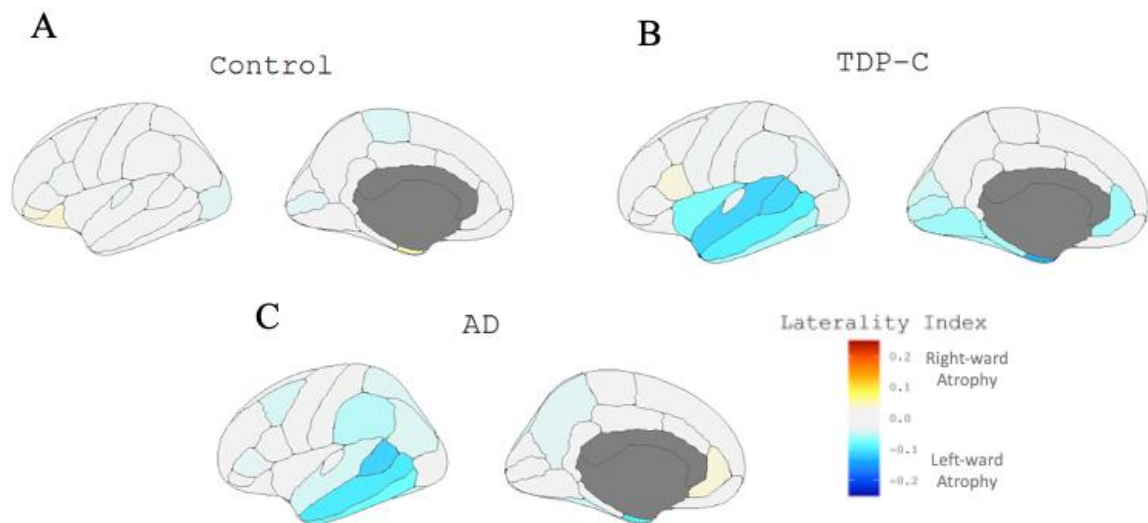


Figure 33. This figure (above) shows the laterality indices for each ROI in the brain for the right and left hemisphere. (a) Shows averaged laterality indices from the control group, (b) shows the averaged laterality indices for the FTLD-TDP-C group, (c) shows the averaged laterality indices from the AD group.

Table 1. Correlation values for the whole brain and six lobes of the brain.

Subtype	Whole Brain	Range for Whole Brain	Medial Temporal Lobe (MT)	Lateral Temporal Lobe (LT)	Frontal Lobe (F)	Parietal Lobe (P)	Occipital Lobe (O)	Cingulate Cortex (C)
TDP-C	0.49	0.11-0.77	0.16***	-0.09***	0.69	0.83*	0.94	0.56**
AD	0.84	0.41-0.97	0.85	0.51*	0.64	0.77**	0.93	0.83
Controls	0.92	0.80-0.97	0.87	0.78	0.70	0.93	0.95	0.87

Verbal domain in Malay speakers with aphasia: Sentence reductions in different language varieties

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Introduction

Agrammatic aphasia has been reported in several languages as a disorder with functional categories with high rates of omissions in verb inflections (Faroqi-Shah & Thompson, 2004). This study explores this phenomenon in Malay speakers with aphasia, a language underrepresented in aphasiology, which exhibits diglossia between standard and colloquial forms (Karaj, 2022). The study aims to (1) investigate the verbal domain in Malay, focusing on the clinical implications of the more lenient grammatical acceptance in colloquial variety, potentially facilitating faster syntactic compared to morphological recovery, and (2) examine the morphological status of different verbal affixes in Malay through the speech of individuals with aphasia.

Methods

Fourteen native Malay speakers participated in an elicited production study, including eight adults classified as non-fluent (mean age = 51.64, SD = 8.24) and six adults classified as fluent (mean age = 48.5, SD = 12.02) according to the Boston Diagnostic Aphasia Examination (BDAE) (Goodglass, Kaplan & Barresi, 2001). Participants were presented with 90 items across three conditions: a picture showing a person showing an action (Condition A), a verb without a picture (Condition B), and a combination of a picture showing an action and the verb (Condition C). Responses were coded for errors based on both colloquial Malay (lenient coding) and standard Malay (strict coding). Errors included a gradient of omissions, from free morphemes, to affixes in verbs and fragments of different nature.

Results

Accuracy for colloquial Malay significantly differed between the groups ($z = -3.979$, $p < .0001$), with no significant differences between conditions (A, B, C) and no interaction between condition and group (see Table 1). In contrast, accuracy based on standard Malay showed significant differences between the groups ($z = -3.084$, $p = .002$), between conditions (A vs B, $z = -2.135$, $p = 0.03$; A vs C, $z = -2.522$, $p = 0.01$), with no interaction between condition and group. A generalized additive model indicated a significant effect of aphasia type (fluent/non-fluent). and on response types ($z = 11.656$, $p < .0001$). Fluent speakers produced sentences without affix omissions approximately 70% of the time, often producing correct standard Malay sentences or omitting "sedang" (acceptable in colloquial Malay). Non-fluent speakers omitted affixes over 60% of the time, frequently resulting in non-grammatical sentences for both varieties (see Figure 1). Additionally, fluent aphasics never omitted subjects, whereas non-fluent aphasics often omitted both subjects and affixes.

Conclusions

The study of Malay-speaking aphasic individuals revealed distinct sentence reduction patterns in fluent and non-fluent speakers, identifiable by coding omissions in free and

bound grammatical morphemes. The non-fluent group exhibited agrammatic speech characterized by sentence reductions involving subject and bounded verbal affix omissions, reflecting a structural sentence reduction with varying complexity. In contrast, the fluent group's speech aligned more closely with colloquial Malay simplifications, indicating a grammatical reduction pattern. The clinical implications of this study suggest that the lenient grammatical acceptance in colloquial Malay may facilitate faster syntactic recovery in aphasic patients compared to morphological recovery, informing targeted therapeutic approaches.

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Table 1. Correct responses by condition (tasks) and group (fluent and non-fluent). Coding is done for colloquial Malay (lenient coding) and standard Malay (strict coding).

Group	Fluent Aphasias (N = 6)	Non-fluent Aphasias (N = 8)
PICTURE ONLY		
Colloquial Malay	179/180 (0.99)	155/240 (0.64)
Standard Malay	62/180 (0.34)	17/240 (0.07)
VERB ONLY		
Colloquial Malay	179/180 (0.99)	141/240 (0.58)
Standard Malay	45/180 (0.25)	18/240 (0.08)
PICTURE + VERB		
Colloquial Malay	178/180 (0.98)	171/240 (0.71)
Standard Malay	42/180 (0.23)	18/240 (0.08)

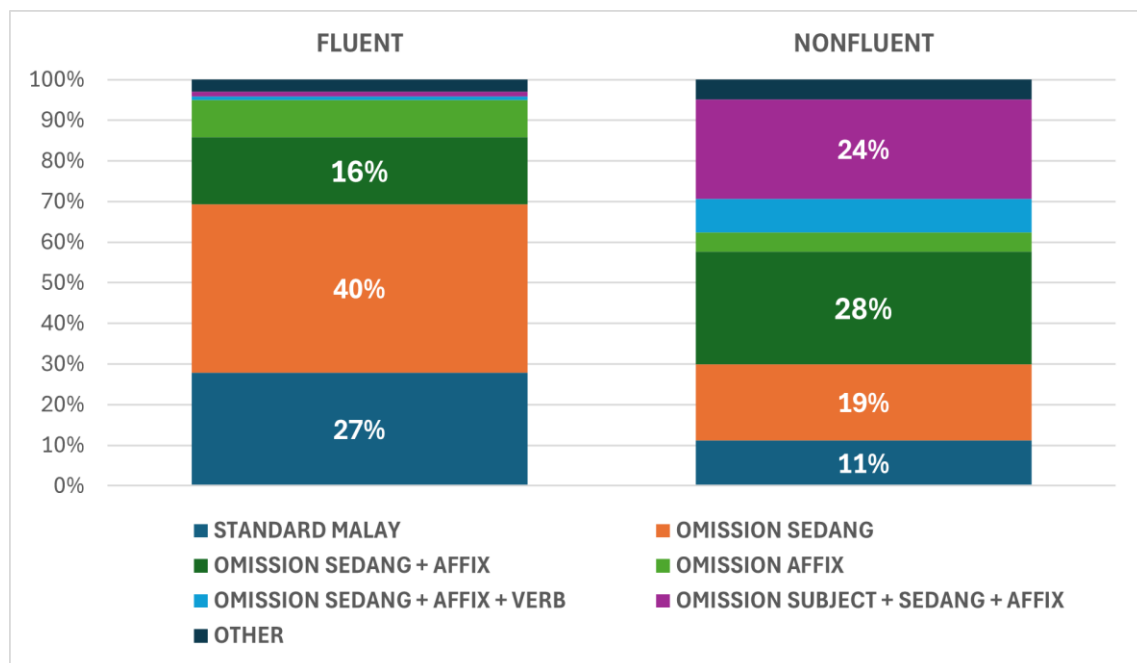


Figure 1. Error analyses of elicited productions by fluent and non-fluent speakers of Malay.

Language alignment in older adults with socially assistive robots: Implications for aphasia rehabilitation

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Introduction

Many persons with aphasia (PWA) experience barriers to sustainable speech therapy services such as limited insurance coverage, geographical distance, and a shortage of speech-language pathologists. Social assistive robots (SARs) are a type of robot that “provide assistance to human users through ... social interactions” (Feil-Seifer 2005). SARs can close this gap by delivering easily accessible in-home speech therapy for PWA and providing social support and companionship for PWA who suffer from social isolation. We investigated clinical potential of SARs by examining if and how older adults align their linguistic expressions with robot partners in an interactive language task. Communication partners echo each other’s linguistic expressions, including use of same sentence types, and those alignment behaviors support implicit language learning in both typical speakers and PWA (Branigan & McLean, 2016; Lee et al., 2023). However, it remains unknown if such alignment effects can also occur when people interact with robots.

Methods

Twelve healthy older adults (age $M=73$, range 67-93; 3 Female, 9 Male) completed a collaborative language game with a human partner and two robots, a machine-like NAO and a human-like Furhat that differ in their levels of anthropomorphism (Figure 1). With each partner, the participants took turns describing transitive action scenes in sentences, with the goal of finding matching pictures. During their turn, the human or robot partners described their pictures in either a passive or active sentence. We measured if the participants would produce a passive sentence more frequently after their partner said a passive rather than an active sentence to evaluate the degrees of linguistic alignment across partner conditions. After interacting with all three interlocutors, we administered the Technology Acceptance Model questionnaire (King 2006) to assess participants’ attitude, usefulness, ease of use, and appearance for each SAR and gained qualitative feedback about their experience via a semi-structured interview.

Results

A repeated-measure ANOVA test revealed that the type of interlocutors did not have a statistically significant effect on participants’ levels of linguistic alignment ($F(2, 22)=0.93$, $p=0.41$). The participants produced passives more frequently after hearing their partner produce passives with all three partner types (human $M=0.75$, $SD=0.25$; NAO $M=0.81$, $SD=0.22$; Furhat $M=0.77$, $SD=0.33$). Paired t-tests showed that there is no statistically significant difference in how participants perceive the usefulness (NAO $M=3.69$, $SD=0.97$; Furhat $M=3.63$, $SD=1.04$; $t(11)=0.22$, $p=0.83$), ease of use (NAO $M=2.86$, $SD=1.36$; Furhat $M=3.22$, $SD=1.15$; $t(11)=-1.65$, $p=0.13$), or appearance (NAO $M=3.73$, $SD=1.20$; Furhat $M=3.79$, $SD=1.03$; $t(11)=-0.51$, $p=0.62$) between the two robots. From the semi-structured interview, seven of the twelve participants shared that NAO felt like a cartoon-like child, while Furhat felt more reactive and comfortable.

Conclusions

The results suggest that both SARs can be as effective in eliciting linguistic alignment effects as a human interlocutor and that the older adults had positive experience interacting with each of the robots. SARs have potential to deliver interventions to improve communication abilities of older adults and persons with aphasia and mitigate some of the barriers to sustainable aphasia rehabilitation.

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Figure 34. NAO, on the left, is a full-body humanoid robot that interacts using vocal utterances and body gestures. In contrast, Furhat, on the right, is a tabletop robot with a human-like face features.

Garden path resolution skills in all variants of primary progressive aphasia: Evidence from a case-series study in Greek

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Introduction

Syntactic processing deficits have been mainly associated with the non-fluent variant Primary Progressive Aphasia (nfvPPA). However, there is evidence that persons with logopenic (lvPPA) or/and semantic variant (svPPA) may also face difficulties with parsing sentences, especially those with high structural complexity (Barbieri et al., 2021; Walenski et al., 2021). Garden path structures are complex sentences, in the sense that they create expectations for parsing strategies that need to be revised as individuals parse the sentences incrementally; for example, in the sentence “While she was cooking the spaghetti burnt in the pot”, the noun ‘spaghetti’ is initially interpreted as the object of the verb ‘was cooking’ only to be re-analyzed as the subject of the verb ‘burnt’, thus, resulting in a garden path effect. In morphologically-rich languages, like Greek, the strength of the garden path effect is modulated by both the lexical features of the subordinate verb ($\pm$ transitivity), and the morphological Case marking of the ambiguous noun, i.e., Nominative and Accusative Case denoting entities in subject and object position, respectively. Here, we investigated the garden path resolution skills of Greek-speaking persons with the three PPA-variants and a group of language-unimpaired controls.

Methods

The study included 8 persons with PPA (2 nfv-, 3 sv- and 3 lvPPA; Mean age: 70;6 yrs.) and a group of 8 age- and education-matched language-unimpaired adults. Participants were administered a self-paced reading grammaticality judgement task that included unambiguous and temporarily ambiguous garden path sentences. The task manipulated the lexical semantics of the verbs (transitive vs. intransitive) and the syntactic function of the post-verbal noun (subject vs. object), which resulted into four experimental conditions: (i) Transitive-Object (TO) (‘While she was knitting the scarves_{ACCUSATIVE} slipped from the table’), (ii) Intransitive-Object (IO-ungrammatical) (‘While she was dancing the paintings_{ACCUSATIVE} fell on the floor’), (iii) Transitive-Subject (TS-Garden path) (‘While she was knitting the scarves_{NOMINATIVE} slipped from the table’), and (iv) Intransitive-Subject (IS-ungrammatical) (‘While she was dancing the paintings_{NOMINATIVE} fell on the floor’). Participants’ grammaticality judgments were recorded.

Results

Table 1 shows each patient’s grammaticality scores per condition and per variant. Crawford and Garthwaite’s (2002) Singlims tests showed that one lvPPA ($p < .03$) and two svPPA patients ($p < .04$) had significantly lower grammaticality rates for TS/garden path structures than controls, while all nfvPPA and svPPA, and two lvPPA patients had worse grammaticality judgment rates for the ungrammatical intransitive-object (IO) sentences than controls ($p < .01$ for all comparisons). One svPPA and one lvPPA patient scored worse than controls in transitive-object (TO) sentences ($p < .001$), while one lvPPA patient scored worse than controls in grammatical intransitive-subject (IS) sentences ($p < .001$).

Conclusions

PPA variants were distinguishable by garden path effect, with svPPA individuals being more vulnerable to temporal syntactic ambiguity, thus, less prone to accept garden path sentences as grammatical. All PPA variants had difficulty with recognizing ungrammatical (IO) sentences, which speaks in favor of an impairment in online sentence processing across all three variants. The results imply that the svPPA variant faces difficulty with resolving syntactic ambiguity.

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Table 1. PPA individuals' and controls' grammaticality judgment scores (%) across sentences.

Patient per variant	TS	TO	IS	IO
nfvPPA#1	50	92	67	50
nfvPPA#2	38	71	71	58**
svPPA#1	46*	83	63	50**
svPPA#2	63	71	67	50**
svPPA#3	44*	44***	72	33**
lvPPA#1	33*	50***	39***	61**
lvPPA#2	94	89	94	33**
lvPPA#3	83	83	75	92
Controls	68.2 (14.2)	75.3 (16.8)	63.3 (21.3)	92 (3.4)

Note. TS = Transitive verb-Subject; TO = Transitive verb-Object; IS = Intransitive verb-Subject; IO = Intransitive verb-Object

Grey color signifies significant differences from controls

* $p \leq .05$

** $p \leq .01$

*** $p \leq .001$

Anatomical properties of the right pars triangularis that contribute to TMS efficacy as a treatment for chronic aphasia

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Introduction

Recovery from post-stroke aphasia requires the recruitment of new brain regions. Many of these regions are right hemisphere homotopes of left hemisphere language regions with different structural and functional properties in persons with aphasia (PWA) relative to controls (Saur et al., 2006). One region, the right pars triangularis (rPTR), has been associated with language dysfunction in PWA (Postmancheux et al., 2010) and has been a target in inhibitory transcranial magnetic stimulation (TMS) combined with language therapy (Medina et al., 2012). While a promising intervention, inhibiting the rPTR does not improve language outcomes in all PWA. One approach to identify moderating factors of TMS efficacy is to identify individual differences in the rPTR that correspond to treatment effects in language outcomes. The current study examines the structural properties of the rPTR and their relationship with naming performance after TMS. To address this, we examined single-tract connections from the rPTR to language regions in the right and left hemisphere using measures such as network centrality (e.g., degree—number of connections from one region to others) and whole brain density (e.g., fraction of observed connections between regions, relative to all potential connections).

Methods

Twenty-nine PWA underwent 10 sessions of inhibitory (1 Hz) TMS to the rPTR followed by 1 hour of Constraint Induced Language Therapy. Twenty patients received active TMS and 9 received sham stimulation. Patients also completed high-resolution MRI scanning. The Philadelphia Naming Test (PNT; Roach et al., 1996) was administered at baseline. Using baseline (pre-treatment) MRI scan, we constructed structural connectomes to estimate edge weights between the rPTR and the left pars triangularis (lPTR), left middle temporal gyrus (lMTG), and right middle temporal gyrus (rMTG). For network centrality measures, we examined degree, betweenness centrality, and eigenvector centrality. We also computed measures for the entire brain, including whole-brain density. In the active and sham group, we correlated each measure with the difference between post- and pre-TMS overall accuracy on the PNT and the proportion of error types (i.e., semantic and phonological). For significant correlations, we ran post hoc regression models to if the relationship for the active group was larger than the sham group.

Results

We found a correlation between proportion of phonological errors made and single edge weight from the rPTR to the rMTG ($r = -.65$, $p < .005$). Specifically, fewer phonological errors were made after TMS when the patient had a weaker connection from the rPTR to the rMTG. The regression model comparing the active to the sham condition was also statistically significant ($b = .11$, $p < .05$), with the active group having a stronger slope than the sham group (Figure 1).

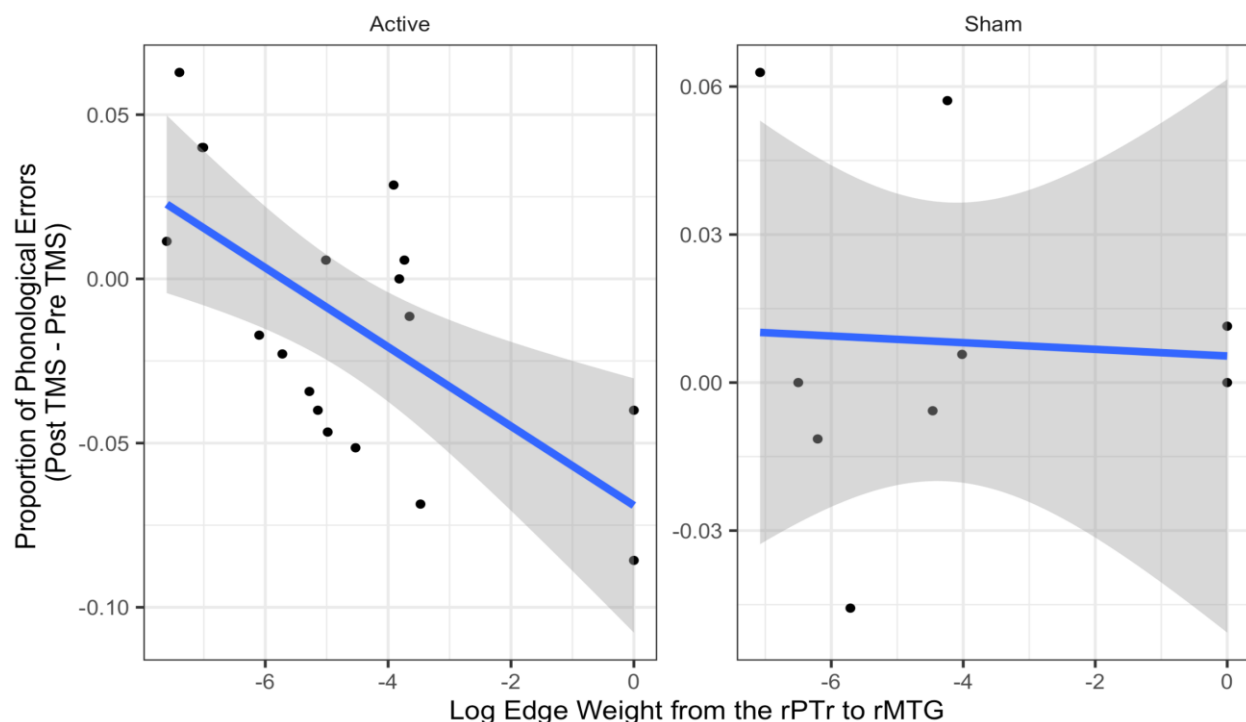
Conclusions

Our findings provide evidence that the strength of anatomical connections from the rPTR to the rMTG moderate TMS efficacy on naming in PWA. Specifically, individuals with a weaker connection at baseline derived greater benefit from TMS. The data raises the possibility that the strength of structural connection from the rPTR to the rMTG could predict response to TMS to the rPTR in chronic aphasia.

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Figure 1: Effect of TMS as a Function of Edge Weight from rPTR to rMTG



Measuring stroke care in Australia: Differences in quality and outcomes for people with and without aphasia in acute and rehabilitation hospitals

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Introduction

There is a growing body of evidence describing poor outcomes for people with aphasia post-stroke (Bersano et al., 2009; Flowers et al., 2016). Yet, little is known about the quality of stroke care received by patients with aphasia, despite evidence-based guidelines for both aphasia and stroke (Burton et al., 2023; Shrubsole et al., 2016; Simmons-Mackie et al., 2016; Stroke Foundation, 2024). We aimed to investigate associations between the presence of aphasia and the provision of evidence-based stroke care and outcomes in acute and inpatient rehabilitation hospitals in Australia.

Methods

This was an observational study of cross-sectional data from the Stroke Foundation National Stroke Audit of acute and rehabilitation services conducted between 2016–2021 in Australia. Services submit ~40 consecutive retrospective medical record audits each year. Processes of care investigated aligned with The Australian and New Zealand Clinical Guidelines for Stroke Management. In-hospital outcomes included complications, independence, and discharge destination. Descriptive statistics and multivariable logistic regression were used to examine associations between aphasia status, processes of care, and patient outcomes (adjusted for age, sex, prior function, stroke severity and type, and hospital clustering).

Results

Among 22,265 audited cases, 3122 (26.9%) had aphasia in the acute setting (aphasia 51% male; median age 78 years; no aphasia 58% male; median age 74 years) and 3160 (32.7%) had aphasia in the rehabilitation setting (aphasia 56% male; median age 75; no aphasia 56% male; median age 76). In both settings, patients with aphasia were more likely to have a mood impairment (acute: 38% vs 28%; rehabilitation: 54% vs 44%), yet had their mood assessed less often in acute (23% versus 30%) and were less likely to be assessed by a psychologist in rehabilitation (40% versus 49%). They were less likely to receive risk factor education on discharge from both settings (acute: 59% versus 70%; rehab 58% vs 60%) and were less likely to be asked about returning to work (67% versus 74%) or driving (41% versus 45%) during rehabilitation. In the acute setting, patients with aphasia were more likely to experience one or more complications (aOR 1.46 95% CI 1.30, 1.63), were less

independent at discharge (aOR 0.48 95% CI 0.42, 0.56) and were more likely to access inpatient rehabilitation (aOR 1.15 95% CI 1.01, 1.30). In the rehabilitation setting, patients with aphasia were also less independent at discharge (aOR 0.71, 95% CI 0.62, 0.81) and were less likely to be discharged home (aOR 0.83 95% CI 0.74, 0.92).

Conclusions

Variations in quality of stroke care and outcomes exist for patients with aphasia post-stroke, compared to patients without aphasia, highlighting potential inequities in care. There is a need for further research to understand and address gaps in quality of care for people with aphasia.

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Fluent speech but inability to repeat: A case report on deep dysphasia

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Introduction

Deep dysphasia is characterized by the production of semantic paraphasias in repetition as its core symptom (Michel & Andreewsky, 1983). It is hypothesized to stem from impairment in phonological short-term memory. Additionally, other symptoms such as imageability effects and the inability to repeat non-words are observed (McCarthy, Kalinyak-Fliszar, Kohen, & Martin, 2017). However, cases with deep dysphasia have been rarely described. In this report, we present a case of deep dysphasia exhibiting these symptoms.

Methods

A right-handed woman in her 50s with 12-year education suffered from left putaminal hemorrhage. She had a history of cerebral arteriovenous malformation and had experienced three hemorrhages in her teens. Gamma knife surgery was performed when she was 16-year-old for the arteriovenous malformation. However, according to her family, there had been no aphasia symptoms. She was transferred to our hospital's rehabilitation ward 34 days after onset. Right-sided paralysis was very mild, and she was independent in activities of daily living. Cognitive function was well preserved, and she maintained etiquette and grooming. Speech was fluent without any phonemic paraphasias. Her chief complaint was difficulty in hearing words clearly. The Standard Language Test of Aphasia (SLTA) (SLTA-Committee, 1977) and Sophia Analysis of Language in Aphasia (SALA) (Fujibayashi et al., 2013) were administered to assess aphasia symptoms. Phonological abilities were assessed through tests of phonemic extraction, and matching and selection of phonemes by using Hiragana characters, de facto phonetic symbols in Japanese. All the assessment were conducted with masks on at all times due to the COVID-19 pandemic.

Results

Both SLTA and SALA showed better performance in reading comprehension compared to listening comprehension. Auditory comprehension showed declines starting from the single word level. Repetition was also impaired at the single word level, with errors observed such as "taiyo" (the sun) being repeated as "akari" (light). SALA repetition of words showed imageability effects but no word length effect was observed, and semantic paraphasias were the most frequent error type. Repetition of non-words was impossible. When repetition was performed without masks, semantic paraphasias were declined and formal paraphasias increased (e.g. "kome" (rice) as "ume" (plum)).

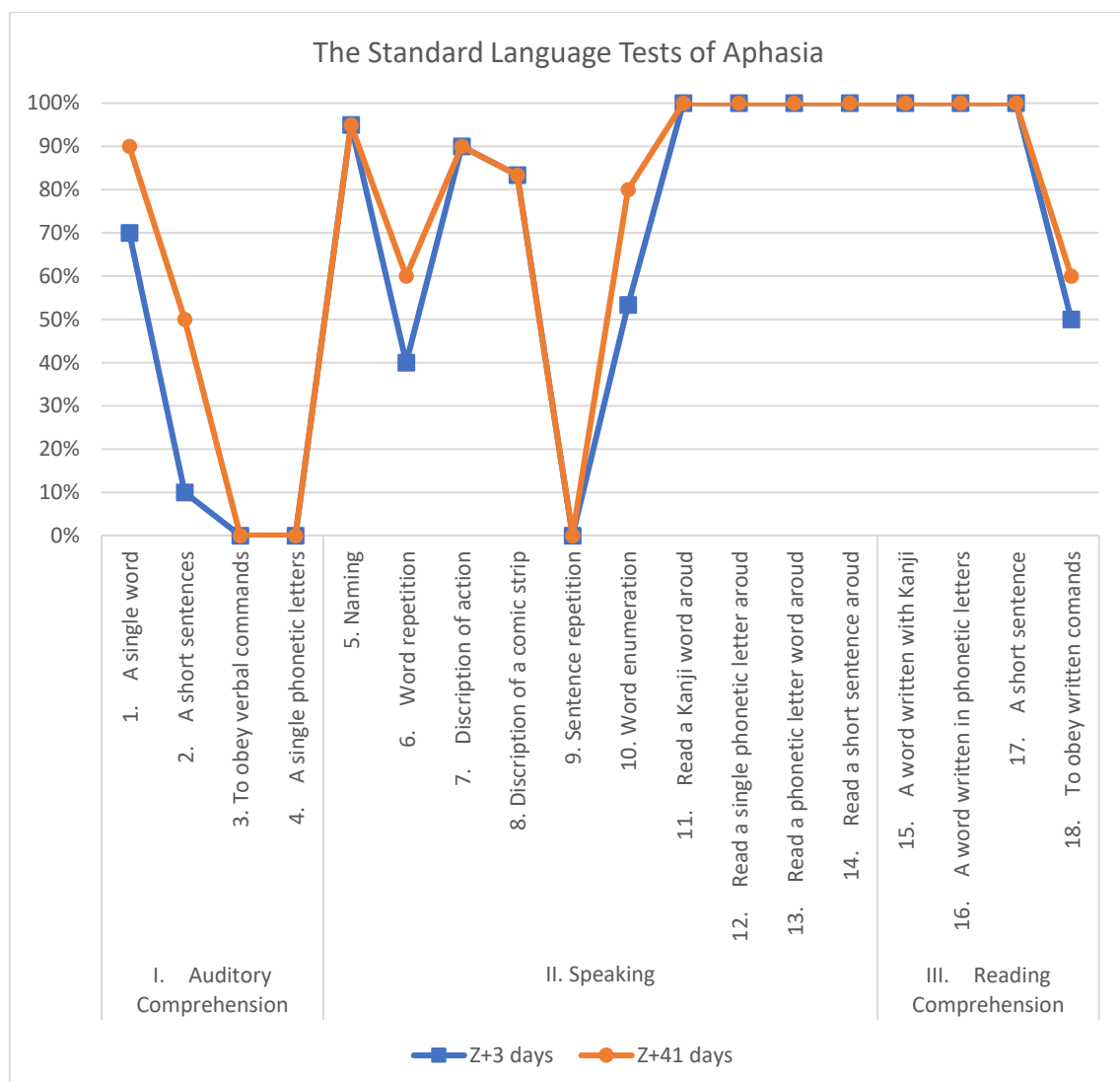
Phonemic extraction showed a decline when words were presented auditorily, but no significant decline when words were presented by illustrations or Chinese characters. Tasks to judge the sameness or difference between auditorily presented single syllables and single hiragana characters yielded 16/18 correct responses, but selecting the correct single syllable from among six hiragana characters resulted in 7/18 correct responses.

Conclusions

This case demonstrated an impairment in phonological short-term memory to the extent that while matching phoneme was almost possible, selection was not. Additionally, when words were presented auditorily, repetition revealed imagery effects and semantic paraphasia, while repetition with the presentation of mouth shapes resulted in an increase in formal paraphasia. This case of deep dysphasia showed a dependency on the semantic lexical route in the logogen model when only auditory stimuli were presented, but switched to a reliance on the non-semantic lexical route with the visual presentation of mouth shapes.

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SALA R29 Word repetition (Out of 52 words): Imageability (I) and Frequency(F)

	High I	High I	Low I	Low I	Total of	Total of	Total of	Total of	Total
	High F	Low F	High F	Low F	High I	Low I	High F	Low F	
	(/13)	(/13)	(/13)	(/13)	(/26)	(/26)	(/26)	(/26)	(/52)
Correct	8	5	2	1	13	3	10	6	16
No reaction within 5 sec	2	1	4	3	3	7	6	4	10
Don't know	0	0	1	4	0	5	1	4	5
Phonemic paraphasias	0	0	0	0	0	0	0	0	0
Semantic paraphasias	1	4	3	2	5	5	4	6	10
Formal paraphasia	0	0	2	3	0	5	2	3	5
Non-related word	0	2	1	0	2	1	1	2	3
Circumlocution	2	1	0	0	3	0	2	1	3

Assessing mild aphasia: Developing and validating high-ceiling serial picture description tasks

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Introduction

Picture description tasks are widely used in aphasia assessment as well as other language impairments (Mueller et al., 2018), with stimuli divided into single pictures (e.g., Cookie Theft; Goodglass & Kaplan, 1983) and picture sequences representing a story (e.g., Cinderella story; Saffran et al., 1989). While single pictures efficiently detect aphasia, they have a ceiling effect and may miss minor impairments in mild aphasia patients. In contrast, serial pictures are more sensitive to mild language impairments (Forbes-McKay & Venneri, 2005). However, no standardized serial picture tasks exist for Chinese speakers, and current pictures lack parallel versions, making them unsuitable for repeated use.

To address this, we designed two serial picture sets based on familiar Chinese scenes, "Market" and "Park", along with a specialized rating scale. This study aims to evaluate these tasks' ability to differentiate speech between healthy individuals and those with mild language impairments, as well as their interchangeability as parallel tasks.

Methods

Participants. Data were collected from two groups of Chinese participants aged 55-84 with varying educational backgrounds: 1) 61 individuals self-reporting good mental and physical health, and 2) 3 individuals with confirmed cognitive and language impairments (WAB < 93.8).

Data collection. All participants completed the two serial picture description tasks and the MoCA and MMSE tests. Those scoring below 20 on MoCA also took the WAB test. Each picture description task was evaluated by two of the four total raters using a partially-crossed design.

Measurement model. The rating data were analyzed using Many-Facet Rasch Measurement (MFRM) with the software FACETS (Version No.4.1.6) (Linacre, 2018). This study involves a three-facet model, including participants' ability (Examinee), rater severity (Rater), and task difficulty (Task).

Results

Wright map from MFRM analyses presented the relationship between all facets (Figure 1). The Rasch model explained 88.14% of the variance, with the chi-squared test supporting the model's fit ($\chi^2 = 246.93$, $p = .3319$). Participants showed a noticeable spread, while tasks did not, aligning with expectations. Raters had a smaller spread, which is usually undesirable but adjusted by the Rasch measures. The examinee separation index was 5.02 for the examinee facet with a reliability of 0.96 (Table 1), indicating reliable separation into about five groups (Linacre, 2012).

Additionally, Pearson correlation analysis revealed that the fair scores of both the Market and Park tasks are significantly and positively correlated with both MoCA (Market: $r = 0.666$, $p < .001$; Park: $r = 0.672$, $p < .001$) and MMSE (Market: $r = 0.526$, $p < .001$; Park: $r = 0.539$, $p < .001$).

Conclusions

The study confirmed the robust differentiation of speech among Chinese-speaking individuals using the two serial picture description tasks. These tasks can be used interchangeably in clinical settings due to their similar difficulty, effectively avoiding practice effects. Additionally, the two tasks were moderately correlated with MoCA and MMSE, indicating their sensitivity in detecting mild language deficits (though may not noticeable in daily communication) associated with cognitive impairments. This aids in detecting of mild Chinese aphasia, which existing tasks cannot adequately describe.

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Measr	+Examinee	+Rater	+Task	Scale
7	+	+	+	+(15)
	*			
6	+	+	+	+
				14
5	+	*****	+	+
		****		---
4	+	**	+	+
		****		---
3	+	*****	+	+
		*****		12
2	+	*****	+	+
		*****		11
1	+	*****	+	+
		*****		10
		*****		---
* 0	* *****	* L	+	+
	*****			9
	*****	Z		8
	*****	H		---
	*****	S		7
-1	+	+	+	+
	*			---
-2	+	+	+	+
	***			6
	**			5
-3	+	+	+	+

-4	+	+	+	+
				4
-5	+	+	+	+
	*			---
-6	+	+	+	+
				3
-7	+	+	+	+
-8	+	+	+	+
-9	+	+	+	+
	*			---
-10	+	+	+	+
				(2)
Measr	* = 1	+Rater	+Task	Scale

Figure 35. Wright map of all facets.

Table 1. Summary statistics for all three facets.

	Facets		
	Examinee	Rater	Task
Fixed χ^2	1296.1	101.5	5.1
<i>p</i>	.00*	.00*	.02*
<i>df</i>	63	3	1
Random χ^2	59.0	2.9	
<i>p</i>	62	.23	
<i>df</i>	.58	2	
Separation	5.02	5.00	1.24
Strata	7.02	7.00	1.99
Reliability of separation	.96	.96	.61
Measure mean	1.19	.00	.00
SD	2.62	.61	.13
Infit MnSq mean	.96	.97	.97
SD	.92	.12	.03
Outfit MnSq mean	.96	.96	.96
SD	.93	.14	.04

* $p \leq 0.05$

Cross-linguistic differences in the semantic networks of an animal fluency task between English and Korean speakers with aphasia

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Introduction

Animal fluency is widely used to assess lexical retrieval by having participants generate as many animal names as possible in one minute. The semantic network associated with the 'animal' category may vary across cultural and linguistic backgrounds. Advances in network science methodologies offer potential revealing these diversities in the semantic networks reflected in the verbal fluency task. Semantic networks represent relationships between semantic units, following principles of small-world networks, characterized by clustering density and path lengths between nodes (Christensen & Kenett, 2021).

This study investigated cross-linguistic and multicultural differences in semantic network measures in an animal fluency task between English and Korean speakers with aphasia. The analysis focused on semantic clustering and switching behaviors, as well as the small-world network characteristics, including activation of semantic association, clustering coefficients, and modularity of subnetworks.

Methods

Participants. A total of 50 people with aphasia (PWA) participated in the study (25 per English and Korean-PWA group). All PWA had stroke-induced aphasia and were assessed using the Korean version of the Western Aphasia Battery-Revised (PK-WAB-R; Kim & Na, 2012) for Korean-PWA or the Western Aphasia Battery-Revised (WAB-R; Kertesz, 2006) for English-PWA. The two groups were not significantly different for age ($p=.587$), education ($p=.069$), and Aphasia Quotients (AQs) ($p=.153$).

Data analysis. Variables analyzed after the 1-minute animal fluency task included: 1) total number of correct responses, 2) mean cluster size, and 3) number of switches using the Semantic Network and Fluency Utility (SNAFU; Zemla et al., 2020). Additional variables from the semantic network analysis (SemNA; Christensen & Kenett, 2021) included 1) average shortest path length (ASPL), clustering coefficient (CC), and maximum modularity coefficient (Q). ASPL indicates the average number of the minimum steps required for spreading activation from one node to all others, with lower ASPL value suggesting more efficient semantic activation. CC is an index of the likelihood of co-occurrence among the neighbors of a node, with higher CC indicating a higher possibility for each item to be connected. Q estimates the density of connections between nodes in different subnetworks, with higher Q indicating more modular and segmented subnetworks.

Results

English-PWA produced significantly more correct responses ($p=.001$) and switches ($p=.026$) than Korean-PWA, although the two groups did not differ in mean cluster size ($p=.450$). Semantic network differences are illustrated in Figure 1 and Table 1. In SemNA, English-PWA presented significantly lower ASPL than Korean-PWA ($p<.001$), whereas the group differences were not significant for CC ($p=.103$) and Q ($p=0.075$).

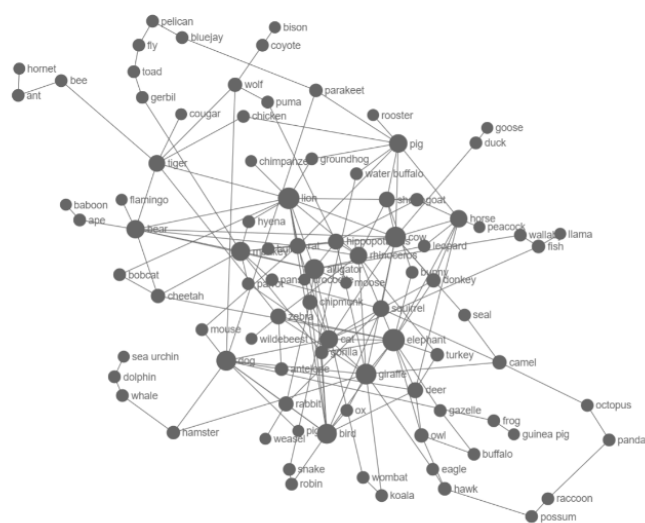
Conclusions

English-PWA generated more items than Korean-PWA. The results may be due to cross-linguistic differences such as lexical frequencies and familiarity with certain animals, resulting in different semantic networks. The greater number of animals from the English-PWA group is likely associated with more switching behaviors and more efficient semantic activation, reflected by lower ASPL. This indicates that English-PWA have shorter paths for spreading semantic activation by frequently switching semantic clusters compared to Korean-PWA. These findings highlight the importance of considering semantic network differences in aphasia assessment, reflecting cross-linguistic and cross-cultural influences on neuropsychological tasks.

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English-PWA



Korean-PWA

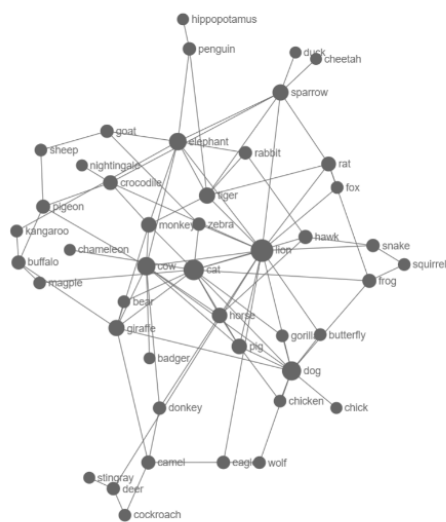


Figure 1. Semantic network comparisons using the Semantic Network and Fluency Utility between English-speaking (Left) and Korean-speaking people with aphasia (PWA) (Right): Nodes (circles) represent each lexical item from the 'animal' category, and edges (lines) indicate the similarity or co-occurrence of the items.

Table 1. Descriptive statistics from the SNAFU and SemNA analysis.

Analysis	Variables	English-PWA	Korean-PWA	p-value
SNAFU	Total Number of Correct Responses	10.40(5.75)	6.08(2.72)	<i>p</i>=.001
	Mean Cluster Size	1.74(1.60)	1.59(1.33)	<i>p</i> =.450
	Number of Switches	5.24(5.00)	3.36(3.00)	<i>p</i>=.026
SemNA	ASPL	1.46(0.06)	1.48(0.09)	<i>p</i><.001
	CC	0.76(0.05)	0.76(0.04)	<i>p</i> =.103
	Q	0.14(0.04)	0.14(0.05)	<i>p</i> =.075

Note: SNAFU=Semantic Network and Fluency Utility; SemNA=Semantic Network Analysis; ASPL=Average Shortest Path Length; CC=Clustering Coefficient; Q=maximum modularity coefficient.

Investigating language differences across contexts and communication partners in individuals with aphasia

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Introduction

Traditional clinical assessments often fail to capture the nuances of language production in naturalistic settings. This study examines the effect of context and communication partners on discourse measures in participants with aphasia (PWA) and non-brain-injured participants (NBI). We compare language patterns across clinical and home settings and between conversational partners (CPs) and SLPs. Using Natural Language Processing (NLP), we automate discourse analyses and explore correlations with standardized tests, including the Quick Aphasia Battery (QAB) and Discourse Comprehension Test (DCT).

Methods

Participants included seven PWA and five NBI aged 30-80, a subset of a total sample of 40 (analysis ongoing). Each provided three conversational samples: two in a clinic and one at home. In the clinic, PWA had 10-minute conversations first with their CP and then with an SLP using standardized prompts. At home, participants recorded interactions using digital language processors over two days. Transcriptions were analyzed using the Natural Language Toolkit in Python for lexical density, type-token ratio (TTR), average sentence length (ASL), and filler words. Lexical density measures meaningful content words, TTR reflects vocabulary variety, ASL assesses sentence complexity, and filler words count non-content words.

Results

Language was more varied and denser in clinical settings compared to home. For PWA, TTR was 0.27 in the clinic and 0.19 at home. They used fewer filler words in the clinic (18.38) compared to home (35.57). ASL increased at home to 14.82 from 8.68 in the clinic. For NBI, ASL was higher in the clinic (17.83) than at home (11.71). TTR in the clinic was 0.27, slightly decreasing at home (0.23). Filler word use increased at home to 49.2 from 46.2 in the clinic. Conversations with SLPs and CPs showed similar language measures for PWA but differed for NBI. For PWA, ASL was 8.76 with SLPs and 8.60 with CPs; the TTR was 0.26 with SLPs and 0.27 with CPs; filler words were 19.75 with SLPs and 17.00 with CPs. For NBI, SLP conversations had higher ASL, TTR, and more filler words compared to CPs. Boxplots illustrating these results can be found in Figure 1.

Higher ASL, varied vocabulary, and fewer filler words correlated with higher standardized scores, particularly in clinical settings. For PWA in clinics, ASL correlated with QAB scores ($r = 0.55$) and TTR with DCT scores ($r = 0.56$). Lexical density positively correlated with QAB scores ($r = 0.51$). For NBI, ASL correlated with QAB ($r = 0.55$) and DCT scores ($r = 0.56$); TTR showed positive correlations with both QAB and DCT scores ($r = 0.56$).

Conclusions

Significant variations in language measures were found based on context for both PWA and NBI:

- Denser and more varied language in clinical settings.
- PWA maintained consistent language performance in average sentence length and lexical diversity regardless of the communication partner.
- NBI adjusted language complexity based on the communication partner.

These findings highlight the importance of environmental and interpersonal factors in assessing language abilities in aphasia. Further research should explore these dynamics and their implications for therapy and assessment.

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Table 1. Correlations between language measures and standardized scores (QAB and DCT) in clinical and home settings.

	Clinic						Home					
	ASL	TTR	LD	Filler Words	QAB	DCT	ASL	TTR	LD	Filler Words	QAB	DCT
ASL	1.00	-0.19	0.70	0.81	0.55	-0.02	1.00	0.44	0.64	0.10	-0.41	-0.38
TTR	-0.19	1.00	0.08	-0.40	0.10	0.56	0.44	1.00	0.65	-0.16	0.42	0.39
LD	0.70	0.08	1.00	0.49	0.51	0.21	0.64	0.65	1.00	0.31	0.08	-0.33
Filler Words	0.81	-0.40	0.49	1.00	0.37	-0.13	0.10	-0.16	0.31	1.00	-0.30	-0.56
QAB	0.55	0.10	0.51	0.37	1.00	0.49	-0.41	0.42	0.08	-0.30	1.00	0.60
DCT	-0.02	0.56	0.21	-0.13	0.49	1.00	-0.38	0.39	-0.33	-0.56	0.60	1.00

Note. ASL: Average Sentence length, TTR: Type-Token Ratio, LD: Lexical Density, QAB: Quick Aphasia Battery, DCT: Discourse Comprehension Test.

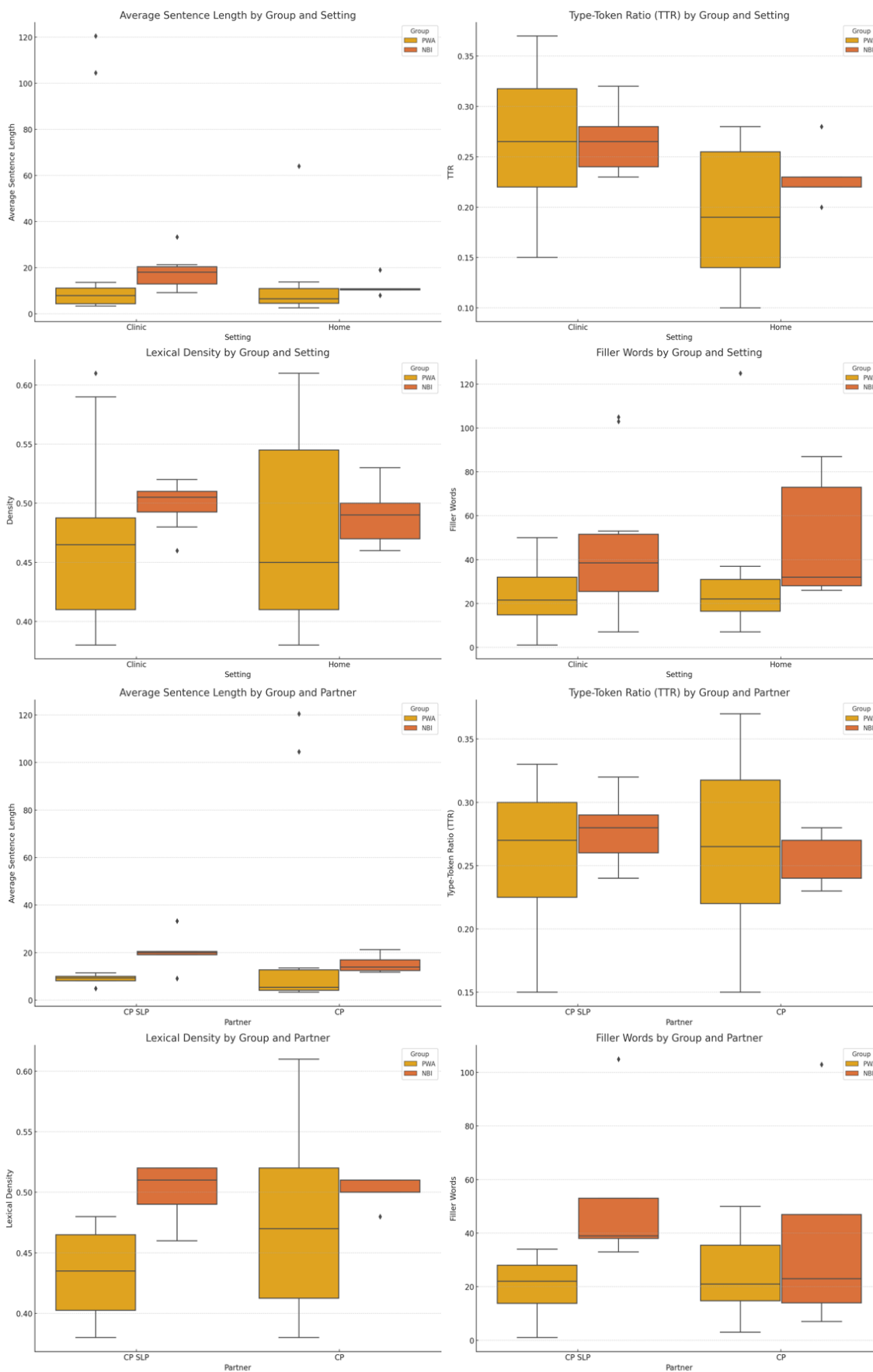


Figure 1. Box plots of language measures for PWA and NBI participants across settings (clinic vs. home) and communication partners (speech-language pathologist (CP-SLP) vs. primary communication partner (CP)).

Dementia resilience and coping during natural disasters and humanitarian crisis: Lessons from Japan

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Introduction

The frequency of disasters has been increasing over time, due partly to the effects of climate change (heat waves, wildfires, hurricanes/typhoons) as well as patterns of human settlement in disaster-prone areas (Center for Research on the Epidemiology of Disasters, 2020). Natural disasters, conflicts, and humanitarian disasters may induce major mental health issues, such as depression, anxiety, stress, and neurocognitive decline. Early life exposure to these stressors can result in the development of neurodegenerative diseases such as mild cognitive impairment and Alzheimer's disease (AD). This mini review aims to explore the humanitarian experiences of patients with dementia and their caregivers while facing natural disasters, wars, and displacements.

Methods

A literature review was conducted in December 2023. We searched for articles published in English from 2000 to 2023 in PubMed, Web of Science, and Scopus databases that addressed dementia resilience and coping following humanitarian and natural disasters. A total of 28 articles were identified. 4 suitable studies were selected. The factors that contributed to successful coping and resilience, as per the literature, were described in terms of type of disaster, medical diagnosis, comorbidities, modality of intervention, and outcome.

Results

Although studies were scarce, they have shown limited compassionate care for victims of war-torn, natural and human-related disasters. They are all originated from Japan. There are significant correlations between post-traumatic stress disorders, neurocognitive vulnerability leading to cognitive decline in the absence of timely intervention. The natural disasters that have been reported were mainly Tsunami, earthquakes, flooding, hurricane while human related disasters included wars and displacements. The intensity and type of disasters may impact their wellbeing, neurocognitive outcome and resilience. Developing an empathy-based approach is an important neuro-protective element for a variety of disaster-related health sequelae, including mental and cognitive impairment. A constant result from this review is the crucial significance of social ties (a community's "social capital") in shielding against the risk factors of post-traumatic stress disorders and involuntary displacement following the disaster. (Otani, 2014; Kawachi et al, 2020)

Conclusions

This mini review showed the interest of developing empathy-based approaches in screening, assessing and treating medical comorbidities in patients with dementia following natural and human catastrophes.

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Mixed fluent variant progressive aphasia with altered eating habits: A new phenotype of primary tauopathy?

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Introduction

A substantial number of primary progressive aphasia (PPA) cases do not align with any of the subtypes proposed by the current diagnostic criteria, which are called mixed or unclassified variants. The lesion locations associated with the mixed or unclassified variant PPA and their underlying neuropathology remain largely unexplored. While behavioral and psychiatric symptoms are frequently observed in patients with PPA, the current diagnostic algorithms for PPA solely rely on features of aphasia or other cognitive symptoms. It may be beneficial to consider behavioral/psychiatric features in order to infer the lesion locations and underlying neuropathology of PPA. Here we present two cases of the logopenic/semantic mixed variant of PPA with mild behavioral symptoms similar to those observed in behavioral variant frontotemporal dementia. Multimodal neuroimaging investigation demonstrates anterior temporal and temporo-parietal neurodegeneration associated with non-Alzheimer's primary tauopathy.

Case Presentation

Case 1. A right-handed man in his late 60s presented with word-finding difficulties and impairment in verbal comprehension one year prior to his initial visit to our hospital. Subsequently, he exhibited a variety of changes in his eating behavior, including a repeated preference for a specific brand of sweet bread and the consumption of peaches with added sugar. On his initial visit, he exhibited fluent speech and did not display any articulation abnormalities. He was talkative and the topics of conversation rapidly changed from one to the next. He exhibited a marked degree of sociability towards hospital staff, frequently engaging in inappropriate humor. On the Western Aphasia Battery (WAB), he demonstrated poor performance on the repetition and naming tasks, with slight impairment in his word and sentence comprehension abilities. He exhibited semantic and phonological paraphasias as well as surface dyslexia. Amyloid-PET (¹⁸F-Flutemetamol) scan was negative. The Tau-PET (¹⁸F-MK6240) scan revealed the accumulation of tau proteins in the bilateral anterior and ventral temporal cortices, as well as the bilateral parietal cortices and left frontal and temporo-parietal cortices.

Case 2. A right-handed man in his late 70s developed verbal comprehension impairment and eating behavior changes including frequent consumption of sweet foods, three years prior to his initial visit to our hospital. On his initial visit, he exhibited fluent speech and did not display any articulation abnormalities. He was talkative and exhibited a marked degree of friendliness towards the hospital staff. On the WAB, he demonstrated moderate impairment in repetition and naming, with mild impairment in his word and sentence comprehension abilities. He exhibited phonological and semantic paraphasias and repeatedly attempted to correct his phonological errors. Surface dyslexia was observed. Amyloid-PET (¹⁸F-Flutemetamol) scan was negative. The Tau-PET (¹⁸F-MK6240) scan

revealed the accumulation of tau proteins in the bilateral anterior and ventral temporal cortices, as well as the bilateral insular and parietal cortices and left frontal and temporo-parietal cortices.

Communication between the hemispheres in PPA: The relationship between functional and structural homotopic connectivity

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Introduction

Investigations of structural and functional connectivity in Primary Progressive Aphasia (PPA) have primarily focused on the connectivity profiles within the hemispheres, with little attention directed at investigating the communication between the hemispheres, which is largely accomplished via the corpus callosum. Previously, we found that non-fluent variant PPA exhibited higher than normal synchronization across the hemispheres as measured by homotopic resting-state functional connectivity¹. These findings raised questions regarding the structural connectivity between the hemispheres in PPA. In this study, we included all three PPA variants and evaluated the relationship between functional and structural connectivity for homologous brain regions across the hemispheres,

Methods

Participants were 72 individuals with PPA: 30 non-fluent (nfvPPA), 29 logopenic (lvPPA), 13 semantic (svPPA), and 26 healthy controls. Scanning included: high-resolution structural imaging, resting-state fMRI, and DTI. Both homotopic functional (FC) and structural connectivity (SC) connectomes were constructed using an atlas of 200 pairs of homotopic cortical parcels². FC corresponded to pairwise Pearson's r (with Fisher's z) of the fMRI timeseries; SC corresponded to the mean fractional anisotropy (FA) of the streamlines connecting every homologous pair of parcels.

We used linear mixed effect modelling to compare the three variants to control participants and to each other. Analysis 1: the dependent variable was the SC values of the 200 connections per participant, fixed effects were group and age, random effects were connection and participants. Analysis 2 was equivalent, with FC as the dependent measure and in-scanner motion as an additional fixed effect. In addition, using regression analysis, we examined the relationship between FC and SC homotopic connectivity and overall disease severity, measured by FTDL-modified clinical dementia rate, FTLD-CDR³).

Results

Structural homotopic connectivity (Fig. 1a). All three variants exhibited reduced homotopic SC relative to controls ($p < 0.001$), and the lvPPA group had reduced SC compared to the other two variants ($p < 0.01$). Furthermore, lower homotopic SC was related to greater disease progression in all three groups, significantly so for both nfvPPA and lvPPA.

Functional homotopic connectivity (Fig. 1b). The three variants exhibited different patterns of FC: nfvPPA had significant higher FC than the controls ($p < 2e-16$) while lvPPA had significant lower FC ($p = 1.08e-09$); svPPA exhibited a regional pattern of both elevated and reduce FC relative to controls. In all variants, greater FC *abnormality* was associated with greater disease severity. Thus, in nfvPPA disease severity was associated with higher homotopic FC, while in lvPPA and svPPA greater disease severity was associated with lower homotopic FC ($p < 1e-04$).

Conclusions

We examined the functional and structural connectivity between the two hemispheres (i.e., homotopic) in the three PPA variants. We found that structural homotopic connectivity was degraded in all variants such that the two hemispheres becoming increasingly less structurally connected with disease severity/progression. Despite the similarity in structural connectivity, the three variants exhibited different patterns of functional connectivity between the hemispheres. These results highlight the range of functional reorganization that can occur in PPA and underscores the complex relationship between structural and functional changes.

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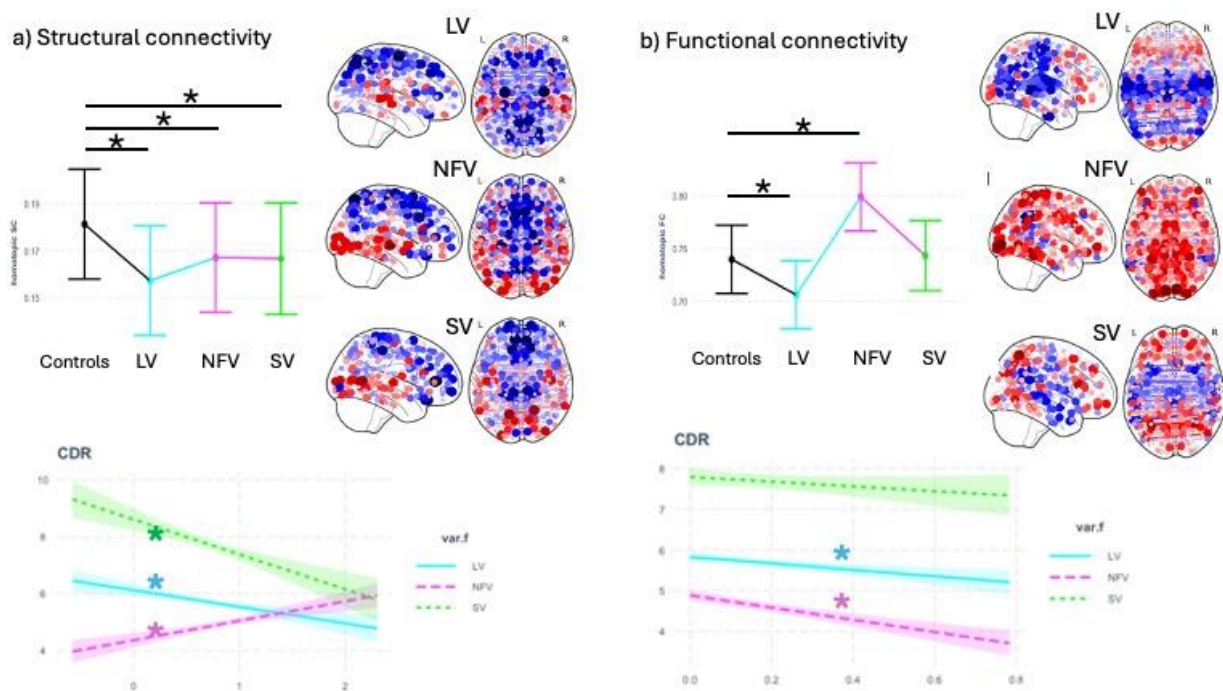


Figure 36. Homotopic structural (SC, panel a) and functional connectivity (FC, panel b) of the three PPA variants. Top: Connectivity values of each variant compared to the healthy controls overall (left) and for each connection (right). The t-values calculated for each connection were visualized, blue indicates values lower than controls and red indicates higher than controls. Bottom: Relationship between connectivity and disease severity/progression measured with CDR, higher CDR score indicates greater severity.

Telepractice assessments for individuals with aphasia: A systematic review

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Introduction

Current literature has broadly demonstrated the effectiveness and feasibility of telepractice services for people with aphasia (Hall et al., 2013). The examination of telepractice assessments for people with aphasia, however, has been limited (Teti et al., 2023). The purpose of this systematic review was to examine the current use of telepractice assessment protocols for people with aphasia. Specifically, the review sought to: a) identify the assessments utilized in the aphasia telepractice literature; b) appraise critically the quality of such investigations; and, c) evaluate critically the psychometric properties of the standardized tests used.

Methods

A review of the literature published in English since 2000 was conducted by searching MEDLINE, EMBASE, PsychInfo, CINAHL, and Scopus databases. A total of 2429 articles were screened. Two reviewers assessed records independently finding 11 articles eligible for inclusion. Data extraction was conducted once and validated by a second reviewer. Quality appraisal was carried out for the included studies as well as the standardized testing measures used in these studies.

Results

Across the included studies there was a lack of variation among the telepractice assessment protocols and aphasia tests used. That is, there was limited investigation of screening tests, discourse analysis, extra-linguistic cognitive measures, and the use of patient-reported measures. Study characteristics lacked high quality and free of bias examinations. Most standardized tests that were utilized exhibited poor validity and reliability properties.

Conclusions

Overall, this systematic review yielded a need to investigate a wider range of aphasia assessment protocols that can be offered via telepractice. More robust research designs are necessary to examine a variety of assessment tests and/or procedures that are similar to those available for in-person aphasia assessment services. However, psychometric evaluation of such tests raised concerns regarding their use in research and clinical practice.

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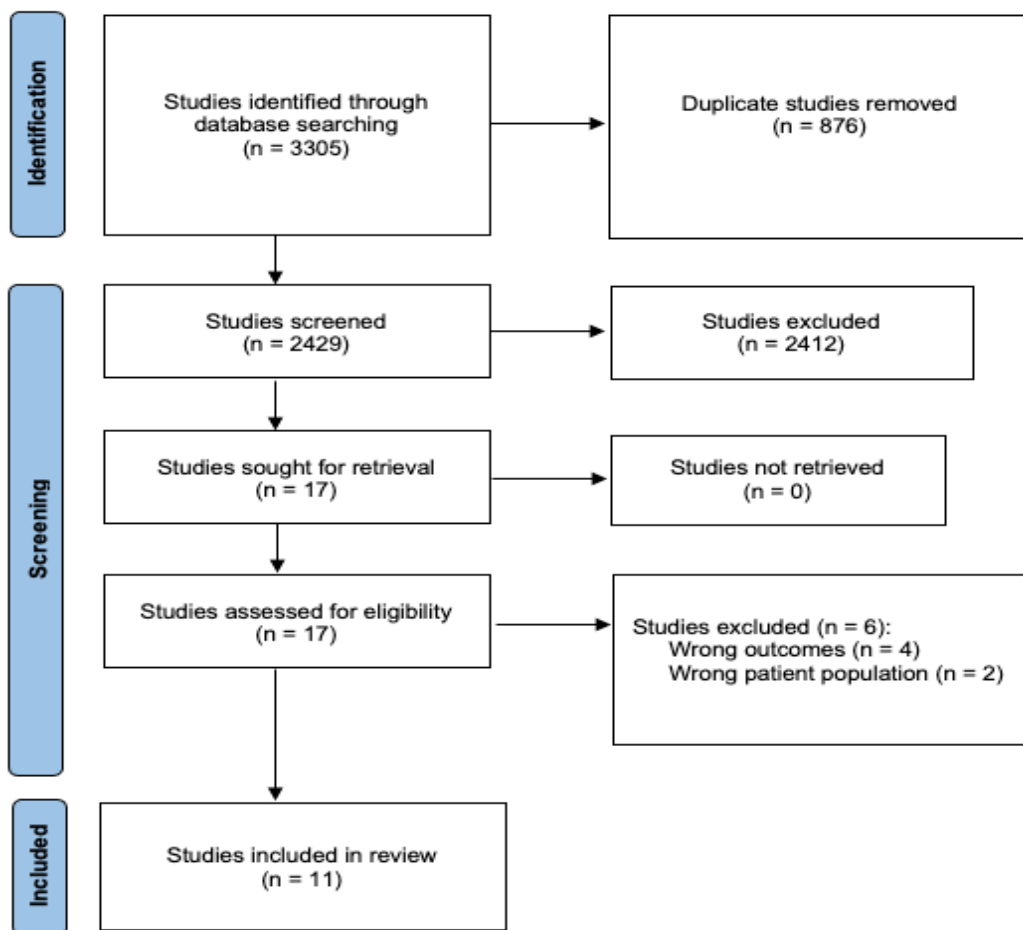


Figure 37. Prisma diagram.

Table 3. Study quality ratings.

Study	Study design	Demographic variables	Aphasia variables	Telepractice characteristics	Data collection	Overall rating
Altaib and Meteyard ⁵³	high	moderate	high	high	moderate	moderate
Choi et al. ²	high	low	moderate	high	low	low
Dekhtyar et al. ¹⁵	high	moderate	high	moderate	moderate	moderate
Georgeadis et al. ⁵⁹	high	moderate	high	high	moderate	moderate
Guo et al. ⁹	high	high	moderate	high	high	high
Hill et al. ¹³	high	low	high	high	moderate	low
Newton et al. ²⁷	high	high	high	high	moderate	high
Palsbo ¹⁶	high	low	low	moderate	low	low
Park et al. ⁵⁴	high	low	low	high	low	low
Rao et al. ⁷¹	high	moderate	high	high	low	low
Theodoros et al. ¹⁴	high	low	high	high	moderate	low

Multiple paths to sentence interpretation in older adults and persons with aphasia

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Introduction

Sentence comprehension is multifaceted, with various cues guiding interpretation. In aphasia, it is commonly thought that semantic cues may dominate interpretation, as compensation for syntactic deficits (Gibson et al., 2016; Saffran et al., 1998). However, prior evidence suggests that the precise nature of sentence processing may vary among unimpaired adults too (Pearlmutter & MacDonald, 1995; Tanner & Van Hell, 2014). Further, offline behavioral measures might not unearth such differences, which may only be evident in online processing (Thothathiri et al., 2023). We hypothesized that variation is normal: individuals with good comprehension may show different paths to interpretation despite behavioral similarity. Using multimodal behavioral and eyetracking measures, we conducted case studies of controls and persons with aphasia (PWA), who were screened for having good sentence comprehension and therefore, had no obvious need for long-term compensatory strategies.

Methods

Two older controls (C1/C2) and two PWA with mild deficits (P1/P2) participated. They were screened for good sentence comprehension using the WAB and the Philadelphia Sentence Comprehension Battery (PSCB) (Table 1). Subsequently, they were tested on syntax-semantics conflict sentences (e.g., “The cop was handcuffed by the robber”) where semantic plausibility can lead to a different interpretation than syntax (i.e., that the cop handcuffed the robber). Each participant completed two versions of the task. In the touchscreen version, they picked the matching picture out of 4 options by touching the screen. The options included the semantically implausible but correct target picture (e.g., robber handcuffing cop), the more semantically plausible reversal picture (e.g., cop handcuffing robber), and two distractors. We collected accuracy and reaction times. In the eyetracking version, they picked the matching picture out of 4 options using a joystick, while we recorded their eye movements. For each participant, we also collected working memory and cognitive control measures (not discussed here).

Results

Eyetracking revealed different paths in C1 vs C2 (not shown) and P1 vs P2 (Figure 1). P1 showed more fixations to the target picture than P2 as the sentence progressed (Left Panel). In contrast, P2 showed more fixations to the reversal picture than P2 even after the sentence was disambiguated (Right Panel). These differences in paths were statistically significant (Growth Curve Analyses. gazeR package in R. Interaction of time course poly1 and poly2 terms with Participant: $z > 2$, $p < .05$). Behavioral analyses revealed high accuracy across the board ($\geq 90\%$).

Conclusions

Participants were selected solely for having good comprehension, without any prior information about their online processing. Yet, we found differences between the two controls and between the two PWA in their online processing patterns. This suggests that comprehenders can engage different paths to sentence interpretation and that such

differences are not hard to find. Focusing on behavioral outcomes alone can miss important processing differences between individuals, as all participants showed good accuracy. These processing differences are important to characterize to enhance theoretical understanding and facilitate customized treatment for aphasia. While some PWA may struggle with sentence comprehension due to over-reliance on semantics, others might be failing for other reasons such as cognitive control deficits.

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Acknowledgments

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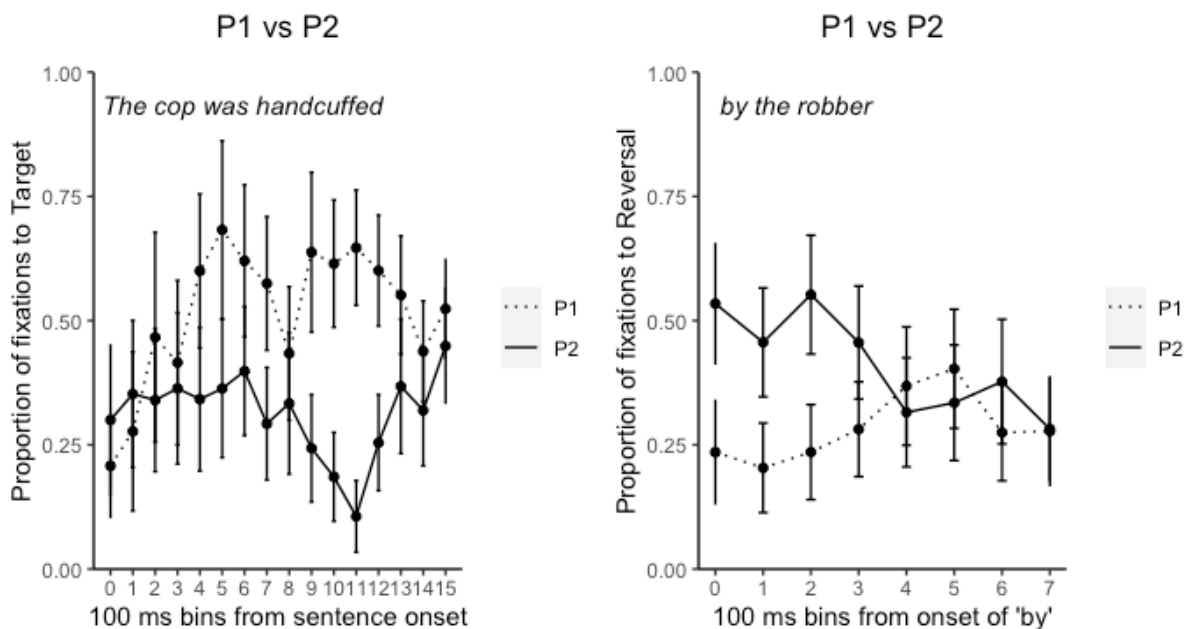


Figure 38. Different sentence processing paths in P1 vs P2.

Table 1. Demographic and background test information.

Participant	Age (Gender)	Education	Time from stroke onset in months	WAB Auditory Comprehension Score	PSCB Reversible Sentence Comprehension Accuracy
C1	59 (M)	16	N/A	N/A	100%
C2	75 (F)	13	N/A	N/A	100%
P1	66 (M)	13	108	10/10	93.3%
P2	53 (M)	18	227	9.85/10	90%

Treatment selection for word retrieval difficulty: Evidence from error types

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Introduction

Following stroke, people with aphasia struggle with word retrieval, and personalized treatment selection is critical for successful rehabilitation. Two effective treatment approaches are retrieval practice (RP) and errorless learning (EL). RP (e.g., naming an object from its picture) prompts word retrieval from long-term memory, engaging both the meaning-to-word mapping (Stage 1) and the word-to-phonology mapping (Stage 2) of word retrieval. In contrast, EL (e.g., repeating the name of a picture) emphasizes reexposure to the mapping at Stage 2, relying less on semantics-driven retrieval compared to RP. Since the two treatment approaches differentially engage the two retrieval stages, errors from different errant stages might benefit differently (Schuchard & Middleton, 2018a, 2018b). In the present work, we investigated if the pre-treatment erroneous nature of items predicts the degree of benefit from these two naming treatments.

Methods

We examined the naming performance of 30 participants with chronic stroke-induced aphasia. For item selection, a 660-item common object picture corpus was administered twice with a naming task. Responses were coded into correct, phonological errors, semantic errors, omission errors, and other errors, with minor phonological deviations allowed. Each participant received treatment on a personalized 120-item set, which was assigned to two treatment conditions in a matched fashion. Each item was treated twice after an initial repetition trial. In the RP condition, participants named the object after seeing its picture. In the EL condition, participants were instructed to repeat the name after hearing it while seeing its picture and its written name. Naming performance for 120 treated items and 30 untreated items was tested one day after treatment.

For each tested word, *item nature* was based on a participant's two responses during item selection, coded into six categories: (1) correct (two correct responses), (2) pure Stage 1 (two semantic errors), (3) general Stage 1 (a semantic error and a correct or omission or other error), (4) pure Stage 2 (two phonological errors), (5) general Stage 2 (a phonological error and a correct or omission or other error), and (6) unclear (not the aforementioned combinations).

Test accuracy was used as the dependent variable in a logistic mixed-effect model. Critically, we tested the interaction between item nature and treatment type (RP versus EL). The model also included treatment accuracy (the averaged accuracy of two treatment trials), target word length and frequency, participant-level apraxia severity, and subject- and word-specific random intercepts. We predicted that Stage 1 items would improve more with RP, whereas Stage 2 items would benefit more from EL.

Results and Conclusions

Both treatment approaches significantly improved naming over the untreated condition (p 's < .001). RP showed a significant advantage over EL for pure (p = .01) and general Stage 1 items (p = .03) and general Stage 2 items (p = .02). RP and EL were comparable for pure Stage 2 and unclear items (p 's > .05). This supports the use of RP in clinical practice, as it

provides better or comparable improvements relative to EL for a variety of naming errors, despite being more effortful.

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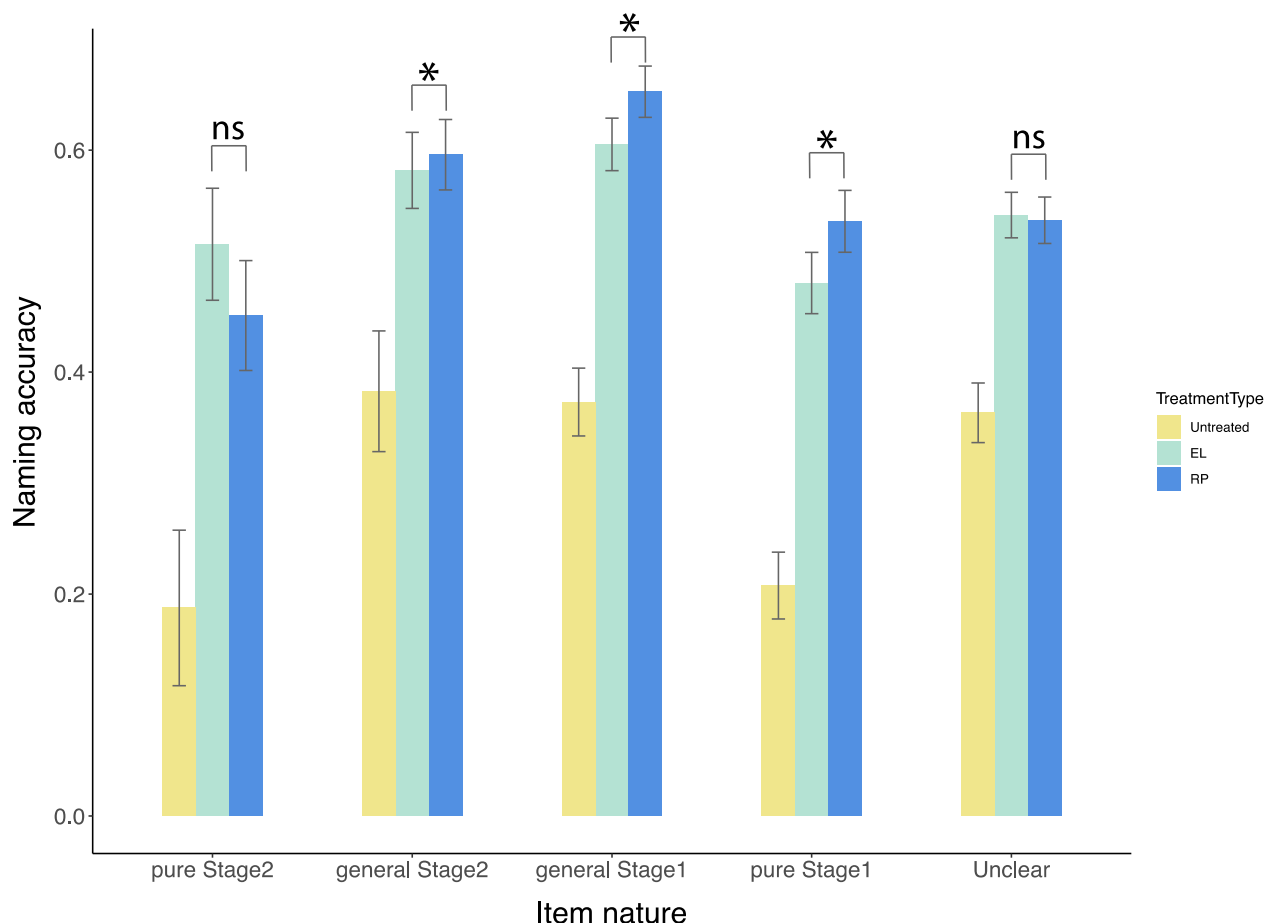


Figure 1. Average test accuracy for naming in different treatment approach and item nature. Error bar = standard error of each condition. RP = retrieval practice, EL = errorless learning. * = $p < .05$, ns = $p > .05$ for the effect of treatment type (RP versus EL) in the logistic mixed effect model.

Cortical pathways toward spoken word production: An electrocorticography study using picture naming and word read-aloud tasks

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Introduction

Word production in speech is a complex task in which the same sensorimotor output can be accessed through different cortical pathways (Indefrey, 2011). Picture naming and word read-aloud are good examples that produce the same output by performing two distinct tasks. Previous research (Wu et al., 2011) reported that, though these tasks both activated left temporal and inferior frontal language networks, picture naming elicited greater neural activation in the left dorsolateral premotor-prefrontal areas and word read-aloud elicited greater activation in the left ventral occipital-temporal areas. However, the number of such reports is still limited, and further research is needed to evaluate whether such results are generalizable to patients with diverse backgrounds. This research reports a new electrocorticography (ECoG) recording study examining task-dependent activation patterns in cortical spoken word production pathways.

Methods

Participant. A 68-year-old right-handed native Japanese speaker diagnosed as having a glioma in the left frontal region participated in this research. The patient was scheduled for surgery to remove the affected area at the Department of Neurosurgery at Tokyo Women's Medical University Adachi Medical Center. Subdural electrodes were placed for pre-surgical examination 5 days before the experiment.

Stimuli presentation. 32 picture images and matching words in Japanese "katakana" fonts were presented on a 19-inch LCD monitor about 60 cm in front of the patient. Each stimulus was randomly presented 8 times during two experimental sessions. Each trial consists of 500 ms fixation and 500 ms stimulus presentation, followed by another 500 ms fixation. Interstimulus intervals were varied between 700 to 1300 ms.

Data acquisition. 36 grid-electrodes and 6 deep-electrodes were surgically implanted covering the left inferior to middle frontal and superior temporal areas. ECoG signals and participants' voice responses were recorded at 1,000 Hz sampling frequency by Nihon Kohden Neurofax 1200 Digital System.

Analysis. Preprocessing and analysis were performed using MNE-Python analysis tools (<https://mne.tools/stable/index.html>). 1,000 ms epochs were extracted from the recording data and baseline-corrected relative to 100 ms before the onset. Event-related potentials (ERPs) were calculated by averaging all the epochs divided into either picture or word conditions.

Results

Amplitude modulation of ERPs was observed at the electrodes placed in the left inferior frontal and superior temporal areas in both picture and word conditions. Picture naming elicited stronger activation at the electrodes located in the left ventrolateral frontal areas.

Word read-aloud elicited stronger activation at the electrodes in the left superior temporal areas (Figure 1).

Conclusions

The current research replicated previous observations that cortical areas are differently involved in picture naming and word read-aloud. The inferior frontal area was more strongly activated in picture naming than in word read-aloud. As a new finding in the current research, word read-aloud activated the left superior temporal area more strongly than picture naming. The current study enhanced previous findings but is limited to the data from a single patient. More study is needed to elucidate the nature of neural networks supporting spoken word production. High-frequency band components of ECoG signals are going to be examined and reported at the conference.

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Acknowledgments

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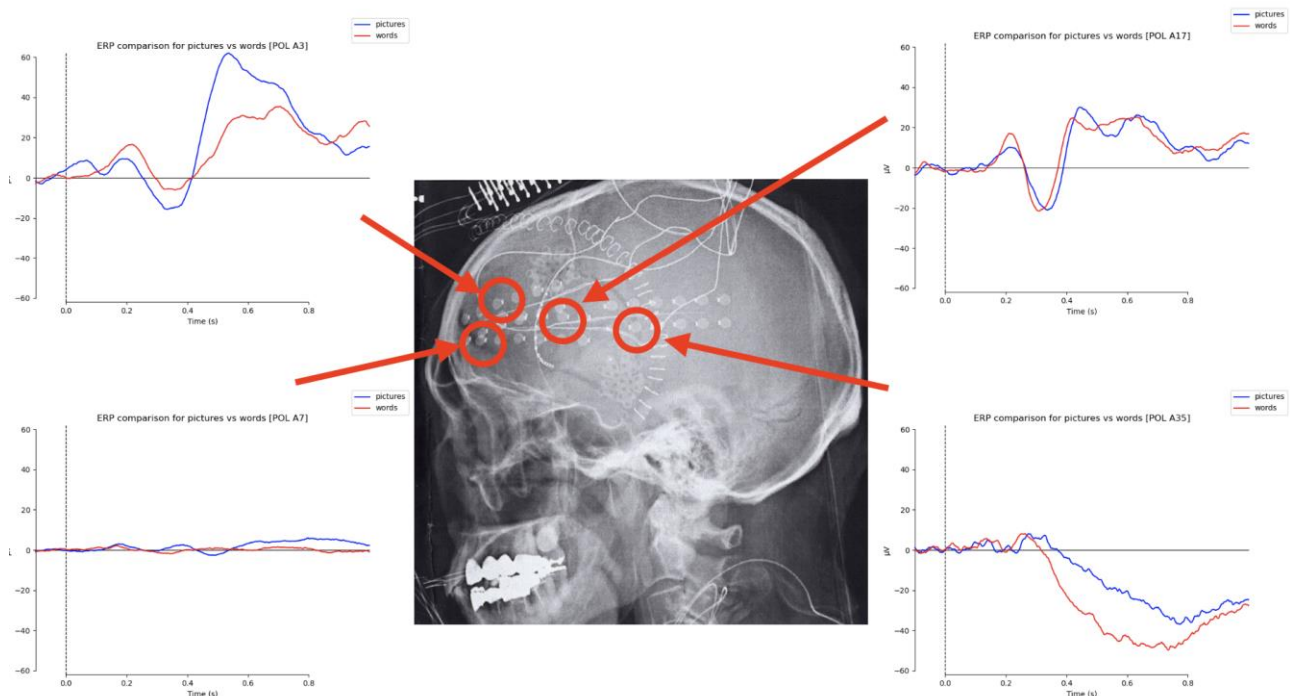


Figure 39. Event-related potential modulation in the left inferior frontal and superior temporal areas in picture naming and word read-aloud tasks the blue line indicate ERPs in picture naming and the red line indicate ERPs in word read-aloud. Picture naming shows stronger ERP modulation in the left inferior frontal area (the figure on top left) whereas word read-aloud exhibits stronger ERP modulation in the superior temporal area (the figure on bottom right). No contrast between the two tasks was observed in the premotor area (the figure on top right).

Formulaic language in spontaneous speech as a marker of fluency in post-stroke aphasia

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Introduction

Formulaic, or non-propositional, language is an under-explored area of research in aphasia. Studies to date have lacked a theoretical framework for systematically advancing translational efforts in assessment and intervention. The primary purpose of this study was to test the utility of a proposed theoretical model for individuals with post-stroke aphasia, which differentiates formulaic language according to six underlying psycholinguistic characteristics (Van Lancker, Sidtis, 2018).

Methods

The dataset included previously described formulaic language extracted from Aphasiabank speech samples produced by 144 individuals with fluent and non-fluent aphasia (Torrington Eaton & Burrowes, 2021, Torrington Eaton & Thomas, 2023). Formulaic language items were coded by psycholinguistic characteristics from the theoretical model. Independent variables included mean values of each psycholinguistic characteristic for the formulaic items produced by participant, demographic variables (i.e., age, gender, education), and motor speech ability (presence of dysarthria and/or apraxia of speech). Analysis of variance and logistic regression were used to compare between-group differences across subtypes and identify psycholinguistic characteristics of produced formulaic items that predict fluency.

Results

Results revealed formulaic language profile differences between individuals with fluent and nonfluent aphasia based on frequency, length, syntactic completeness, and literality, but not context-boundedness or nuance of produced formulaic items (Figure 1). The most parsimonious regression model classified individuals with fluent and nonfluent aphasia with 85.6% and 69.2% accuracy respectively according to three predictor variables: frequency and syntactic completeness of formulaic language, and apraxia of speech (Table 1).

Conclusions

Findings demonstrate that characterizing formulaic language in spontaneous speech is useful as a marker of fluency status. Formulaic language analyses can be added to newly refined propositional language analyses of spontaneous speech samples to further increase the efficiency of assessment practices (Dalton et al., 2020). Results of this study validate the proposed theoretical model for individuals with post-stroke aphasia to systematically guide future research efforts that capitalize on or target formulaic language in intervention.

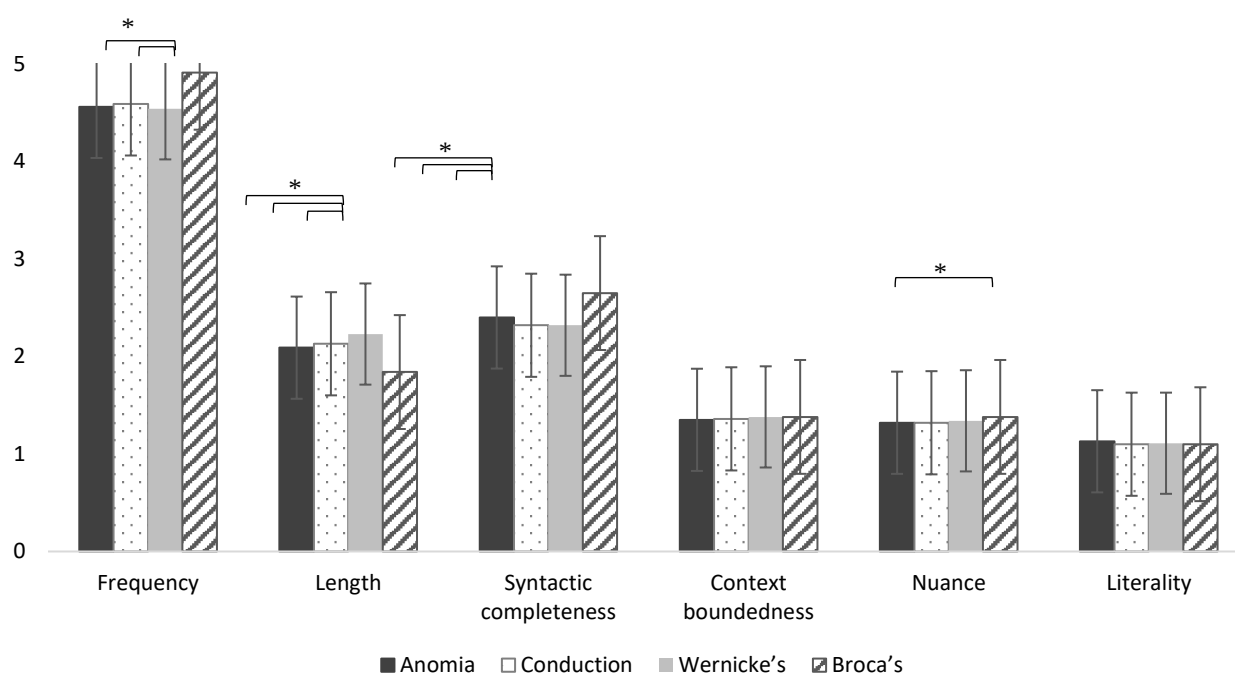
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Acknowledgments

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Note: Frequency includes log transformed values from Corpus of Contemporary American English (COCA); Length = number of words; Syntactic completeness: 1 = incomplete, 3 = complete, independent utterance; Context boundedness: 1 = independent of context, 2 = specific to listener, setting or situation; Nuance: 1 = purely grammatical construction, 3 = strongly conveying emotion or attitude; Literality: 1 = literal, 2 = nonliteral.

Figure 40. Psycholinguistic characteristics of produced formulaic language by WAB-R aphasia subtype.

Table 1. Results of final binary logistic model for dependent variable fluency status.

	B	SE	Sig	Exp(B)	95% Confidence intervals	
					Lower	Upper
Constant	16.609	3.539	<.001	16335968.9		
AOS	.997	.368	.007	2.711	1.319	5.574
Frequency	-2.483	.692	<.001	0.84	.022	.324
Syntactic completeness	-2.584	.725	<.001	.075	.018	.313

Towards automated detection of fluent aphasia: A classification and interpretable natural language processing study

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Introduction

According to the classical taxonomic approaches, fluent aphasia, which include the subtypes Wernicke's, anomic, and conduction aphasia, are characterized by impaired language comprehension and production. The classification of individuals with fluent aphasia into subtypes can be costly, laborious, and often requires expertise in the form of clinical neurologists and speech pathologists. The goal of the current study is to employ a state-of-the-art natural language processing (NLP) model, to automatically distinguish between fluent aphasia types and healthy controls using spontaneous speech transcripts.

Methods

Transcribed spontaneous speech samples from the Aphasia Bank database (MacWhinney, 2019) were used. We selected transcripts from individuals with Wernicke's (47), anomic (202) and conduction (99) aphasia as well as 267 healthy controls (HC). The transcripts consisted of picture description tasks (e.g., cat rescue), narration (e.g., Cinderella story), and open-ended questions (e.g., tell me about your speech problems). To address data imbalance in each classification task, we downsampled the larger groups to match the sample size of the smaller groups. A pre-trained DistilBERT model (Sanh et al., 2019) was fine-tuned and used for the classification. The model's performance was evaluated using accuracy metrics. To make the model's predictions interpretable, we used the Transformer Interpret (Pierse, 2021), an explainable Artificial Intelligence model that identifies words and phrases that contribute most significantly to the DistilBERT model's predictions (see Figure 1). Further, we propose to use these highlighted words for subsequent feature extraction, to provide insights into the linguistic features (e.g., word or phrasal properties) that differentiate these clinical groups from healthy controls.

Results

Our preliminary results demonstrate that the DistilBERT model achieves high classification accuracy, showing over 90% accuracy for each comparison. Specifically, the model attained an accuracy of 96.2% for Wernicke's vs. HC, 91% for anomic vs. HC, and 95.4% for conduction vs. HC. A three-way classification between the three clinical groups, however, showed a reduced accuracy of 67.39%. Figure 1 shows an example of Transformer Interpret's output, where words highlighted in green and red indicate positive and negative contributions to the model's predictions, respectively. The results indicate that for Wernicke vs. HC, filled pauses (FP) and words such as 'yeah' and 'okay' give significant positive attributions to the model's classification of the text, as belonging to the Wernicke group.

Conclusions

The results of this study demonstrate the potential of NLP methods and interpretability models in automatically detecting different types of fluent aphasia. The high accuracies suggest that the model effectively captured the linguistic patterns and features associated with each group. However, the lower accuracy observed in the three-way classification

among the clinical groups highlights the inherent challenges in differentiating between fluent aphasia based solely on language samples. Despite this, we believe automatic feature extraction and analysis can further enhance our understanding of the specific linguistic features that contribute to the model's predictions. This improved understanding may facilitate the diagnostic process in the clinic, while maintaining a high level of accuracy. Further, these models offer new insight into the underlying linguistic deficits of each aphasia type.

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Acknowledgments

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Legend: ■ Negative □ Neutral ■ Positive					
True Label	Predicted Label	Attribution Label	Attribution Score	Word Importance	
n/a	(0.23)	CONTROL	-5.71	[CLS] and then [FP] [FP] let 's see . and then [FP] yeah . okay [FP] and then page . [FP] [FP] and then [FP] laughing and talking mean man girl . and [FP] and then [FP] and then horse . and a nice girl and horse . and then [FP] laughing and talking [FP] a [FP] three girls mean man . [FP] and then [FP] and then [FP] cinderella and . oh boy ! and then [FP] [FP] and then [FP] dancing . cinderella and another man and dancing . and then [FP] at twelve o ' clock at midnight and . uh ##oh . and . [FP] [FP] oh boy . oh ah yeah . and then [FP] and then next day and then [FP] mean man tree mean man . and then sit down and [FP] slip [FP] slip [FP] perfect . and . ah . [FP] [FP] two girl and man married . and wow , lord . [SEP]	
n/a	(0.77)	WERNICKE	5.22	[CLS] and then [FP] [FP] let 's see . and then [FP] yeah . okay [FP] and then page . [FP] [FP] and then [FP] laughing and talking mean man girl . and [FP] and then [FP] and then horse . and a nice girl and horse . and then [FP] laughing and talking [FP] a [FP] three girls mean man . [FP] and then [FP] and then [FP] cinderella and . oh boy ! and then [FP] [FP] and then [FP] dancing . cinderella and another man and dancing . and then [FP] at twelve o ' clock at midnight and . uh ##oh . and . [FP] [FP] oh boy . oh ah yeah . and then [FP] and then next day and then [FP] mean man tree mean man . and then sit down and [FP] slip [FP] slip [FP] perfect . and . ah . [FP] [FP] two girl and man married . and wow , lord . [SEP]	

Figure 1. An example of Transformer Interpret highlighting words and their contributions to the DistilBERT model's prediction of whether the text belongs to the healthy control or Wernicke group. The predicted label indicates the probability of the text belonging to either group.

Clown therapy improves language and quality of life

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Introduction

Research underscores the importance of humor (Sherratt & Simmons-Mackie, 2016; Scharp, Brock, & Mazzaglia, 2021) and the therapeutic potential of theater (Wood et al., 2020; Osa Garcia et al., 2021) for individuals with aphasia. Clown therapy improves well-being and provides a platform for participants to explore their inner clown (Carp, 1998; Gordon, Shenar, & Pendzik, 2018). A single-case study showcased positive outcomes of clown therapy for a woman with non-fluent aphasia and depression, demonstrating notable improvements in well-being and communication over six months (Duarte, Rocha & Brandão, 2020). This study aims to fill a research gap by evaluating quality of life and language abilities before and after clown therapy with a group of participants with aphasia.

Methods

Thirty participants with chronic non-fluent aphasia were recruited primarily from two aphasia groups affiliated with public university speech therapy. After accounting for acceptances and dropouts, the total sample comprised 26 individuals. Eleven participants were excluded from analysis due to involvement in either individual speech and language therapy or aphasia group participation. The study included fifteen participants exclusively undergoing clown therapy (view sample features in Table 1).

Clown therapy sessions occurred weekly over 20 sessions of 2-hours duration. Each session was facilitated by actors collaborating with speech therapists, psychologists, and undergraduate students. The program guided participants into assuming the role of the clown through games and improvisations, culminating in theater presentations. Operating within a multimodal framework (Pierce et al., 2019), clown therapy had a special focus on nonverbal modalities - gesture, facial expression, *gravelot*, music, and dance.

Pre- and post-intervention effects were assessed using quality of life and language measures. The Stroke and Aphasia Quality of Life scale (SAQOL-39) was chosen for its robustness and good acceptability with reliable test-retest reliability and adaptations to Brazilian Portuguese. The Brief Montreal-Toulouse Language Assessment Battery was chosen for the same reasons and for assessing linguistic skills comprehensively. The Paired-samples t-test and Wilcoxon's nonparametric test compared pre- and post-intervention scores.

Results

Overall quality of life average scores increased mildly but significantly ($p=0,012$; $d = 0,376$) from $M= 3.7(SD=1.1)$ to $M= 4.2 (SD=1.2)$. Communication and energy domains were responsible for these changes. Physical and psychosocial domains did not improve significantly. The improvement in communication was moderate ($p=0,008$; $d = 0,712$) from $M= 2.9 (SD=1.0)$ to $M= 3.7 (SD=1.5)$. Energy improved mildly ($p=0,040$; $d =0,289$) from $M=3.5 (SD=1.4)$ to $M= 3.9 (SD=1.1)$.

The comparison between total language scores before ($M=103,1$; $SD=31,1$) and after ($M=105,2$; $SD=28,8$) intervention demonstrated improvement, but did not show significant differences ($p=0,098$; $d=0,071$) and had a very small effect. However, when results for each subtest were analyzed separately, significant language improvements were observed. Improvement with a medium effect was detected in written word comprehension ($p=0,026$; $d=0,613$), and with a small effect in word reading ($p=0,034$; $d=0,134$), and in verb naming ($p=0,023$; $d=0,231$).

Conclusions

Quality of life and language skills of participants with chronic non-fluent aphasia were improved after clown therapy.

Table 1. Sample features.

	M	SD
Age	63.00	11.187
Years of study	8.47	3.603
Number of minimum salaries in the family	5.07	2.165
Number of ischemic strokes	1.50	0.650
Time post-stroke in years	10.62	9.717

Understanding the mechanisms of nonword reading impairment of kana and kanji in Japanese acquired phonological dyslexia

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Introduction

Previous studies reported that no single impairment locus, such as phonological impairment or nonlexical reading impairment, could account for all cases of phonological dyslexia (Nickels et al., 2008). Namely, phonological impairments are not thought to be the only cause of phonological dyslexia. Determining whether similar findings apply to Japanese, a writing system that differs, is crucial. However, only four case reports of Japanese phonological dyslexia have thoroughly examined the reading of nonwords in both Kana (phonogram) and Kanji (logogram) (Kato et al., 2006). Thus, it is necessary to perform the same test on multiple cases and to explore the reading difficulty of both Kanji and Kana in detail. This study investigated the presence or absence of phonological impairments and character-to-mora conversion impairments in Japanese patients with phonological dyslexia. Additionally, we investigated the linguistic and cognitive factors contributing to the oral reading accuracy of nonwords in Kana and Kanji.

Methods

The following tasks (see Table 1 for details) were administered to 12 participants with phonological dyslexia and compared with the performance of normal participants in each task: oral reading and lexical decision tasks of Kanji and Kana strings, picture naming tasks, phonological tasks (nonword repetition, mora deletion, mora reversal), oral reading of single-character and rapid oral reading tasks (no-meaning single Kana and Kanji characters; ゃ, 宇). In addition, a generalized linear mixed model (GLMM) analysis was conducted to examine task performance affecting reading accuracy for each nonword in Kana and Kanji. The independent variables were the scores of lexical decision tasks, picture naming tasks, single-character reading, single-character rapid reading, and the total score of phonological tasks. For Kanji, the single-character reading score was excluded as an independent variable because there is a strong correlation between single-character reading and rapid reading scores).

Results

There were two cases whose scores on the phonological task were within the mean range for normal. Additionally, there were four cases whose scores in both reading and rapid reading of single characters were within the mean range for normal, one patient for Kana, and three for Kanji. The GLMM results showed a significant contribution of single-character rapid reading and phonological tasks to the oral reading accuracy of Kana nonwords. For Kanji nonwords, the phonological task, single Kanji rapid reading task, and lexical decision task significantly contributed to the oral reading accuracy.

Conclusions

There are two cases of phonological dyslexia with character-to-mora conversion impairment but preserved phonological processing. This result suggests that character-to-mora conversion impairments can cause phonological dyslexia. Thus, phonological impairment might not be the only cause of phonological dyslexia. Furthermore, in contrast to Kana, performance on the lexical decision task affected oral reading accuracy for Kanji nonwords. These results indicate that orthographic lexical processing affects Kanji, even in nonword reading.

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Table 1. The performances from cognitive neuropsychological assessments.

	Phonological dyslexia types in 12 cases			
	X	X	✓	X
Kana-mora conversion	X	✓	X	X
Kanji-mora conversion	X	X	X	✓
Phonological processing	6 cases	3 cases	1 case	2 cases
Mean (range: min-max) of percentage correct				
Kana reading aloud				
Words	0.98 (0.90-1.00)	1.00 (1.00)	0.95	1.00 (1.00)
Pseudo-homophone	0.87 (0.73-1.00)	0.96(0.93-1.00)	0.80	0.93 (0.93)
Nonwords	0.68 (0.57-0.80)	0.66 (0.50-0.83)	0.67	0.68 (0.60-0.77)
Lexicalization error	0.18(0.13-0.27)	0.07 (0.00-0.17)	0.30	0.17 (0.07-0.27)
Kanji reading aloud^a				
Words	0.89 (0.79-0.95)	0.98 (0.96-0.99)	0.80	0.94 (0.90-0.98)
Pseudo-homophones	0.62 (0.52-0.75)	0.85 (0.81-0.89)	0.55	0.69 (0.56-0.81)
Nonwords	0.34 (0.16-0.47)	0.66 (0.58-0.70)	0.23	0.52 (0.41-0.64)
Lexicalization error	0.29 (0.11-0.48)	0.31(0.11-0.17)	0.48	0.23 (0.14-0.31)
Single-character reading and rapid reading				
Single-Kana reading	0.95 (0.83-1.00)	0.98 (0.93-1.00)	1.00	0.94 (0.90-0.98)
Single-Kana rapid reading	0.87 (0.75-0.95)	0.85 (0.80-0.90*)	1.00	0.88 (0.85-0.90)
Single-Kanji nonword reading	0.58 (0.38-0.65)	0.88 (0.85-0.90)	0.80	0.68 (0.68)
Single-Kanji nonword rapid reading	0.54 (0.15-0.75)	0.90(0.90)	0.75	0.68 (0.55-0.80)
Phonological tasks				
Nonwords repetition ^b				
3-mora	0.92 (0.79-1.00)	0.98 (0.93-1.00)	0.29	0.96 (0.93-1.00)
5-mora	0.71 (0.29-0.93)	0.79 (0.64-1.00)	0.00	0.96 (0.93-1.00)
Mora reversal	0.26 (0.00-0.75)	0.53 (0.08-0.83)	0.33	0.92 (0.92)
Mora deletion	0.92 (0.83-1.00)	0.94 (0.83-1.00)	0.83	0.92 (0.92)
Lexical decision task				
Kana-strings	0.79 (0.48-0.95)	0.88 (0.87-0.90)	0.80	0.62 (0.62)
Kanji-strings	0.81 (0.60-0.96)	0.98 (0.97-0.99)	0.89	0.96 (0.94-0.98)
Picture naming task^c				
40 nuns	0.75 (0.35-.093)	0.86 (0.80-0.93)	0.55	0.91 (0.88-0.95)

Note: X = impaired.; ✓ = preserved.

^a Hashimoto, K., Uno, A., & Sambai, A. (2018). Development of a lexical decision task with kanji pseudo-homophones: Toward the application for aphasia assessment. *Japanese Journal of Speech, Language, and Hearing Research*, 15(4), 321-331.; ^b Jochi University SALA Project Team. (2004). *Sophia Analysis of Language in Aphasia (SALA)*. Tokyo: Escor.; ^c Fujita et al. (2000). *A Test of Lexical Processing in Aphasia (TLPA)*. Escor.

Structural priming yields cross-modality treatment gains in aphasia: Evidence from webcam-based eye-tracking

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Introduction

Many persons with aphasia (PWA) experience deficits in both sentence production and sentence comprehension (Clark, 2011). Most sentence-level treatments focus on one modality, and studies examining generalization to the untrained modality find unclear and conflicting effects (Adelt et al., 2018; Schröder et al. 2015, Luzzatti et al. 2010). Investigating cross-modal generalization of treatment gains from production to comprehension or vice versa could therefore elucidate not only the efficacy of aphasia treatments, but could also provide insight into the underlying dynamics of language processing. In this study, we evaluated treatment generalization from sentence production structural priming training to comprehension of complex syntactic structures in PWA.

Methods

Twenty-four PWA ($M_{age} = 59.83$, $SD_{age} = 11.43$) and 16 age-matched controls ($M_{age} = 63.4$, $SD_{age} = 11.1$) took part in a sentence production priming training evaluating the effectiveness of same-verb and different-verb priming. Target structures were passives and double-object sentences, and training sessions consisted of reading aloud prime items and completing picture descriptions. Primes either contained the same verb as picture description prompts (same-verb condition) or a different verb (different-verb condition). Participants completed three training sessions for each structure. A sentence comprehension task was administered at baseline, one day after training ceased (immediate post-testing) and one week following immediate post-testing (delayed post-testing): a sentence-picture matching format was used with one distractor image and auditorily presented passive, double-object, and locative (control) items. Eye movements were recorded through participants' own webcams (Van Boxtel et al., *under review*; Papoutsaki et al., 2017).

Results

Both groups showed higher accuracy and shorter response times (RTs) at immediate post-testing compared to baseline (accuracy: $z = 2.43$, $p = 0.015$; RTs: $t = -6.03$, $p < .001$), and this effect was maintained at delayed post-testing (accuracy: $z = 3.86$, $p < .001$; RTs: $t = -9.66$, $p < .001$). PWA showed *less* accuracy improvement from baseline to immediate post-testing following same-verb priming compared to different-verb priming; this effect was reversed in controls ($z = -2.96$, $p < .05$). On eye movements, PWA showed greater training-induced changes than controls, and looked substantially more to the correct (target) picture at immediate post-testing ($z = 1.959$, $p = .05$) and delayed post-testing ($z = 4.135$, $p < .001$) compared to baseline. Additionally, same-verb training led to reduced changes in looks to the target from baseline compared to immediate post-testing ($z = -7.112$, $p < .005$) and to delayed post-testing ($z = -3.898$, $p < .001$).

Conclusions

Structural priming training in sentence production generalized to sentence comprehension in both PWA and controls. Comprehension accuracy and proportions of eye fixations to the

correct picture increased and reaction times decreased reliably following production training in PWA. We therefore suggest structural priming is an effective tool for achieving cross-modal treatment generalization in aphasia. In addition, including different verbs in prime and target items may lead to clearer generalization in PWA, suggesting greater effects when treatment gains are not verb-specific or situation-specific.

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Psycholinguistic effects on silent reading comprehension accuracy in aphasia-based alexia

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Introduction

Aphasia-based alexia results from damage to the sublexical-phonological and/or lexical-semantic routes of reading (Rapcsak et al., 2007; Ross et al., 2017). The gold standard for diagnosis is oral reading performance on words of varied word frequency, spelling-to-sound consistency (hereafter, “consistency”), and imageability, which differentially rely on these two reading routes (Friedman, 2002). However, alexia manifests in difficulty with both oral and silent reading (Webster et al., 2023). It remains unclear if psycholinguistic effects on silent reading comprehension parallel those observed in oral reading given that the goal of comprehension is extraction of meaning, rather than verbal production of the word. The aim of the current study is to investigate the impact of word frequency, consistency, and imageability on silent reading comprehension accuracy in a group of individuals with aphasia-based alexia. We hypothesize that imageability, as a measure of semantic processing (Duarte-Expósito et al., 2004), will predict accuracy, particularly for individuals with deficits in the lexical-semantic route.

Methods

Thirty-seven individuals with alexia following a left-hemisphere stroke (Brookshire Madden et al., 2018) completed two silent reading tests from the Psycholinguistic Assessments of Language Processing in Aphasia (PALPA 50 – Written Synonym Judgment and 51 – Word Semantic Association) (Kay et al., 1996), which are balanced between high- and low-imageability items. To obtain an item-level metric for frequency and consistency, all words within each item were averaged (i.e., 2 words and 5 words, respectively) and dichotomized using the median value. Two logistic mixed effects models (LMMs) tested if these psycholinguistic features predict silent reading accuracy in individuals with alexia. Next, participants were categorized into two groups: 1) phonological alexia – primary sublexical-phonological impairment and 2) non-phonological alexia – additional lexical-semantic impairment. Separate LMMs tested for group by imageability, frequency, and consistency interactions. Helmert coding was implemented to contrast the effect of all dichotomized variables on silent reading accuracy (high-frequency vs. low-frequency, high-imageability vs. low-imageability, regular vs. irregular).

Results

For all participants, there was a positive main effect of high-imageability on silent reading accuracy on both subtests (see Table 1 for ORs and p-values for these LLMs). On PALPA 50, there was also a main effect of high-frequency words, significant two-way interactions of frequency×imageability and frequency×consistency, and a significant three-way interaction of frequency×imageability×consistency (see Figure 1). Participants with non-phonological alexia also had reliably lower silent reading accuracy on both subtests (OR=-1.41, p=.002;

OR=-0.82, $p=.02$). On PALPA 50, there was a significant group×imageability interaction (OR=-1.22, $p=.003$) such that low-imageability items were read with lower comprehension accuracy, and even more so for individuals with non-phonological alexia.

Conclusions

Consistent with our hypothesis, word imageability influenced silent reading comprehension in individuals with aphasia-based alexia and had an even greater influence in non-phonological alexia (i.e., sublexical-phonological plus lexical-semantic deficits). This is an important addition to the documented frequency and consistency interaction noted in oral reading tasks (Jared, 1997), and supports findings that psycholinguistic variables' effects are task dependent (Fisher-Baum et al., 2014). Our results support further investigation of alexia interventions that target both lexical-semantic and sublexical-phonological skill rehabilitation (Johnson et al., 2017).

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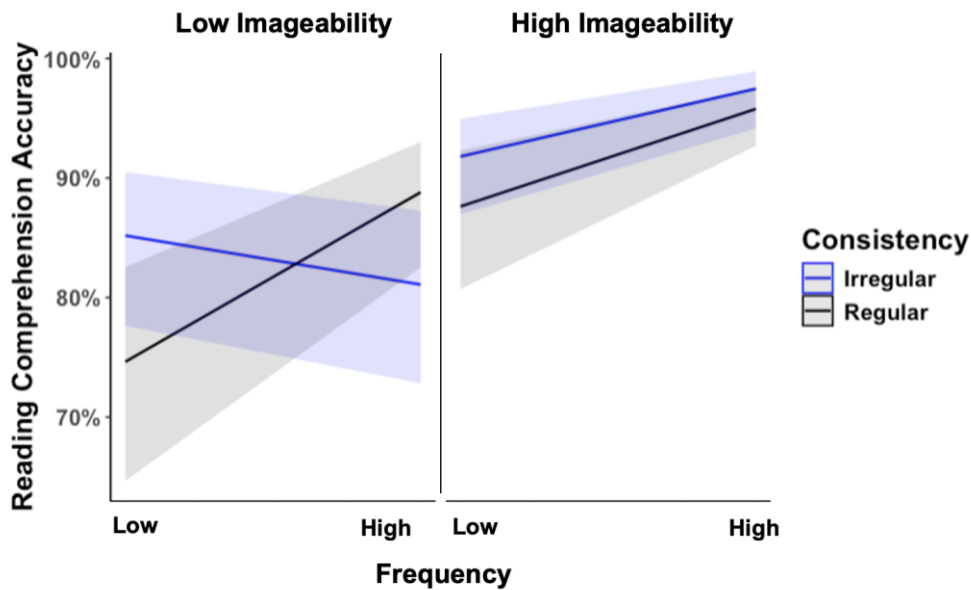


Figure 41. Three-way interaction on PALPA 50 written synonym judgment. High imageability, irregular words are comprehended with greater accuracy regardless of frequency. In contrast, when words have low imageability, regularity interacts with frequency such that irregular words are only comprehended more accurately than regular words when they also have low frequency.

Table 1. LLM results across all participants.

PALPA 50 – Written Word Synonym Judgement	Odds Ratio	SE	z-value	p-value
Intercept	2.62	0.42	6.29	< .001*
Imageability (High vs. Low)	1.20	0.16	7.13	< .001*
Frequency (High vs. Low)	0.77	0.16	4.77	< .001*
Consistency (Regular vs. Irregular)	-0.26	0.15	-1.72	.09
Word Length [†]	-0.07	0.06	-1.22	.22
Imageability × Frequency	0.85	0.30	2.80	.005*
Imageability × Consistency	-0.47	0.31	-1.50	.13
Frequency × Consistency	0.61	0.31	1.96	.05*
Imageability × Frequency × Consistency	-1.36	0.61	-2.23	.03*
PALPA 51 – Semantic Association	Odds Ratio	SE	z-value	p-value
Intercept	0.86	0.27	3.13	< .002*
Imageability (High vs. Low)	1.09	0.45	2.42	.02*
Consistency (Regular vs. Irregular)	-0.77	0.45	-1.71	.09
Frequency (High vs. Low) ^{††}	0.74	0.47	1.59	.11
Imageability × Consistency	-0.10	0.86	-0.12	.91

* Denotes significant effects and interactions.

[†]High/low imageability items on PALPA 50 are not evenly balanced on word length ($t = -3.08$, $p = .003$), so it was included as a covariate in the respective model.

^{††}High/low imageability items are not evenly balanced on word frequency ($t = 2.11$, $p = .04$), so it was included as a main effect only in the respective model.

Standardization of the digital version of the Diagnostic Instrument for Mild Aphasia (DIMA-app)

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Introduction

Patients with gliomas (primary brain tumors) frequently show subtle language disturbances, with negative impact on quality of life. The Diagnostic Instrument for Mild Aphasia (DIMA) was developed, standardized and validated as the first Dutch test battery to detect mild aphasia in glioma patients at the levels of phonology, semantics and (morpho-)syntax, at production and perception (Satoer et al., 2022; Vogrincic et al., in prep). DIMA is also useful in the preparation of glioma patients undergoing awake craniotomy with intraoperative language monitoring, as it was developed as an addition to the Dutch Linguistic Intraoperative Protocol (DuLIP) (De Witte et al., 2015).

In a rather busy clinical practice, administration and scoring of pen-and-paper tests can be time-consuming. Therefore, a digital DIMA was developed, DIMA-app. With DIMA-app, scores can be (semi-) automatically calculated and reaction times can be measured more accurately. Aims: to test the feasibility of DIMA-app in healthy participants and to examine the comparability of DIMA-app versus the pen-and-paper DIMA.

Methods

101 healthy Dutch-speaking participants were tested with DIMA-app (mean age 46.15, sd 20.35). Participants were matched with the retrospective pen-and-paper cohort (mean age 45.9, sd 20.02) and divided into two age groups: <55 years old (n=57) and ≥55 years old (n=44) and two groups of education: ≤12 years (n=25) or >12 years (n=76). Accuracy scores (%) were calculated for the subtests repetition ((non-)words, sentences), semantic odd-picture-out and sentence completion and for the total score. Raw scores of DIMA-app were compared with those from the pen-and-paper version using an independent samples t-test.

Results

The mean accuracy of the total score on both DIMA versions was 94%. For the different subtests, see Table 1.

Between both versions, there was only a significant difference for sentence completion ($p = .023$) with a higher score on the pen-and-paper version versus the DIMA-app. On DIMA-app, participants <55 years old scored significantly higher than participants ≥55 years old on repetition of 3-syllabic words ($p = .022$), non-words ($p < .001$), the total phonology score ($p < .001$) and on the total DIMA-app score ($p < .001$). No significant differences were found between the two groups of education.

Conclusions

DIMA-app appeared to be feasible, given high accuracy rates and it was comparable to the pen-and-paper version apart from sentence completion. An error analysis should be conducted to further investigate this difference as well as reaction times. Younger

participants performed better on DIMA-app than older participants, particularly on phonological tasks, corresponding to the original DIMA study (Satoer et al., 2022). It is rather unexpected that lower educated participants do not differ from higher educated participants (De Witte et al., 2015; Satoer et al., 2022) and might be explained by the skewness of the data. More data collection is ongoing in healthy participants and in patients (expected N=200, N=50 resp.) to better investigate sensitivity and validity. We expect that DIMA-app has high potential to examine mild aphasia in glioma patients, and also in other neurological patient groups. International adaptation of DIMA-app (e.g. English, French) is ongoing.

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Table 1. Accuracy (%) and p-values DIMA-app vs. pen-and-paper version.

Subtest	Accuracy app	Accuracy pen-and-paper	p-value
<i>Phonology</i>			
Repetition 3-syllabic words	98%	99%	.451
Repetition compound words	99%	97%	.167
Repetition non-words	91%	92%	.550
Sentence repetition	92%	91%	.449
Total	95%	95%	.954
<i>Semantics</i>			
Odd-picture out	90%	90%	.793
<i>(Morpho-)syntax</i>			
Sentence completion	92%	95%	.023
Total DIMA	94%	94%	.704

The Sant Pau Sentence Elicitation Task: A new tool to assess sentence production deficits in Spanish-speaking patients with primary progressive aphasia

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Introduction

The presence of expressive agrammatism is a key diagnostic criterion for the non-fluent/agrammatic variant of primary progressive aphasia (nfvPPA) (Gorno-Tempini et al., 2011). However, there is a limited number of validated tests to assess sentence production in PPA in English, and even fewer in Spanish. This lack of validated tools poses a significant challenge for clinicians and researchers working with Spanish-speaking populations. To address this need, we designed The Sant Pau Sentence Elicitation Task, tailored specifically for Spanish-speakers with PPA.

Methods

Our task incorporates features aimed at optimizing time efficiency and utility for both clinical management and research purposes. The task includes 18 sentences, divided into two categories: nine short (main clause only) and nine long (main and subordinate clause) sentences. Each length category comprises three sentences of distinct grammatical constructions: short sentences include active, passive, and object-verb-subject (OVS) order; long sentences include subject-relative, object-relative, and passive object-relative structures. We administered this task to a cohort of 50 participants, including 11 controls, 17 with nfvPPA, 14 with logopenic variant PPA (lvPPA), and 8 with semantic variant PPA (svPPA). We employed separate generalized mixed-effects models to compare performance between 1) the whole patient group versus controls and 2) among the different PPA variants. The primary outcome measure was accuracy (correct/incorrect), with subject and item-ID included as random factors. Accuracy was analyzed as a function of diagnostic group, sentence length, and grammatical construction. Additionally, we evaluated the impact of disease severity by including Mini-Mental State Examination (MMSE) scores in our models.

Results

Our findings revealed that all PPA groups performed significantly worse than controls (Table 1-Model 1). Both length (Table 1-Model 2) and grammatical construction significantly (Table 1-Model 3) affected accuracy across all groups; overall, long sentences elicited significantly

lower accuracy than short sentences, and active sentences elicited significantly higher accuracy compared to all other sentence types. When comparing PPA variants (Table 1-Model 4), we found that individuals with nvPPA showed poorer performance than those with lvPPA, and a trend towards poorer performance compared to those with svPPA. We also found a significant interaction between group and MMSE score, showing that as disease severity increases (reflected by lower MMSE scores), the performance disparity between nvPPA and lvPPA becomes more pronounced (Figure 1).

Conclusions

Overall, our novel sentence elicitation task holds significant potential for advancing both clinical practice and scientific research related to language deficits in PPA. By providing a reliable means to assess expressive grammar in Spanish-speaking individuals, it supports the development of more effective diagnostic tools and therapeutic approaches, ultimately contributing to better care and understanding of PPA across diverse linguistic and cultural contexts.

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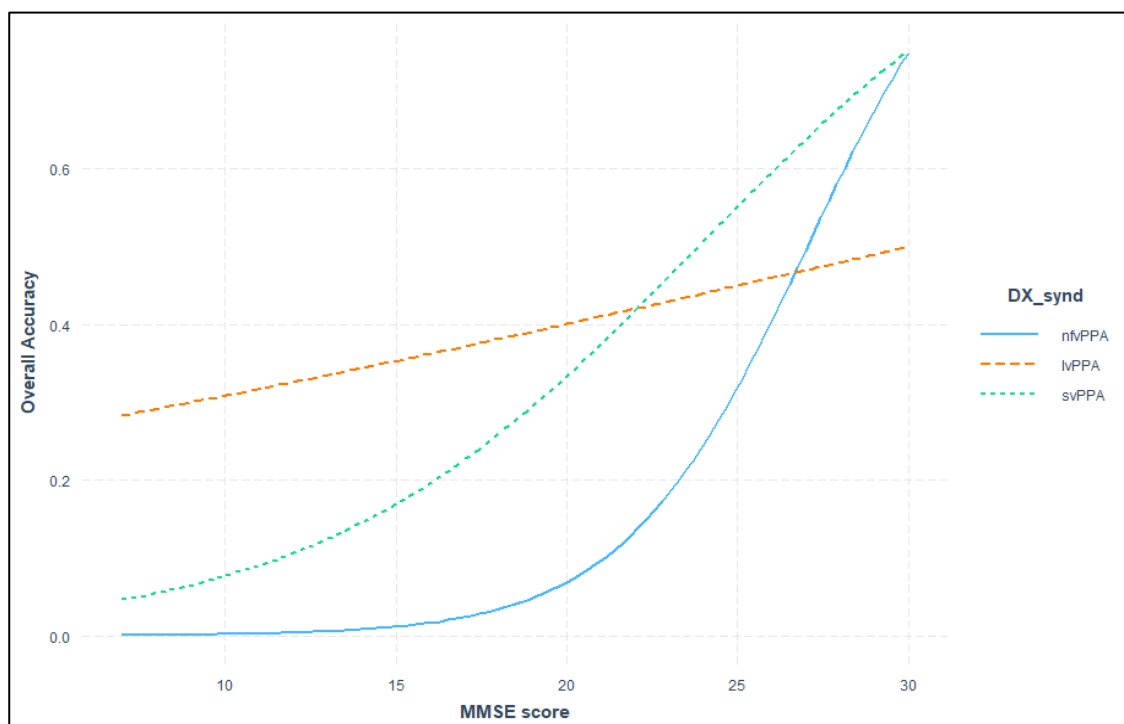


Figure 1. Interaction plot illustrating how MMSE scores moderate the difference in overall performance between the nvPPA and lvPPA groups.

Table 1. Mixed effect model results.

	Estimate	SE	t-value	p-value
Model 1				
Intercept	2.30	0.54	4.23	<0.001
Controls vs lvPPA	-2.54	0.55	-4.54	<0.001
Controls vs nfvPPA	-2.63	0.54	-4.83	<0.001
Controls svPPA	-2.30	0.64	-3.60	<0.001
Model 2				
Intercept	1.50	0.53	2.81	<0.01
Short vs Long	1.59	0.37	4.26	<0.001
Model 3				
Intercept	4.45	0.54	8.13	<0.001
Active vs Passive	-2.26	0.40	-5.64	<0.001
Active vs OVS	-1.45	0.39	-3.66	<0.001
Active vs Subject-Relative	-1.71	0.40	-4.24	<0.001
Active vs Object-Relative	-4.29	0.45	-9.35	<0.001
Active vs Passive Object-Relative	-3.20	0.42	-7.48	<0.001
Model 4				
Intercept	-10.01	2.56	-3.90	<0.001
nfvPPA vs svPPA	5.72	3.24	1.76	0.07
nfvPPA vs lvPPA	8.80	2.72	3.23	<0.001
MMSE	0.37	0.09	3.90	<0.001
nfvPPA vs svPPA * MMSE	-0.19	0.12	-1.50	0.13
nfvPPA vs lvPPA * MMSE	-0.33	0.10	-3.16	<0.01
lvPPA: logopenic variant primary progressive aphasia; nfvPPA: nonfluent variant primary progressive aphasia; svPPA: semantic variant primary progressive aphasia; OVS: object-verb-subject; MMSE: Mini-Mental State Examination				

Microstructure features as a compensatory mechanism for word-finding deficits in people with aphasia

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Introduction

Aphasia is often associated with confrontation naming and lexical word retrieval deficits, irrespective of aphasia type (Raymer, 2005). Abnormally prolonged pauses have mainly been associated with word finding behaviors for agrammatic speakers (Sahraoui et al., 2015), but also for anomic speakers and individuals with Wernicke's aphasia. However, it is unclear whether the distribution of pauses differs between groups reflecting distinct impairments in word retrieval processes. Recent studies have shown that microstructure features, such as *filled and unfilled pauses, word lengthening and false starts*, can be used as an index of the underlying cognitive processes supporting sentence planning and lexical selection (Fraser et al., 2014; Mack et al., 2015; Yunusova et al., 2016), as they are associated with cognitive processes and mental skills responsible for speech planning, monitoring, and successful word retrieval. For instance, fewer pauses between utterances have been attested in individuals with higher working memory (WM) skills, compared to peers with low WM resources, suggesting that pauses can be used as an index of efficiency at incremental planning (Swets et al., 2021). The aim of the present study is to examine the distribution of such features in connected language samples of people with aphasia (PWA) and investigate the interrelation with participants' lexical, syntactic and executive control abilities.

Methods

Data from eighteen PWA and a control group of language and education matched individuals without aphasia, have been analyzed. Given that word retrieval patterns vary depending on the elicitation context (Conroy et al., 2009; Croot et al., 2014), narrative sample included a personal narration, the production of an unknown story based on a 6-picture set, and the retelling of a familiar and an unknown story (Kakavoulia et al., 2014). All language samples were derived from the Greek Corpus of Aphasic Discourse (GREECAD; Varlokosta et al., 2016). The analysis included speech rate, filled and unfilled pause durations and pause distribution in relation to lexical variables (i.e., word class, word frequency, word length).

Results

A positive correlation was attested between Mean Length of Utterance (MLU) and duration of pauses during speech in individuals with agrammatic aphasia, although no such correlation was confirmed between MLU, words per minute, and pause duration in the other aphasic subtypes. Significant differences were attested across microstructure features depending on the narrative type; PWA use pauses more frequently and for longer durations

in picture-based narrations, compared to memory-based narratives (in line with Pistono et al., 2018; Angelopoulou et al., 2024). Within-group comparisons additionally revealed positive correlations between performance in the narrative tasks, and word retrieval, WM, and semantic verbal fluency tasks, supporting the interrelation between cognitive mechanisms and word-finding deficits.

Conclusions

Our results suggest that different microstructure features, depending on the narrative type, can effectively be used as biomarkers for screening and classification/diagnostic purposes.

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Investigating treatment efficacy, generalization patterns and cross-linguistic validity of the Italian adaptation of the Treatment Underlying Forms for agrammatic aphasia

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Introduction

Treatment of Underlying Form (TUF, Thompson & Shapiro, 2005) is a linguistically-based training program for enhancing production of complex sentences in people with aphasia and agrammatism. Previous studies with English-speakers with aphasia confirmed that TUF is effective for training different sentence types (Thompson, 2019). Results of these studies have followed the principles of the Complexity Account of Treatment Efficacy (CATE, Thompson et al. 2003), according to which generalization patterns go from complex to simpler syntactic structures that entail the same type of syntactic movement. Therefore, no generalization occurs between sentences characterized by A'-movement (e.g., relatives and clefts) and A-movement (e.g., passives). This study explores the cross-linguistic validity of TUF efficacy and of CATE, by evaluating data obtained from its first Italian adaptation.

Methods

We developed an Italian adaptation of TUF targeting the production of object relatives (e.g., 'John sees the man that the woman chases'). Five participants with chronic post-stroke agrammatism underwent six-weeks of intensive training. Production and comprehension performance of trained and untrained object relatives (A'-structures), object clefts (e.g., 'It is the man that the woman chases': simpler A'-structures), passives (e.g., 'The man is chased by the woman': A-structures) and simple active sentences (e.g., 'The woman chases the man': no syntactic movement) was tested at multiple time points, i.e., pre- and post-treatment, during training and at follow-up (after six weeks). Treatment was preceded by a six-week control period with no intervention. A standardized aphasia assessment, including the Aachen Aphasia Test (AAT, Luzzatti et al. 2003), the Northwestern Assessment of Verbs and Sentences-Italian (NAVS-I, Barbieri et al., 2019), and the Communicative Effectiveness Index (CETI, Moretta et al., 2021) was also administered pre- and post-treatment. Changes in performance were measured using Cohen's *h*.

Results

All five participants showed significant improvement in production and comprehension of trained and untrained object relatives (*Table 1*). Changes were found only during the training period and were maintained at follow-up. No improvement was observed during baseline assessments or during the control period. Results also showed generalization to object clefts and actives in all participants, and to passive sentence production in 3/5 participants comprehension in 4/5. General improvement in language functions was found on

standardized aphasia assessments (AAT and NAVS) at post-treatment, especially for morphosyntactic abilities, and on a measure of self-reported communication effectiveness (CETI).

Conclusions

Our results demonstrated that the Italian adaptation of TUF yields is efficacious for object relatives (trained structures) and yields generalization to both untrained structures and other language functions, thereby endorsing its application in clinical settings. To account for unexpected generalization from object relatives (A'-movement) to passives (A-movement), we hypothesize that the richer morphology of Italian (vs. English) may facilitate processing of passives, in a similar way as in language acquisition (Phillips, 2010). Therefore, we propose an amendment of CATE that takes the syntactic operation of *Internal Merge* as a primitive (i.e., TUF targets syntactic movement *per se*), while holding the A- vs. A'-movement distinction as a modulating factor along with other morphosyntactic phenomena subject to cross-linguistic variation.

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Table 1. Average performance (percentage of correct answers) in production evaluations for each participant and each sentence type at baseline, post-treatment and follow-up evaluations. Differences in performance between time points are reported, together with a measure of effect size.

	B	P	FU	Δ P-B	<i>h</i> P-B	Δ FU-B	<i>h</i> FU-B
ORs							
<i>PP</i>	6.3%	95.0%	95.0%	88.8%	2.185	88.8%	2.185
<i>EB</i>	3.8%	75.0%	87.5%	71.3%	1.705	83.8%	2.029
<i>SP</i>	1.2%	90.0%	55.0%	88.8%	2.274	53.8%	1.447
<i>LM</i>	0.0%	100%	95.0%	100%	3.142	95.0%	2.691
<i>AG</i>	0.0%	75.0%	47.5%	75.0%	2.094	47.5%	1.521
OCs							
<i>PP</i>	10.0%	100%	90.0%	90.0%	2.498	80.0%	1.855
<i>EB</i>	0.0%	80.0%	80.0%	80.0%	2.214	80.0%	2.214
<i>SP</i>	0.0%	90.0%	55.0%	90.0%	2.498	55.0%	1.671
<i>LM</i>	0.0%	60.0%	40.0%	60.0%	1.772	40.0%	1.369
<i>AG</i>	0.0%	20.0%	10.0%	20.0%	0.927	10.0%	0.644
Passives							
<i>PP</i>	22.5%	80.0%	85.0%	57.5%	1.226	62.5%	1.358
<i>EB</i>	2.5%	50.0%	25.0%	47.5%	1.253	22.5%	0.730
<i>SP</i>	12.5%	50.0%	35.0%	37.5%	0.848	22.5%	0.543
<i>LM</i>	3.3%	0.0%	5.0%	-3.3%	-0.367	1.7%	0.084
<i>AG</i>	0.0%	0.0%	0.0%	0.0%	0.000	0.0%	0.000
Actives							
<i>PP</i>	92.5%	100%	100%	7.5%	0.555	7.5%	0.555
<i>EB</i>	72.5%	100%	85.0%	27.5%	1.104	12.5%	0.309
<i>SP</i>	82.5%	100%	100%	17.5%	0.863	17.5%	0.863
<i>LM</i>	83.3%	100%	95.0%	16.7%	0.841	11.7%	0.390
<i>AG</i>	40.0%	100%	95.0%	60.0%	1.772	55.0%	1.321

Notes. ORs=Object Relatives; OCs=Object Clefts; B=Average of baseline evaluations (percentage of correct answers); P=Post-treatment evaluation; FU=Average of the follow-up evaluations; Δ=Difference between the performances; *h*=Cohen's *h* between the two proportions of correct answers.

Investigating language recovery after rehabilitation: A retrospective study with the Aachen Aphasia Test on 218 Italian people with aphasia

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Introduction

Studies on aphasia rehabilitation are usually focused on the chronic phase and consider specific trainings at high dose (Breitenstein et al., 2017; Rose et al, 2022). Moreover, in a subacute phase, it is difficult to determine whether an improvement is due to language treatment or to spontaneous recovery. This study investigates language recovery after rehabilitation, accounting for spontaneous recovery and including both subacute and chronic aphasic populations.

Methods

The retrospective study included 218 individuals suffering from aphasia following acquired focal brain lesion consecutively admitted to two Italian rehabilitation units. All participants underwent language assessment at admission and discharge with the Italian version of the Aachen Aphasia Test (AAT) and received 3-to-5 hours of language therapy per week for a median period of 7 months (inter-quartile range: 5-12). Concurrent neurodegenerative or psychiatric diseases, time of first assessment < 20 days after onset and incomplete assessment were considered as exclusion criteria. Information regarding age, sex, occupation, years of education, time post onset (TPO), length of treatment (LOT), and pre/post-treatment AAT performance was collected. Significant pre/post-treatment improvement in AAT profile height (outcome: responders vs. non-responders) were studied with single-case diagnostic procedures (Luzzatti et al., 2023), both with and without correction for expected spontaneous recovery (Willmes et al., 1983; 1984). The association of the demographic, clinical and linguistic characteristics of the participants with the outcome measure was tested with univariate analyses (Mann-Whitney U and χ^2 tests) and a logistic regression model. JASP 0.18.3 was used for the statistical analyses.

Results

Considering the results without correction for expected spontaneous recovery, 89.9% of the sample (196/218) showed a significant improvement, with TPO being the only clinical variable negatively associated with recovery ($p < .01$). After correction for spontaneous recovery, 59.2% of participants (129/218) showed a significant improvement. The univariate analyses (see Table 1) reported negative association with significant improvement for age, while positive association with education, intellectual/manager occupation, TPO, LOT, type of aphasia (all $ps < .01$), and AAT Comprehension subtest scores ($p < .02$). Types of aphasia with highest proportion of responders were Broca's (73.9%), non-classifiable (71.2%), and anomic (62.5%). The logistic regression model corroborated TPO ($p < .05$) and LOT ($p < .02$) as positive predictors while age ($p = .01$) and global aphasia ($p = .02$) as negative predictors for significant improvement after correction for spontaneous recovery.

Conclusions

This study showed that significant recovery of aphasia after rehabilitation occurs both in the subacute and chronic phase. Therefore, the chronic phase should not be considered as exclusion criterion for aphasia rehabilitation. Interestingly, after correction for spontaneous recovery the proportion of responders decreased but maintained a satisfying rate (59.2%), in line with similar studies (Peitz et al., 2024). This supports that, also in the subacute phase, language treatment specifically induces an improvement, beyond the effect of spontaneous recovery. Moreover, length of treatment emerged as a positive predictor of recovery. Finally, the positive association of education and high-level occupation with being a responder hints at the effect of cognitive reserve on aphasia recovery.

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Table 1. Descriptive statistics and comparisons between the group of participants that presented a significant improvement after correction for spontaneous recovery (responders) and the group that did not (non-responders).

	Responders n=129/218 (59.2%)	Non-responders n=89/218 (40.8%)	Test*
Age (years)	60 [47-69]	68 [61-77]	U=7901.5; p<.001
Sex			
<i>Female (n=87)</i>	47 (54.0%)	40 (46.0%)	$\chi^2=1.590$; <i>p</i> =.207
<i>Male (n=131)</i>	82 (62.6%)	49 (37.4%)	
Education			
<i>University (n=15)</i>	13 (86.7%)	2 (13.3%)	$\chi^2=17.991$; p<.001
<i>High-school (n=74)</i>	53 (71.6%)	21 (28.4%)	
<i>Middle-school (n=60)</i>	34 (56.7%)	26 (43.3%)	
<i>Primary school (n=69)</i>	29 (42.0%)	40 (58.0%)	
Occupation ^a			
<i>Intellectual (n=24)</i>	22 (91.7%)	2 (8.3%)	$\chi^2=12.698$; p=.002
<i>Technical (n=51)</i>	34 (66.7%)	17 (33.3%)	
<i>Manual (n=96)</i>	51 (53.1%)	45 (46.9%)	
Etiology			
<i>Vascular (n=194)</i>	111 (57.2%)	83 (42.8%)	$\chi^2=5.280$; <i>p</i> =.152
<i>Focal traumatic (n=15)</i>	12 (80.0%)	3 (20.0%)	
<i>Neoplastic + surgery (n=6)</i>	3 (50.0%)	3 (50.0%)	
<i>Focal infective (n=3)</i>	3 (100%)	0 (0.0%)	
Time post onset (days)	113 [53-293]	72 [40-123]	U=4113.0; p<.001
Length of treatment (days)	259 [155-465]	166 [131-247]	U=3698.5; p<.001
AAT (T scores)			
<i>Token Test</i>	46 [39-53]	37 [32-52]	U=5025.0; <i>p</i> =.118
<i>Repetition</i>	46 [39-52]	45 [33-50]	U=5855.5; <i>p</i> =.802
<i>Written Language</i>	47 [40-53]	42 [36-49]	U=5661.0; <i>p</i> =.863
<i>Naming</i>	45 [39-53]	41 [32-46]	U=6009.0; <i>p</i> =.557
<i>Comprehension</i>	49 [42-55]	42 [38-52]	U=4620.5; p=.014
<i>AAT profile height</i>	46 [40-52]	42 [34-49]	U=5627.0; <i>p</i> =.805
Type of aphasia			
<i>Anomic (n=24)</i>	15 (62.5%)	9 (37.5%)	$\chi^2=5.280$; p=.003
<i>Broca (n=46)</i>	34 (73.9%)	12 (26.1%)	
<i>Global (n=30)</i>	12 (40.0%)	18 (60.0%)	
<i>Wernicke (n=66)</i>	31 (46.9%)	35 (53.1%)	
<i>Not classifiable (n=52)</i>	37 (71.2%)	15 (28.8%)	

Notes. *Median, inter-quartile range in squared brackets (median [inter-quartile range]), and Mann-Whitney U test for continuous variables; n. of responders/non-responders, percentages by row (n (%)), and χ^2 test for categorial variables; *p* values for significant differences are in bold face. ^aInformation concerning occupation was available only for 171 participants.

Language functions in glioma patients with repeated awake brain surgery

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Introduction

Despite treatment in glioma patients, tumor regrowth is inevitable (Duffau, 2016). There is no clear consensus regarding the optimal treatment option for patients with recurrent gliomas (Redjal et al., 2021). However, repeated (awake) surgery is a feasible and efficient approach for (eloquent) gliomas (Chaichana et al. 2013; Duffau, 2022). Most studies on tumor recurrence focus on the extent of resection (EOR) and overall survival (OS) (Chaichana et al., 2024), however to a lesser extent on functional outcome (Duffau, 2022). We aim to better understand language functions in glioma patients with repeated awake brain surgery.

Methods

We conducted a single-center retrospective study (2004-2024) of 32 consecutive glioma patients (WHO grade 2-4) who underwent repeated awake brain surgery and preoperative language assessment. We investigated: (1) presence/severity of aphasia (Token test (TT) (De Renzi & Faglioni, 1978)), (2) word retrieval (WR) (Boston Naming Test (Kaplan & Weintraub, 2001), DuLIP (De Witte et al., 2015)), (3) phonology (repetition tasks of the Aachen Aphasia Test (Huber et al., 1984), DuLIP (De Witte et al., 2015), DIMA (Satoer et al., 2022)), (4) semantic fluency (animals (SFa), professions (SFp)) and (5) letter fluency (LF) (Dick, 2015; Schmand et al., 2008)). Raw scores were transformed into z-scores according to Dutch norms. To compare the preoperative language assessment of the 1st surgery with the preoperative language assessment of the 2nd surgery, Wilcoxon signed rank test on paired samples was conducted. To explore the relationship of the age of the patient, time (years) between 1st and 2nd surgery and the assessment time points with language scores, we performed post-hoc multiple linear regression. Data was analyzed in R, version 2024.04.0.

Results

There was a significant difference between preoperative z-scores of the 1st surgery and the z-scores of the 2nd surgery ($p < 0.001$) in all language tests (Table 1). At 2nd preoperative time point, performance in TT, repetition and SFp was lower and higher in naming, SFa and LF (Figure 1.) than at 1st time point. Age was a significant predictor for repetition ($b = -0.0371$, $t(99) = -2.44$, $p = 0.018$), as well as TT ($b = -0.0503$, $t(99) = -4.11$, $p < 0.001$). Furthermore, time between both surgeries was a significant predictor for LF ($b = 0.0983$, $t(99) = 2.24$, $p = 0.03$) and TT ($b = 0.099$, $t(99) = 2.33$, $p = 0.02$).

Conclusions

Repeated awake surgery appears to be feasible in glioma patients with relative language preservation. Between the 1st and 2nd awake surgery, performance on half of the tests

deteriorated, and half improved. Phonological tasks were sensitive to detect a decrease, whereas WR and most verbal fluency subtests improved as found in previous studies (Capo et al., 2020; Satoer et al., 2014; El Hachoui et al., 2013). As expected, better test results were found when time increased between surgeries, possibly facilitated by neural plasticity (Herbet et al., 2016), whereas older patients showed less resilience in their language performance. To our knowledge, this is the first study investigating language functions in glioma patients undergoing repeated awake surgery. As a next step, the role of WHO grade, molecular subtypes, EOR, OS, and tumor location will be explored on postoperative long-term language outcome.

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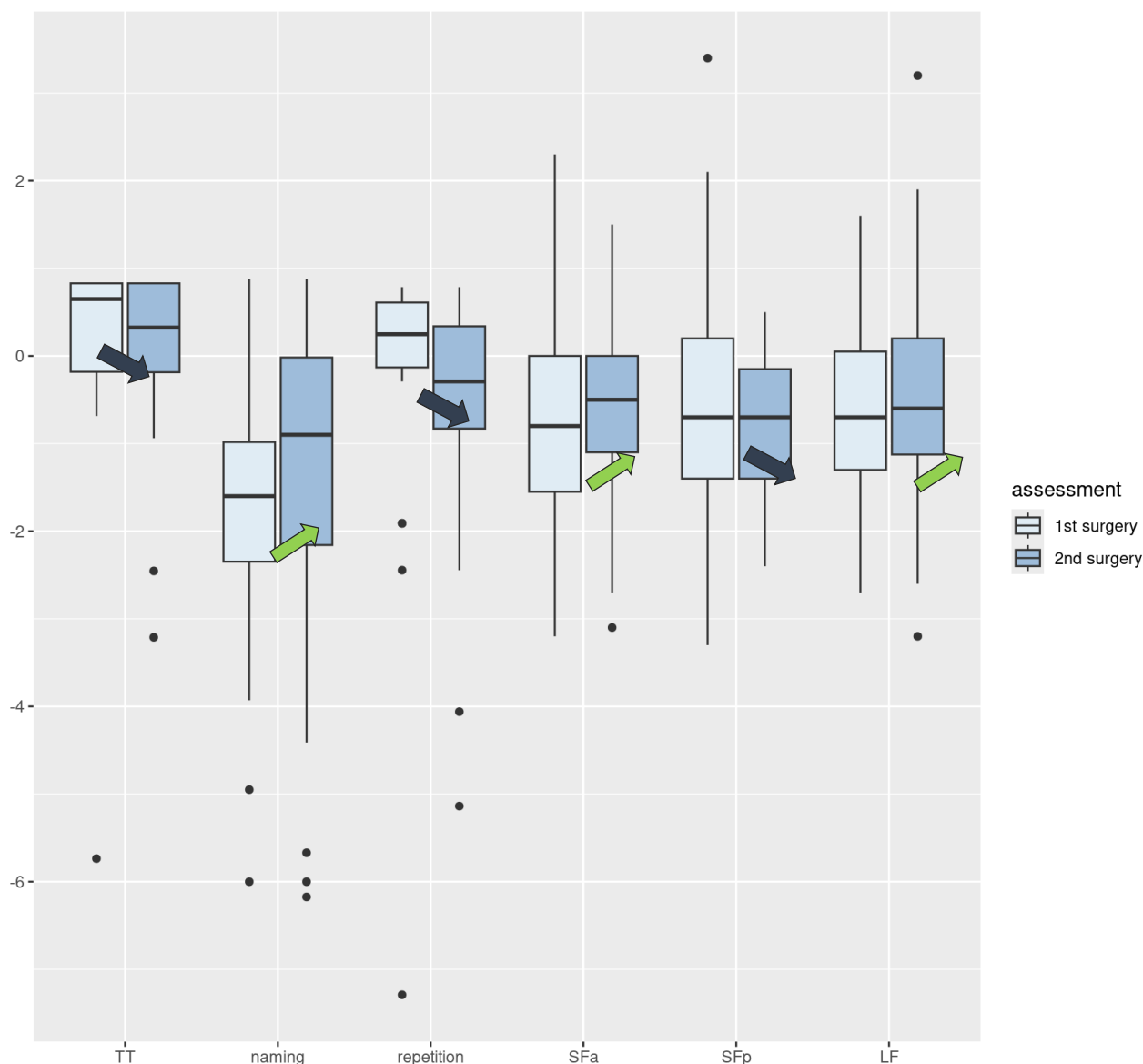


Figure 1. Mean z-scores of the language tests measured before the 1st surgery and before the 2nd surgery (TT - token test, SFa - semantic fluency animals, SFp - semantic fluency professions, LF - letter fluency). Outcome variables are visualized on the x-axis and z-score values are visualized on the y-axis. A blue arrow indicates a significant decline and a green arrow indicates a significant improvement.

Table 1. Descriptive data of patients with recurrent gliomas.

	Nº of patients	Percentage
Sex	32	100
Female	13	41
Male	19	59
Handedness		
Right	26	81
Left	6	19
Tumor location (lobe)		
Frontal	16	50
Parietal	5	16
Temporoparietal	4	13
Temporal	3	9
Fronto-parietal	3	9
Parieto-occipital	1	3
Hemispheric tumor location		
Left	20	62.5
Right	12	37.5
Tumor type of 1st surgery		
Astrocytoma	17	53
Oligodendroglioma	12	38
Glioblastoma	3	9
WHO grade of 1st surgery		
2	20	62
3	6	19
4	6	19
Tumor type of 2nd surgery		
Astrocytoma	15	47
Oligodendroglioma	12	37
Glioblastoma	5	16
WHO grade of 2nd surgery		
2	13	41
3	9	28
4	10	31
Radio- and/or chemotherapy between 1st and 2nd surgery		
Yes	18	56
No	14	44

The production of clitics in Serbian speakers with acquired aphasia

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Introduction

Production of different morphosyntactic elements (e.g., clitics) can be selectively impaired in stroke-induced aphasia (Niemi and Laine, 2012), but their cross-linguistic applicability remains unclear. Cross-linguistic research on nonfluent agrammatic aphasia has shown that the production of clitics is problematic and often omitted (see Martínez-Ferreiro et al., 2017, 2019 in Catalan/Spanish; Rossi, 2007 in Italian; Stavrakaki & Kouvava, 2003 in Greek) but the degree of cross-linguistic influence depends on the languages involved. Serbian language has a rich system of clitics, which may serve as a notable method for pinpointing grammatical impairments in Serbian speakers with aphasia. This is the first study to investigate different types of clitics (proclitics and enclitics) and evaluate the relationship between clitics production and short-term and working memory in Serbian speakers with aphasia.

Methods

46 individuals with stroke-induced aphasia (25 participants with nonfluent (NFA) and 21 with fluent aphasia (FA)) and 54 healthy controls (HC) were administered an experimental Serbian clitic production test, where participants were prompted to produce clitic sentences in response to various scenarios. We examined production performances on 18 enclitics such as pronouns (e.g., Sara se razbolela.) or auxiliary verbs (e.g., Glumac će dobiti novu ulogu.), and 12 proclitics such as prepositions (e.g., Marija i Marko su došli iz škole.) or conjunctions (e.g., Bele pantalone ili crvenu haljinu). We then correlated clitics performances with performances on sentence repetition and digit span forward/backward tasks, across and within groups.

Results

The one-way ANOVA analyses revealed that both aphasia groups showed significantly greater difficulty in clitics production compared to HC ($p < .001$). However, individuals with NFA produced significantly fewer clitics and showed no clitic type effects ($p = .329$) compared to those with fluent aphasia which produced proclitics with greater accuracy than enclitics ($p = .028$). There were significant correlations between clitic production scores and performances on sentence repetition and number span tasks. However, the correlation between clitics and digit span scores varied across different aphasia groups. Specifically, associations between digit span backward and both enclitics and proclitics were observed in NFA ($r = .44$, $p = .029$; $r = .55$, $p = .004$), whereas digit span backward and forward appear to be correlated with only enclitics in FA ($r = .53$, $p = .007$; $r = .48$, $p = .027$). Likewise, a positive correlation between sentence repetition and both enclitics and proclitics was noted in NFA ($r = .53$, $p = .007$; $r = .59$, $p = .002$), whereas in FA, it was only correlated with enclitics ($r = .63$, $p = .002$).

Conclusions

These findings indicate that the production of clitic sentences shows a distinct pattern among participants with nonfluent and fluent aphasia, and is related to working and verbal memory resources. Standard measures indicate a distinct benefit in processing proclitics in only fluent aphasia.

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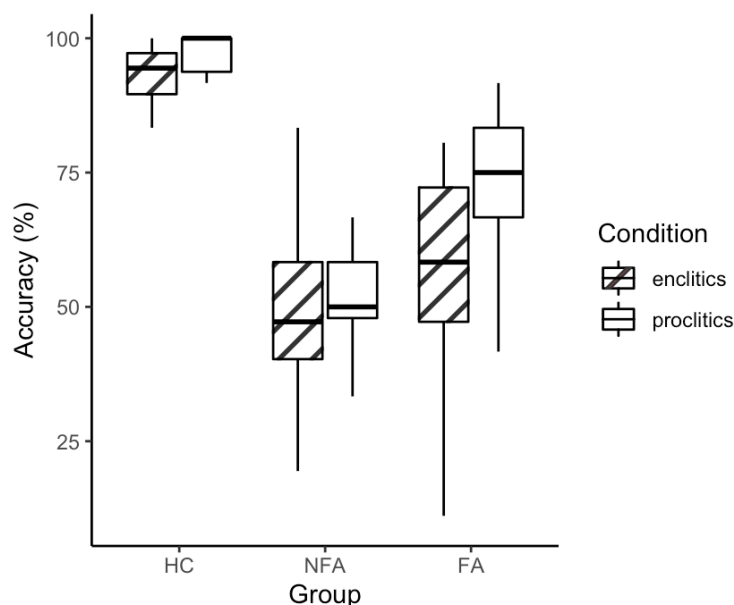


Figure 42. Performance differences across clitic conditions for a group of healthy controls (HC) and adults with nonfluent (NFA) and fluent (FA) aphasia.

Understanding the experience of returning to driving or not for people with aphasia post-stroke: A qualitative study using patient journey mapping

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Introduction

Return to driving is pivotal to community reintegration post-stroke (Finestone et al., 2010), and is a top 10 research priority for people with aphasia, their caregivers, and clinicians (Franklin et al., 2018). The role of language in driving remains unclear and the aphasia population has largely been excluded from research into driving post-stroke. Stroke survivors with aphasia face unique barriers in return to driving due to linguistic and communication demands in the patient journey, and poor understanding of aphasia (Wallace et al., in-press). No research has investigated the impact of aphasia on the process of returning to driving. This study explored the lived experience of people with aphasia who return to driving or not post-stroke.

Methods

Qualitative descriptive study using the Standards for Reporting Qualitative Research (O'Brien et al., 2014). People with aphasia participated in semi-structured interviews online. Journey mapping was used to explore "touch points" (moments shaping experience) relating to return to driving. Recorded interviews were transcribed for speech and non-speech communication and analysed using inductive qualitative content analysis.

Results

Fifteen people with aphasia in Australia (67% male; < 65 years 73%) participated in interviews (duration 75-150 minutes) (see table 1). Five broad categories emerged, with data related to: Thoughts about driving; communication and communication breakdowns; instigating return to driving; the assessment process and managing driving cessation. Embedded across these categories, four core themes captured the experience of returning to driving and navigating driving cessation with aphasia (see figure 1): (1) "Too much paperwork": Communication requirements in the patient journey; (2) "They should have warned me": Lack of communication; (3) "What happens to those who don't have an Anna?": Dependence on others; (4) "If I had my car, I'll be able to actually start to have a life": Importance of driving. Thirteen subthemes were identified.

Conclusions

People with aphasia face unique barriers in returning to driving and navigating driving cessation post-stroke. Difficulties with communication lead to challenges in self-advocacy and managing administration and logistics. Communication difficulties may impact understanding of and performance in assessments. Managing driving cessation also

presents challenges. Poor awareness of aphasia means healthcare professionals lack skills in accommodating communication needs (Cameron et al., 2015), leaving people with aphasia exposed to a lack of information, guidance, and communication support to facilitate return to driving. Many are dependent on others to instigate and navigate a return to this valued occupation. Yet return to driving provides a crucial means to restore independence for people with aphasia and is a high priority. The role of family and aphasia support groups is instrumental in facilitating return to driving, as is involvement of healthcare professionals skilled in accommodating communication needs, and who reduce the communication burden placed on people with aphasia.

This research has implications for people with aphasia worldwide. One third of stroke survivors live with aphasia. We need to recognise the unique challenges this population faces in returning to driving and adapting to driving cessation post-stroke, and work collaboratively to implement effective strategies to address these concerns.

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Table 1. Descriptive statistics.

Category		Frequency (%)	
Gender	Male	10	(66.7)
	Female	5	(33.3)
Age	Below 65	11	(73.3)
	65+	4	(26.7)
Aphasia severity*	1 (minimal/no functional speech)	1	(6.7)
	2	3	(20.0)
	3	8	(53.3)
	4	2	(13.3)
	5 (minimal difficulties)	1	(6.7)
Geographical remoteness	Major city	13	(86.6)
	Inner regional	1	(6.7)
	Remote	1	(6.7)
RTD or not	RTD	9	(60.0)
	In process	3	(20.0)
	Ceased	3	(20.0)
Time taken to RTD	<3 months	3	(20.0)
	<6 months	2	(13.3)
	<12 months	4	(26.6)
	In process >6 months	1	(6.7)
	In process >2 yrs.	1	(6.7)
	In process >10 yrs.	1	(6.7)
	Ceased (n/a)	3	(20.0)
Importance assigned to driving (self-rated out of 5)	1 (not important)	1	(6.7)
	2	0	(0.0)
	3	3	(20.0)
	4	3	(20.0)
	5 (very important)	8	(53.3)
Modified car required/would be required.	Yes	5	(33.3)
	No	10	(66.7)
Assessment process	GP only	1	(6.7)
	Rehab consultant	2	(13.3)
	Neurologist	1	(6.7)
	OTDA on road-Ax	5	(33.3)
	Standard driving test	1	(6.7)
	Returned independently	1	(6.7)
	Awaiting assessment	3	(20.0)
	Ceased without assessment	1	(6.7)
Type of off-road assessment completed	Cognitive assessment	9	(60.0)
	Road sign recognition only	1	(6.7)
	Other (no cognitive component)	1	(6.7)
	Driving theory test	1	(6.7)
	No assessment**	3	(20.0)

* Aphasia severity rating as per Goodglass and Kaplan's Aphasia Severity Rating Scale (1983), where 1 = minimal/no functional speech; 2 = basic functional output only; 3 = conversation about certain material difficult ; 4 = occasional difficulties at conversational level, and; 5 = minimal difficulties not apparent to most listeners.

** No assessment (returned independently/ceased without assessment/awaiting assessment).

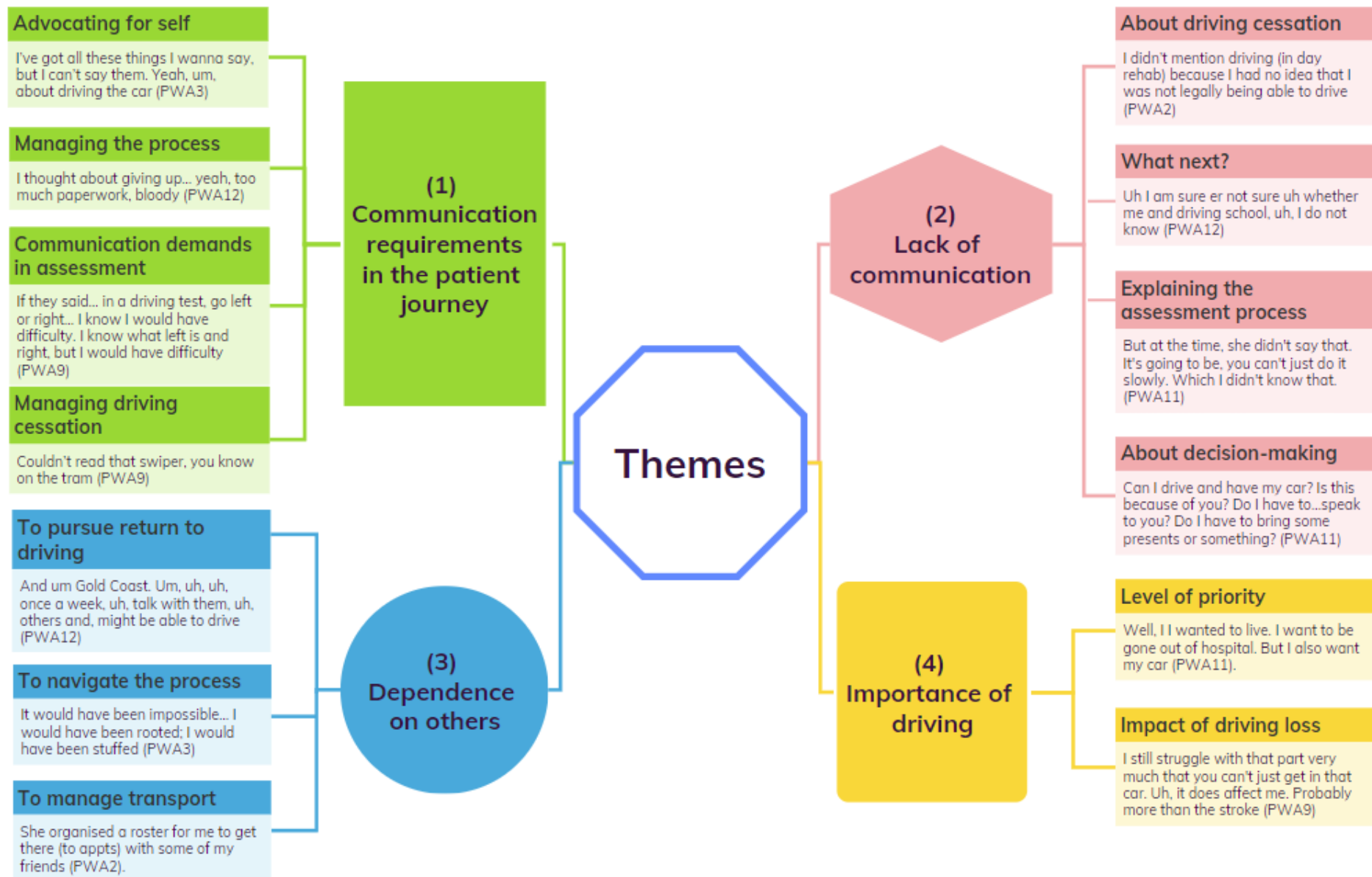


Figure 1. Themes, sub-themes and meaning units related to the lived experience of returning to driving for people with aphasia.

Developing the AphasiaFit app

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Introduction

Self-management is a model of care that empowers individuals to manage their own health care (Barlow, 2002), however many existing programs do not meet the needs of people with aphasia (Wray et al., 2018). We describe the process and outcomes of a study to co-develop a mobile health application support aphasia self-management.

Methods

People with aphasia (n=4), significant others (n=4), and clinicians (n=3) participated in an iterative co-design process over 15 weeks. Each session was co-facilitated by two research assistants with lived experience of aphasia. Flexible participation was supported using a combination of videoconferencing, individual sessions, and asynchronous completion of design journals. In reference to experiences, barriers and facilitators identified in a previous stage of research; technology components, functionality, and user interface designs, were co-created.

Results

The resulting co-designed technology was named *AphasiaFit*. It is a 'platform' consisting of a central database and three apps (see figure 1). Motivation for treatment is supported through collaborative goal setting, progress monitoring/visualisation, and an embedded private social network. Communication access is facilitated through personalised interfaces; text, picture and audio supports; and functionality to record personal information and life history.

Conclusions

AphasiaFit is a co-designed technology-based platform which aims to support and motivate adherence to self-managed aphasia treatment. Experience testing is complete, and a final phase of field testing will soon commence.

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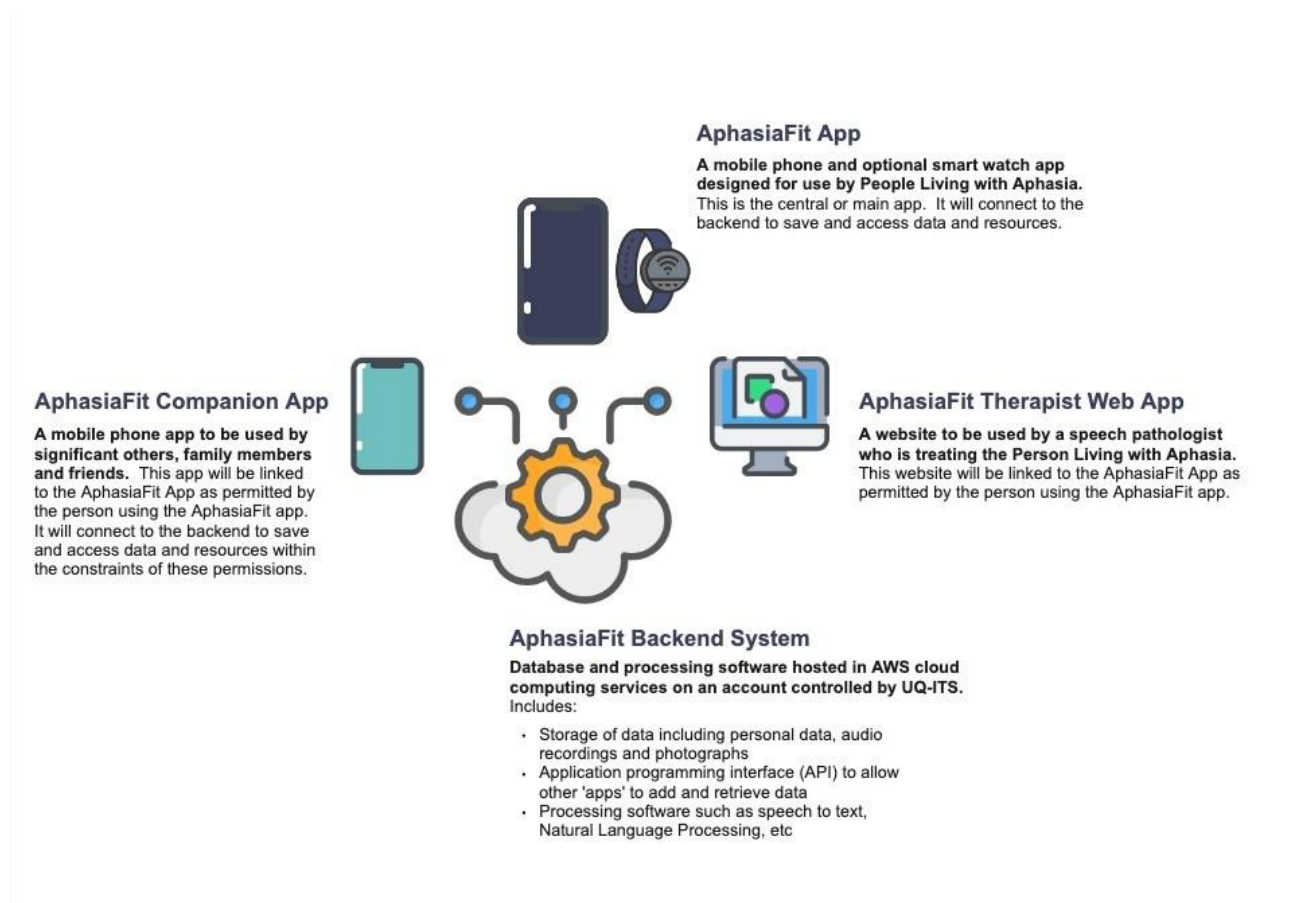


Figure 43. The components of the AphasiaFit platform consisting of three software apps and a cloud hosted backend system.

Stability and validity of visual world paradigm measures of lexical access in aphasia

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Introduction

The visual world paradigm (VWP) is commonly used to study lexical access in aphasia (e.g., Mirman et al., 2011). It measures lexical-access processes via gazes at images while participants listen to words. Target-image gazes index lexical access. Phonological-competitor gazes index lexical-phonological processing (Allopenna et al., 1998). Semantic-competitor gazes index lexical-semantic processing (Huettig & Altmann, 2005). Previous VWP work has demonstrated that persons with aphasia (PWA) show atypical phonological- and semantic-competitor gazes, suggesting disordered lexical-semantic or lexical-phonological processing (Mirman et al., 2011; Yee et al., 2008). However, the relationship between VWP gazes and standardized measures of lexical-access or semantic/phonological impairments has not been examined. Furthermore, it is unknown whether VWP lexical-access indices are stable across time. The current study therefore aimed to determine both the stability and validity of VWP measures of lexical access.

Methods

22 PWA participating in an ongoing clinical trial [NCT04215952] examining Semantic Feature Analysis (Boyle, 2010) completed VWP procedures at two timepoints before receiving treatment. Participants heard target words while gazing at four images: target (*lime*), phonological competitor (*lion*), semantic competitor (*grapefruit*), unrelated distractor (*rock*). Participants also completed the Comprehensive Aphasia Test (CAT: Swinburn et al., 2004) and Philadelphia Naming Test (PNT: Roach et al., 1996). CAT Modality-Mean T-score (CAT-MM: mean=52.92; range=44.33-65.17) measured participants' aphasia severity. S- and p-weight were estimated from participants' PNT performance (Foygel & Dell, 2000) and measured lexical-semantic and lexical-phonological impairment.

Results

Gaze data were analyzed using growth curve analysis (GCA: Mirman, 2016). Linear GCA models tested the stability of target, semantic-competitor, and phonological-competitor gazes by examining the effect of timepoint (pre-treatment 1 vs. 2) on target/semantic-/phonological-competitor advantage over unrelated distractors. Target advantage increased from timepoint 1 to 2 (timepoint $\times$ target-unrelated: $\beta = 0.04$; $CI: 0.03 - 0.05$) and phonological-competitor advantage decreased from timepoint 1 to 2 (timepoint $\times$ phonological-unrelated $\times$ linear: $\beta = 0.04$; $CI: 0.02 - 0.07$). There was no reliable effect of timepoint on semantic-competitor advantage, suggesting semantic-competitor effects were stable over time.

Zero-inflated beta GCA models tested the validity of target, semantic-competitor, and phonological-competitor gazes by examining the effect of aphasia severity on target gazes and of lexical-semantic/lexical-phonological impairment on semantic-/phonological-competitor gazes at timepoint 1. Higher CAT-MM (lower aphasia severity) was associated with more target gazes (CAT-MM $\times$ target-unrelated: $\beta = 0.04$; $CI: 0.02 - 0.07$). Higher s- and

p-weight (less lexical-semantic and lexical-phonological impairment) were both associated with fewer semantic-competitor gazes (s-weight $\times$ semantic-unrelated: $\beta = -0.01$; $CI: -0.01 - -0.00$; p-weight $\times$ semantic-unrelated: $\beta = -0.01$; $CI: -0.01 - -0.00$). Higher p-weight (less lexical-phonological impairment) was associated with fewer phonological-competitor gazes (p-weight $\times$ phonological-unrelated: $\beta = -0.00$; $CI: -0.01 - -0.00$). Higher s-weight (less lexical-semantic impairment) was associated with more phonological-competitor gazes (s-weight $\times$ phonological-unrelated: $\beta = 0.00$; $CI: 0.00 - 0.01$).

Conclusions

These findings provide preliminary evidence for the stability of VWP measures of lexical access in aphasia, especially semantic-competitor gazes (cf. Mack et al., 2016). This is encouraging for using VWP measures to detect treatment-related changes for anomia treatments targeting lexical-semantic processing (Boyle, 2010). These findings also provide preliminary evidence for the validity of VWP lexical-access measures. Lower aphasia severity was associated with greater target advantage, indexing more successful lexical access. However, the relationship between semantic-/phonological-competitor gazes and semantic/phonological impairment measures was less straightforward. Further work is needed to establish the validity of VWP measures of lexical-semantic and lexical-phonological processing.

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The essential language network

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Introduction

Language is seen today in the context of cognition (Jackson, 2021) or social interaction (Dor, 2015). Accordingly, large parts of the brain are involved in language (Price, 2012). But is there anything specific to language in the human brain at all? How can one approach the question of which parts of the brain are truly essential for language? One way might be to look for conditions that lead to a disruption of language or prevent a patient from recovering from a language disorder. We have therefore investigated which brain structures are responsible for the occurrence or severity of aphasia.

Methods

As language is seen as a network function, we applied a new technique, streamline-based lesion symptom mapping (SLSM) in over 200 patients with an acute (< 10 days) first ever stroke due to a singular left hemispheric ischemic lesion on MRI. Using non-parametric statistics the individual disconnectome map can be related to the performance in the Aachen Aphasia Test (AAT), the most widely used and well validated aphasia test for German (Huber et al., 1984). A normative structural connectome from 183 participants of the Human Connectome Project (HCP) corpus (3T HCP) (<https://ida.loni.usc.edu/login.jsp>) (Weiller et al., 2021) was used.

Results

Using both the binary presence of aphasia or not and parametric correlation with severity, a convolute of streamlines was found (Fig1). Besides some commissural fibres, these streamlines reflect association fibres in the left hemisphere. Using established regions of interest (ROIs) on the normal connectome, we were able to attribute the streamlines to the arcuate fasciculus (AF) (Weiller et al., 2022), to extreme capsule fibres (EmC) (Saur et al., 2008) (Weiller et al., 2021), and to the middle longitudinal fascicle (MdLF) (Makris et al., 2017). Conjugation of the three tracts revealed interaction sites in the inferior frontal gyrus (IFG) ("Broca"), posterior superior/middle temporal gyrus (MTG) ("Wernicke") as "hubs" of AF with EmC, angular gyrus (AG) ("Geschwind") as a hub of AF with MdLF, and the anterior temporal lobe (ATL) ("semantic hub" (Patterson & Lambon Ralph, 2016)) as a hub of EmC with MdLF. A remainder of streamlines was constituted by vertical fibres connecting AG and MTG (Obersteiner, 1888).

Conclusions

Connectivity provides structure: The four zones of the cerebral cortex considered most relevant for language (IFG; STG/MTG; AG; ATL) are the interaction hubs of the three association tracts, which are critical for maintaining language after a stroke and for recovery from aphasia. Two systems can be differentiated: the IFG and MTG connected along AF and EmC fibres, the "dual-loop model", combining processing of sequence and structure (Weiller et al., 2022), and the AG and ATL as part of dorsal and ventral systems, connected by the MdLF related to multimodal integration for conceptual processing (Lambon Ralph et

al., 2010). The data provide an anatomical framework useful to constrain cognitive theory and essential for understanding patients with aphasia and their recovery.

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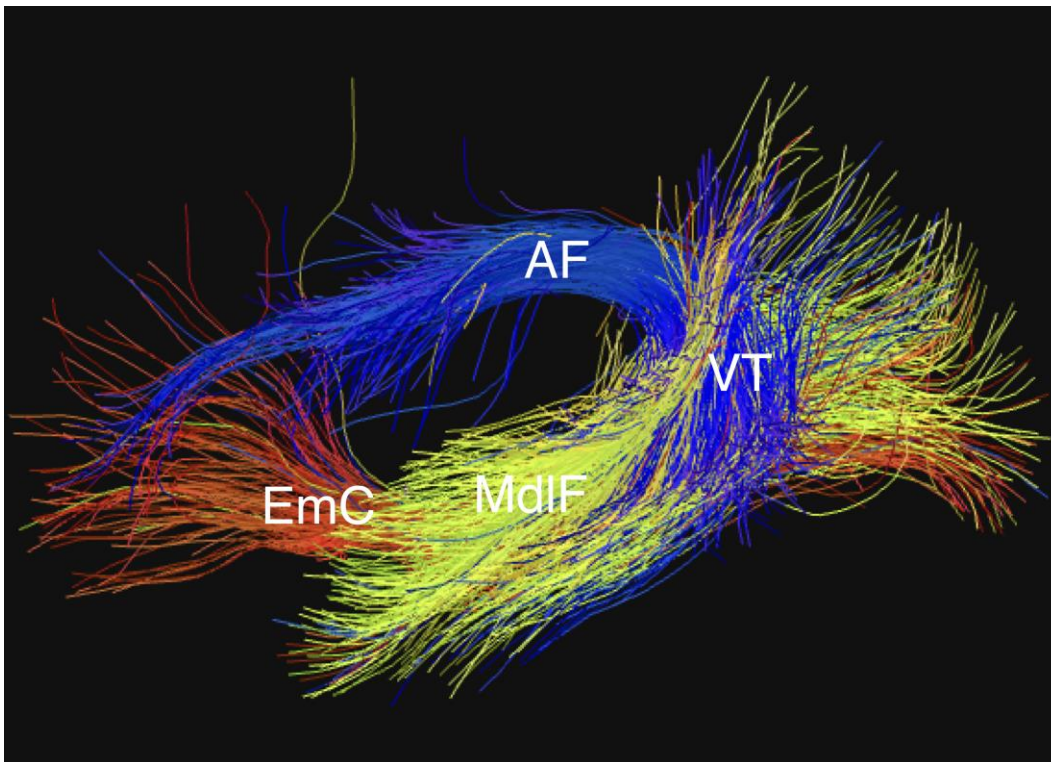


Figure 44. Streamlines related to severity of aphasia at the acute stage after stroke. Colour coding and nomenclature derived by applying the ROIs derived from previous definitions of tracts on a normal connectome from participants of the human connectome project. AF= arcuate fascicle, EmC= extreme capsule fibres, MdIF= middle longitudinal fascicle, VT= vertical tract connecting angular gyrus and middle temporal gyrus.

Assessing mild word-finding difficulties in naming: Introducing the Picture Naming cards

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Introduction

Word-finding difficulties are commonly assessed through classical naming tests, where individuals name single pictures without time pressure. However, these tests may be less sensitive for detecting mild word-finding difficulties (e.g., Mooijman et al., 2022). Patient-reported outcome measures sometimes indicate experienced word-finding difficulties in everyday conversations, despite high naming test performance (Cavanaugh & Haley, 2020). Therefore, tests are needed that tap into mild word-finding difficulties.

When faced with time pressure and additional distractions – like one has in everyday conversations – naming becomes more challenging. Therefore we developed a test that introduces additional cognitive demands to picture naming by adding time pressure and interference, simulating real-world challenges. This test is straightforward to administer and feasible to implement in clinical practice, given its simple visual presentation and easy scoring system.

Methods

Our test consists of two cards, each featuring 20 pictures to be named as quickly and accurately as possible (see Figure 1a.). One card is bare picture naming, the other has written words overlaid onto pictures with similar semantic concepts, creating an interference effect. Time to finish the card and naming accuracy are compared between the two cards. Additional norming studies have been conducted.

Here, we report on one study, where the test was administered to neurologically healthy individuals in a diverse age range ($n = 17$; $mean^{age} = 51.1$, $range^{age} 22-75$) and to stroke survivors who had their stroke below an age of 50 years (i.e., young-stroke, $n = 3$; $mean^{age} = 47.3$). Data collection is still ongoing.

Results

Results are presented in Figure 1b. The neurologically healthy individuals took longer ($p = 0.035$) to finish the Interference Naming card compared to the Bare Naming card. There was no difference in naming accuracy. Descriptively, the three young-stroke survivors (no to mild aphasia with subjectively reported challenges in everyday conversations) took more time to finish the Interference Naming card compared to the Bare Naming card. Additionally, they gave fewer on-target responses for the Interference Naming card compared to the Bare Naming card.

Conclusions

Our findings suggest performance differences between the card versions for neurologically healthy individuals. Moreover, the three young-stroke survivors show this pattern as well. The larger descriptive difference between the cards in the young-stroke survivors (15 sec on average) relative to controls (3 sec on average) suggests a stronger interference effect. This may be related to their real-world challenges in finding the right words in conversations when experiencing distraction. Ongoing investigations will further examine whether the Picture Naming cards effectively reveal mild word-finding difficulties in a larger sample of young-stroke survivors who subjectively report challenges in their everyday conversations. We expect that with a larger sample, those with mild word-finding difficulties in the young-stroke group will show slower performance and greater differences in time and accuracy between card types, indicating the test's potential sensitivity.

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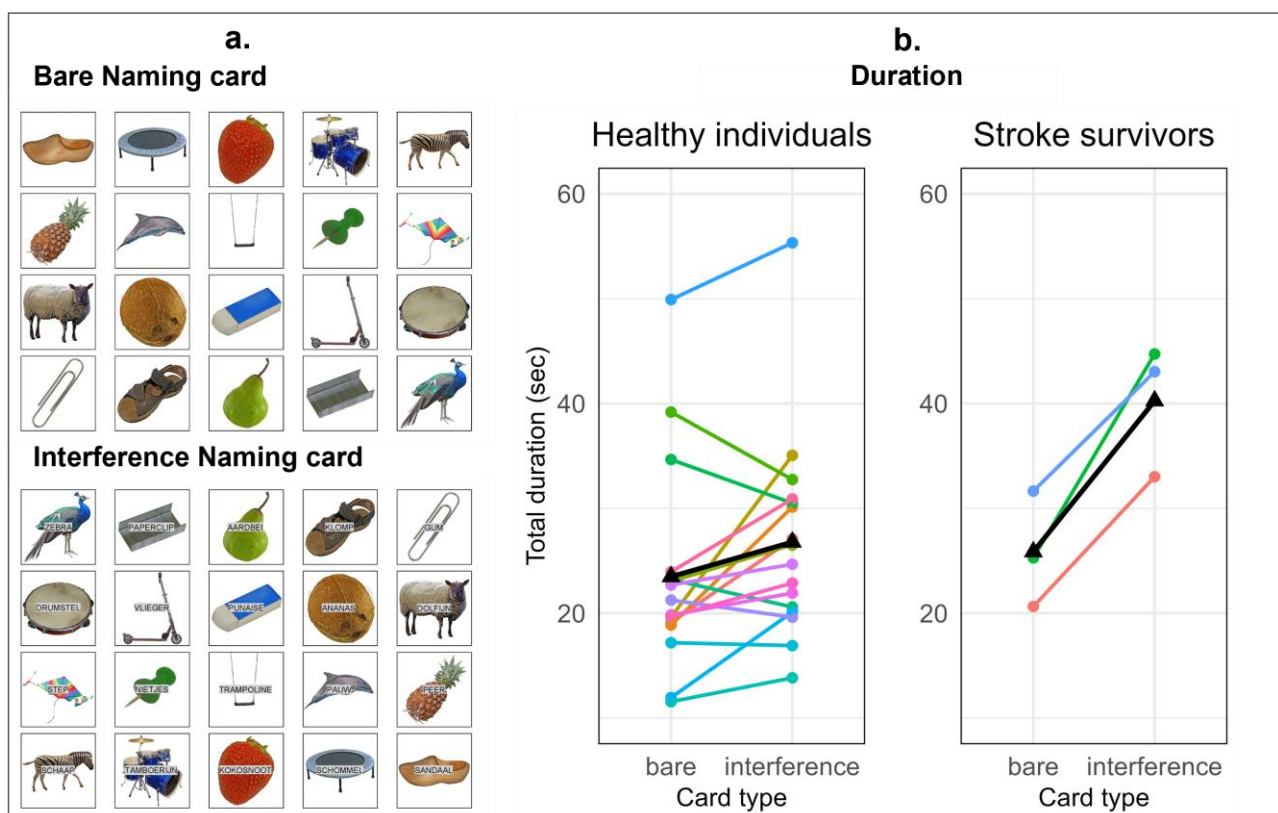


Figure 1. a. Visual presentations of the two Picture Naming cards. b. Individual (in color) and mean (in black) results of the time to finish the card (duration) for the Picture Naming cards (Bare Naming and Interference Naming) for neurologically healthy individuals ($n = 17$) and stroke survivors ($n = 3$).

Table 1. Raw means, standard deviation and range of the time to finish the card (duration) and total score of on-target responses (accuracy) for the Picture Naming cards (Bare Naming and Interference Naming) for neurologically healthy individuals and stroke survivors.

Tests	<i>healthy individuals (n = 17)</i>		<i>stroke survivors (n = 3)</i>	
	Mean (sd)	Range	Mean (sd)	Range
Bare Naming Card				
Duration (sec)	23.5 (9.91)	11.6 – 49.9	25.9 (5.53)	20.6 – 31.7
Accuracy	16.5 (2.45)	12 – 20	14.3 (1.53)	13 – 16
Interference Naming Card				
Duration (sec)	26.8 (9.37)	13.8 – 55.3	40.3 (6.33)	33.0 – 44.7
Accuracy	16.1 (2.45)	11 – 20	11.3 (0.58)	11 – 12

Social participation in aphasia: Insights across WHO-ICF domains

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Introduction

Social participation involves the interactions and activities individuals engage in daily. Communication is vital for successful social participation, yet many persons with aphasia (PWA) face difficulties that affect their social interactions and broader social networks. Cognitive deficits in attention, memory, and executive functioning further hinder their ability to comprehend and produce language, crucial for social participation. PWA often report decreased participation in domestic and leisure activities, leading to feelings of sadness, loneliness, frustration, and detachment. Reduced engagement and smaller social networks negatively affect their recovery and well-being (Dalemans et al., 2007; Hilari & Northcott, 2012).

The World Health Organization's International Classification of Functioning, Disability and Health (WHO-ICF) model describes and measures functioning and disability, and contextual factors. Previous research has explored individual ICF domains, but a comprehensive study examining all ICF domains and their interconnectedness in aphasia and effects on quality of life (QOL) is needed. The primary research question was to understand how various components of the ICF model are linked in PWA related to social participation. Understanding how PWA perceive their social participation can help clinicians identify areas of dissatisfaction and tailor treatments to enhance overall social satisfaction.

Methods

A social participation self-report survey was designed using six individual questionnaires, each targeting distinct domains of the ICF model (see Figure 1), which was distributed via an online platform. The Nottingham Health Profile (NHP), Stroke Social Network Scale (SSNS), Community Integration Questionnaire (CIQ), Measure of Stroke Environment (MOSE), Medical Outcomes Study-Social Support Survey (MOS-SSS), and Dartmouth COOP Charts (COOP) questionnaires were utilized.

Each questionnaire included images and voice recordings to assist respondents (PWA). These questionnaires are previously validated and deemed appropriate for PWA. Data analyses involved extracting demographic details and questionnaire scores and were analyzed using SPSS version 20.0.

Results

Out of 20 respondents, 15 completed all questionnaires, achieving a 75% completion rate. Participants ranged in age from 30 to over 80, with 35% aged 60-69. Most were female (70%) and identified as White (60%). The duration post-onset of aphasia varied from one year to over 20 years, with 60% reporting one to five years. Half of the respondents were undergoing treatment.

Significant correlations were found between various ICF domains. The COOP questionnaire, measuring QOL, correlated significantly with the NHP ($p=.031$), MOSE ($p=.046$), and CIQ ($p=.034$; see Table 1). The CIQ also correlated with the SSNS ($p=.030$). Further, subdomain analysis revealed correlations between social isolation, perceived social support, and QOL. Higher social support levels correlated with better social participation ($p=.045$), and a significant correlation ($p=.025$) was found between social integration and

communication environment. No significant differences were observed in communication abilities based on social integration levels.

Conclusions

Results revealed that the performance in one ICF domain can have a significant effect on the performance of another domain as it relates to social participation in aphasia. Therefore, this research highlights the significance of social participation in the recovery and well-being of PWA, potentially leading to socially oriented assessments and therapy programs (Mohapatra & Mohan, 2023) promoting inclusivity and support.

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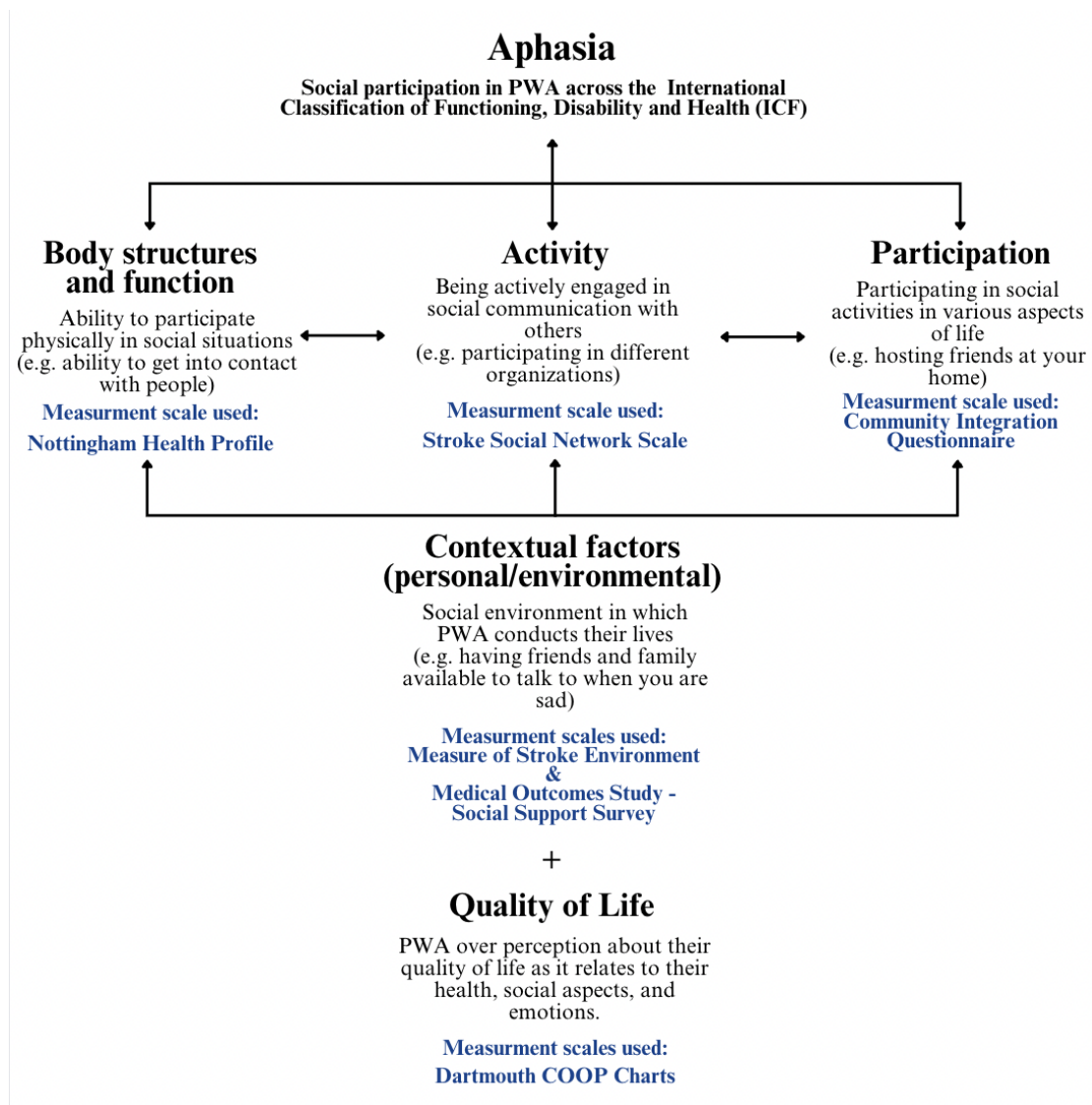


Figure 1. Social participation across the WHO-ICF domains and the measurement scale/questionnaires utilized to evaluate each domain and quality of life.

Table 1. Correlations between WHO-ICF domains.

	NHP_ Social Isolation	SSNS	CIQ	MOSE_ Communication	MOS- SSS
COOP	557 (<i>p</i> =.031)*	-.393 (<i>p</i> =.147)	-.549 (<i>p</i> =.034)*	-.523 (<i>p</i> =.046)*	-.175 (<i>p</i> =.533)
MOS-SSS	.010 (<i>p</i> =.971)	.037 (<i>p</i> =.895)	-.067 (<i>p</i> =.812)	.271 (<i>p</i> =.328)	
MOSE_ Communication	-.249 (<i>p</i> =.371)	.407 (<i>p</i> =.132)	.214 (<i>p</i> =.444)		
CIQ	-.392 (<i>p</i> =.149)	.560 (<i>p</i> =.030)*			
SSNS	-.055 (<i>p</i> =.847)				

Note. **p*<.05

NHP- Nottingham Health Profile, SSNS- Stroke Social Network Scale, CIQ- Community Integration Questionnaire, MOSE- Measure of Stroke Environment, MOS-SSS- Medical Outcomes Study-Social Support Survey, COOP- Dartmouth COOP Charts

Linguistics and non-linguistics cognitive performance of Cantonese-speaking people with aphasia: An investigation using the listening comprehension version and speed of processing battery of the Cantonese version of Computerized Revised Token Test

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Introduction

There is a growing literature suggesting that people with aphasia (PWA) have deficits in non-linguistic cognitive functions in addition to the language deficits that define them (Huang et al., 2023; McNeil, Hula, Sung, 2011; Murray, 2012, Villard & Kiran, 2017; Yoo, et al., 2020). In order to further explore this relationship, this study investigated the differences and relationship among language listening processing and non-linguistic cognitive performance of PWA compared to healthy controls (HC).

Methods

The English version of Computerized Revised Token Test – Speed of Processing (CRTT-SOP; McNeil, 2015) was initially translated and adapted to create the Cantonese version of CRTT-SOP (CRTT-SOP-Cantonese). The CRTT-SOP includes six subtests: (1) finger tapping speed; (2) simple reaction time (RT); (3) simple RT with fine movement control; (4) Go/NoGo; (5) simple mapping with one stimulus and a two-choice response; and (6) complex mapping with two stimuli and two sequenced responses. The test also estimates the time taken for cognitive processing times including stimulus detection, controlled movement, stimulus inhibition, goal maintenance, simple stimulus-effector mapping, and complex stimuli-effector mapping for two sequenced responses.

The participants included 14 native Cantonese-speaking PWA (mean age: 55.50, $SD = 5.43$) and 53 HCs (mean age: 58.11, $SD = 6.56$) matched for age and education level. All participants completed the listening comprehension version of the Cantonese Computerized Revised Token Test (CRTT-L-Cantonese; Bakhtiar, et al., 2020) of the Computerized Revised Token Test (CRTT-L; McNeil, et al., 2015) and CRTT-SOP-Cantonese test batteries.

Mann-Whitney U tests were computed to assess differences between groups for overall score and overall efficiency score for the CRTT-L-Cantonese and each of six subtests and seven derived measures of the CRTT-SOP-Cantonese. Spearman correlations were computed to assess associations among CRTT-SOP-Cantonese and CRTT-L-Cantonese scores for each of the groups.

Results

Results showed that the PWA group scored significantly lower than the HC group in both the overall score and efficiency score of the CRTT-L-Cantonese. The PWA group performed significantly slower in subtests (2) to (6) than the HC group in CRTT-SOP-Cantonese. The PWA group was significantly slower than the HC group for controlled movement, goal maintenance, and simple decision-mapping. No significant differences were found between

the two groups on the stimulus detection and inhibition. However, the PWA group was significantly slower than HC for the first but not the second response for mapping the two sequenced responses.

There were significant moderate to weak correlations between the CRTT-SOP times for controlled movement, goal maintenance, and complex mapping and CRTT-L-Cantonese overall and efficiency scores for the HC group but not in the PWA group. Both groups showed no significant correlation between stimulus detection, stimulus inhibition, simple mapping, Go/NoGo performance, with the CRTT-L-Cantonese scores.

Conclusions

Results supported the growing body of literature supporting the relationship between nonlinguistic and linguistic processing in PWA. CRTT-SOP-Cantonese can differentiate non-linguistic processing of the PWA group and HC group across several cognitive tasks. Some significant moderate to weak correlations between cognitive functions and CRTT-L-Cantonese were found in the HC group but not in the PWA group.

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The characteristics and the longitudinal changes of language dysfunction in Alzheimer's disease

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Introduction

With the global increase in the aged population, the socio-economic burden of Alzheimer's disease (AD) has been continuously up-ticking on both patients and their caregivers [1,2]. There has been a consensus about language dysfunction in AD and related dementia cases, while Although language dysfunction is common in the early stage of typical AD, the mechanism underlying the pathological process is still unexplored [3]. Recently, it has been revealed that A β accumulation may have a significant impact on the language network in the early stage of AD [4]. However, the implications of amyloid and tau pathologies underlying the AD pathomechanism are not well-defined. Therefore, we evaluated the longitudinal associations of the progression of language impairment based on the expression of neurocognitive and neuroimaging markers of AD and whether the ATN framework might mediate the progression of AD pathology.

Methods

The mild dementia, mild cognitive impairment, and cognitive unimpaired (CU) participants were collected in Beijing Tiantan Hospital. Acoustic parameters were collected for semantic fluency, picture naming tasks, and sentence repetition tasks by Praat software. The relationship between acoustic parameters and imaging characteristics was calculated to explore the imaging mechanisms of Alzheimer's disease. Imaging and language characteristic from ADNI database was used to verify the results from our own database, and to clarify the potential roles by taking cerebrospinal fluid (CSF) biomarkers into consideration. The longitudinal changes of language function were also evaluated by multiple regression and mediation analysis.

Results

Among 75 participants, significant differences were found for several acoustic parameter in the semantic fluency task(word production per unit time, the proportion of audio and silent segments, clustering and switching), in the picture naming task(the total number and different types of errors), and in the sentence repetition task(word rate, silent pause and filled pause).

The gray volume of bilateral temporal pole, fusiform gyrus, left middle occipital gyrus and left inferior frontal gyrus are negatively correlated with the total errors in picture naming task, while the bilateral inferior parietal lobule, hippocampus, left posterior superior temporal gyrus, left inferior frontal gyrus and right middle frontal gyrus was positively correlated with the number of effective words in semantic fluency task. The ADNI database suggests a significant correlation between CSF markers and language dysfunction, with the left temporal pole and posterior temporal gyrus mediating CSF A β deposition and language dysfunction.

Subjects with poor baseline semantic fluency have a higher risk of progression to MCI or AD, while those with a significant decrease in naming have a higher risk of subsequent progression to MCI or AD. According to ATN framework, confrontation naming and semantic fluency was declined faster for AD-continuum. The right temporal pole is important for the

decline of picture naming, while the left hippocampus and posterior temporal gyrus is important for the decline of semantic fluency.

Conclusions

Multiple acoustic parameters can evaluate cognitive impairment even in the prodromal stage. The temporal lobe serves as a convergence area for proper nouns and vocabulary retrieval, while the left posterior superior temporal gyrus and inferior parietal lobule may be related to the acquisition and storage of word phonetic. A β 42 mediates language dysfunction through the left temporal pole and left posterior temporal gyrus.

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Acknowledgments

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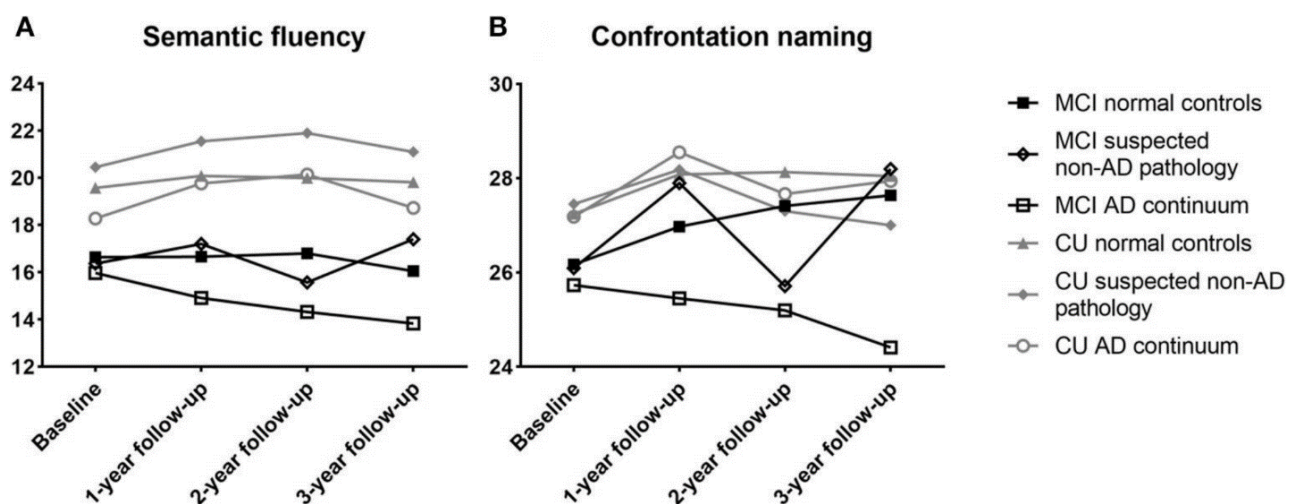


Figure 45. Performance of semantic fluency (a) and confrontation naming (b) for non-demented participants between different ATN profiles. CU, cognitive unimpaired; MCI, mild cognitive impairment.

Table 1. Association with the longitudinal changes of language function with gray matter volume.

	cluster	Peak T value	MNI(mm)		
			X	y	Z
Positively correlated with the change rate of the confrontation naming					
Right temporal pole	941	4.22	12	12	-42
Positively correlated with the change rate of the confrontation naming					
Left inferior parietal lobule	2111	4.72	-60	-30	36
Left hippocampus	4337	4.58	-27	-8	-17

VBM results of the brain areas of the longitudinal changes of language function($P < 0.05$, TFCE-FEW corrected).

The distinction between aphasia and motor speech disorders in primary progressive aphasia

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Introduction

In evaluating speech/language disorders in post-stroke aphasia and primary progressive aphasia (PPA), a distinction is often drawn between aphasia and motor speech disorders (apraxia of speech (AOS) and dysarthria). Although these diagnostic categories are considered in the consensus criteria for PPA variant classification^[1], they are not determinative of variant types^[2-4], raising questions about their contribution to our understanding of PPA. In this study, we addressed the following: 1) How are diagnoses of aphasia/AOS/dysarthria distributed across PPA variants? 2) Do these diagnoses identify atrophy in different brain regions? 3) How does atrophy identification based on the aphasia/motor-speech categories differ from atrophy identification based on PPA variants?

Methods

Participants were 23 right-handed individuals diagnosed with PPA (11 nonfluent, 8 logopenic, 4 semantic) using the consensus criteria^[1]. A certified and experienced speech-language pathologist (blind to PPA variant) diagnosed aphasia without motor speech impairments and aphasia with concomitant AOS and/or dysarthria based on audio recordings of confrontation naming (Boston Naming Test, Hopkins Action Naming Assessment), single-word repetition (Apraxia Battery for Adults) and connected speech during picture description.

To calculate gray matter parcel volumes, T1 images were processed in MRICloud identifying a total of 276 cortical parcels across the two hemispheres. Volumes were normalized by individual intracranial volume.

Analysis 1. Participants were divided into 3 groups: Aphasia Only, Aphasia+AOS, Aphasia+AOS+dysarthria. For each brain parcel, a one-way ANOVA followed by a Tukey's HSD served to identify normalized brain volumes that differed across the three groups.

Analysis 2. Participants were divided into 3 groups according to PPA variant classifications (nfv, lv, sv), and the same statistical tests were performed.

Results

(1) *Distribution of aphasia/motor speech diagnoses across PPA variants.* None of the svPPA participants had AOS or dysarthria (Figure 1), dysarthria was only found in nfvPPA participants, and AOS was present in both nfvPPA and lvPPA.

(2) *Analysis 1.* Different aphasia/motor speech diagnoses were associated with atrophy in different brain areas, all related to speech and language processing. Individuals with Aphasia Only had greater atrophy in semantic processing regions (e.g., bilateral temporal poles), while individuals with aphasia and motor speech impairments (AOS and/or dysarthria) had greater atrophy in motor planning/execution areas (e.g., bilateral pre and post central gyri).

(3) *Analysis 2*. PPA variants identified atrophy in a much larger number of parcels, both language and non-language-related. Notably, however, the variant-based analysis did not reliably identify all of the motor planning/execution parcels identified in Analysis 1.

Conclusions

We found that while the absence of motor speech impairments distinguished semantic variant PPA (svPPA) from the other two variants, and that the presence of dysarthria distinguished nfvPPA from the other variants, the presence/absence of AOS did not help distinguish between nfvPPA and lvPPA. This is consistent with findings from other studies^[5-8] that AOS is not exclusively associated with nfvPPA. Furthermore, we found that the diagnostic categories of aphasia/AOS/dysarthria may be especially well-suited for identifying atrophy in motor speech processing brain regions. These findings serve to underscore the value of standard diagnostic categories in furthering our understanding of PPA.

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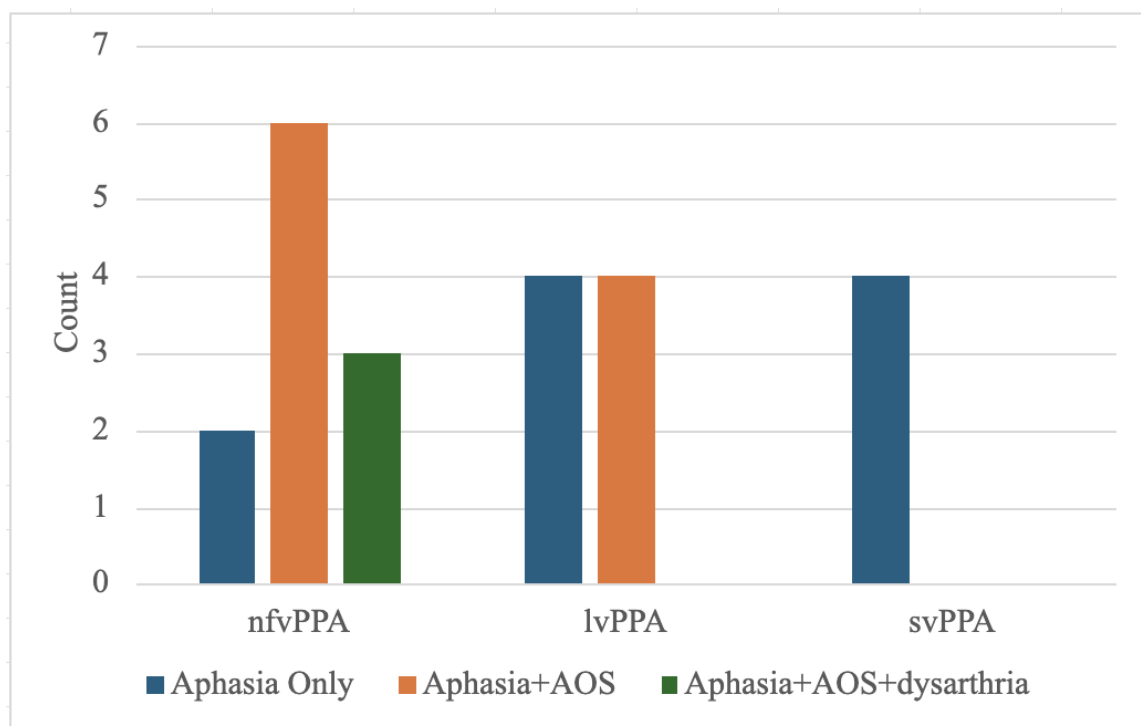


Figure 1. Absence/presence of aphasia/AOS/dysarthria in the three PPA variants.

Enhancing cross-language generalization from cross-modal discourse-based treatment in English-Chinese bilingual Broca's aphasia

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Introduction

Recent advancements in bilingual aphasia treatment have predominantly focused on word or sentence-level interventions, neglecting the potential benefits that discourse-based approaches may offer. Moreover, existing research in this domain primarily examines European languages, neglecting the exploration of languages with significant typological dissimilarities, such as Chinese and English. This study investigates the differential effects of these two treatment modalities on cross-language generalization in a 32-year-old Chinese-English post-stroke individual with chronic Broca's aphasia. Notably, the patient had only received prior treatment in oral Chinese before the commencement of this study and was at the bottleneck phase of recovery.

Methods

The interventions comprised sequential blocks of treatment administered by a licensed speech-language therapist. Treatment 1 and Treatment 2 were conducted, with each including two phases: first in Chinese followed by English after a 6-week break. Each phase lasted 1 hour/day, 3 days/week for 3 weeks. Treatment 1 focused on sentence-level interventions, utilizing color pictures depicting various actions to facilitate language production, following Kempler & Goral (2011). Treatment 2 implemented cross-modal discourse-based approaches, incorporating narrative production and writing tasks. During each session, participants listened to short stories, answered questions, paraphrased the story, and wrote down the story as part of their practice.

Pre- and post-treatment evaluations, along with follow-up assessments, utilized English-Chinese Bilingual Aphasia Test (BAT). Additionally, a picture description task probing different sentence structures was employed to test accuracy in sentence production. Furthermore, the number and complexity of sentences produced or written by the patient during discourse-based treatment sessions were recorded to gauge treatment effectiveness.

Results

The study revealed nuanced nonparallel recovery patterns influenced by language choice and treatment modalities. Sentence-level treatments primarily improved structures shared between Chinese and English, with enhanced efficiency observed in both languages following L2 English treatment. No improvements of L2 English were found after L1 Chinese treatment. In contrast, discourse-based interventions led to broader gains, with significant improvements in the complexity of sentence structures and the number of words produced or written during all of the discourse-based treatment sessions. Interestingly, these improvements were most evident in L1 Chinese and L2 English after L2 English treatment. Furthermore, the participant's Chinese proficiency also improved significantly after L2 English treatment. However, no generalization was observed in L2 English proficiency after L1 Chinese treatment.

Conclusions

Our findings support the Integrated Model of Treatment Effects in Multilingual Aphasia (Goral & Lerman, 2020), suggesting that bilinguals undergoing treatment in one language must suppress interference from their other languages, with stronger inhibition needed for less-used or attrited languages, such as L2 English in this case. Consequently, L2 treatment imposes additional demands on the control system, leading to increased activity in the brain network responsible for language control (e.g., prefrontal cortex), thereby facilitating functional gains in both English and Chinese. Notably, the discourse-based treatment combined with writing appears to impose even greater demands on the control system compared to sentence-level treatment, likely due to its cross-modal nature. These findings suggest that tailored treatment approaches that consider linguistic factors, treatment preferences, and cross-modal interventions are promising for optimizing bilingual aphasia rehabilitation strategies.

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Acknowledgments

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Table 1. Background information of the participant.

Basic Information		
Age at enrolment in the study	32 years old	
Education	Master degree	
Age at cerebrovascular accident (CVA)	28 years old	
Lesion Site	A left CVA resulting in a lesion extending to the left frontal and temporal areas	
Aphasia type	Broca's, diagnosed with WAB (Chinese version) 6 months post onset (AQ=52)	
Language History	Chinese	English
Age learned	Birth	10
Use pre CVA	Frequently	Frequently
Use post CVA	Frequently	Rarely
Had the participant lived in a country that the language was spoken pre CVA?	Yes, China (22 years).	Yes, America (6 years).
Proficiency pre CVA—self-rating	Native	Proficient
Proficiency post CVA— <i>Bilingual Aphasia Test</i> , pre-treatment (maximum score)		
Pointing (10)	10	5
Simple Commands (10)	8	6
Complex Commands (20)	17	14
Verbal Auditory Discrimination (18)	17	13
Syntactic Comprehension (87)	62	58

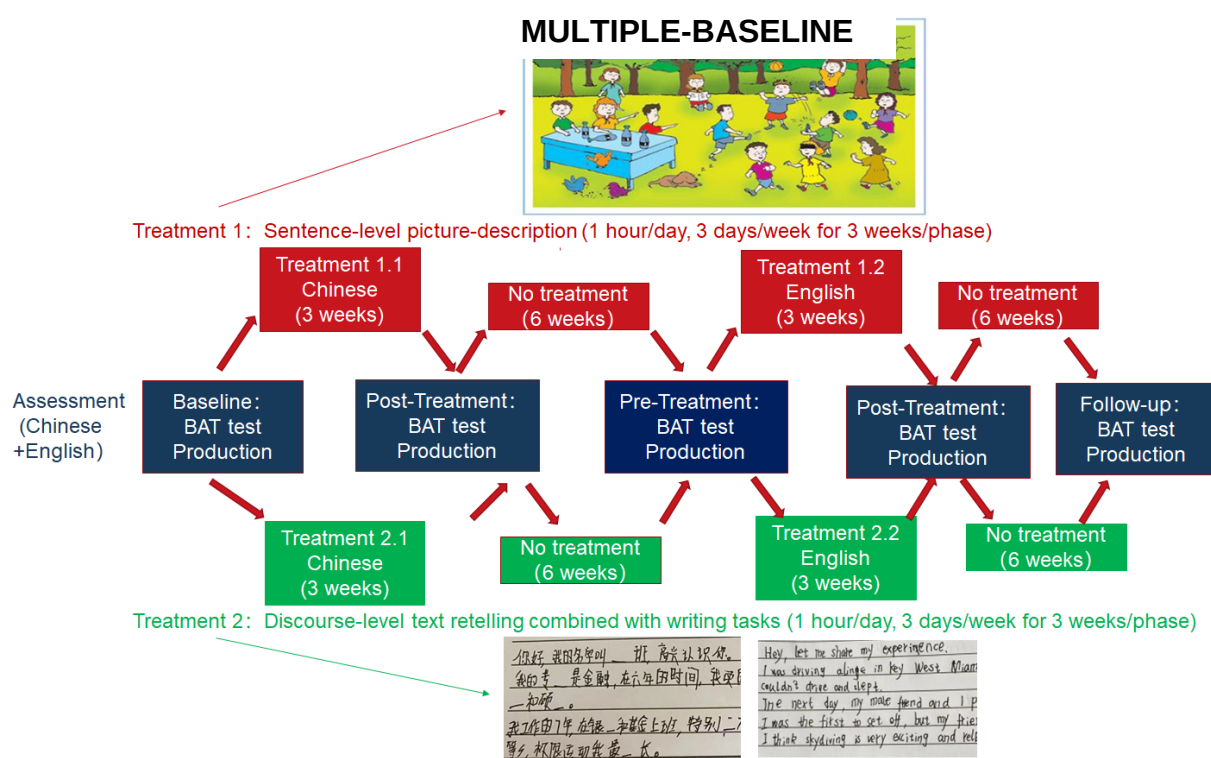


Figure 1. Procedures and examples: sentence-level treatment (top) vs. discourse-based treatment with writing tasks (bottom). Each treatment divided into English and Chinese, with a washout period between.

Comparing idiomatic and compositional compound verb dissociation in the speech of Persian-speaking people with aphasia

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Introduction

Compound (complex) verbs (CV) in Persian are structures with generative essence yet challenging in definition, categorization, and theoretical ground (Tabatabaei, 2005). CVs are made up of more than one word, comprising a nominal and a verbal part (e.g. /værzeʃ kærdaen/ “to exercise”). CVs are prone to inaccurate production in PWA (Mamani et al., 2023; Sazegar Nejad et al., 2021).

CVs may be divided into idiomatic and compositional (Karimi, 1997). The meaning of the idiomatic CVs cannot be extracted from their constituents (e.g. /u ra dour zæd/ (literally means “he twisted around her” but idiomatically means, “he ignored her”), so they seem semantically opaque. The meaning of the compositional CVs is more directly related to their constituents, so they appear semantically transparent.

We hypothesize that semantic transparency may affect CV retrieval. As Lorenz et al. (2014) indicated, more constituent errors were observed for transparent than opaque compound words. They interpreted these results according to decomposition and dual-route accounts of compound word representation (Lorenz et al., 2014). In the current study we aimed at examining the dissociation pattern of idiomatic versus compositional (non-idiomatic) CVs in Persian-speaking people with aphasia (PWA).

Methods

Twenty PWA participated in the study. They included 11 persons with fluent aphasia (including 5 males; mean age=58.27 years, mean post-onset time (POT)=18.73 months), and 9 persons with non-fluent aphasia (including 6 males; mean age=53.33 years, mean POT=81.11months).

The task protocol contained the Persian Narrative Discourse Test (PNDT) (Ghayoumi et al., 2015), Picture description task (Nilipour et al., 2016), and open-ended questions. The inter-rater and intra-rater reliability was calculated for 25% of the speech samples.

Results

Inter-rater and intra-rater agreement for CVs were strong (>95%). The total number of idiomatic and compositional CVs as well as number of errors for these two categories are depicted in table 1. Interestingly, we found no error in idiomatic CVs.

Conclusions

Lack of any error in the idiomatic CVs in comparison to the erroneous production of the compositional CVs may be explained through weaver ++ model (Levelt et al., 1999).

There were different error patterns in the transparent compositional CVs: use of semantically related noun with wrong verbal element (e.g., /naxon mikone/ for /naxon migire/ “trims nails”, and /naxongir migire/ “trims nail clipper” for /naxon migire/ “trims nails”); CV-making (e.g.,

/xab mikone/ for /xabidæn/ “to sleep”); applying wrong verbal part (e.g. /tʃɛjmæk kærdæn/ for / tʃɛjmæk zædæn/ “winking”, or /surax zædæn/ for / surax kærdæn/ “to puncture”); and elimination of the nominal or verbal part of compositional CV.

Based on the semantic transparency account, we may assume that a whole conceptual-semantic representation besides their constituents will appear for non-idiomatic CVs, while idiomatic CVs will be represented as a whole without their constituents. At the lemma level, a parallel activation of full-form besides the constituents are expected for non-idiomatic CVs (see figure 1). The effect of semantic transparency is consistent with the dual-rout model that assume full form access for opaque compounds and decomposable access for transparent compounds.

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Table 1 comparing idiomatic and compositional compound verbs in PWA.

		PWA (Total)	Fluent PWA	Non- fluent PWA
Idiomatic compound verbs	Number of verbs	34	25	9
	Number of errors	0	0	0
Non- Idiomatic compound verbs	Number of verbs	2638	1675	963
	Number of errors	357	140	217

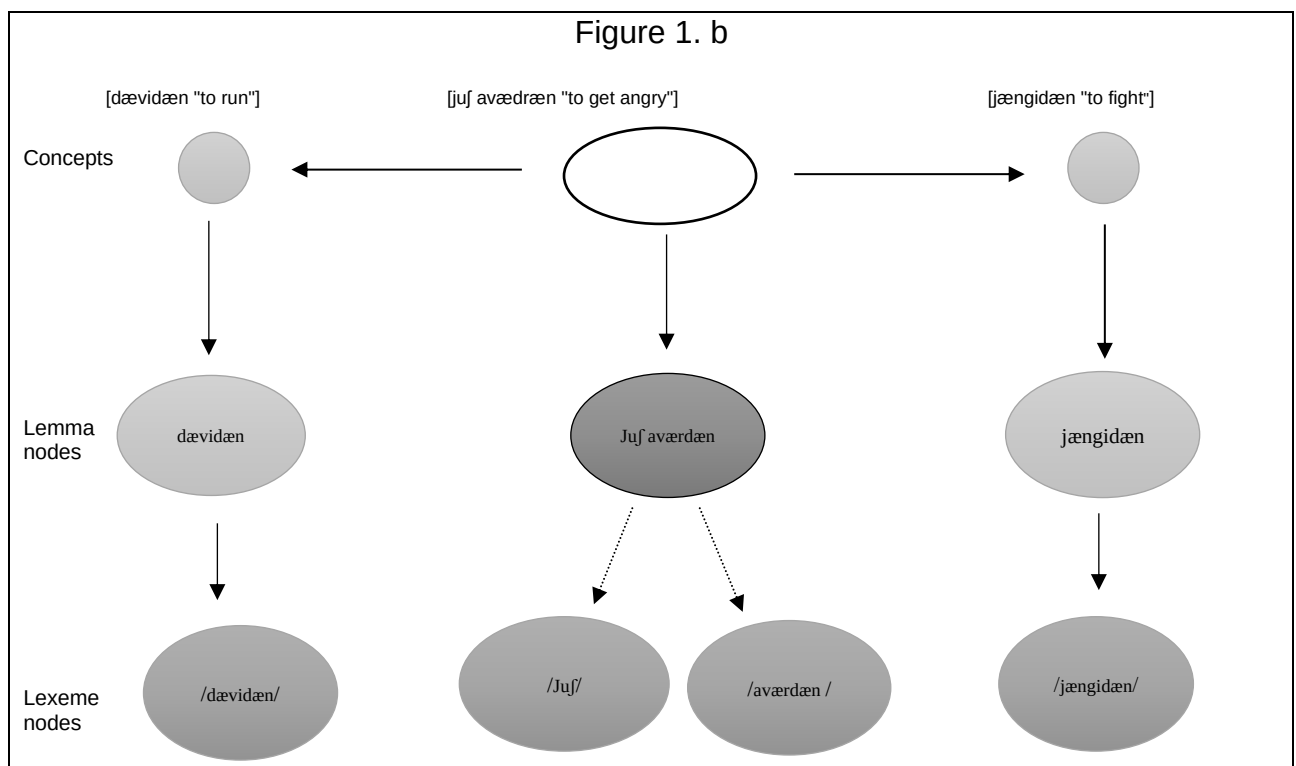
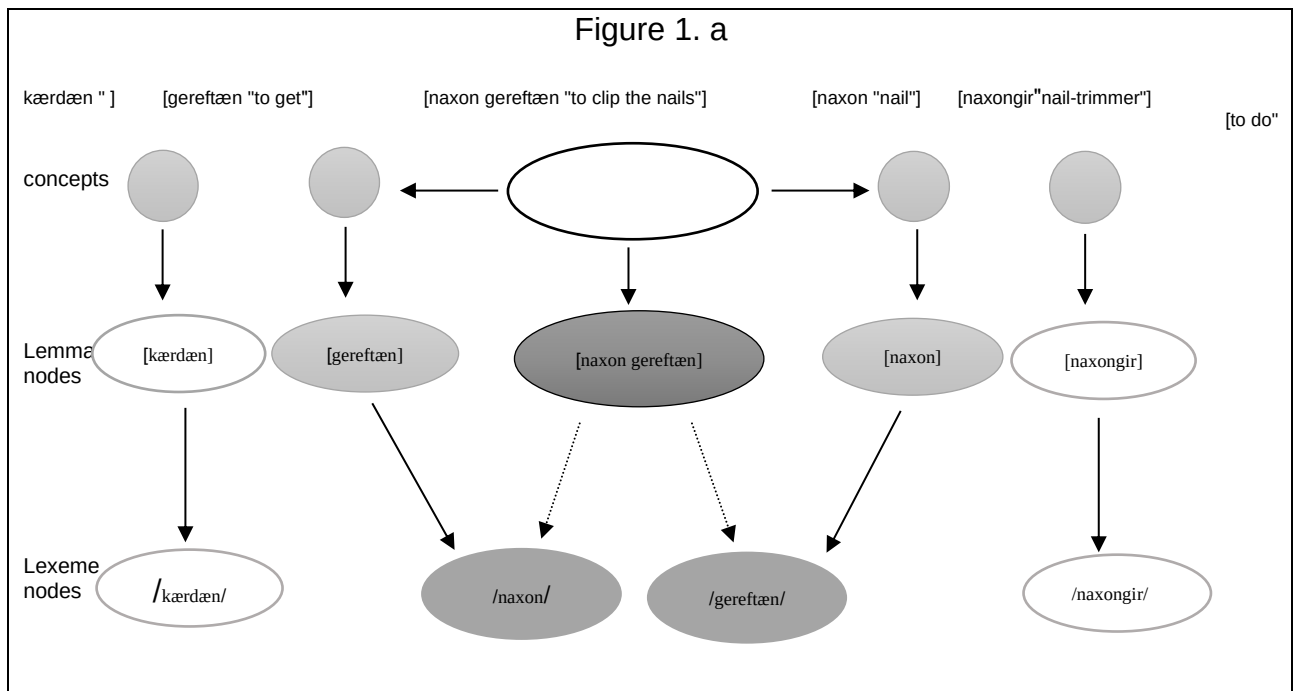


Figure 1 a. compositional verb representation scheme; b. idiomatic verb representation scheme.

Phenotyping expressive syntactic deficits

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Introduction

There are two main types of expressive syntactic deficit in aphasia: agrammatism and paragrammatism. Agrammatism is often characterized by reduction or simplification of morphosyntax, while paragrammatism is characterized by over- and/or misuse of morphosyntax, rather than reductions. Paragrammatism has received less attention than agrammatism with no large-scale structural descriptions available in the literature. Prior work on (par)agrammatism has largely relied on perceptual judgments based on patient observation rather than structured neuropsychological or linguistic testing batteries. Such perceptual judgments appear to be quite reliable for agrammatism, but much less so for classifying paragrammatism (c.f., Matchin et al., 2020). In order to fill this gap, we have introduced a novel error-coding scheme—the Syntactic Utterance-Based Analysis (SUBA)—a framework which allows for a systematic approach to syntactic errors observed in elicited discourse samples. This framework is based on assumptions from extant theoretical, mechanistic models of sentence production and focuses on capturing breakdowns in positional (more agrammatism-like) vs functional (more paragrammatism-like) processing (Bock & Levelt, 1994).

Methods

We analyzed transcripts of 88 people with aphasia (PWA) and 53 healthy controls (HC) retelling the story of Cinderella. Perceptual judgments for 53 of the 88 PWA were available from Matchin et al. (2020). Each utterance in the sample was coded as containing no errors (G), containing only a semantic (S) or phonological (N) error, or containing an error in functional (F) or positional (P) processing. For each participant (PWA & HC), proportion of utterances (e.g.: $n_G/\text{total } n \text{ utterances}$) and proportion of errors (e.g.: $n_P/(\text{total } n \text{ utterances} - n_G)$) was calculated for each code/error type. These proportions—interpretable as each participants' distribution of error types—were then submitted to an unsupervised k-means clustering algorithm which attempted to group them, minimizing distance between cluster centers, and selecting the appropriate number of clusters to use.

Results

The algorithm produced 10 clusters of participants, ranging in size from $n = 7$ to $n = 26$. Four of these clusters were dominated by HCs, but still contained some PWA indicating that 1) some PWA produce qualitatively and quantitatively similar distributions of errors to HCs, and 2) that HCs as well can be grouped by the kinds and frequency of errors in discourse. Among the clusters of PWA, we found clusters dominated by positional, functional, and mixed errors. Interestingly, about half of the participants grouped into the functional processing cluster that had been classified by Matchin et al. were perceptually categorized as being neither agrammatic nor paragrammatic, while the other half had been classified as paragrammatic. In the positional processing cluster, however, almost all participants had been classified as agrammatic by Matchin et al. (2020).

Conclusions

These results highlight the importance of integrating linguistic theory into structural descriptions of disordered output, as well as how that can inform our understanding of the neurobiology of syntax.

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Validity of the videoconference administration of the Comprehensive Aphasia Test-Hungarian

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Introduction

The demand for telehealth aphasia assessment is increasing, yet only a limited number of instruments' validity and feasibility in telehealth have been evaluated. The Comprehensive Aphasia Test (CAT) is a widely available language test with established psychometric properties in several languages, including Hungarian. The current study aimed to evaluate the validity of administering the Hungarian version of the CAT (CAT-H) via videoconference and explore the satisfaction of people with aphasia (PWA) with videoconference assessment compared to in-person assessment.

Methods

Twelve PWA with left hemisphere stroke (mean age = 50.83 years, mean post-onset = 19 months), exhibiting mild-to-moderate aphasia, completed both in-person and videoconference assessments using the CAT-H Language Battery. The study used a comparison design, incorporating elements of counterbalancing and blinding. The assessments were conducted by speech-language pathologists (SLPs), with one person leading the in-person assessment and another leading the videoconference assessment for each participant. The order of administration (in-person or videoconference) was counterbalanced across participants. SLPs leading the second assessments were blind to the results of the first assessments. One key adjustment for the videoconference assessment was the utilization of the screen sharing and/or control sharing features within the videoconferencing software. Participants also filled out a satisfaction questionnaire after each assessment and expressed their preference between the two assessment methods at the end of the study. Intraclass correlation coefficients (ICCs) were calculated to compare the CAT-H modality summary scores and the CAT-H language battery score between in-person and videoconference assessments.

Results

There was good-to-excellent agreement between in-person and videoconference assessments, with ICCs ranging from 0.80 to 0.96 ($p < 0.001$) for the CAT-H modalities (Table 1) and an ICC of 0.97 for the CAT-H language battery score. At the individual level, minor inconsistencies were observed in the language battery score between the two assessments. Participants reported high satisfaction with both assessment methods, with satisfaction levels for the videoconference assessment being comparable to those for the in-person assessment. While most participants did not exhibit a preference between the two methods in terms of understanding the clinician, approximately half of them favored the in-person assessment for expressing themselves and comfort.

Conclusions

Our results suggest that the CAT-H can be effectively administered via videoconference, offering a viable alternative to in-person assessment when necessary. Future studies should

replicate these findings with a larger and more diverse study sample, involving participants with moderately severe and severe aphasia.

Acknowledgments

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Table 1. Intraclass correlations for the CAT-H modalities.

CAT-H modality	N of participants	df1	df2	ICC	p	95% CI	
						LCF	UCF
Spoken language comprehension	12	11.00	11.26	0.84	< 0.001	0.54	0.95
Written language comprehension	12	11.00	10.74	0.80	< 0.001	0.45	0.94
Repetition	12	11.00	11.25	0.93	< 0.001	0.79	0.98
Naming	12	11.00	11.01	0.95	< 0.001	0.83	0.99
Spoken picture description	12	11.00	11.88	0.94	< 0.001	0.82	0.98
Reading aloud	12	11.00	11.26	0.96	< 0.001	0.88	0.99
Writing	12	11.00	11.27	0.95	< 0.001	0.85	0.99
Written picture description	12	11.00	11.43	0.90	< 0.001	0.70	0.97

Note. ICC = Intraclass correlation coefficient, LCF = lower confidence limit, UCF = upper confidence limit. Intraclass correlations are presented for raw scores.

Prosody of speech production in latent aphasia

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Introduction

Latent aphasia is a mild aphasia type in which affected individuals perform within normal limits on clinical aphasia batteries. Identification of latent aphasia is challenging and very little is known about speech output in this aphasia type. To address these knowledge gaps, we examined: (1) how latent aphasia affects features of expressive prosody according to different word positions in utterances. (2) To investigate whether prosody markers can identify people with latent aphasia versus neurotypical controls. (3) To explore the potential of expressive prosody and demographic information in correctly classifying people with latent aphasia versus neurotypical controls.

Methods

Speech of the story of Cinderella from AphasiaBank (MacWhinney et al., 2011) was used from 10 speakers with latent aphasia (WAB severity mean = 97.2) and 10 neurotypical controls, similar in age, education, and sex.

Following Cooper and Sorensen (1977), mean fundamental frequency (f0), mean intensity and duration of words in utterance-initial and utterance-final positions were extracted using Praat (Boersma & Weenink, 2023) to investigate if prosodic cues differ between the two groups of participants.

For classification, we extracted 988 acoustic features using the *emobase* features in the *openSMILE* (Eyben et al., 2010) toolkit. Additionally, we used random forest models to examine: a) whether expressive prosody and demographic information (age, sex, education) can reliably predict classification; (b) the importance of prosodic features among other acoustic features. Finally, we used two cross-validation methods to evaluate the classification: *CV_Random* used a 70%-30% train-test data-split across all data points; *CV_Balanced* used a balanced dataset of four speakers (two per group) as the test dataset.

Results

Linear mixed effects models (see Table 1) revealed an effect of word position, with utterance-final f0 being significantly higher than word-initial. Controls produced utterance-final words with significantly higher f0 values than the utterance-initial words. The latent aphasia group showed significantly higher f0 in utterance-initial than utterance-final words. Similarly, mean intensity was significantly higher at utterance-final position than utterance-initial position for the controls, but lower for the latent group. Finally, mean word durations were significantly longer for the aphasia group. Across groups, utterance-final words were significantly longer than the utterance-initial words.

CV_Random showed 97.8% accuracy (sensitivity=.986; specificity=.971) showing the features were sufficient for predicting the classification. *CV_Balanced* showed an accuracy of 78.4% (sensitivity=.619; specificity=1), showing good inter-speaker prediction.

To further investigate prosodic aspects, we also examined the top 10 important factors in the *CV_balanced* random forest model (Figure 1). The top 6 factors and the 10th key factor were all intensity-related Pulse Code Modulation; the 7th to the 9th factors were f0-related.

Conclusions

The two groups differed in mean f0 and intensity in utterance-initial and utterance-final word positions, which may be due to different manners the two groups executed speech plans. The longer word durations in the latent group could reflect slower speaking rates possibly due to processing speed limitations (DeDe & Salis, 2022). The random forest modelling further supports the regression findings and holds promise for developing online speech-based assessment tools for clinical uses.

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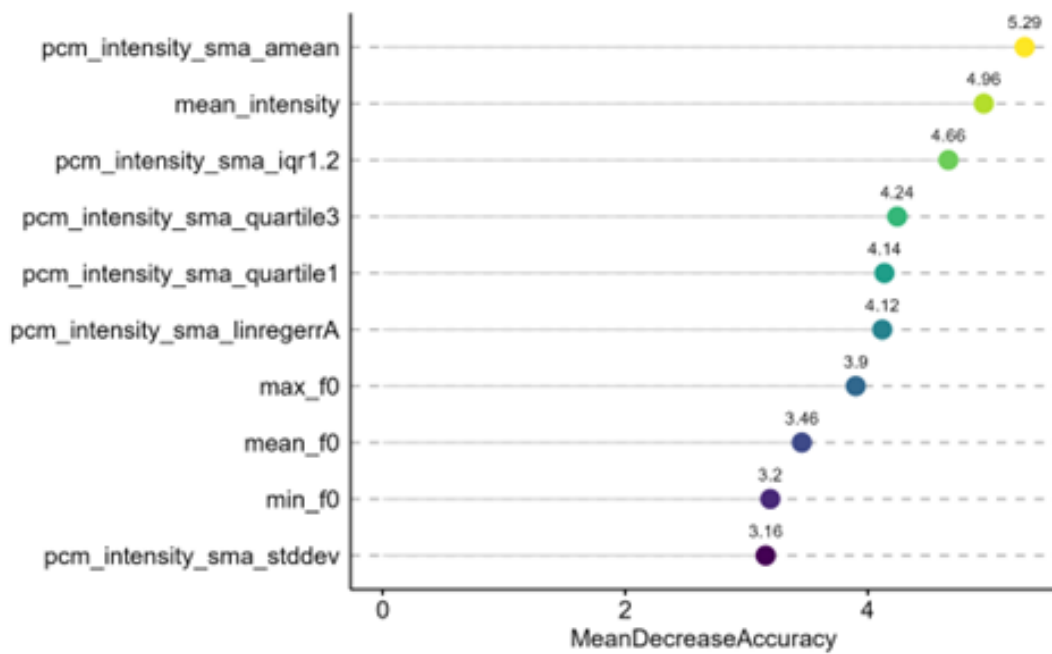
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Table 1. Results of linear mixed effect models.

	Predictors	Estimates	t	p
Mean f0	(Intercept)	136.28	16.56	<0.001
	group [latent]	20.00	1.71	0.102
	position [F]	14.42	4.13	<0.001
	group [latent] × position [F]	-17.30	-2.98	0.003
Mean Intensity	(Intercept)	67.93	25.50	<0.001
	group [latent]	-6.33	-1.68	0.110
	position [F]	0.54	1.96	0.050
	group [latent] × position [F]	-1.05	-2.22	<0.050
Mean Word Duration	(Intercept)	0.27	12.92	<0.001
	group [latent]	0.07	2.44	<0.050
	position [F]	0.16	13.10	<0.001
	group [latent] × position [F]	0.01	0.53	0.597



Note. The higher the Mean Decrease Accuracy value, the more important it is in predicting the classification.

Figure 1. The top-10 features for predicting the classification of speaker group.

Priming adjuncts: Improving content informativeness in aphasia

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Introduction

Efficient use of adjunct phrases (*on the rug, by the weekend*) is crucial to informativeness in language production, although they are not obligatory parts of speech. Impoverished information content is common in persons with aphasia (PWA). However, little research has focused on a) the processing of adjunct phrases in aphasia, and b) strategies to improve PWA's production of adjunct phrases. Structural priming – a tendency to reuse previously encountered linguistic structures ("prime") – implicitly facilitates the production of complex syntactic structures such as passives in PWA (Lee et al., 2023; Saffran & Martin, 1997). However, it remains unknown whether structural priming is also effective in increasing the informativeness of speech in PWA. We investigated whether PWA and controls can use locative adjunct phrases (*on the bench*) more frequently following implicit priming and which different factors (syntactic, lexical, and attentional saliency) enhance such priming effects.

Methods

18 PWA and 18 age- and gender-matched controls completed a reading-to-picture description priming task. They read a prime sentence and then described a target action picture depicting a person performing an action with a background location (*the boy is crying on the rug*). As in Table 1, the priming task involved a 2 x 2 x 2 factorial design: prime type (locative phrase prime vs. no prime), lexical overlap (same vs. different locatives) and attentional saliency (sentence-initial vs. sentence-final position of locatives). Additionally, participants completed a set of discourse tasks before and after the priming task to assess generalized priming effects on more naturalistic speech. It was predicted that if priming is successful, participants would be more likely to include the optional background location in their speech production.

Results

Both groups produced more locative phrases during picture descriptions after reading primes with locative phrases compared to primes with no locative phrases ($B = 1.38$, $z = 5.23$, $p < .001$), although the priming effect was smaller in PWA ($B = -0.86$, $z = -2.76$, $p < .05$). Having lexical overlap boosted priming effects: both groups showed a larger priming effect in the same vs. different locative primes ($B = 0.93$, $z = 3.01$, $p < .01$). However, priming effects did not vary as a function of sentence-initial vs. final positions of locative phrases ($p > .05$). The discourse data are currently being analyzed.

Conclusions

These findings provide novel evidence that implicit priming is effective in improving information content in PWA and controls. After simply reading sentences with locative phrases, our participants were more likely to use locative adjunct phrases to provide more details about the pictured events in their utterances. Lexical repetition, but not attentional saliency of the locatives, resulted in enlarged priming effects. Together, these results suggest priming of lexical-syntactic information is most crucial for improving the informativeness of speech (Chang et al., 2006; Reitter et al., 2011). Further theoretical and clinical implications will be discussed. We will also present discourse data (analysis in

progress) to support the generalization of the current priming effects to improved informativeness in more natural language processing.

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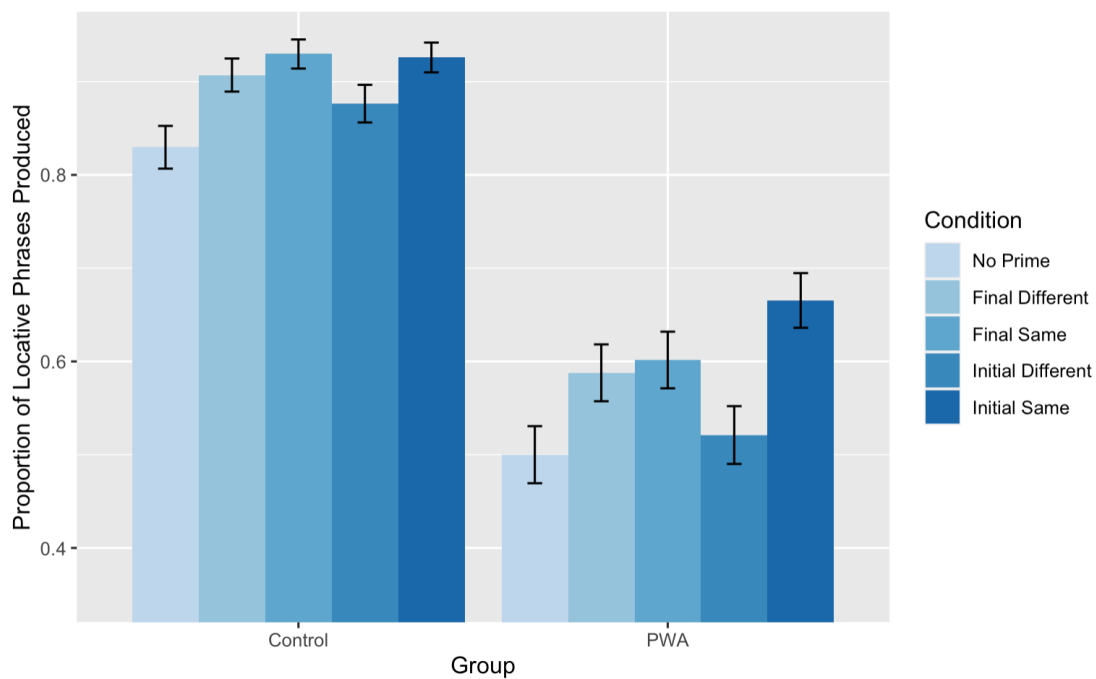
Acknowledgments

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Table 1
A set of example of prime and target stimuli used in the experiment

Prime Type	Lexical Overlap	Attentional Saliency (Position of locatives)	Prime Example	Target Picture
Locative	Same	Final	The actor is smoking on the rug	
Locative	Different	Final	The actor is smoking at the bar	
Locative	Same	Initial	On the rug, the actor is smoking	The boy is crying (on the rug)
Locative	Different	Initial	At the bar, the actor is smoking	
No Prime	No Prime	No Prime	The actor is smoking	

Figure 1
Priming effects across different conditions for PWA and Age-matched controls



Note:

Final Different: sentence-final, different locative phrases between prime and target

Final Same: sentence-final, same locative phrases between prime and target

Initial Different: sentence-initial, different locative phrases between prime and target

Initial Same: sentence-initial, same locative phrases between prime and target

The effects of music training on rehabilitation of speech categorical perception in Chinese people with post-stroke aphasia

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Introduction

Music and speech share many acoustic commonalities and cognitive mechanisms. Previous studies have found that music training can improve rehabilitation of speech perception in people with post-stroke aphasia. However, it remains to be established whether music training can enhance the rehabilitation of categorical perception of Mandarin tones and VOT in Chinese people with post-stroke aphasia and whether the training effects can be influenced by the training programs and training duration.

Methods

In the present study, 30 patients were assigned randomly to carillon group, drum group and control group. With the design of pretest, middle-test and posttest, the two musically-trained groups received pitch-based training (carillon playing) or rhythm-based training (drum beating) three times a week, 40 minutes each time, and the control group carried out handcraft activities simultaneously. Three experiments were included: tests of the sound processing under music condition, CP of lexical tones and VOT under speech condition before the onset of study, after 6-month and 12-month training or activities.

Results

Results showed that before training and after 6-month training, there was no significant difference in various music sound processing abilities among the three testing groups. However, after 12-month training, the overall musical abilities in carillon group and drum group were significantly better than control group, and there was no significant difference between the two musically-trained groups. These results indicated that long-term musical training, being pitch-based and rhythm-based, could enhance patients' overall abilities to process music sounds. Furthermore, pitch perception and song singing scores in the carillon group were significantly higher than those in the drum group and the control group, and both music groups performed much better than the control group in beat synchronization tests, demonstrating that pitch-based training enhanced patients' sensitivity to music pitch and temporal information, while rhythm-based training only improved their abilities to process temporal cues in music.

Conclusions

These findings are significant for researchers and clinicians in speech-language rehabilitation, clinical psychology, and cognitive communication.

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Aphasia-related functioning assessment: ICF-based item response modeling

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Introduction

The International Classification of Functioning, Disability, and Health (ICF) provides a standardized theoretical framework for individual functioning. Wallace et al. have used the ICF to identify domains for a core outcome set for aphasia (Wallace et al., 2017). However, the psychometric properties of the present core set has not yet been validated. By applying item response theory (IRT) techniques, we aimed to extract and validate a concise ICF core set for people with aphasia (PWA) and suggest a potential person-item goal-setting strategy.

Methods

A convenience sampling cross-sectional study of 93 PWA was conducted using the maximum variation sampling strategy. All subjects and their relatives completed a 66-item ICF questionnaire. **Figure 46** shows the workflow referred to relevant studies (Gikaro et al., 2023; Chen et al., 2023; Jiang et al., 2023; Feng, Geng, et al., 2022; Feng, Jiang, et al., 2022; Zhu et al., 2024). The ICF categories were filtered by two non-parametric item response models (IRMs) in the Mokken scale analysis (MSA), including the monotone homogeneity model (MHM) and the double monotonicity model (DMM). Four parametric IRMs were constructed based on the MHM, including the 1-parameter logistic model (1PLM), 2PLM, 3PLM, and 4PLM. We selected the optimum model via model-data goodness-of-fit and likelihood-based model-model comparison. The optimum PLM offered the person ability values (θ) and the item difficulties for plotting the final person-item map.

Results

The MSA generated a 33-item MHM and a 33-item DMM. The optimum parametric IRM was a 26-item 2PLM with Cronbach's $\alpha = 0.8845$, Guttman's $\lambda^2 = 0.8924$, the Molenaar-Sijtsma statistic = 0.8911, and the latent class reliability coefficient (LCRC) = 0.9375. Person ability (θ) values estimated by the 2PLM were significantly correlated with the Aphasia Quotient (AQ) of Western Aphasia Battery (WAB) ($p < 0.001$, $r=0.59$). We exemplify the possible assessment-to-treatment insights from the person-item map by interpreting one case of the participants. In **Figure 47**, the logit value corresponding to θ was plotted on the left side, the higher the ability, the higher the score. On the right side was the logit value corresponding to item difficulty, the more difficult the item, the higher the score. The dotted line represented the θ of the subject L., W. Those listed below the dotted line were expected to be competent, while those listed above the dotted line were assumed to be unable. Incompetent entries were marked with an asterisk.

Conclusions

This study developed a concise 26-item ICF scale with optimum psychometric properties for making comprehensive aphasia-related functioning assessments and rehabilitation goal settings.

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FL and Z-LJ contributed to the research concept, supervised the entire study, performed the analysis, and generated the images. L-JZ recruited subjects, processed the data, and wrote the manuscript with JG. X-TY, C-GW, and QZ recruited subjects. All authors contributed to the article and approved the submitted version. The authors appreciate all the study participants' cooperation.

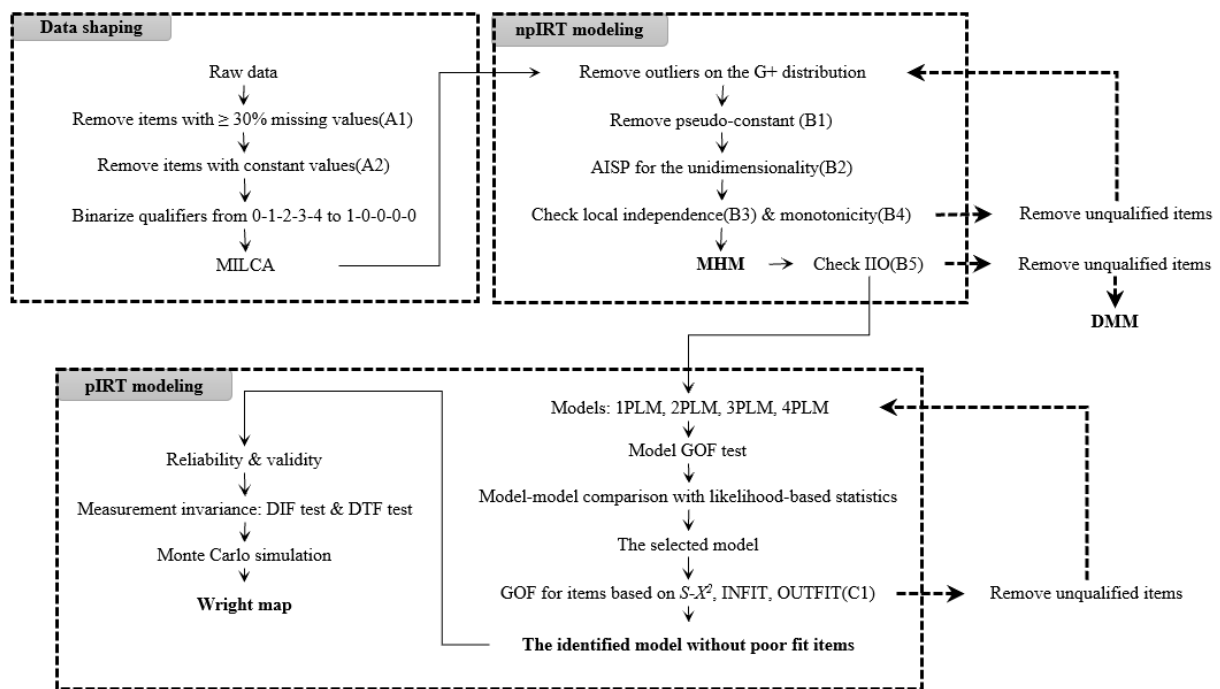
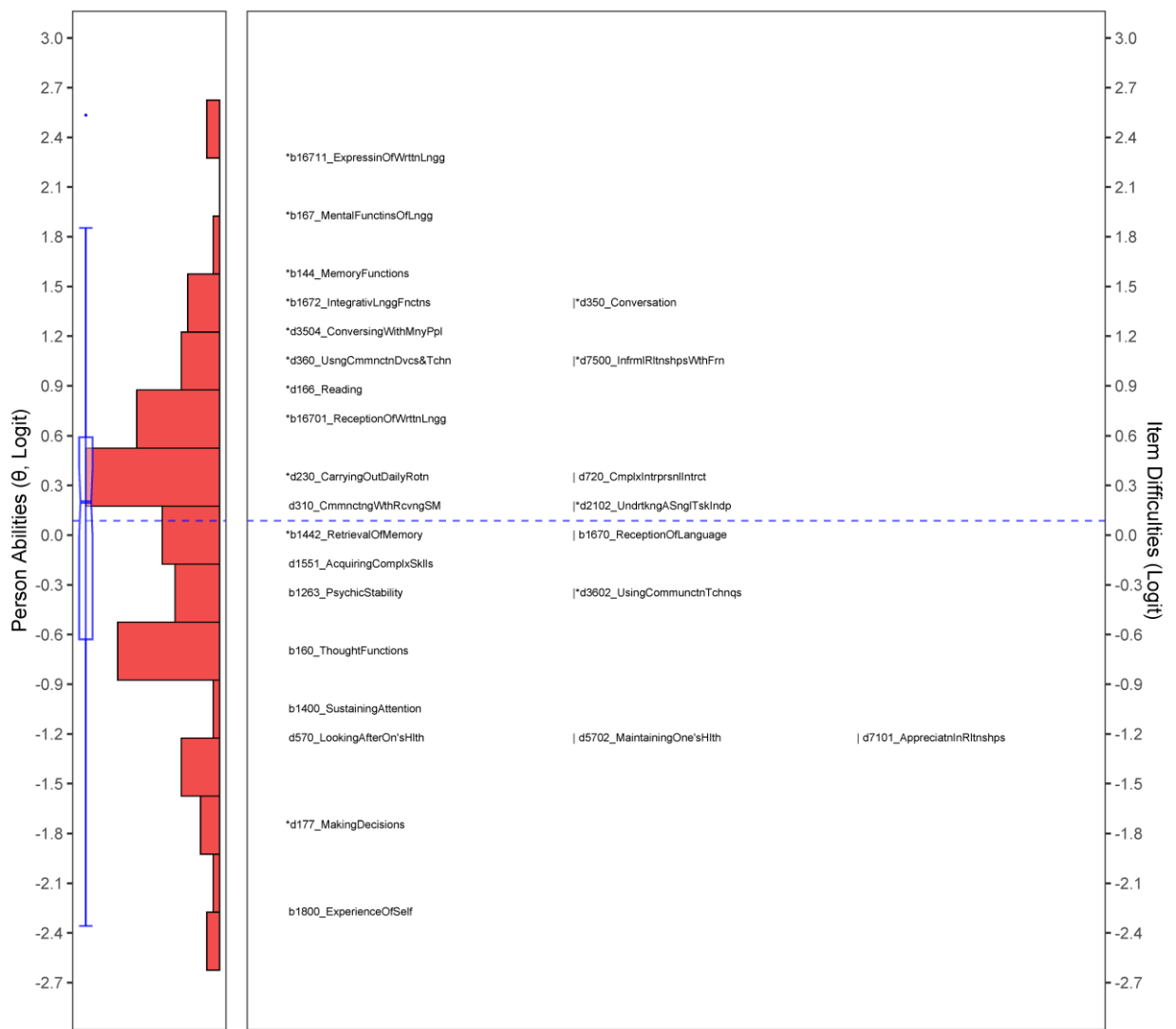


Figure 46. IRT modeling flowchart.

1PLM: one-parameter logistic item response model. 2PLM: two-parameter logistic item response model. 3PLM: three-parameter logistic item response model. 4PLM: four-parameter logistic item response model. AISP: automatic item selection procedure. DIF: differential item functioning. DMM: double monotonicity model. DTF: differential test functioning. G+: number of Guttman errors. GOF: goodness-of-fit. IIO: invariant item ordering. INFIT: inlier-sensitive fit/information-weighted fit. IRT: item response theory. MHM: monotone homogeneity model. MILCA: multiple imputation procedure based on latent class analysis. npIRT: non-parametric IRT. OUTFIT: outlier-sensitive fit. pIRT: parametric IRT. S-X²: signed chi-squared test statistic.



Median of person ability: 0.2003. Specific Person: L., W. Dashed Line: $\theta = 0.0863$ Logit
 *. Dysfunctional items of the specific person. Binwidth = 0.35 Logit. Item difficulties were median values estimated via Monte-Carlo Simulation

Figure 47. Adjusted Wright map of subject L., W.
 Dashed Line: person ability of subject named L., W. with $\theta = 0.0863$ Logit.

Measuring the health impacts of aphasia treatments: Does the EQ-5D-3L measure up?

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Introduction

The cost-effectiveness of aphasia treatments needs to be assessed via economic evaluations based on health-related quality of life (HRQOL). In turn, decision makers can direct resources to treatments that show the greatest health benefits to individual patients and value to society (Whitehurst et al., 2015). However, people with aphasia are often excluded from the relevant research. Typically, economic evaluations express health benefits in terms of Quality Adjusted Life Years converted from generic quality of life instruments (Drummond et al., 2015). The generic EuroQol 5-Dimensions Health Questionnaire, 3-Level (EQ-5D-3L) permits conversion to utility values required for economic evaluations but is not validated for use for people with aphasia (Whitehurst et al., 2015). The aphasia-specific Stroke and Aphasia Quality of Life Scale-39g (SAQOL-39g) measures HRQOL, however, cannot generate utility values (Hilari et al., 2003). This study aimed to compare the structure and performance of the EQ-5D-3L and the SAQOL-39g (Figure 1).

Methods

Pooled survey data from the Constraint Induced or Multi-Modal Personalised Aphasia Rehabilitation (COMPARE) randomised control trial. Quality of life was rated by participants at baseline and 12-week outcome assessment using the SAQOL-39g and the EQ-5D-3L. Spearman's rank correlation coefficient ρ was used to describe correlations between the EQ-5D-3L (domain and utility scores; visual analogue scale) and the SAQOL-39g (domain; total mean scores). Area Under the Curve (AUC) analysis assessed the EQ-5D-3L's sensitivity and specificity in distinguishing poor HRQOL.

Results

193 participants completed both surveys (69% male, median age 63.6 years, median time since stroke 2.5 years). 45-79% of participants rated themselves at full health across the EQ-5D-3L dimensions, compared to 0-6% on the SAQOL-39g at baseline (Table 1). Ceiling effects on the EQ-5D-3L limited responsiveness to change. Convergent validity between the SAQOL-39g communication domain and the EQ-5D-3L (r 0.15-0.26) was weak. EQ-5D-3L

utility scores demonstrated considerable accuracy (AUC =0.80) in detecting compromised HRQOL.

Conclusions

Our findings suggest that EQ-5D-3L use in economic evaluations including people with aphasia requires caution. With approximately a third of patients with stroke experiencing aphasia, the EQ-5D-3L instrument may underestimate the overall burden of stroke. These results raise implications for economic evaluations comparing stroke outcomes with other health conditions. Development of utility valuation for HRQOL instruments for people with aphasia is needed to ensure economic evaluations are meaningful and aphasia treatments can be reliably evaluated.

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Dimensions	EuroQol EQ-5D-3 Level					EQ-5D-Visual Analogue Scale	Stroke and Aphasia Quality of Life Scale-39g		
	Mobility	Self-care	Usual activities	Anxiety/depression	Pain/discomfort	Overall health	Physical	Psychosocial	Communication
Full health Worst health	1= No problems 2= Some problems 3= Extreme problems						5= No trouble at all 4= A little trouble 3= Some trouble 2= A lot of trouble 1= Couldn't do it at all		
Recall period	Today					Today	In the last week		

Figure 48. Comparison of features between the EQ-5D-3 Level and the Stroke and Aphasia Quality of Life Scale 39-g Quality of Life Instruments.

Table 1. Distributions of scores for self-rated quality of life.

EQ-5D-3L*	Mobility n (%)	Self-Care n (%)	Usual Activities n (%)	Anxiety/Depression n (%)	Pain/Discomfort n (%)
Baseline (n=201)					
No problems	117 (58)	156 (78)	91 (45)	151 (79)	118 (59)
Some problems	84 (42)	43 (21)	98 (49)	39 (20)	80 (40)
Extreme problems	0 (0)	2 (1)	12 (6)	3 (1)	3 (1)
12 weeks (n=193)					
No problems	109 (56)	154 (80)	98 (50)	151 (78)	122 (63)
Some problems	82 (43)	37 (19)	90 (47)	39 (20)	66 (34)
Extreme problems	1 (1)	2 (1)	5 (3)	3 (2)	5 (3)
Change (n=193)					
Improved	22 (12)	12 (6)	31 (16)	15 (8)	17 (9)
No change	151 (78)	165 (86)	119 (62)	159 (82)	152 (79)
Decline	20 (10)	16 (8)	43 (22)	19 (10)	24 (12)
SAQOL-39g ⁺	Physical n (%)		Psychosocial n (%)		Communication n (%)
Baseline (n=201)					
No trouble at all	12 (6)		2 (1)		0 (0)
A little trouble	115 (57)		74 (37)		32 (16)
Some trouble	54 (27)		79 (39)		79 (39)
A lot of trouble	17 (8)		40 (20)		66 (33)
Couldn't do it at all	4 (2)		7 (3)		25 (12)
12 weeks (n=193)					
No trouble at all	15 (8)		3 (1)		2 (1)
A little trouble	103 (54)		74 (39)		32 (17)
Some trouble	52 (27)		68 (36)		87 (45)
A lot of trouble	18 (10)		39 (20)		53 (28)
Couldn't do it at all	2 (1)		7 (4)		17 (9)
Change (n=193)					
Improved	86 (46)		92 (49)		100 (53)
No change	15 (8)		11 (6)		23 (12)
Decline	87 (46)		86 (45)		66 (35)

*EQ-5D-3L: Euroqol EQ-5D 3 Level; ⁺SAQOL-39g: Stroke and Aphasia Quality of Life Scale, 39 item.