Jaargang 23, Supplement 1, september 2018

Stem-, Spraak- en Taalpathologie

19th International Science of Aphasia Conference - Venice

Conference Program

19th Science of Aphasia Conference, Venice, 18-22 September 2018

Tuesday, September 18, 2018

18.00 - 19.00 **Welcome drink and registration**

Wednesday, September 19, 2018

8.15 – 9.00 **Registration**

9.00 – 9.15 **Welcome and Introduction**

9.15 – 11.45 **Invited talks: Embodied Cognition**

9.15 - 10.15 Luciano Fadiga (University of Ferrara) -
Action, Interaction, Communication

10.15-10.45 coffee

10.45-11.45 Greig de Zubicaray (Queensland University of Technology) -
If embodiment is the answer, what was the question?

12:00 – 13.30 **Lunch**

13:30 – 15:00 **Contributed papers oral session 1**

1. Georgia Roumpea, Anastasia Nousia, Stavroula Stavrakaki, Grigorios Nasios, Cristina Manouilidou - Revisiting aspect in Mild Cognitive Impairment and Alzheimer's disease: evidence from Greek
2. Svetlana Malyutina, Valeriya Zelenkova, Aleksandra Savcenko - Effects of three verb argument structure parameters on action naming and sentence production in aphasia
3. Ana Murteira, Lyndsey Nickels - Gesture comprehension and semantic knowledge in people with aphasia: evidence for dissociation of performance
4. Valentina Bambini, Luca Bischetti, Chiara Bonomi, Giorgio Arcara, Serena Lecce, Mauro Ceroni - Beyond the motor account of Amyotrophic Lateral Sclerosis: Relationship between pragmatics and Theory of Mind deficits as revealed through metaphors and jokes
5. Cecilia Devers, Silvia Martínez Ferreiro, Seçkin Arslan - Using Support Vector Machines to identify determinants of pronoun difficulty in aphasia: a preliminary critical review and meta-analysis of individual data

6. Marieke Blom-Smink, Mieke van de Sandt-Koenderman, Hester Lingsma, Majanka Heijenbrok-Kal, Gerard Ribbers - Validation of a prediction model for verbal communicative ability of aphasic stroke patients after inpatient rehabilitation

15.00–15.30 Coffee

15.30 – 17.00 Poster Session I

15.30- 16.00 Short (3 slide) presentations poster session I

1. Martina Abbondanza, Laura Passarini, Francesca Meneghello, Daniela D'Imperio, Carlo Semenza - Topic and Focus: The activation of Left Periphery in neglect dyslexia
2. Ann-Katrin Ohlerth, Antonio Valentin, Keyoumars Ashkan, Francesco Vergani, Molood Sadat Safavi, Frank Zanow, Roelien Bastiaanse - Eliciting verb inflection in the English language – The Verb and Noun Test (VAN) for Presurgical Language Mapping with navigated TMS and Interaoperative DES
3. Juliana Andrade Feiden, Srđan Popov, Roelien Bastiaanse - The influence of conceptual number agreement on intra and inter-sentential co-reference establishing: An ERP study in Brazilian Portuguese
4. Seçkin Arslan, Lilla Zakariás, Christos Salis, Isabell Wartenburger - Language and working memory in a bilingual Turkish-German individual with aphasia
5. Anita Bethge, Nicole Stadie - Semantic Complexity in the treatment of naming deficits in Alzheimer's disease
6. Ioanna Bourotzoglou, Stavroula Stavrakaki, Vassiliki Koukoulioti, Panagiotis Ioannidis - Therapy gains of a linguistically based intervention in Primary Progessive Aphasia. Insights from a single case study
7. Ashley Cameron, Kyla Hudson, Emma Finch, Jennifer Fleming, Jennifer Lethlean, Steven McPhail - "I've got to get something out of it. And so do they": Experiences of people with aphasia and university students participating in a communication partner training program for healthcre professionals.
8. Willemijn J. Doedens, Lotte Meteyard - Face-to-Face Communication in Aphasia: a Theoretical and Experimental Approach to Functional Communication
9. Megan Esler, Maria Garraffa - First Simple makes last complex: construct irrelevant variance effects in the test of grammatical comprehension.
10. Byurakn Ishkhanyan, Violaine Michel Lange, Kasper Boye, Anke Karabanov, Gesa Hartwigsen, Hartwig Roman Siebner - Grammar and lexicon distinction in the left inferior frontal gyrus: a TMS study
11. Tóth Alinka, Ivaskó Lívia, Kis Orsolya, Jakab Katalin, Vécsei László - Interaction between linguistic and numerical abilities of Hungarian patients living with mild or moderate aphasia
12. Khwaileh, Tariq - The Gulf Arabic Aphasia Test

Thursday, September 20, 2018

9.00 – 11.00 Invited Talks: Action

09.00 – 10.00 Angelika Lingnau (Royal Holloway London) -
The organization of observed actions in the human brain

10.00 – 11.00 Roel Jonkers (University of Groningen) -
Verb processing in speakers with acquired language disorders: the role of verb type

11.00 – 11.30 coffee

11.30 – 13.00 **Poster session 2**

11.30 – 12.00 **Short (3 slide) presentations poster session 2**

13. Gregoire Python, Bertrand Glize, Marina Laganaro - What underlies similar behavioral facilitation and interference in blocked-cyclic naming: ERP results in two aphasic individuals with different lesions and anomic profiles
14. Alessia Serafini, Chiara Zanini, Serena De Pellegrin - Assessing and treating expressive linguistic prosodic difficulties: two cases of Broca's aphasia.
15. Wilasinee Siriboonpipattana, Frank Burchert, Roelien Bastiaanse, Alexandre Nikolaev - The Effect of Structural Frequency and Word Order in Thai Agrammatism
16. Suzan Dilara Tokaç, Srđan Popov, Seçkin Arslan, Roelien Bastiaanse - Processing of evidentiality in Turkish: An ERP study
17. Aikaterini Tsarouch - Morphological Decomposition in Primary Progressive Aphasia: Evidence from Greek
18. Kazuki Sekine, Karin van Nispen, Kim ten Felde, Jiska Koemans, Ellen van Drie, and Basil Preisig - Do you see what they mean?: An eye-tracking study on the attention for gestures produced by people with aphasia
19. Christine Versluis - Why this now? A genre analytic approach to mixed aphasic / non-aphasic interactive events
20. Mile Vuković, Irena Vuković - Executive functions in patients with Broca's aphasia
21. Lilla Zakariás, Helen Kelly, Christos Salis, Chris Code - The methodological quality of short-term/working memory treatments in post-stroke aphasia: A systematic review
22. Roelant Ossewaarde, Roel Jonkers, Fedor Jalvingh, Roelien Bastiaanse - Graph based measurements of the decline of syntactic complexity in speakers with dementia.
23. Nienke Wolthuis, Ingeborg Bosma, Roelien Bastiaanse, Wencke S. Veenstra, Michiel Wagemakers, Arnaud Vincent, Perumpillichira J. Cheria, Djaina Satoer – Functional connectivity brain networks and language functioning in low-grade glioma patients

13.00 – 14.30 Lunch

Social programme; social dinner

Friday, September 21, 2018

9.00 – 12.00 **Invited talks: Interaction**

09.00 – 10.00 Wendy Best (University College London) -
Conversation Intervention in Action

10.00 – 11.00 Gloria Olness (University of North Texas) -
From Reference to Prominence: Toward a Model of Communicative Functionality in Discourse

11.00 – 11.30 coffee

11.30 – 12.30 Anne-Catherine Bachoud-Levi (Inserm, Paris) -
Striatum and Language

12.30 – 14.00 **Lunch**

14.00 – 15.30 **Contributed papers oral session 2**

7. Emma Pilkington, Maitreyee Wairagkar, Karen Sage, James Douglas Saddy, Holly Robson - Do lexical processing demands affect Jargon perseveration?
8. Giorgio Arcara, Fabio Campanella, Miran Skrap, Valentina Bambini - Pragmatic impairment in patients with left- and right-hemisphere brain tumor
9. Frank Tsiwah, Silvia Martínez Ferreiro, Roelien Bastiaanse - Processing of time reference in a grammatical tone language speakers with agrammatic aphasia
10. Svetlana Averina, Olga Dragoy, Roelien Bastiaanse - Treatment-induced improvements in communicative abilities and spontaneous speech in chronic aphasia
11. Leonie Lampe, Nora Fieder, Solène Hameau, Lyndsey Nickels - Effects of Semantic Variables on Picture Naming in a Large Group of People with Aphasia
12. Ella Creet, Lyndsey Nickels, Julie Morris, Serje Robidoux, David Howard - Name it Again! Repetition Priming in People with Aphasia

15.30 – 16.00 Coffee

16.00 – 17.30 **Poster session 3**

16.00 – 16.30 **Short (3 slide) presentations poster session 3**

24. Rodrigo Koch, Simone Calabrich, Byurakn Ishkhanyan - Revision and Adaptation of the Bilingual Aphasia Test (BAT) in Brazilian Portuguese
25. Vasiliki Koukoulioti, Stavroula Stavrakaki - Past perfective in stroke aphasia and semantic dementia: the effect of temporal and aspectual marking
26. Giulia Krethlow, Raphaël Fargier, Marina Laganaro - Recovery from aphasia and new exemplar-word learning. A pilot study
27. Svetlana Kuptsova, Ludmila Zhavoronkova, Alexey Petrushevsky, Oxana Fedina - Functional brain activity in task switching in persons with aphasia (an fMRI study)
28. Nathaniel Lartey, Roelien Bastiaanse - The interplay between syntax and phonology in the resolution of resumptive pronouns in Akan agrammatic speakers
29. Jin Luo, Karl Neergaard - Cross-linguistic normative study of the neighbor fluency task: A novel instrument for clinical assessment
30. Amaia Munarriz-Ibarrola, Silvia Martínez-Ferreiro - Development in language production in chronic aphasia: a longitudinal case study of a bilingual individual
31. Davide Nardo, Katerina Pappa, John Duncan, Peter Zeidman, Oliver Josephs, Martina Callaghan, Alexander Leff, Jennifer Crinion - Modulating the left inferior frontal cortex in chronic aphasic stroke patients
32. Özlem Oğuz, İlknur Maviş - Assessing spontaneous and automatic language production by sentence completion task in aphasia
33. Yulia Akinina, Roelien Bastiaanse, Olga Buivolova, Ekaterina Iskra, Olga Soloukhina - Verb and Sentence Impairment in Aphasia: Insights from Cluster Analysis
34. Elise Oosterhuis, Valeriya Tolkacheva - The influence of sensorimotor stereotypes on the comprehension of spatial constructions in Dutch and Russian
35. Dorothea Pregla, Frank Burchert, Shravan Vasishth, Nicole Stadie - Comprehension of control structures in German individuals with aphasia

Saturday, September 22, 2018

09.30 – 10.30	**Invited Talks: Wrap up**
09.30 – 10.30	David Caplan (Massachussets General Hospital, Boston) – *Comments on language and its relation to action and social interaction*
10.30 – 11.00	Coffee
11.00 – 13.00	**Workshops**

11.00 – 12.00

- Suzanne Beeke (University College London) -
Talk matters in aphasia: Changing communication behaviours using Conversation Analysis

IIt is now recognised that the study of language disorder needs to account for speakers' abilities within interaction, in addition to elicited discourse. Recognition of the importance of everyday conversation goals to speakers with aphasia and their families has led to a proliferation of approaches to intervention, subsumed under the umbrella term conversation therapy. One type of conversation therapy is grounded in Conversation Analysis (CA), a systematic procedure for the analysis of recorded, naturally occurring talk produced in everyday human interaction. The principal aim of CA is to uncover how participants understand and respond to each other via turns at talk, and how such turns are organized into sequences of interaction. Its application to aphasia has revealed aspects of aphasic talk as strategic behaviour motivated by the interactional drive to take a turn in a conversation despite linguistic limitations.
This workshop aims to give participants an understanding of how CA can be used to increase insight into communication and scaffold the development of strategy use in a person with aphasia and their communication partner. Examples will be taken from Better Conversations with Aphasia, a free e-learning resource about CA-informed therapy designed for healthcare professionals, people with aphasia and their families, and developed with key stakeholders in the UK (the third sector organisations Connect, and the Tavistock Trust for Aphasia). Participants will gain an understanding of the potential mechanisms underpinning change in conversation behaviours for people with aphasia and their communication partners, a result of preliminary research into BCA using behaviour change theory and methods.

12.00 – 13.00

- Frank Zanow (Eemagine Berlin, ANT Enschede) –
The future of mobile EEG and pervasive neurotechnology

Electroencephalography (EEG) is a widespread tool for investigating neurophysiology and human cognitive function in clinical routine and medical research. Triggered by significant improvements in recording technology, signal analysis and general applicability, new fields of application have been emerging rapidly. Lightweight, high-grade EEG electronics and gel-free electrode sensors enable quick application, whereas cloud storage and automated analysis, e.g. with modern deep-learning algorithms, go far beyond classical procedures of visual interpretation and current computational strategies.
Innovative EEG technology unfolds numerous valuable possibilities for studying and analysing human brain function in natural, day-life environments. Brain-computer interfacing has been examined for more than two decades and applications allowing users to compensate physiological limitations like controlling protheses, environmental conditions or communication are evolving. Mobile, long-term and repetitive EEG acquisitions at home enable new ways of remote monitoring of, e.g., Epilepsy, Dementia or progress in rehabilitation after stroke. New fields of application also include neurofeedback for treatment of neurological conditions as well as training of mental fitness. Likewise, EEG analysis is increasingly being used in cognitive assessment, e.g. in meditation or during exercise.
In this talk, selected novel applications of EEG acquisition and analysis will be presented. The requirements and technical hurdles of mobile pervasive EEG will be outlined including both conventional and novel dry sensors. The specifics of analysing EEG recorded during movement, at home and under challenging environmental conditions will be addressed. The future perspective of this rapidly growing domain of neurotechnology and opportunities arising from these new developments will be discussed.

Revisiting aspect in Mild Cognitive Impairment and Alzheimer's disease: evidence from Greek

Georgia Roumpea[1], *Anastasia Nousia[2], Stavroula Stavrakaki[3] Grigorios Nasios[2], Christina Manouilidou[1]*

[1]University of Ljubljana, [2]Technological Educational Institute of Epirus, [3] Aristotle University of Thessaloniki

Introduction

This study examined the ability of Greek-speaking individuals diagnosed with Alzheimer's disease (AD) and Mild Cognitive Impairment (MCI) to name, comprehend and produce verbs that vary with respect to their grammatical and lexical aspect. Lexical aspect concerns situation types with different semantic and temporal features, e.g. verbs which indicate activity (*trexo* 'run'), achievement (*spao* 'break'), accomplishment (*χtizo* 'build'), state (*ksero* 'know') and semelfactive (*χtipao* 'hit'). *Achievement* and *semelfactive* describe instantaneous events which result or not in a change of state. *States* are stable situations without internal structure and complexity. Both *accomplishments* and *activities* are durative verbs with or without completion (Smith, 1997). Grammatical aspect conveys information about time and is divided to *perfective* (*elisa* 'I untied') which refers to the situation as a complete event and *imperfective* (*elina* 'I was untying') which presents the duration and internal structure of the event (Comrie, 1976). AD and MCI individuals' abilities to produce single-words, understand their semantic features and complete demanding tasks are impaired due to degraded semantic and working memory (Taler & Philips, 2008). While previous studies have investigated the role of *grammatical aspect* in the performance of brain-damaged population, the interaction between grammatical and lexical aspect has not been examined before. Agrammatic patients were found more impaired in expressing past-reference, especially perfective, than in expressing present or future imperfective meaning (Bastiaanse et al., 2011). Vulnerable tense/aspect morphology and the discourse-linked reference to the past could explain this performance. In contrast, Fyndanis et al. (2013) report impaired grammatical aspect in mild-to-moderate AD patients and preponderance of perfective over imperfective aspect. The researchers attributed this performance to difficulties in processing *duration.* In a pilot study (Roumpea et al., 2017) AD and MCI patients were found equally impaired in perfective and imperfective aspect. Our study aims to further investigate the role of *duration* by manipulating both grammatical and lexical aspect. If, indeed, MCI and AD individuals' abilities to process duration are limited, then we expect them to perform worse in inherently durative verbs (*activity, accomplishment*). Also, an interaction between lexical and grammatical aspect might emerge. Thus, we expect participants to have difficulty in attributing durative meanings to instantaneous verbs (*achievement, semelfactive*) and that perfective forms will be preferred even in imperfective contexts. About *activity, state* and *accomplishment* verbs, even they appear mainly in imperfective forms, a better performance on the perfective should be expected, again if duration poses difficulties.

Methods

Participants

Twenty-two monolingual native Greek-speakers, 11 diagnosed with MCI and 11 with AD were tested. Nine healthy participants were tested in the same tasks as the control group. All participants were right-handed, with an average age of 77 years. Also, they did not differ significantly in years of education. Additional psychometric tests (e.g. MOCA, Boston Naming Test) were administrated to participants in order to collect more information about their cognitive, functional and linguistic profile.

Experimental tasks

Off-line picture-naming task and sentence-completion task were designed. The same 100 verbs (20 per verb category) were used for both tasks. For the picture-naming task 100 colored pictures depicting as accurately as possible the target verbs were gathered. For the sentence-completion task 100 pairs of sentences (50 for the perfective and 50 for the imperfective aspect) were designed. Verbs were matched for frequency, number of letters, phonemes, syllables, orthographic and phonological neighbors and imageability.

Results

Analysis of patients' answers in the naming-task revealed a main effect of group (p=.000), a main effect of lexical aspect (p=.000) and a significant interaction between group and lexical aspect (p=.000). Post-hoc comparisons showed that both MCI and AD performed significantly lower than control group, with the AD being worse than MCI (p=.000). The AD group performed statistically better in *activities* and *accomplishments* compared to *states* (p=.035) and *achievements* (p=.000). In MCI, *activities* were better preserved than *states* (p.012) and *achievements* (p=.020). When it comes to sentence-completion task, a main effect of group (p=.000) was found but no effect of grammatical neither lexical aspect. Post-hoc comparisons showed that the AD group was significantly more impaired than MCI and control groups (p=.000). MCI individuals performed equally well as controls (p=.108). Figure 1 illustrates the performance of control, MCI and AD groups in both tasks.

Discussion

When it comes to *lexical aspect*, as the naming task revealed, an effect of duration was found for both AD and MCI individuals. Activity *(run)* and accomplishment *(build)* verbs were found better preserved compared to the other categories. These verbs share the same semantic and temporal features, describing events with internal structure and duration. Hence, duration, as part of lexical representation of the verb, together with internal structure, seems to play a role in naming verbs. Specifically, it appears that the rich semantic representations of *activities* and *accomplishments* make them prominent and, thus, better preserved for populations with semantic limitations, such as AD and MCI. In Breedin et al. (1998) similar performance was observed in aphasics who performed better at retrieving semantically complex verbs than semantically simpler.

With respect to *grammatical aspect,* as examined through the sentence completion task, analysis on AD revealed no significant preponderance of perfective over imperfective. This suggests, contrary to Fyndanis et al. (2013), that duration, as a temporal feature of the functional category of grammatical

aspect, did not affect patients' performance. This might reflect an impairment which equally affects AD individuals' ability to produce and comprehend either the temporal and/or morphological features of the different types of grammatical aspect (perfective *'I solved'*, imperfective *'I was solving'*) and it is open to further investigation. Finally, the lack of interaction between lexical and grammatical aspect in sentence completion task, is indicative of the independence of the two variables which can be affected differentially in populations with semantic and cognitive decline.

References

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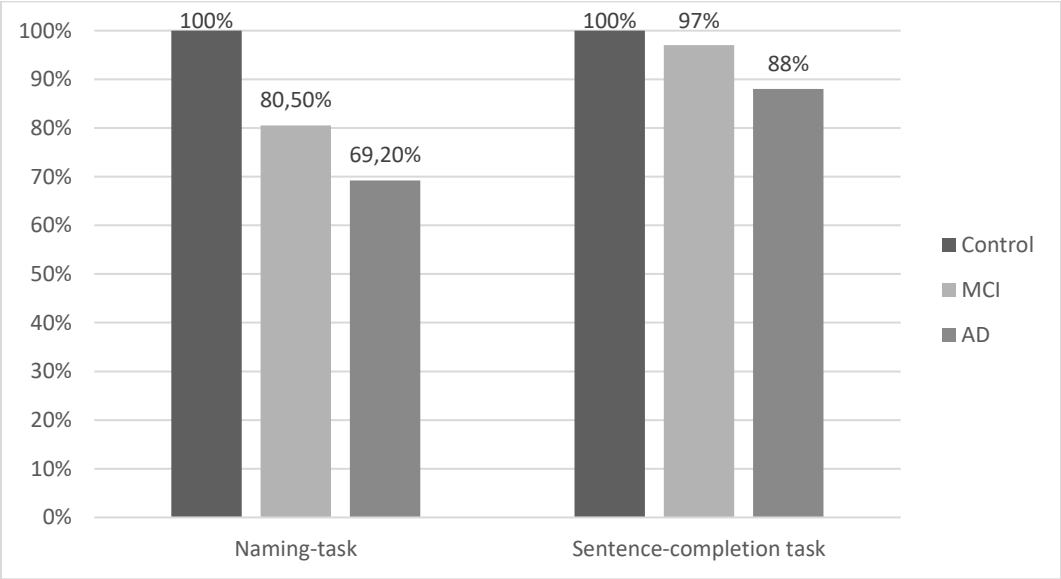

Figure 1: Percentages of correct responses in picture-naming task and sentence-completion task.

Effects of three verb argument structure parameters on action naming and sentence production in aphasia

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Introduction

Verbs are pivotal to sentence construction, since they determine participant roles, their grammatical form and syntactic position in a sentence. Thus, many successful therapies of sentence processing in aphasia select and/or sequence verbs based on verb argument structure (VAS) complexity (Bazzini et al., 2012). So far, the most well-studied VAS parameter is the number of arguments, whereas other parameters have received much less attention. Our goal is to investigate the effects of three VAS parameters within a single experiment: besides the number of arguments, these are the canonicity of thematic roles (unaccusativity) and the number of valency options (optionality).

Traditionally, more complex VAS has been expected to increase the verb processing cost. But recent behavioral and neuroimaging evidence from healthy individuals (Malyutina & Den Ouden, 2017) suggests that VAS effects may differ dramatically depending on the task. In single-word tasks, more complex VAS may actually have a facilitatory effect, likely due to additional lexical access routes via semantic connections with possible arguments. Thus, we test VAS effects across two tasks: action naming and sentence production. We hypothesize that greater VAS complexity may have a facilitatory effect in action naming and a negative effect in sentence production, which requires deeper processing of VAS information.

Methods

Participants were 17 individuals with non-fluent aphasia (efferent motor and/or dynamic aphasia, possibly accompanied by afferent motor aphasia, by Luria's classification) due to left-hemisphere stroke, recruited at the Center for Speech Pathology and Neurorehabilitation (Moscow, Russia). Participants completed two tasks: action naming was followed by sentence production. In action naming, participants were asked to name a black-and-white picture of an action (Akinina et al., 2015) with one word. Accuracy and naming latencies (for correct responses only) were analyzed. In sentence production, participants were shown the same pictures but now provided with the verb and its arguments (in written and oral form) and asked to build a grammatically correct sentence using all of these words (similar to the argument structure production task in the Northwestern Assessment of Verbs and Sentences; Cho-Reyes & Thompson, 2012). The dependent variables were "total" accuracy (assessing whether the participant produced the target sentence with no grammatical, lexical or morphological errors) and VAS accuracy (assessing whether the participant produced the target VAS structure, with possible lexical, morphological or phonological errors).

The stimuli were 65 Russian verbs belonging to four groups: obligatory transitive verbs (verbs requiring an object: 'to build', 'to catch'), optional transitive verbs (verbs that can be used both with and without an object: 'to vacuum', 'to smoke'), unergative intransitive verbs (intransitive verbs with an "active" thematic role of the argument: 'to run', 'to swim'), and unaccusative intransitive verbs (intransitive verbs with a "passive" thematic role of the argument: 'to sleep', 'to fall'). The groups were balanced on lexical frequency, length, imageability, name agreement, visual complexity, familiarity, etc. The effect of transitivity was tested by comparing obligatory transitive to unergative intransitive verbs; the effect of canonicity was tested by comparing unergative intransitive to unaccusative intransitive verbs; the effect of the number of valencies was tested by comparing obligatory transitive to optional transitive verbs.

Results

In the naming task, the mean naming accuracy was 72% (SD 28%, range 8%-100%). Naming accuracy tended to be higher for transitive than intransitive verbs ($t(16)=1.98$, $p=.07$); canonicity and the number of valencies had no significant effect on naming accuracy (all $p>.10$). Naming was faster for optional transitive than obligatory transitive verbs ($t(15)=2.79$, $p=.01$); transitivity and canonicity had no significant effect on naming latencies (all $p>.10$).

In the sentence production task, the mean "total" accuracy was 76% (SD 29%, range 13%-100%). The mean VAS accuracy was 89% (SD 20%, range 25%-100%). None of the three investigated VAS parameters demonstrated a significant effect on either "total" or VAS accuracy (all $p>.10$).

Discussion

In naming, more complex VAS tended to have a facilitatory effect, which manifested in a trend for higher naming accuracy for transitive verbs and in faster naming for verbs with a greater number of valency options. The results are inconsistent with previous studies showing a negative effect of more complex VAS in single-word tasks in aphasia (for example, Thompson et al., 1997). The discrepancy can be due to differences in how the experimental designs isolated specific VAS parameters from others. However, the facilitatory effect of more complex VAS in single-word processing is consistent with recent data from healthy individuals (Malyutina & Den Ouden, 2017). Possibly, more complex VAS provides more numerous or more diverse lexico-semantic associations with possible arguments, thus facilitating lexical access to the verb. We are now testing whether the effect will hold in individuals with fluent aphasia who have pronounced lexico-phonological deficits (the data will be available by the time of presentation).

We hypothesized that the effect of VAS complexity would be the opposite (negative) in sentence production, which requires deeper processing of VAS information in comparison to naming. However, we found no significant effects of any of the three investigated VAS parameters on sentence production accuracy. Possibly, this can be due to insufficient sensitivity of the task: all arguments of the verb were presented to the participant before sentence production, which provided certain "scaffolding" for the correct sentence structure. Further research with uncued sentence production tasks is warranted.

References

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Gesture comprehension and semantic knowledge in people with aphasia: evidence for dissociation of performance

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Introduction

There has been longstanding interest in the relationship between the gestural and language abilities of people with aphasia (PWA). PWA commonly present with deficits in gesture processing (e.g., Goldenberg, Hartmann & Schlott, 2003), however the nature of these impairments is yet not clear. Some early studies found strong links between gesture comprehension and verbal semantic impairments (e.g., Duffy & Duffy, 1981; Wang & Goodglass, 1992), suggesting that the same mechanism underlies these two deficits – the asymbolia hypothesis. In contrast, other studies found that gesture comprehension deficits in aphasia were independent from linguistic deficits (e.g., Bell, 1994; Goodglass & Kaplan, 1963). These studies have compared PWA performance across gesture comprehension tasks and comprehension of spoken words. Rothi and colleagues' cognitive model of limb praxis (Rothi, Ochipa& Heilman, 1997) suggests an interaction between gestural and language systems through a shared semantic system. However, in their model, the authors suggested that semantic knowledge associated with actions, tool use, and the objects of actions is represented separately from other types of semantic knowledge, such as verbal semantic knowledge in an "action semantic system". While there is evidence for dissociations between action semantic and verbal semantic knowledge (e.g., Raymer & Ochipa, 1997), few studies in PWA have investigated whether the same semantic information underlies gesture comprehension processes and comprehension of action concepts.

Using a cognitive neuropsychological case series approach, we investigated whether we could find evidence supporting shared or independent representations underpinning gesture comprehension and conceptual knowledge of actions. If there is dependence between the systems, there should be an association between performance on gesture comprehension and semantic processing of actions, and a double dissociation between performance on the two tasks should not occur. Alternatively, if the two tasks rely on functionally independent systems, a dissociation in participants' performance across the tasks is possible (Shallice, 1988).

Methods

Participants

Ten participants (3 female) were included with the only criterion being chronic post-stroke aphasia and some ability to name pictures of actions (as the participants were recruited for a study of action naming

running in parallel). All participants presented no reported previous history of other neurological conditions, no other marked cognitive co-morbidities and ranged from mild to severe aphasia.

Measures

Participants were administered a range of gesture and language sub-tests from standardized tests, including the Florida Apraxia Battery – Extended and Revised Sydney (FABERS; Power, Code, Croot, Sheard & Gonzalez-Rothi, 2010) and the Comprehensive Aphasia Test (CAT; Swinburn, Porter & Howard, 2004).

The critical measures for this study were selected from the background assessment and included: a) gesture comprehension task from the FABERS battery where participants were asked to point to a photograph of an object that matched the action pantomimed; b) the Kissing and Dancing Test pictures version (KDT; Bak & Hodges, 2003), which assessed conceptual knowledge of actions by requiring the selection of one of two pictures associated to a stimulus action picture; c) two verbal-semantic tasks from the CAT (i.e., spoken and written word-picture matching tasks).

Analysis

A multiple single-case analysis was performed examining: a) the differences between each participant's score on a given task and the control population (Crawford et al, 2010); b) participants' performance on gesture comprehension with performance in the semantic tasks (Fisher exact test). If there was a significant difference between scores obtained in the gesture comprehension task and in each semantic task, this would demonstrate a dissociation in performance between the two modalities.

Table 1 reports the participants and control scores in all tasks.

Results

Three participants were significantly below controls in gesture comprehension (ALM, JOT and MAS), despite having unimpaired gesture recognition skills. Two of these participants (ALM, MAS) also performed significantly below the normal population in the KDT. JOT presented a classic dissociation with selective deficits in gesture comprehension, despite spared performance in the KDT ($p=.002$, Fisher exact test). ALM also showed a dissociation - he was significantly more impaired on gesture comprehension than on action semantic knowledge ($p=.003$, Fisher exact test). For MAS differences in performance on the gesture comprehension task and KDT did not reach significance ($p > .05$, Fisher exact test).

These three participants also showed dissociations between gesture comprehension and verbal semantic knowledge. MAS demonstrated a classic dissociation as she presented with gesture comprehension deficits, yet spared verbal semantic knowledge. ALM and JOT were significantly more impaired on gesture comprehension than on the spoken and/or written picture-matching tasks (ALM pantomime comprehension task versus sWPM/wWPM: $p=.02$; JOT pantomime comprehension task wWPM: $p = .04$, Fisher exact test).

Three participants (SJS, GOE and DEH) showed impaired performance on the KDT, in the context of intact gesture comprehension. DEH exhibited a classic dissociation with impaired performance in the KDT reflecting selective deficits in action semantic knowledge, but spared gesture comprehension (p = .004, Fisher exact test). SJS and GOE did not show significant differences in performance between the two tasks (p > .05, Fisher exact test).

Table 1. *Participant's scores (as proportion correct) and error types in the selected assessment tasks.*

	N items	Controls mean score (SD)	Cut-off	ALM	JOT	MAS	SJS	GOE	STR	JOG	REA	DEH	RYT
P' mime Dis	40	36.4 (1.6)	0.83	0.88	0.83	0.83	0.75*	0.78*	1	0.75*	0.85	0.80*	0.85
P'mime Rec	20	18.75 (1.0)	0.85	**0.55***	**0.60***	**0.70***	0.85	0.85	0.90	1	1	**1**	1
Error type:													
Semantic				6	1	2	0	0	0				
Associative				4	4	3	1	2	1				
Motoric				0	3	1	2	1	1				
KDT	52	50.4 (1.5)	0.92	**0.88***	**0.92**	0.85*	0.90*	0.83*	1	0.94	0.94	**0.67***	0.92
sWPM[a]	15	29.15 (1.35)	0.90	**0.87***	0.66*	**1**	0.70*	0.97	0.83*	1	1	1	0.70*
Error type:													
Phonological				0	1		1		1				2
Semantic				2	2		3		1				0
Unrelated				0	1		0		0				0
wWPM[a]	15	29.63 (0.79)	0.93	**0.87***	**0.87***	**0.97**	0.63*	0.87*	1	0.93	1	0.90*	0.93
Error type:													
Phonological				0	0		0	1		1		0	0
Semantic				2	2		5	1		0		1	1
Unrelated				0	0		0	0		0		0	0

*Crawford's test t-scores p < 0.05; Cut off score represents the lowest score before which performance becomes significantly different to controls (Crawford et al., 2010); significant dissociations between gesture comprehension and action/verbal semantic knowledge are reported in bold. P'mime disc = pantomime discrimination test (FABERS, Power et al, 2010); P' mime Rec = pantomime recognition test (FABERS, Power et al, 2010); PPT = Pyramids and Palm Tree test (Howard & Patterson, 1992); KDT = Kissing and Dancing test Bak & Hodges (2003); sWPM = spoken word picture-matching (Swinburn & Howard, 2004); wWPM = written word picture-matching (Swinburn & Howard, 2004); [a]0-2 scoring; ; [b] Controls' performance as reported in Bak & Hodges (2003);

Discussion

This study aimed to investigate the relationship between gesture comprehension deficits and conceptual semantic knowledge for actions in people with aphasia. The results demonstrate that semantic knowledge of actions does not crucially contribute to gesture comprehension deficits. This conclusion is supported by a double dissociation: one participant (JOT) showed impaired gesture comprehension and unimpaired non-verbal action semantic knowledge and b) another participant (DEH) who had deficits in non-verbal action semantic knowledge, yet showed intact gesture comprehension. In line with previous findings (e.g., Raymer & Ochipa, 1997), we have also demonstrated dissociating patterns of performance between gesture comprehension and verbal semantic knowledge.

In conclusion, our results support a theory where the mechanisms underlying comprehension of action concepts (as assessed by the KDT) and gesture comprehension are (at least partially) independent.

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Beyond the motor account of Amyotrophic Lateral Sclerosis: Relationship between pragmatics and Theory of Mind deficits as revealed through metaphors and jokes

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Introduction

Classic neurology has long looked at Amyotrophic Lateral Sclerosis (ALS) as a "pure" MND, assuming that in this disease the body wasted yet the mind was spared. In contrast, modern studies indicated that the disease might affect also the domains of cognition (Strong et al., 2017) and social cognition (Bora, 2017). One aspect that might be compromised in ALS is social communication, with a range of pragmatic language disorders that span from failure in understanding non-literal language to struggle in narrative tasks (Bambini et al., 2016; Roberts, Savundranayagam, & Orange, 2017). A relevant question in pragmatic language disorders is the relation with Theory of Mind (ToM), which has been largely debated with respect to Autism, Traumatic Brain Injury and Schizophrenia (Andrés-Roqueta & Katsos, 2017; Champagne-Lavau & Stip, 2010; Rowley, Rogish, Alexander, & Riggs, 2017). In this study, we explored the relation between pragmatics and ToM in ALS, by using two novel pragmatic tasks tapping into metaphor and joke understanding and modulating the mentalist inferential load. We expected the relation between pragmatics and ToM to vary depending on the mentalistic load. Results will have implications not only for the description of the phenotype of ALS, but also for the theoretical debate upon the reciprocal status of pragmatics and ToM.

Methods

Participants

We recruited 30 non-demented patients ALS patients (15 females; mean age 67.63, SD 5.99; mean education 9.43, SD 3.05), diagnosed according to El Escorial Criteria (Ludolph et al., 2015) and electro-diagnostic criteria (de Carvalho et al., 2008), with a mean disease duration of 45.37 (SD = 33.26) and a mean ALS Functional Rating Scale of 37.50 (SD = 5.75). Disease onset site was bulbar for six patients and spinal for twenty-four patients. In addition, we recruited 29 neurologically healthy subjects (mean age 65.69, SD 5.37; mean education 10.86, SD 3.49). The two groups did not differ for age ($p = .19$) or education ($p = .1$).

Assessment

All subjects underwent a broad assessment including cognition (ECAS; Poletti et al., 2016), ToM (Faux Pas; Stone, Baron-Cohen, & Knight, 1998), and pragmatics (APACS; Arcara & Bambini, 2016).

Physical and Mental Metaphors (PMM) task: The test consisted of 14 novel metaphors in the nominal form, half expressing physical characteristics (e.g., "Lifeguards are lizards") and half expressing psychological characteristics (e.g., "Grandparents are pillars"). The two types of metaphors were determined based on extensive pre-tests, and were balanced for a number of characteristics such as familiarity and word lexical frequency. Subjects were required to explain the meaning of the expressions. Responses were scored for accuracy (0-1-2 for incorrect, partial, and correct answers) and interpretation (0-1-2-3 for null, physical, descriptive, and mental explanations).

Phonological and Mental Jokes (PMJ) task: The test was composed of 14 jokes, adapted from existing books and web repositories. In half of them the humorous incongruity originated from phonemic changes and in the other half from the attribution of a false belief to one character. Each item was presented as a brief story with three possible endings, one funny, one straightforward, and one unrelated. For example, for phonological jokes: *Two university professors: "Dear colleague, starting tomorrow I'll leave my duties for a year and I'll move to Brasil." And the other says: "Oh, I see, you take a sambatical/sabbatical/leap year to rest a bit"*. For ToM jokes: *Two fiancées are spending the evening on a couch, when the guy starts looking sad. The guy says: "Honey, have you ever longed for something really hard but you could not obtain it?" And then he continues: "I feel like that now, because the fridge/wedding/carburetor is so far away".* Subjects were asked to choose which ending worked best as a punchline for the joke. Responses were scored for accuracy (0-1 for incorrect and correct). Then, subjects were asked to rate the funniness of the completed joke on a scale from 0 to 10.

Results

Patients performed worse than controls in ECAS, Faux Pas, and APACS tests (all ps<0.001).

When considering PPM, patients performed worse than controls in mental metaphors, both in accuracy and interpretation, but not in physical metaphors, neither in accuracy or interpretation. When considering PMJ, patients scored lower in accuracy than controls both in phonological and mental jokes. However, ratings of funniness did not significantly differ for patients and controls.

The correlation analysis of PMM scores with Faux Pas scores showed no significant correlations in controls. Conversely, in patients, we observed a significant relationship between accuracy in physical metaphors and ToM scores. The correlation analysis of PMJ scores with Faux Pass scores did not show any significant correlation in controls, whereas in patients all correlations were significant or close to significant. Details in Table 1.

Discussion

The results of the PMM task showed that patients struggle with metaphors compared to controls, but their difficulties seem to be specific when metaphor comprehension requires inferring about

psychological rather than physical aspects. The correlation analysis suggests indeed a complex interplay of pragmatic and ToM aspects in metaphor. While in controls the performance in metaphors is not influenced by ToM, in patients we observed a relationship between physical metaphors and Faux Pas. This might indicate that the understanding of physical metaphors, although on average not impaired, might be influenced by individual ToM skills, which might play a role in inferential processes in communication in general, i.e., not only in inferring mental aspects.

The results of the PMJ showed that patients struggle with all types of jokes. The correlation analysis suggests that such difficulties are closely tied to difficulties in ToM, which also influence the perception of funniness.

Overall, our findings strengthen the observation of cognitive, sociocognitive, and pragmatics disruptions in ALS, but also show that the ALS cohort is a suitable testing ground to understand the relationship between pragmatics and ToM. The use of tasks with different mentalistic inferential load allowed us to scrutinize different aspects of the pragmatic disorder of ALS patients, which is relatively independent of ToM for metaphor understanding, but largely tied to ToM for joke understanding.

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Table 1. On the left: Comparison between the performance in the PMM task and in the PMJ taks in controls and ALS patients. On the right: Correlations between the scores in the PMM and PMJ tasks and Faux Pas scores in controls and ALS patients.

		Group comparison					*Correlation analysis with Faux Pas*	
Pragmatic Task	Score	Controls *mean* (*SD*)	ALS *mean* (*SD*)	*t*(*df*)	*p*	*d*	*Controls*	*ALS*
Physical and Mental Metaphors (PMM)	Physical Set - Accuracy	10.18 (1.70)	9.33 (2.83)	t(48.035)=1.3882	0.1715	0.36	r=0.33 p=0.084	r=-0.54 p=0.002*
	Physical Set - Interpretation	9.14 (2.01)	8.67 (1.83)	t(54.476)=0.94142	0.3506	0.25	r=-0.21 p=0.289	r=--0.32 p=0.086
	Mental Set - Accuracy	10.04 (2.57)	7.33 (2.89)	t(55.881)=3.7633	0.0004*	0.98	r=-0.15 p=0.451	r=-0.12 p=0.515
	Mental Set - Interpretation	17.36 (2.41)	12.50 (3.29)	t(53.071)=6.449	0.0000*	1.68	r=-0.34 p=0.073	r=-0.10 p=0.617
Phonological and Mental Jokes (PMJ)	Phonological Set - Accuracy	5.89 (1.31)	4.40 (1.73)	t(53.471)=3.6781	0.0005*	0.96	r=-0.12 p=0.557	r=-0.44 p=0.01*
	Phonological Set - Funniness	6.40 (1.34)	6.03 (1.69)	t(54.175)=0.91484	0.3643	0.24	r=-0.02 p=0.907	r=-0.46 p=0.011*
	Mental Set - Accuracy	5.41 (1.65)	4.10 (1.60)	t(54.043)=3.0289	0.0038*	0.80	r=--0.05 p=0.812	r=-0.32 p=0.082
	Mental Set - Funniness	6.61 (1.39)	6.33 (1.35)	t(54.002)=0.76903	0.4452	0.20	r=--0.04 p=0.858	r=-0.37 p=0.044*

Using Support Vector Machines to identify determinants of pronoun difficulty in aphasia: a preliminary critical review and meta-analysis of individual data

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Introduction

The literature has strongly evidenced that people with aphasia (PWA) demonstrate a difficulty processing pronouns (Choy & Thompson, 2010; Vasić, Avrutin, & Ruigendijk, 2006). This difficulty is not well understood due to variability in sample sizes, conditions tested, and linguistic constraints relevant to their processing in different languages. Attempts have been made to theorise the underpinning elements contributing to this difficulty, however, with little resulting agreement across authors.

Differential performance patterns have been documented under different on-line and off-line experimental paradigms (de Roo, 2003; Piñango & Burkhardt, 2001); and, with relation to differentiating variables relating to pronoun use. These include different modalities (comprehension/production) (Abuom, Shah, & Bastiaanse, 2013; Fabbro & Frau, 2001; Goral, Levy, & Kastl, 2010), aphasia type, pronoun position and type (e.g. subject, personal, clitic; (Baauw, Ruigendijk, Cuetos, & Avrutin, 2011; Luzzatti, Toraldo, Ghirardi, Lorenzi, & Guarnaschelli, 2001), simplified versus complex structures (e.g. passive, wh-movement; Arslan, Gür, & Felser, 2017; Kljajevic & Murasugi, 2010).

A collection of theoretical explanations has been developed to explain the difficulty underlying pronoun processing in PWA. Plausible explanations straddle two primary conceptual constructs: representational and processing capacity accounts. Theoretical explanations range from a general syntactic processing impairment that encompasses computations necessary to resolve referential relationships (Edwards & Varlokosta, 2007; Kohn, Cragnolino, & Pustejovsky, 1997; Love, Swinney, & Zurif, 2001; Ruigendijk & Avrutin, 2003) to limitations of processing capacity necessary to execute syntactic operations during pronominal resolution (Burkhardt, Avrutin, Piñango, & Ruigendijk, 2008; Grodzinsky, Wexler, Chien, Marakovitz, & Solomon, 1993) and to a possible lexical integration and/or discourse-linking impairment (Bos, Dragoy, Avrutin, Iskra, & Bastiaanse, 2014; Choy & Thompson, 2010).

Given the uncertainty in understanding these phenomena, the present meta-analysis was designed to systematically analyse the current literature corpus relevant to studies that have investigated pronoun processing in PWA with a view to draw on common themes that may clarify why these referential linguistic items are problematic. The findings from this study will advance the understanding of pronoun processing in PWA.

Methods

Data

An exhaustive search in PubMed/MEDLINE and Web of Science was conducted with the following key word combination: "aphasia AND [pronoun OR clitic]". A total of 105 papers were retrieved. Those reporting individual accuracy results from PWA were included (n=30). Papers that merely report group means data (n=24) were noted and their inclusion postponed pending access to individual results. The remaining 51 papers were excluded due to a) reports of individuals with right hemisphere lesions (n=4); b) reports of individuals with non-aphasic symptoms primarily (e.g., dementia, echolalia, SLI; n=20) or of healthy individuals (n=7), and c) review articles (n=6) and articles that report no accuracy data for pronouns (n = 14). The original search was complemented through a subsequent search in Google Scholar and 22 additional papers and dissertations were added, increasing the total amount of studies included so far to 52.

These studies reported pronoun data across 21 languages comprising a total of 476 PWA (ranging from 1-50 per study). The languages reported in our meta-analysis include Cantonese (N=10), Catalan (N=6), Croatian (N=6), Czech (N=2), Danish (N=4), Dutch (N=54), English (N=126), French (N=35), Friulian (N=4), Galician (N=22), German (N=43), Greek (N=5), Hebrew (N=1), Italian (N=81), Québec French (N=5), Russian (N=20), Scledense (N=2), Spanish (N=59), Swahili (N=11), Swedish (N=2), Turkish (N=13), and Venetian (N=1).

Data analysis

The data were analysed using the Support Vector Machines regression model (SVM; Scholkopf & Smola, 2001) as this machine learning algorithm is well-suited for continuous data with large number of predicting variables and is also able to calculate variable importance. The meta-data was assessed using variable importance (see Figure 1a), variables that are important were further included in our analyses. For the time being, the present study has focused on experimental data reporting individual percent accuracy.

Results

Figure 1a. illustrates the variable importance measures, which showed that linguistic factors such as reflexives, relative pronouns, *wh*-movement (applicable in interrogatives), and passives ranked as important variables. Our trained SVM regression model predicted individual pronoun performances with a moderate success rate (RMSE=25.5), see Figure 1b for an illustration. It is conceivable that the model accuracy will increase as more data and features are added into our meta-dataset. A detailed look into the data showed that reflexive elements are found to be better preserved (80%) than non-reflexive elements (62.3%). PWA seemed to perform slightly better when pronouns are placed in subject positions (65%) than in object positions (45.7%) in production tasks. However, this asymmetry did not seem to hold in comprehension tasks (subjects=67.6%, objects=65.5%). An informative factor was the presence of pronouns in passive sentences, which seems to render pronoun comprehension harder (59.4%) than when used in non-passive sentences (67%). Crucially, individual languages were also important factors. Whether

pronouns appear in interrogative or declarative sentences (65.4% vs. 64.4%), and whether pronouns are expressed as clitics or not did not seem to matter (66.6% vs. 61.2%) to an important extent.

Discussion

Findings from this preliminary meta-analysis have led us to three general lines of conclusion so far. First, pronoun difficulty in aphasia persists across languages notwithstanding whether pronouns are expressed as clitics or full morphemes. Second, our findings suggest that pronoun difficulty increases as the structures encompassing pronouns also increase in complexity (e.g. passives), providing support to the limited processing capacity account in aphasia, as opposed to a structural deficit account. Further, reflexive elements being better preserved in aphasia than non-reflexives seems to be in line with this line of reasoning. At present, we are unable to contemplate on each specific hypothesis, as we are currently seeking access to more data. This meta-analysis has provided us with insights into how pronoun processing is impaired in aphasia varies across languages. Nonetheless, this cross-linguistic variability may be linked to diverse profiles of individuals and to the different nature of tasks used in examining pronoun resolution.

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Topic and Focus:
The activation of Left Periphery in neglect dyslexia

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Introduction

Left Periphery (Rizzi, 1997), known also as CP, is the highest layer of syntactic structure, above TP and VP. LP represents the interface between pragmatics and syntax. LP is related both to the outside and the inside of the clause, expressing the clause type and, simultaneously, encoding the relation between the higher portion of the structure and the content of the rest of the clause. Topic and Focus are the two central projections of LP and they are the most representative interfaces between pragmatics and syntax. People with neglect dyslexia (PWND) make substitution and omission (rarely, addition) errors in reading the contralesional part of the sentence. It has been demonstrated (Friedmann, 2011) that manipulation of the syntactic structure may affect reading performance of PWND. Furthermore, it has been demonstrated that neglect patients' bias is modulated by stimulus type (Veronelli et al. 2014). The reading performance of PWND may inform us on the attention requirement of mental operations involved in the activation of LP. In this perspective, the present study will test whether the presence of Focus and Topic structures affects the reading performance of PWND. Our prediction is that PWND would be less impaired in reading sentences associated to Topic and Focus, rather than in reading sentences with SVO syntactic structures.

Methods

Participants

Five Italian-speaking individuals with acquired left neglect dyslexia as a consequence of right brain lesions were recruited, three males and two females. Mean age was 63,4 years (49-76).

Material and method

We created a list of 103 sentences: 31 containing a Topic, 31 containing Contrastive Focus, 4 containing a Wh-movement and 37 SVO sentences as controls. Both sentences with Topic and Focus, and SVO sentences were 5 words long on average. They were matched for number of graphemes (n=23,5). Each sentence contained high frequency words, controlled and matched for frequency with the itWac corpus. Stimuli were presented in Arial font size 26 in the middle of a horizontal A4 page, 5 stimuli in each page. Participants were asked to read aloud each sentence as accurately as possible. No time limit was imposed and each participant was tested individually in a quiet room.

Results

Both omission and substitution errors were considered. Results (Table 1) indicate that more errors were made on sentences with simple SVO structures, while the performance on sentences with Topic and Focus structure was less impaired (p<.01 - Mann-Whitney). The effect was obtained for each individual participant.

	Total errors	Error rate Topic and Focus	Error rate control sentences
MG	22	**18,182%**	**27,027%**
BP	35	**30,303%**	**40,541%**
CG	27	**22,727%**	**32,432%**
OL	14	**12,121%**	**16,216%**
GG	14	**10,606%**	**18,919%**

Discussion

Data suggest that syntactic structure is a crucial factor in driving a subject's attention in reading, even in PWND. These findings have several implications. Firstly, these results indicate that shifting attention in reading can be modulated by internal linguistic factors. Sentences with different syntactic structure yield different reading patterns. The readers tend to shift their attention to the left side of the sentence when a constituent is fronted. Secondly, it can be observed that severity of impairment and facilitation effect of Topic and Focus structure are directly related. More errors were made; indeed, less impairment showed in sentences with Focus and Topic than in SVO structures. On a clinical perspective, representational besides spatial factors modulate attention in PWND.

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Eliciting Verb Inflection in the English Language – The Verb and Noun Test (VAN) for Presurgical Language Mapping with navigated TMS and Interaoperative DES

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Introduction

To ensure maximal removal of tumour in eloquent areas of the brain while preserving function, Direct Electrical Stimulation (DES) during awake brain surgery is the gold standard for intraoperative language mapping. To reduce the duration of the surgery and, thus, the stress for the patient, preoperative language mapping using navigated Transcranial Magnetic Stimulation (nTMS) can be beneficial (Tarapore, 2016). The method is, however, still not widely used in clinical practice. Reason for this could be the low predictive value of nTMS compared to DES mapping (Picht et al., 2013).

In the recent years, advances have been made to further improve preoperative language mapping under nTMS. Parameters such as intensity, frequency, duration etc. of the stimulation, picture-presentation-time, inter-picture-interval of the stimuli etc. have been tested out and consensus has been reached that is used by the majority of centres (Krieg et al., 2017).

However, the question of choice of task has not been further explored: whereas in the intraoperative situation, a variety of tasks is used and carefully chosen based on the individual's characteristics, most centres only rely on one task, namely object naming, for preoperative mapping of language.

It is known from stroke-induced aphasia research, that tasks involving only noun retrieval and production can hardly capture the individual's language skills. The necessity of including verb tasks is evident (Bastiaanse, Wieling & Wolthuis, 2016). While some studies (Hauck et al., 2015, Hernandez-Pavon et al., 2014) have looked into the comparison of noun vs. verb tasks under nTMS, they neglected the actual contribution a verb task can have: the elicitation of the inflected form of a verb.

However, while naming action in English, participants tend to use the progressive form of the verb (*he is sleeping*). This would diminish the morphological processes required for inflection, compared to inflection in tenses such as simple present and past (*he sleeps/he slept*). Therefore, adding a lead-in phrase with an adverb to the picture can help triggering tenses other than simple progressive (*Daily, he sleeps*). This has not been tested before regarding nTMS mapping.

In this validation study, we established a reliable item list for both object and inflected action naming tasks for British English (BE) that uses lead-in phrases triggering one-word answers and that is feasible to use

under nTMS parameters. We present a validated picture set with each 50 items for object naming and 50 for action naming with a high naming agreement.

Methods

From a collection of around 400 available black-and-white drawings (Bastiaanse et al., 2016), the researchers chose 90 suitable pictures to elicit possible one-word targets in English. This preselection was shown to 5 BE native speakers with the instructions to name the object/action on the picture. Only pictures consistently named with one label were considered good depictions and chosen for the next step.

Next, the remaining 80 object and 74 action stimuli were implemented in an experiment, following parameters commonly used in nTMS language mapping.
Participants were instructed to name the pictures with the first word coming to their mind in one word.
For the object naming task, they were asked to each time complete and read out the sentence “this is a…”, printed above.
For the action naming task, elicitation of the progressive form of the verb was avoided, and instead the inflection of the verb in different tenses was triggered. For the first half of the stimuli, the participants were asked to complete and read out the sentence “Daily, he…”, triggering the the verb in simple present. In the second half, the printed lead-in phrase “Yesterday, he…” triggered the verb in simple past.
The picture presentation time was 700ms for the objects and 1000ms for the actions with an inter picture interval of 2500ms comparable to conditions under TMS.
After two practice items, the test began and was not further interrupted. Answers were recorded. The test took around 12 minutes. 28 native speakers of BE (15 female; age range: 23-65, age average: 40.91 with a wide range of educational background) took part in London, UK.

Result

Only items that were consistently named by at least 80% of the participants were selected for the final item list.
71 object stimuli and 50 action stimuli proofed to fulfill the criterion. To keep the lists even, another 21 objects were excluded. The final item lists consist of 100 items sorted by ascending values for Age of Acquisition of the words. All items are also matched for frequency, length in syllables, animacy (for objects); regularity, transitivity, number of arguments, instrumentality and name relatedness to a noun (for the actions).
In the action naming paradigm, both subtests (present and past) have a balanced number for irregular vs. regular verbs. No difference was observed in the correct/incorrect naming of the irregular vs. regular verbs, neither within nor across tasks.

Discussion

This validation study resulted in a reliable set of stimuli: we established two tasks that are capturing the linguistic abilities more adequate than a noun task alone could. The tasks are balanced for age of acquisition and frequency, as well as irregularity for the verbs.
Moreover, all stimuli are controlled for linguistic factors, known to be impaired in clinical populations, and can, hence, be sorted participant-tailored.
The inclusion of a lead-in phrase was necessary to trigger the inflected form of the verbs. While it makes the visual input more complex and the answer longer, it did not hinder the participants for completing the tasks correctly and in time.
Even for the more complex pictures depicting less frequent actions, the picture presentation time has shown to be sufficient to recognize and name the target, yet short enough to be challenging and to stay as close as possible to the commonly used protocols.
This proofs the paradigm to be feasible for usage under nTMS. The test will be made freely available for neurosurgical teams; it can be adapted to other languages.

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The influence of conceptual number agreement on intra and inter-sentential co-reference establishing: An ERP study in Brazilian Portuguese

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Introduction

Number agreement depends mainly on two kinds of information: one of a grammatical/syntactic nature and one of a conceptual/semantic nature (Bock, Eberhard, & Cutting, 2004; Eberhard, Cutting, & Bock, 2005). When we say *a house*, we are referring to one entity only, meaning that the noun *house* should be in the singular form. However, when we say *two houses,* we are referring to more than one entity, thus requiring the plural form of the noun (Schweppe, 2013).

Collective nouns, however, are a unique category because they are grammatically/syntactically singular but are conceptually/semantically plural. In relation to co-reference establishing, when a collective noun is the antecedent, as in the example *The band played last night. They are very talented,* the pronoun *they* violates number agreement, not making a direct syntactic reference to its antecedent, *the band*, present in the previous sentence. The anaphoric relation between the singular antecedent and the pronoun *they* is thus conceptual, since the noun phrase (NP), *the band,* refers to a group of individuals. When the anaphora agrees in conceptual number but not in grammatical number, it is called a 'conceptual anaphora'.

With respect to pronoun processing in Alzheimer's Disease, previous studies showed that Alzheimer patients present more difficulty when performing tasks in which they have to connect an antecedent with its anaphor, because co-reference establishing relies not only on grammatical information, as in subject-verb agreement, but also on conceptual information (Almor et al., 1999; Almor et al., 2001). The processing of conceptual anaphora in Alzheimer's Disease has not yet been investigated and studies conducted with non-brain damaged participants in different languages have shown different patterns. In English and Spanish conceptual anaphora were considered more natural than grammatical anaphora (Gernsbacher, 1991; and Carreiras and Gernsbacher (1992). In German, however, the pronoun interpretation relied on the distance between the antecedent and its anaphor (Schweppe, 2013). In Brazilian Portuguese, Farias & Ferrari-Neto (2012), concluded from the results of a self-paced reading task that, even though a significant effect was observed on the verb following the critical pronoun, it took longer for participants to read sentences containing conceptual anaphora than sentences containing grammatical anaphora.

Before investigating how conceptual anaphora are processed in Alzheimer's Disease, it is important to have a better understanding of how they are processed by non-brain-damaged individuals. One possibility of investigating the influence of conceptual number in co-reference establishing is by using Event-Related Potentials, as they are differentially sensitive to syntactic and semantic aspects of comprehension.

It is also important to investigate how co-reference establishing depends on conceptual information when the antecedent is in a different sentence than its anaphor (inter-sentential anaphor) from when

the antecedent is in the same sentence of the anaphor (intra-sentential anaphor) as these two types of anaphors are likely subject to different types of grammatical and semantic constraints. In the case of the inter-sentential anaphora, it is possible that the pronoun is making a reference to the antecedent from the previous sentence, but it could also be introducing a new topic, which is not the case for the intra-sentential anaphora. Due to this fact, inter-sentential anaphora may rely more on conceptual information in order to connect the antecedent to its anaphor, which could influence the role of conceptual number in co-reference establishing.
For this reason, this study aims to a) investigate the role of conceptual number in establishing co-reference; b) investigate how conceptual number influences the processing of intra- and inter-sentential anaphora.

Methods

Participants

Thirty non-brain-damaged native speakers of Brazilian Portuguese will be tested.

Materials

Two experiments will be conducted, one focusing on inter-sentential anaphora and the second one on intra-sentential anaphora. The experiments consist of passive reading tasks, which will be presented by using E-prime software and each sentence will be displayed word-by-word. The experimental materials comprise 80 fillers and 80 experimental sentence pairs per experiment. Each experiment consists of four conditions, as follows.

Experiment 1 (Inter-sentential anaphora):

1. **Collective noun + grammatical anaphor**
   O clube perdeu a competição. Ele enfrentou críticas da imprensa.
   The team lost the competition. It faced criticism from the press.
2. **Collective noun + conceptual anaphor**
   O clube perdeu a competição. Eles enfrentaram críticas da imprensa.
   The team lost the competition. They *faced criticism from the press.*
3. **Regular noun (singular) + grammatical anaphor**
   O jogador perdeu a cabeça. Ele enfrentou a rejeição pública.
   The player lost his mind. He *faced the public rejection.*
4. **Regular noun (plural) + grammatical anaphor**
   Os jogadores perderam a cabeça. Eles enfrentaram a rejeição pública.
   The players lost their minds. They *faced the public rejection.*

Experiment 2 (Intra-sentential anaphora):

1. **Collective noun + grammatical anaphor**

   O clube perdeu a competição e ∅ enfrentou críticas da imprensa.

   The team lost the competition and ∅ faced criticism from the press.
2. **Collective noun + conceptual anaphor**

   O clube perdeu a competição e ∅ enfrentaram críticas da imprensa.

   The team lost the competition and ∅ faced criticism from the press.
3. **Regular noun (singular) + grammatical anaphor**

O jogador perdeu a cabeça e ∅ enfrentou a rejeição pública.

The player lost his mind and ∅ faced the public rejection.

4. **Regular noun (plural) + grammatical anaphor**

   Os jogadores perderam a cabeça e ∅ enfrentaram a rejeição pública.

   The players lost their minds and ∅ faced the public rejection.

Predictions & Discussion

We are currently conducting the experiments. Our hypothesis is that conceptual number will have a different effect on intra- and inter-sentential anaphors. In the case of the inter-sentential anaphora experiment, we predict that sentences containing grammatical anaphora will be more complex to process, due to the fact that conceptual information is crucial to co-reference establishing, and the increase in processing is expected to be reflected in a larger P600 effect. However, in the case of the intra-sentential anaphora experiment, we predict that, as the anaphor is present on the same sentence as the antecedent, it relies less on conceptual information, thus the conceptual anaphor condition will demand more processing, which will be reflected in a larger P600 effect.

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Language and working memory in a bilingual Turkish-German individual with aphasia

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Introduction

Bilingual aphasia assessment has been under scientific enquiry for more than a century. However, it was only recently that bilingual persons with aphasia (PWA) speaking less commonly studied language pairs came under the spotlight, see for instance Kambanaros and Grohmann (2011) for Greek-English and Knoph (2011) for Farsi–Norwegian. There is still a need to document linguistic and other cognitive aspects of bilingual aphasia with other understudied language pairs, such as Turkish–German. To date, Turkish–German bilingual aphasia has received scant attention. For example, Arslan and Felser's (2017) examination of two Turkish-German PWA pointed to different patterns of syntactic impairment, which was explained in terms of onset of bilingualism and language dominance.The goal of the present case study is to understand the value of verbal working memory (WM) assessment in addition to language assessment in PWA, who often present with WM deficits (Murray, Salis, Martin, & Dralle, 2018). Research from monolingual aphasia suggests a complex relationship between WM and language processing and has highlighted the importance of assessing WM abilities in this population (Martin, Minkina, Kohen, & Kalinyak-Fliszar, 2018). To our knowledge, no previous studies have explored WM capacity for L1 and L2 in bilingual aphasia. Comparing L1 and L2 WM performances in PWA would make a significant contribution to our understanding of the relationship between WM and language processing. Furthermore, such a comparison could also provide clinical insights into the use of WM tasks in bilingual aphasia assessment.

Methods

Participant

HK is a 59-year-old illiterate Turkish-German bilingual woman who had been suffering from aphasia for 16 months prior to our initial examination. Her husband reported that she was fluent in both the languages premorbidly, with Turkish being more proficient than German. Her aphasia resulted from a traumatic brain injury and subsequent intracranial haemorrhage that damaged large areas of her left hemisphere, including most parts around the perisylvian fissure. Her clinical reports indicated that she had been suffering from global aphasia in both languages prior to our examination.

Materials and Procedures

Language assessment tasks we administered included: (1) the Aphasia Check List in German (ACL; Kalbe, 2002); (2) a complete short screening version and subtests of the long version of the Bilingual Aphasia Test in Turkish (Örkurt & Paradis, 1987); (3) the long version of the BAT in German (Lindner & Paradis, 1987);

(4) the naming part of the LEMO test (De Bleser, Cholewa, Stadie, & Tabatabaie, 1997) in German; and (5) the Token test (De Renzi & Faglioni, 1978) for both German and Turkish, administered twice. The WM assessments included the forward and backward repetition digit span in both languages and the forward pointing digit span in German (i.e., Wechsler Intelligence Scale-4; Petermann, 2012). WM span was defined as the number of items in the longest success trial. Additionally, we calculated: (i) item recall in terms of the proportion of digits correctly recalled independently of their serial position relative to the total number of items recalled; (ii) serial order recall scores (i.e., the proportion of correct items recalled in correct position relative to the overall number of items recalled). For between-language statistical comparisons chi-square and Fisher exact tests were used.

Results

Table 1 illustrates the assessment results. The ACL indicates a severe spoken language deficit in German. Results from the BAT suggest that HK's syntactic comprehension is severely affected in both languages. Her auditory word comprehension and word repetition abilities mimic the results of syntactic comprehension, although there is a suggestive trend that German is worse than Turkish overall. This trend is comparable to the Token test results. She virtually failed to respond to the German Token test (6%) whilst the Turkish version was better (38%), although still severely impaired. A similar pattern was also observed in her object naming ability, which was better in Turkish (100%) than in German (30%). Note that in Turkish we only administered the short screening version of the BAT naming. Regarding the results from the WM tasks, HK's performance was below average in both forward and backward digit span in both languages. Her forward digit span was similar in both languages, but her backward digit span was higher in Turkish than German; in the latter she failed to respond to the task at all. Furthermore, item recall was higher in Turkish (94%) than German (73%); a difference was present for serial order recall, albeit smaller than item recall. However, cross-language comparisons for WM scores were not statistically significant.

Discussion

To our knowledge, this is the first study to document language abilities and WM abilities in a Turkish-German bilingual PWA. We showed that HK presents with low WM capacity and exhibits severe syntactic and lexical processing difficulties in both the languages. Severity of her aphasic symptoms in German overextends those in Turkish. For instance, this is evidenced by the results in the Token test and the BAT (naming and repetition). We believe that worse performance in German than Turkish represents both different extensions of impairments and premorbid bilingualism profile (i.e. language imbalance). We found no difference between the languages for WM capacity as indexed by forward digit span. Differential performance in L1 and L2 item and serial order recall measures may be associated with the difference in the participant's residual lexical abilities. This is in line with language-based models of WM (e.g., Martin & Saffran, 1997), proposing that retention of item information is closely dependent upon language abilities.

However, considering that digits are high frequency words in both languages, the digit span task may not be sensitive enough to discern language-specific WM problems.

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Table 1. Assessment outcomes in Turkish and German

	Turkish (L1)	German (L2)	Significance test *p*
Language tests			
BAT (%)			
Spontaneous speech			
Pointing to objects	100*	30	**.01**
Simple, semi-simple commands	100*	0*	
Complex commands	100*	N.A.	
Auditory comprehension of words	55	30	.18
Syntactic comprehension	39	36	.63
Naming objects	100*	30	**<.01**
Repetition of words & non-words	58*	39	.21
Repetition of sentences	66*	N.A.	
Series	100	N.A.	
Verbal fluency (no max.)	0*	Data not collected	
Semantic opposites	0*	Data not collected	
Token (%)	38	6	**<.01**
LEMO Naming (%)	Data not collected	30	
WM tasks			
Forward digit span (repetition)			
Span	3	3	
Item recall (%)	94	73	.15
Serial order recall (%)	77	60	.44
Backward digit span (spoken)			
Span	2	N.A.	
Forward digit span (pointing)			
Span	Data not collected	2	
Item recall (%)	Data not collected	75	
Serial order recall (%)	Data not collected	44	

Note. N.A. = Not possible to administer; * = BAT short version; bold indicates a statistically significant difference; results of the language tasks were analyzed by using Chi-square test ($p < .05$, two-tailed); scores in the WM tasks were analyzed by Fisher's exact test ($p < .05$, two-tailed).

Semantic Complexity in the treatment of naming deficits in Alzheimer's disease

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Introduction

Naming deficits have been described as an initial symptom of the decline in linguistic ability due to Alzheimer's disease (AD) (e.g. Kempler, 1991; McKhann et al., 2011). Previous studies investigated the knowledge and loss of semantic features in AD and suggest that naming deficits originate in the deterioration of semantic feature representations (Martin, 1992). More specifically, it has been proposed that the loss of semantic feature representations correlates with the severity of naming deficits (Garrard et al., 2005). Thus, at the mild stage, AD can primarily be associated with a loss of distinctive semantic features (e.g. "spiny red skin" for lychee), while -as the disease progresses- a decrease in knowledge about semantic features at the non-distinctive feature level (e.g. features shared by the majority of category members, "sweet" for fruits) is observable (Flanagan et al., 2013; Garrard 2005).

Concerning the treatment of naming deficits in individuals with aphasia, a treatment protocol based on the Complexity Account of Treatment Efficacy (CATE, Thompson et al., 2003) has been applied by training semantically complex items in order to induce generalization effects on untrained and less complex items (Kiran, 2008; Kiran & Thompson, 2003; Schröder & Stadie, 2010; Stanczak et al., 2006). This outcome is explained by the assumption that atypical items which have in comparison to typical items less semantic features in common with their category members are characterized through distinctive *and* typical semantic features (i.e. complex) of the relevant semantic category. Thus by training and relearning features of atypical items, semantic features of typical category members (i.e. less complex) are inherently strengthened too, leading to an increased naming performance of untrained and less complex items.

The objective of the current study is to investigate the effectiveness of the treatment protocol with another population group namely with patients with AD. Since the loss of semantic feature representations is claimed to cause naming deficits in AD, it is expected that (re-)learning semantic features describing atypical items should lead to improved naming accuracy of these items. Moreover and in line with the complexity account, a generalization to typical items of the same semantic category should occur. Consequently the results may allow further inferences with respect to the nature of the semantic impairment in AD.

Methods

We conducted a treatment study with an A-B-A design and follow-up assessment (6-10 weeks post treatment) targeting the naming deficits of three participants with probable AD (mean age: 70 years,

range: 64 - 78 years; Mini-Mental State Examination Test range: from 20/30 to 24/30). Treatment focused on naming performance and the knowledge of semantic features trained with different tasks (e.g. yes/no questions, selection of semantic features). These tasks are complemented by repetitive naming. 10 atypical items of a semantic category (e.g. fruits, vegetables, means of transport, animals, clothes, musical instruments) were trained. The typicality rating of the material is based on normative data (Schröder et al., 2012). Comprehension of the items was assessed with a word-picture-matching task. In total 12 treatment sessions (1-2 times per week, each à 45 minutes) were administered. Outcome measures are the accuracy in picture naming (trained items, untrained items and items from two non-trained semantic categories) and the number of elicited semantic features. For every participant a control task was administered based on the individual language profile.

Results

Results of the post-treatment assessment revealed that two participant (patient A and patient B) showed a significant increase in naming accuracy of trained atypical items (p<0.05, two-tailed) and of untrained typical items (p<0.05, two-tailed). Performance on the control task (spelling of PG-regular and irregular words; repeating of words and nonwords backwards) remained stable (p>0.05, two-tailed). In addition, the mean number of elicited semantic features increased in comparison to the pre-treatment performance (patient A and B: p<.01, paired t-test). The follow-up assessment for patient A reveals that treatment effects maintained for 8 weeks. Further results of the follow-up assessments will be outlined on the poster. Participant C demonstrated a significant increase regarding the mean number of elicitated features (p<.05, paired t-test) but no improvement regarding naming accuracy of the trained and untrained items.

Discussion

For two out of three participants a positive treatment outcome became apparent. Prior to treatment, a weak performance in the elicitation task co-occurred with a naming deficit. It seems that the repetitive naming and training of semantic features lead to a reactivation of semantic representations as indicated by the increase of produced semantic features in the elicitation task. This increase appears in association with a significant improvement in naming accuracy of trained atypical items. This co-occurrence strengthens the assumption that the naming deficits originate from a semantic deficit in these two participants and that re-learning or re- establishing semantic features supports the access to phonological word forms.

Patient C exhibited prior to treatment a severe naming deficit but in contrast a better performance in the elicitation task before treatment, leading to the assumption that the naming deficit is not primarily originating from a semantic impairment. Accordingly, training semantic features did not lead to positive treatment effects on naming accuracy.

To conclude, it has been evidenced that the Complexity Account of Treatment Efficacy (CATE) can result in positive outcomes not only in stroke-induced aphasia but also in patients with Alzheimer`s disease. Our results are in line with the assumption, that the training of distinctive and shared features of atypical category members inherently strengthens features of typical items. Given that a semantic impairment is identified as the source of the naming deficit in an individual with AD the applied

semantically based naming therapy seems to be successful in reactivating semantic features and restoring naming.

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Therapy gains of a linguistically based intervention in Primary Progessive Aphasia. Insights from a single case study

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Introduction

Verb argument structure (VAS) has been shown to affect language production in agrammatic stroke-induced aphasia (AgStr). In particular, the more the arguments of a verb and the higher the level of complexity, the more difficult it is for patients to produce the verb (Thompson, 2003). Cross-linguistic findings (Bastiaanse & van Zonneveld, 2004; Thompson, 2003) have shown that unaccusative verbs are more difficult to produce than transitive and unergative verbs. Notably, research findings indicated that patients with the non-fluent/agrammatic variant of Primary Progressive Aphasia (PPA-NF/A), a neurodegenerative disease involving language decline without other cognitive deterioration for at least 2 years, share similar linguistic deficits in verb production especially as verb argument structure complexity increases (Stavrakaki et al., 2014; Thompson et al., 2012). Intervention studies on AgStr indicated that therapy gains from training more complex linguistic structures can be generalized to easier, untrained but linguistically related structures (Thompson et al., 2003).

Against the above background, our study was designed to evaluate the effect of intervention on the performance of a patient with PPA-NF/A. Specifically, we address the question of whether therapy focusing on unaccusative verbs can improve performance on these verbs. In addition, we examine whether recovery gains from therapy on unaccusative verbs (complex structure) can be transferred to less complex (unergative and transitive) untreated verbs in a Greek PPA-NF/A patient. Unaccusatives are considered more complex than unergatives and transitives in Greek, a language without A-movement (Anagnostopoulou & Alexiadou, 1998). Unlike transitive and unergative verbs, unaccusatives lack [+Agentive] voice and their unique argument is not agentive (Koukoulioti & Stavrakaki, 2014).

METHOD

Participant

The 59 year-old female patient (KS) was recruited from the 2nd neurological clinic of the AHEPA hospital in Thessaloniki and fulfilled the current diagnostic criteria for PPA (Gorno-Tempini et al., 2011). She was diagnosed with PPA-NF/A on the basis of clinical observations and scores from psychometric tests including the Greek versions of the Addenbrooke's Cognitive Examination-Revised (Konstantinopoulou et al., 2011) and Boston Aphasia Examination (Tsapkini et al., 2009/2010).

Materials

The assessment materials included sentences with 8 unergative, 8 transitive and 8 unaccusative verbs (plus training verbs/fillers) employed in the study by Koukoulioti et al. (2018). The intervention materials

included 130 good quality photos depicting nouns and verbs. These pictures were tested (for suitability) with 5 healthy controls of similar age and education with KS. Unaccusative verbs and their arguments were shown so the patient could be trained in the unaccusative structure production.

Procedure

Pre-therapeutic evaluation

KS was assessed (i) in the production of verbs with complex argument structure (unaccusative verbs) and (ii) in the production of verbs with less complex argument structure (unergative and transitive verbs). The patient was presented with 30 videos and had to describe what was happening in the video.

Intervention

Intervention was completed in 13 sessions (40'-45' each). The patient was received intervention for unaccusative structures (verbs and their nominal argument) twice a week. *Post-therapeutic evaluation*

In this session, the patient was assessed by the means of the materials employed in the pre-therapeutic session. In addition, the same procedure, as in pre-therapeutic session was followed, to check improvement and potential generalization of training gains from the complex treated to the less demanding untreated verbs (from unaccusatives to unergatives and transitives).

Results

The results are presented in Table 1.

Table 1. The patient's correct performance on the production of unaccusative, unergative and transitive verbs.

	Unaccusative verbs N=8	Unergative verbs N=8	Transitive verbs N=8
Pre-therapeutic performance	1	3	3
Post-therapeutic performance	7	5	4

As Table 1 indicates, pre-therapeutic assessment showed difficulties in the production of transitive and unergative verbs). KS's performance in the complex unaccusative verbs was very low. Her performance agrees with previous research showing severe deficits in the domain of verb production for patients with PPA-A/NF.

In the post treatment evaluation, production of unaccusative verbs was impressively improved *(Fisher's exact test with 95% confidence interval, p= 0.01, OR = 0.032),* indicating the intervention efficiency for the patient's performance. Her performance on transitive and unergative verbs showed non-significant improvement *(p=1* and *p=0.62,* respectively), which might imply limitations in potential generalization of the training gains into the untrained less complex verbs.

Discussion

This study indicates that our participant significantly improved her production of unaccusative verbs after training. The results also suggest limitations in generalizing the training gains into easier untrained verbs (transitives and unaccusatives). This limitation may be related to the progressive nature of the disease which might prevented the patient to transfer the training gains to the less complex structures. Notably, these results contrast with findings coming from patients with AgStr which reveal the patients' generalization ability (Thompson et al., 2003). However, we point out that the generalization reported by Thompson and colleagues concerned untreated structures that have processes in common with treated structures. That was not exactly the case in our study as unaccusatives do not share the same syntactic properties with unergative and transitive verbs. Despite the attested limitations in generalization, taking the progressive nature of the disease into account, we consider this improvement in the production of unaccusative verbs a significant treatment outcome. Further research should be performed with larger samples of PPA-A/NF patients to develop effective intervention and investigate the maintenance of training gains in a progressive disease.

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"I've got to get something out of it. And so do they": Experiences of people with aphasia and university students participating in a communication partner training program for healthcare professionals.

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Introduction

Interactions between patient and provider in healthcare are dependent on communication accessibility (O'Halloran, Grohn & Worrall, 2012). Without this, patient outcomes are significantly limited and moreover, providers are not able to meet a basic standard of care (O'Halloran, et al., 2012). It has been documented in the aphasia literature that people with aphasia (PWA) have reduced health-related quality of life (QoL) outcomes compared to health-related QoL outcomes without aphasia (Hilari, Needles & Harrison, 2012). Areas that are likely to be impacted include emotional, medical and social domains. Communicative interactions are one focus of exploration when considering the main QoL themes impacted by aphasia. Communication partner training (CPT) (an environmental intervention that uses communication resources and strategies) has been used to support communication partners to interact successfully with people with aphasia (PWA). It offers a possible solution for supporting QoL for PWA and their communication partners. Through successful CPT interaction PWA's accessibility to healthcare is also notably improved. The main purpose of CPT is to increase participation through functional communication and promotion of well-being (Simmons-Mackie, Raymer & Cherney, 2016). Studies have documented positive effects of training for a range of communication partners including family members or caregivers of PWA, volunteers, and health professionals (HPs) (Cameron et al. 2015, 2017a, 2017b; Finch et al. 2013, 2017; Simmons-Mackie, Raymer, Armstrong, Holland & Cherney, 2010). The present study sought to build on prior studies by investigating the experiences of individuals with aphasia and healthcare providers to ascertain what they deemed to be beneficial from CPT and what could be refined or improved, dependent on the setting and skill-set of those participating. The aim of the present study was to gain an understanding of the opinions and experiences of PWA involved in the provision of CPT to HPs and HP students. This study also investigated the experiences of HP students who participated in the CPT program.

Methods

Eight PWA and 77 HP students, who had completed a CPT program, participated in a focus group / semi structured interview (PWA) and feedback session (HP students) moderated by two speech-language pathologists (SLPs). These sessions were recorded (audio and video), transcribed verbatim, including non-verbal communication, and analysed using qualitative content analysis.

Results

Overall, the study sought to understand the experiences of the training. Both the PWA and HP students reported positive experiences of CPT. PWA discussed their perception that CPT improved HPs and HP students understanding and interactions conversing with them and emphasised the need for training and education for all health related professions. HP students enjoyed the opportunity to experience interacting with PWA, without being 'assessed' and felt it consolidated their learning based on lecture content.

Discussion

Inclusive and accessible healthcare is paramount to ensure the engagement of patients and providers. Based on the experiences and feedback of the participants in this current study, CPT offers a salient and practical training method with potential to improve practice. Participants perceived CPT to be beneficial and validated the need for the training to support PWA accessing healthcare.

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Face-to-Face Communication in Aphasia: a Theoretical and Experimental Approach to Functional Communication

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Introduction

Background

Whatever the underlying approach of therapy, the overarching aim of SLT intervention is for the person with aphasia (PWA) to communicate as effectively as possible in "his or her own everyday environment" (Thompson, Worrall, & Martin, 2008; Worrall, 1995). This is what most measures of *functional communication* aim to capture. Thus, functional communication is often seen as the principle measure for assessing outcomes after speech and language therapy (SLT) intervention (Brady, Godwin, Enderby, Kelly, & Campbell, 2016). However, the term has been used and interpreted in a wide variety of ways depending on the purpose of the definition (e.g. empirical or clinical; Elman & Bernstein-Ellis, 1995), resulting in a large number of measures that overlap, but essentially measure different aspects of real life communication (e.g. transmitting a message, taking part in specific social events or behaviours, using linguistic skills, multimodal aspects of communication, and even quality of life). In addition, research has failed to produce consistent, reliable generalisation effects from SLT intervention to measures that target functional communication (Brady et al., 2016; Webster, Whitworth, & Morris, 2015). We believe these two problems are linked. The lack of consensus on what skills and behaviours are required for functional communication, makes it inherently difficult (if not impossible) to measure and predict performance on such a construct. Furthermore, it makes it nearly impossible to say with certainty what kind of intervention will lead to a change at this level of functioning. In a similar pattern to most psycholinguistic research over the last 30 years (Meteyard & Vigliocco, in press), SLT interventions typically rely on tasks that do not reflect the complex dynamics of contextualized communication. Rather, they usually take language out of its context, e.g. by presenting single words and sentences or practicing isolated tasks such as picture naming, repetition or judgements about stimuli. Without a clear understanding of how such isolated language skills behave and interact in the rich, dynamic and complex environment of everyday communication, it will remain difficult to predict how generalization to functional communication will take place.

Aims

We propose that aphasiology needs a specific and measurable, theoretically founded definition of situated language use that outlines what factors are important in communication and how these can be measured. Such a model needs to cover both internal (e.g. individual skills) and external (e.g. environmental) factors that influence a person's ability to communicate efficiently. Critically, there is a wealth of research from the communication sciences, psychology, neuroscience, sociology and psycholinguistics to support such a model. Using an extensive review of these literatures, the model

defines functional communication in narrow terms as *language use* (Clark, 1996), the most basic form of which is face-to-face communication. Three core components set face-to-face communication apart from the traditional, decontextualized approach to language: (1) The presence of another interlocutor (language use is *interactive, a joint activity*), (2) the use of multiple modalities of expression such as gesture, facial expressions, body posture and prosody (language use is *multimodal*) and (3) the use of context in a physical sense (i.e. the physical environment in which communication takes place), a communicative sense (i.e. what has already been communicated) and a personal sense (i.e. shared experiences and knowledge) (language use is based on *common ground*). Given this framework, the model outlines key skills or factors to be measured and considered when evaluating communication. Examples of skills are the ability to self-monitor and to monitor feedback from the interlocutor, the familiarity of the interlocutor and the number of different modalities that can be used for production and comprehension. We will also attempt to relate these components to traditional linguistic and non-linguistic measures (e.g. working memory, executive functioning, and attention).

We aim to explore the influence of each of these components on face-to-face communication in aphasia, to better understand how communication works for PWA: are PWA able to rely on these elements as healthy control subjects do, or have these processes been affected by the brain impairment?

Methods

The poster includes a review of the literature on functional communication in aphasia, the proposed model of face-to-face communication and a description of the methodological approach we will take. The experimental design of the study will consist of a collaborative, referential communication task that will allow for the manipulation of the three core components: 1) the availability of different modalities in communication, for example by using a barrier (Clark & Krych, 2004), 2); the presence or absence of another interlocutor, or the familiarity of the conversation partner (Clark & Krych, 2004), and 3) common ground, such as the embeddedness of the communicative situation in the referential context (Zwaan, 2014; Clark, 1996).

The poster will include details on the first experiment and the outcome measures to be used, in which the degree of familiarity of the conversation partner is manipulated (common ground). Familiarity is manipulated by comparing task performance of familiar and unfamiliar subject pairs. Outcome measure will be based on the literature review and include measures such as communicative efficiency (i.e. accuracy, time taken to complete), error detection, self- and other-monitoring, and measures taken from Conversation Analysis such as repairs and patterns of sequence construction (Beeke, Maxim & Wilkinson, 2007; Damico, Oelschlaeger & Simmons-Mackie, 1999). Familiarity will vary on a personal level (i.e. having shared experiences) and on knowledge of aphasia (i.e. what the impairment is and how to support communication).

Discussion

Over the past decades, much research has been done on functional communication in aphasia. Most researchers agree that the main components of the proposed model play a role in the ability of the PWA to communicate in everyday life. However, these components have, to the knowledge of the authors, not been brought together in one, theoretically founded model that is systematically and experimentally manipulated in an attempt to get a better understanding of the complex relationship between the separate components and how these influence functional communication in aphasia. A better understanding of functional communication, or situated language use, in aphasia will help tease apart the intricate relationship between traditional linguistic and cognitive (executive functioning, memory, attention) functioning and the ability to *use* language in everyday life. Understanding what language *use* entails for PWA will help narrow down how this concept can best be measured and how intervention at one level of functioning might translate to communication in everyday life.

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First Simple makes last complex: construct irrelevant variance effects in the test of grammatical comprehension.

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Introduction

Reliability of a test increases with test length, offering opportunities for insights on a phenomenon. However, 'artificial inflation' may pose psychometric disadvantages to item score. An extraneous variable (a construct Irrelevant Variance) can negatively affect assessment outcome, with items towards the end of a test receive less attention.

The current study draws upon a widely used test for sentence comprehension; the Test for Reception of Grammar (TROG-2) (Bishop, 2003). Specifically, when looking at standardized scores, the normative data illustrated as developmental trend graphs depict age equivalent scores for each construct, and appear to follow an incremental format. However, in the final constructs, participants at the higher end of the age scale, 14 to 16y display a low performance. This study examines whether the order of the constructs or 'blocks', although representationally coherent in an incremental complexity scale, can affect TROG-2 score. TROG-2 is suitable for children from 4 years old to adults. It has been widely used across various clinical groups (hearing impairment, SLI, Neurological patients).

Methods

40 participants (18 male) were randomly allocated in two groups. All were of undergraduate education and English native speakers. Prior to being tested with TROG-2, each participant completed a Digit Span test to establish equal working memory in both group and a minimum inclusion score of four digits for each participant.

One half of the sample, Group A, were in the control condition whereby they were tested using TROG-2 in the correct order, whilst remaining half, Group B, were presented with the blocks in TROG-2 in the reverse order.

Results

Group A (N=20) was associated with a TROG-2 test score of M=16.35 (SD=2.35), Group B (N=20) who completed the study in the reverse order, was associated with a numerically overall higher test score of M=18.15 (SD=1.23). The difference in TROG-2 overall test scores between the two groups was significant, t (28.66) =-3.04, p=.005.

Overall, TROG-2 scores were calculated on a pass/fail basis per block. In order to pass a block, all four items within a block must be successfully answered. Group B scored higher in all blocks individually

excluding Block A, B, C, D, L, N (see Table 1 and Figure 1). Block T scores for Group A (mean rank=14.53) and Group B (mean rank=26.48) were significantly different (p=.001).

Discussion

The aim of this study was to determine whether the directionality of which the constructs or blocks are presented to participants would affect their block score and overall score on TROG-2, assessing whether the low standardized scores reported in the final blocks can be explained by task difficulty or whether it can be attributed to an order effect. The order manipulation was effective with participants in the reverse group making significant less error on the center-embedded relative clauses. Data will be discussed in a more comprehensive model including the interaction with working memory reported in the literature for this specific linguistic construct.

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Table 1. Performance of Group A (standard order) and Group B (reverse order) for each TROG Block.

Blocks (A-T)	TROG-2 (Means and SD) Group A	Group B
A	4±0	4±0
B	4±0	3.95±0.22
C	4±0	3.95±0.22
D	3.95±0.22	3.9±0.3
E	3.85±0.37	3.9±0.3
F	3.85±0.37	3.9±0.3
G	3.95±0.22	4±0
H	3.9±0.3	3.95±0.22
I	3.95±0.22	4±0
J	3.9±0.3	3.95±0.22
K	3.7±0.57	3.95±0.22
L	3.75±0.44	3.65±0.22
M	3.8±0.52	3.95±0.22
N	3.8±0.52	3.75±0.44
O	3.85±0.36	4±0
P	3.8±0.52	4±0
Q	3.7±0.47	3.8±0.52
R	3.45±0.76	3.55±0.83
S	3.35±0.67	3.75±0.64
T	2.55±1.1	3.7±0.57

Grammar and lexicon distinction in the left inferior frontal gyrus: a TMS study

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Introduction

Recent neuroimaging studies have shown that the anterior part of the left inferior frontal gyrus (aIFG) is activated in lexico-semantic tasks, whereas the posterior part (pIFG) is activated in syntactic processing (reviews: Cappa, 2012; Hagoort, 2005; Price, 2010). Transcranial magnetic stimulation (TMS) has been used to generate "virtual lesions" in the left IFG to probe the causal structure-function relationships (Devlin & Watkins, 2008). TMS studies have further corroborated the involvement of the left aIFG in lexical-semantic processing and the pIFG in syntactic processing (Devlin et al., 2003, Zhu et al., 2015, Hartwigsen et al., 2015, Schumann et al., 2012, Acheson & Hagoort, 2013, Sakai et al., 2002).

The previous studies, however, focused on single word processing. Moreover, they have not demonstrated a functional-anatomical double dissociation for lexical and grammatical tasks within the left IFG. In the current TMS study, we investigate the role of the left aIFG and pIFG in grammatical and lexical processing in a multi-word production paradigm. We expect a double dissociation for grammatical and lexical tasks when left pIFG (BA 44) and aIFG (BA 47) are targeted with TMS.

Methods

Participants

Thirty right-handed healthy Danish native speakers were recruited for this study. Due to drop out and technical issues, the data were analyzed from 18 participants (9 male, mean age = 25, SD = 4).

Design, materials and procedure

We used a 2x2x2 crossed factorial design with the factors TMS site (BA 44/BA 47), TMS type (effective/sham) and task (grammatical/lexical). The tasks were presented in blocks consisting of 32 target and 8 filler items. The grammatical and lexical tasks comprised a conversational-like setting, where lexical

numerals were contrasted with grammatical indefinite articles. In both tasks first, the participants saw a line drawing in different colors representing a concrete noun and heard a sentence like 'I have two red letters' (1) (lexical task) or 'I have a red letter' (2) (grammatical task). Next, the participants saw another picture, heard a question and they had to answer the question based on what was in the picture.

Grammatical condition

(1) Jeg har to røde breve. Hvor mange har du?

'I have two red letters. How many do you have?'

Expected response: et rødt brev.

'One red letter.'

Lexical condition

(2) Jeg har et rødt brev. Hvad har du?

'I have a red letter. What do you have?'

Expected response: et blåt brev.

'A blue letter.'

100 ms after the stimulus was presented the participants received a train of three TMS pulses (10 Hz, 110% and 30% of resting motor threshold for effective and sham stimulation respectively). The target sites were located using neuronavigation through robotized TMS system ("TMS Navigator robotic edition", Localite GmbH, Sankt Augustin, Germany; Axilum Robotics TMS Robot). The participants' head was co-registered onto their own T1-weighted images. The Talairach coordinates for the target sites (for BA 44 x = -52, y = 10, z = 28 and for BA 47 x = -46, y = 33, z = -3) were converted to MNI coordinates.

Results

RTs and accuracy were analyzed using linear mixed models and generalized mixed models respectively. TMS type, TMS site and task were fixed effects, participants and items were random effects in both models. The results showed a significant three-way interaction between TMS type, TMS site and task (b = 42 ms, t (4676) = 2.4, p = 0.02) for RTs (Figure). RTs significantly increased in effective stimulation compared to sham, and the increase was larger when BA 47 was stimulated in the grammatical task compared to the lexical task. TMS type (b = - 36, t (4672) = -3.2, p < 0.001) and site (b = 72, t (4673) = 7.6, p < 0.001) had significant main effect on RTs, whereas task did not (b = -13, t (4673) = -1.4, p = 0.16).

For accuracy, the interaction between the three fixed effects was not significant (b = -0.08, z = -0.1, p = 0.9). There was no main effect of TMS type (b = 0.2, z = 0.5, p = 0.7) or TMS site (b = -0.3, z = -0.9, p = 0.4) or task (b = -0.5, z = -1.5, p = 0.15).

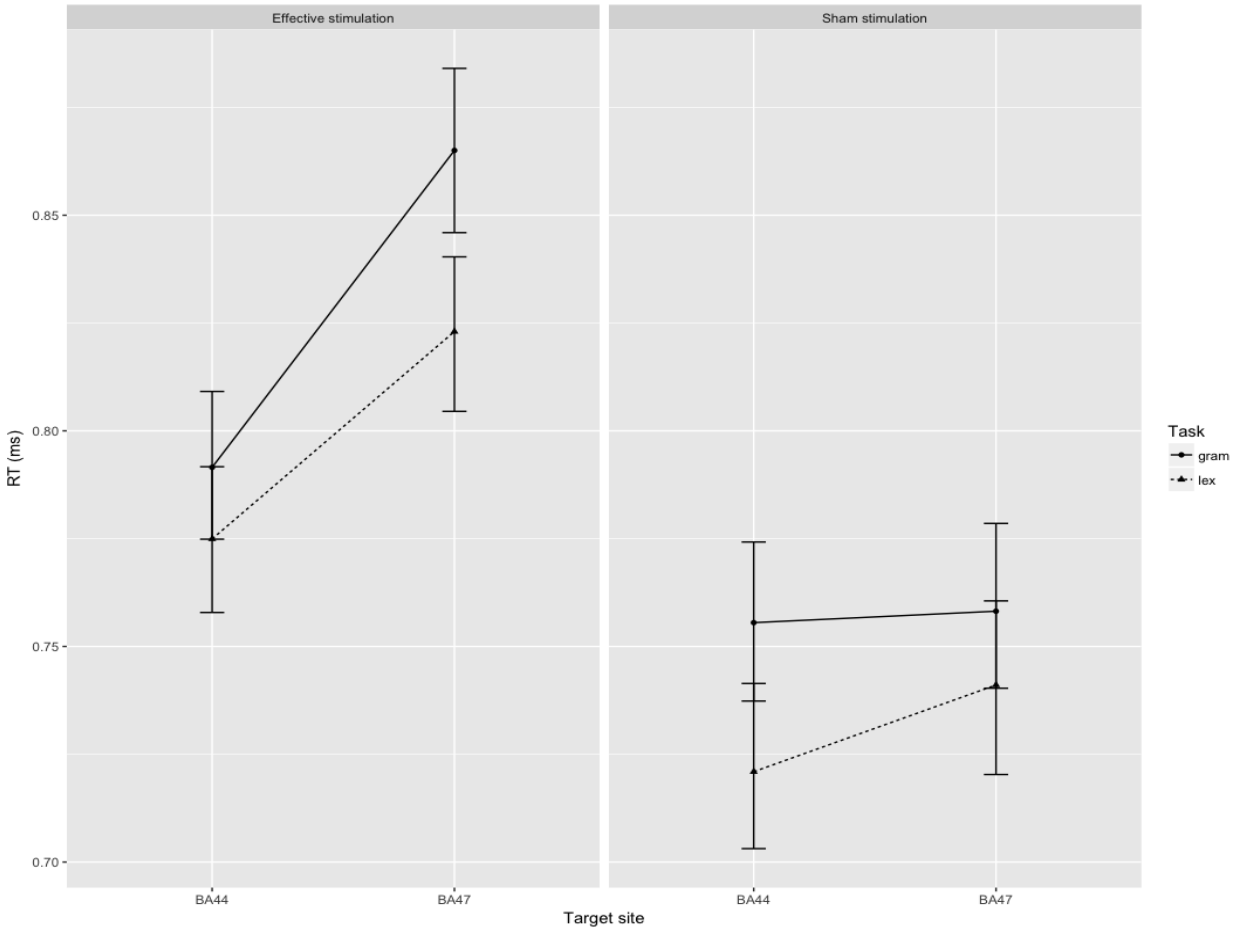

Figure: The three-way interaction shows that the reaction times (RTs) difference between the grammatical (gram) and lexical (lex) task is bigger when BA 47 is stimulated compared to BA 44 in effective stimulation compared to sham.

Discussion

The results show that both BA 44 and 47 are involved in performing the grammatical and lexical tasks but the RTs for the grammatical task selectively increase when BA 47 is stimulated. Earlier studies have shown that BA 47 is involved in lexico-semantic encoding (e.g. Devlin et al., 2003; Hartwigsen et al., 2016) but its engagement in grammatical encoding in the current study is a novel finding, which may be explained by semantic differences between grammatical and lexical items and in this particular case between the determiner and the numeral. As for BA 44, it is known for its involvement in syntactic processing (e.g. Hagoort, 2005). In the current study since both tasks have similar syntactic complexity, the RTs are similarly affected when BA 44 stimulated but semantic differences result in RTs being more affected in the grammatical task when BA 47 is stimulated compared to the lexical task.

Despite the challenges of a multi-word production paradigm in a TMS study, we succeeded in showing different ways BA 44 and 47 are involved in language processing. Future research can expand this paradigm to other cortical areas and temporal windows.

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Interaction between linguistic and numerical abilities of Hungarian patients living with mild or moderate aphasia

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Introduction

There are competitive conceptions of the relation between linguistic and numerical abilities (Semenza, 2008; Roselli, Ardila, 1997, Denes, 2011). Recently numerous study have reported that numerical abilities are connected with language processing (De Luccia, Ortiz, 2015; Messina, Gianfranco, Basso, 2009), at the same time some numerical mechanism are independent from language (Rath et al. 2015; Semenza, 2008). Our aim was to compare Hungarian aphasic patients' numerical abalities in different arithmetical and numerical tasks (as counting, arithmetic operations: addition, subtraction, multiplication and division, and complex numerical tasks) with healthy controll's depending on the severity of their linguistic abilities.

Methods

Patients and methods

We examined 17 aphasic patients' numerical abilities. Patients were tested by linguistic and numerical tests as follows: Hungarian version of Western Aphasia Battery (Osmanné Sági, 1991), Boston Naming Test (Kaplan, Goodglass, Weintraub, 2001) and Token Test (Osmanné Sági, 1983), Hungarian version (Igács et al, 2008) of Number Processing and Calculation (NPC, Delazer et al. 2003) were used. Depending on the severity of aphasia 8 mildly and 9 moderately damaged aphasic patients were invited to this research. All of the patients were treated at the Department of Neurorehabilitation of Neurology of the University of Szeged. Healthy controlls were matched to the clinical group. All of data of the participants were included by the ethical norms of the Department. All of them were Hungarian native speakers.

Results

Patients with aphasia showed worse performance during the tasks correlated to healthy groups. They had the worst results in calculation (69%) and numerical transcoding tasks (81%). Multiplication (61%) and division (63%) seemed to be the most difficult operations while they could solve the addition exercises almost correctly (85%). They also had difficulties in solving text problems (57%) and written calculations (57%). Comparing mildly and moderately damaged aphasic patients' performance we found that mildly damaged aphasic patients had significantly better performance (77%) than severe ones (60%) in all kind of tasks.

1. To compare the general performance of the three groups, we conducted a One-Way ANOVA with the GROUP factor (healthy, mildly aphasic, moderately/severly aphasic). The ANOVA was significant, $F(2, 25)$

= 17.980, *MSE* = 92.020, $p < .010$, $\eta_p^2 = 0.590$. The healthy group showed the best performance, followed by the mildly aphasics and the moderately/severly aphasics. Post hoc tests revelaled that the healthy group did not differ significantly from the mildly aphasic group ($p = .105$), but there was a significant difference between the healty and moderately/severly aphasic groups ($p < .001$) and between the midly and moderatly/severly aphasics ($p = .007$).

2. To see if there are any selective diffences in between the different arithmetical operations of the three groups we conducted a Mixed Design ANOVA with the following factors: GROUP (healthy, mildly aphasic, moderately/severly aphasic) and OPERATION (addition, subtraction, multiplication and division).

The main effect of GROUP was significant, $F(2, 25) = 9.032$, *MSE* = 714.773, $p = .001$, $\eta_p^2 = 0.419$, so was the main effect of the OPERATION, $F(1.980, 49.508) = 19.698$, *MSE* = 220.903, $p < .001$, $\eta_p^2 = 0.441$. Most importantly, the interaction of GROUP x OPERATION also reached significance, $F(3.961, 49.508) = 6.402$, *MSE* = 220.903, $p < .001$, $\eta_p^2 = 0.339$, indicating that the effect of opeartion was was not similar in the three groups.

Post hoc tests revealed that there was no difference in performance with different operations in the healthy group (all *p*s > .999). Mildly aphasics showed better performance on the addition/subtraction items than on the division items (significant difference between addition and division, $p = .012$; trend level difference between subtraction and division, p =.053). Moderately/severly aphasics showed a better performance on the addition/subtraction items than on the multiplication/division items (all ps < .001). From another perspective, while performance on the addition and subtraction items did not differ between groups (all *p*s > 0.261), multiplication and division was better accomplished by healthy individuals than by moderately/severly aphasics (both *p*s < .002); and the mildly aphasiacs also performed better on these items than the moderately/severly aphasics (multiplication $p = .009$, division $p = .086$ – a trend towards significance).

Discussion

Aphasic people's numerical performance is worse than that of a healthy control group, depending on the rate of the linguistic disruption/disturbance. As for the overall numerical performance of aphasic people, there is a significant difference between healthy and semi-severe aphasic, as well as between mild and semi-severe aphasic groups. The examined task-groups also reflected upon the significant differences between the groups. The participants of the study achieved the best results in the task-group tackling the notion of number, whereas the calculation task-group appeared to be the most difficult. In the case of arithmetic facts and rules, when studying basic arithmetic operations, both aphasic groups had better results in addition and subtraction than in multiplication and division. By analysing the results of textual tasks, it can be said that the patients could do half of the tasks successfully. According to these analyses, the performance in textual tasks did not depend on the required operation, however, the mild and the semi-severe aphasic groups' performance was worse in all four basic arithmetic operations.

Our findings have shown that aphasic patients had difficulties with numerical tasks. It can be seen that the range of numerical abilities are influenced by linguistic disorders.

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The Gulf Arabic Aphasia Test (GAAT)

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Introduction

Linguistically informed clinical assessments for aphasia are not available for Arabic. Researchers and clinicians in the Arabic speaking world have made use of translated English assessments, such as the Boston Diagnostic Aphasia Examination (Goodglass and Kaplan, 1983) and the Comprehensive Aphasia Test-CAT (Swinburn, Porter and Howard, 2004), which are not linguistically driven by the structures of Arabic, resulting in challenges for diagnosis and intervention. The modified tests are also not informed by psycholinguistic factors such as imageability, age of acquisition, frequency, familiarity, length, and name agreement for Arabic concepts/words.

The aim of the current project is to develop theoretically-driven assessments for Gulf Arabic, a variety that has not been explored before. The battery aims to assess all areas of language comprehension and production (including reading and writing), as well as associated neuropsychological deficits (that may impact on recovery/rehabilitation strategies), and perceived disability together with the impact on patients' lives. It is divided into three different sections; the cognitive screen, the language battery, and the disability questionnaire in line with the CAT. Each section has different subtests that assess independent areas of language and cognitive abilities. Each subtest is constructed on the basis of contemporary knowledge of the factors/variables influencing aphasic performance that were reported in a recently published normative database of the same variety (Khwaileh et al., 2018). The stimuli were controlled for word frequency, age of acquisition, length, familiarity imageability, name agreement, image agreement, visual complexity, normative reaction time, morpho-syntactic regularity, and syntactic complexity.

Methods

To assess the validity of the tests, we aimed to administer the full battery to around 50 healthy speakers, with the exception of the disability questionnaire as it is aimed at assessing the impact of aphasia on patients. The reliability of the tests is also being assessed by administering it to people with chronic aphasia (>6 months duration) on two occasions a month apart. This will allow us to assess test-re-test reliability to permit the investigator to assess the significance of changes in each test/sub-test. A detailed prognosis of the expected severity of a patient's deficit at 12 months post onset will also be available for patients and clinicians. We will obtain this information by testing around 30 people with aphasia on four occasions: 1 month post-onset, 3 months post-onset, 6 months post-onset, and 12 months post-onset. Therefore, such data will help therapists to devise a clear treatment plan depending on each patient's individual progress.

Participants

So far, 51 normal speakers have been administered the full test, and are aged between 19 and 62. They all had no language or hearing deficits, and their level of education was at least of 12 years. The tests were conducted in one session and took participants 35 to 50 minutes to complete. All subjects were native speakers of Gulf Arabic.

In addition, 19 aphasic patients (12 females, 7 males) so far have done the full test. All had ischemic or hemorrhagic stroke in the left hemisphere of the brain. 18 patients are aged between 51 and 84, and one patient is 29 years old. 15 participants were diagnosed with non-fluent aphasia, and 4 were diagnosed with fluent aphasia. All subjects were native speakers of Gulf Arabic.

Results

Overall, results from the control data showed almost perfect performance for all the tests (>95%) in terms of accuracy and very low standard deviation scores. The highest mean scores in terms of accuracy were obtained for the reading tests (99%), indicating that written material were transparent. On the other hand, results from the aphasic data showed relatively low scores with highly variable standard deviation values. Data from the reading tests showed some of the lowest scores across all tests (36.50%). Scores were also extremely low on production tasks (35%), indicating severe impairment in lexical retrieval.

However, the aphasic participants did fairly well on the comprehension tests where the highest mean score was achieved (67%), and particularly better performance on single word (spoken and written) comprehension tasks than in sentence comprehension. These results indicate that comprehension is not severely impaired amongst this group of aphasics, and difficulty mainly surfaced on reading and production tests.

Discussion

Results from the control data showed relatively high scores for each subtest across all language sections, thus confirming the validity of the items used in the battery and the linguistic and cultural features they were controlled for. The project aims to further continue recruiting aphasic patients to assess test-re-test reliability. After completion of collecting data, the battery will be available for researchers and clinicians, as well as patients to access from an online platform. An Android version of the battery has been developed and is being tested at the moment.

The battery will be clinically useful, as clinicians will have access to a test manual that will guide them to further assessment strategies and treatment plans that are directly related to the patients' identified problems. The entire battery is kept relatively brief and can be completed in 1 to 2 sessions, each taking 45-60 minutes, depending on the impairment severity. The present battery will help improve the communication skills as well as the quality of life of patients.

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What underlies similar behavioral facilitation and interference in blocked-cyclic naming: ERP results in two aphasic individuals with different lesions and anomic profiles

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Introduction

In word production, the blocked-cyclic naming paradigm (Damian, Vigliocco, & Levelt, 2001) has been often used to create semantic interference and facilitation, consisting in behavioral differences between semantically homogeneous and heterogeneous contexts. It has been shown that multiple mechanisms normally underlie semantic interference and facilitation in this paradigm (Python, Fargier, & Laganaro, 2018). In brain-damaged speakers it has been recently argued that frontal lesions impair the decision threshold adjustment for lexical selection in this paradigm (Anders, Riès, Van Maanen, & Alario, 2017). In anomic patients, the lesion site and the error types are traditionally used to hypothesize the underlying impairment causing anomia. However, the use of electro-encephalography (EEG) in aphasia further helps to determine the impaired process(es) during picture naming (Laganaro et al., 2009). Here we compared the event-related potentials (ERP) signatures of two persons with aphasia presenting with different anomic profiles and different lesion sites (frontal vs temporal) in standard picture naming and blocked-cyclic naming, in order to assess *how* the naming process operates after their stroke.

Methods

Population

Two French-speaking participants, who suffered from aphasia following a left hemispheric stroke six months earlier, participated in this study (aged 64 & 65, two males). One participant (PT504) was presenting with a temporal lesion and anomia disturbing multiple processes (semantic, lexical and phonological), whereas the other (PF505) with a frontal lesion and anomia perturbing predominantly lexical selection.

Material & Procedure

The participants had to name pictures either in a standard way (120 different pictures in a row) or in the blocked-cyclic naming paradigm (32 different pictures presented in three successive cycles in semantically

homogeneous vs heterogeneous blocks). During both tasks, EEG was recorded with 128 electrodes (Biosemi V.O.F Amsterdam, Netherlands) at a 512 Hz sample.

Results

In standard picture naming, accuracy was 58% for PT504 (omissions, semantic and phonological errors) and 93% for PF505 (omissions and semantic errors). **ERPs** of PT504 did not differ significantly on amplitudes from a group of 11 aged-matched controls, whereas ERP waveforms of PF505 significantly differed from the control group between 150 and 260 ms post picture onset.

In blocked-cyclic naming, both patients showed the classical RT pattern also observed with the same task on a group of 24 young adults, namely semantic facilitation in the first cycle and semantic interference in subsequent cycles. Accuracy was 84% for PT504 and 94% for PF505. **ERPs** of PT504 were quite similar to those of young controls (Python, Fargier & Laganaro, 2018), with amplitude differences in two distinct time-windows between homogeneous and heterogeneous blocks, namely an early (post-)lexical effect around 320-345 ms post picture onset and a late effect -280 to -160 ms pre-response. ERPs of PF505 showed no modulation between the types of blocks (homogeneous vs heterogeneous), contrary to young controls.

Discussion

Despite presenting with different lesion sites (frontal vs temporal) and different anomic patterns (semantic-phonological impairment vs lexical selection impairment), PT504 and PF505 showed the same classical RT pattern of semantic facilitation (1st cycle) and interference (3rd cycle) in the blocked-cyclic naming paradigm.

The similar ERP pattern between PT504 and the controls in both simple naming and blocked-cyclic naming tasks suggest that the picture naming network operates normally in PT504 when lexical access is successful (i.e. on correct trials), even though his anomia was more severe than PF505. In contrary, ERP divergences in standard naming from 150-260 ms post-picture onset for PF505 suggest that semantic-to-lexical connections are deregulated by the frontal lesion. The deregulation of activation spreading from semantic to lexical processes could explain the disappearance of the expected ERP effects in the blocked-cyclic naming paradigm despite the presence of behavioral effects. This deregulation originating during pre-lexical processes may consequently affect lexical competition, self-monitoring and/or response preparation.

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Assessing and treating expressive linguistic prosodic difficulties: two cases of Broca's aphasia.

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Introduction

It is not uncommon for speakers suffering from acquired language impairments to experience some difficulties at the level of prosody (the "melody of language"). However, this linguistic aspect is still far from being thoroughly understood and has been scarcely considered in the clinical setting. Indeed, no unquestioned measures for prosodic abilities nor standard treatment protocols are available yet (Peppé, 2009; Hargrove, 2009, 2013).

This work aims at contributing to fill such gap in the literature. Drawing on the few studies on dysprosody in Italian aphasia (Marotta, 2008), we ideated an assessment procedure designed for experimental purposes that involved an acoustic analysis and a perceptual evaluation by a group of native unimpaired speakers. Moreover, on the basis of the linguists' theories highlighting the link between prosody and information structure (Frascarelli, 2004, 2007; Bocci, 2013), we proposed a treatment that involved the repetition and the elicitation of sentences typically used in conversation, which are characterized by distinctive prosodic contours. We hypothesized that training these structures could trigger an overall improvement of the prosodic abilities.

Participants

Two right-handed native Italian speakers with left-hemisphere lesion and a diagnosis of Broca's aphasia joined in the study, which started approximately 2.5 years post-onset, when their rehabilitation program was already concluded. Patient BF, a man aged 65, and patient ED, a woman aged 42, had both recovered fluency of speech but still displayed mild to moderate articulatory and phonological difficulties, and the clinicians perceptually evaluated their production as moderately dysprosodic (BF) and mildly dysprosodic (ED).

Materials and procedure

The assessment materials consisted of 40 sentences, 20 with the structure exemplified in (A) and 20 with the structure exemplified in (B).

(A) [Le viti]$_{\text{TOPIC}}$ le trovi nel primo cassetto.

(The screws, you'll find them in the first drawer)

(B) [PER DOMANI]$_{\text{FOCUS}}$ sono questi compiti.

(This homework is for tomorrow)

The sentences were created using patients' everyday vocabulary and typical communicative contexts. Patients were asked to repeat these sentences and to produce a sample of spontaneous speech while they were recorded. The same tasks were administered four times: at the beginning and at the end of the treatment as well as at one and at three months after treatment.

The training material consisted of a list of stimuli and a series of contexts aiming at eliciting the prosodic structures of interest. The 25 individual treatment sessions were one per week, 45 minutes each, and the treatment lasted 5 months. Patients were asked to practice at home about 20 minutes per day.

For each assessment session, the patients' speech was analyzed by means of the PRAAT and ToBI software for the acoustic analysis and R software for the statistical analysis. We considered the following linguistic variables: pitch, intonation and duration (speech rate) at the level of the sentence, the phrase and the tonic syllable. The analysis also included a perceptual evaluation by a group of naive listeners who were asked to choose the item which sounded more natural and well-formed to them. Lastly, we performed a quantitative and qualitative analysis of errors and pauses.

Results

Patient BF. The acoustic analysis showed a main effect for the duration of the phrase [$F(1,76)= 4.894$, $p < .05$], indicating that the patient needed a shorter time to produce phrases in the post-treatment condition.

The difference in pitch range at the phrase level was significant [$F(1,76)= 14.925$, $p < .001$], indicating that the patient produced more modulation of pitch in the post-treatment assessment. This finding was confirmed in the follow-up assessments [$F(3, 152)= 10.231$, $p < .05$]. The difference in pitch range of the tonic syllable was significant [$F(1,76)= 46.881$, $p < .05$], which indicated that a greater modulation was present at the syllable level. Again, this finding was confirmed in the follow-up assessments [$F(3, 152)= 12.926$, $p <.05$].

No alteration of the melodic contour was found either pre- or post-treatment. The number of errors and the number and duration of atypical pauses decreased in the post-treatment assessment, whereas the number of syntactically and prosodically acceptable pauses increased, both in the repetition task and in the spontaneous speech.

	Pre-T	**Post-T**	**Follow-up 1 month**	**Follow up 3months**
BF Repetition task				
Errors	30	20	15	12
Atypical pauses/all pauses	17/39	13/53	9/50	9/49
Duration of atypical pauses (ms)	417	229	368	279
BF Spontaneous speech				
Errors	16	12	10	4
Atypical pauses/all pauses	7/21	4/22	4/13	4/17
Speech rate (syll/sec)	0.51	0.43	0.389	0.392

Lastly, participants to the perceptual evaluation preferred the post-intervention performance in 75% of cases for patient BF.

Patient ED. The acoustic analysis showed a main effect for pitch range of the tonic syllable [F(1,76)= 6.243; p< .05] indicating that the patient produced more modulation in the post-treatment assessment. In follow-up assessments, however, this finding was not confirmed.
No alteration of the melodic contour was found, and the number of errors and atypical pauses decreased. The number of acceptable pauses increased.

	Pre-T	**Post-T**	**Follow-up 1 month**	**Follow up 3months**
ED Repetition task				
Errors	44	19	10	7
Atypical pauses/all pauses	12/27	2/43	14/50	6/46
Duration of atypical pauses (ms)	780	255	309	347
ED Spontaneous speech				
Errors	5	3	4	4
Atypical pauses/all pauses	2/23	0/16	2/13	2/13
Speech rate (syll/sec)	0.405	0.38	0.374	0.383

Discussion

The procedure we adopted to assess prosody identified many aspects of the difficulties experienced by our patients, including alterations of speech rate and pitch range, phonological errors and atypical pauses. These findings generally tended to confirm what can be found in the literature, though we noticed no alteration of the intonation contour, which is often found instead (Marotta, 2008).
Moreover, our intervention proposal proved partially effective, with both patients displaying improvement in pitch range, fewer errors and atypical pauses. Patient BF, however, benefited the most from our treatment, as confirmed by the results of the perceptual evaluation. Several reasons could account for this, the primary one being that not all interventions work for all patients. The results that proved significant, however, were mainly confirmed up to three months post-treatment, and the qualitative improvement of the patients' spontaneous speech was stable over time. These considerations support our proposal.
We are not unaware of the many limitations of our work, some of which are the absence of a control condition (i.e. patients receiving no treatment or receiving a different treatment), the small number of patients included in the study and the absence of blinding of clinicians and statisticians. Even so, we believe this to be a promising starting point for future research on dysprosody in Italian aphasia.

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The Effect of Structural Frequency and Word Order in Thai Agrammatism

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Introduction

The Derived Order Problem Hypothesis (DOP-H: Bastiaanse & Van Zonneveld, 2005; 2006) proposes that languages have a base order, and other orders are derived. The base order is different in every language. For example, in Dutch and Japanese, it is Subject-Object-Verb (SOV), and in English and Thai, it is SVO. The derived orders are the orders whose constituents have been moved from their base position; thus, requiring more processing capacity, and are harder for agrammatic speakers. The DOP-H has been examined and supported by many languages both for comprehension and production (Bastiaanse & Thompson, 2003; Bastiaanse & Van Zonneveld, 2005; 2006; Burchert, Meiner & De Bleser, 2008).

Menn, Reilly, Hayashi, Kamio, Fujita, and Sasanuma (1998), however, argued that agrammatic individuals have more difficulties comprehending passive derived sentences than active base sentences because, for most transitive verbs constructed, passives occur less frequently than actives. Menn (2000) explained that active and passive structures tested in the previous studies contained transitive verbs (e.g. to kick and to break), which are used more frequently in the active form. The poor results on comprehension of passive sentences may be as a result of this confounding factor.

Thai has a particular type of verbs, the so-called adversative verbs that convey unfavorable meaning, associating with unpleasantness or distastefulness (Filbeck, 1973). While adversative verbs are strongly biased for passive structures, non-adversative verbs are mainly used in active structures. This gives us the unique opportunity to test the interaction between word order and frequency. The research question is: does the syntactic restriction on passive biased adversary verbs influence comprehension of derived word order sentences in Thai agrammatic speakers?

Methods

Materials and Design

A two-choice spoken sentence-to-picture matching task (72 items) was administered on 8 native speakers of Thai—4 agrammatic speakers and 4 non-brain-damaged speakers. All sentences were semantically reversible, with one picture corresponding to the sentence, and another picture the

thematic roles reversed. Our test items were categorized into 4 conditions on a 2x2 design (word order x verb type), which are actives with adversative verbs, actives with non-adversative verbs, passives with adversative verbs, and passives with non-adversative verbs.

Procedure

Participants performed a sentence-picture matching task by listening to a recorded audio while being presented with a pair of images. Before an experiment started, practice items (8 items) were presented. When participants made an error (or errors) on the practice items, they were corrected and provided feedback. The practice items were repeated until it was clear that the task was fully understood. During the experiment (64 items), no more feedback was given. There was no time limit, and breaks could be taken upon requests.

Results

The non-brain-damaged speakers performed at ceiling and their results were not included for further analyses. The agrammatic speakers had more problems comprehending sentences in a derived order (passives) condition *(61.37%; range 54.55-68.19%)* than in a base order (actives) condition *(97.73%; range 95.46-100%)*. However, the difference between the performance between adversative verbs and non-adversative verbs was significant only in passive derived order conditions, in that passives with adversative verbs *(70.46%; range 63.64-81.82%)* were better understood than passive with non-adversative verbs *(52.27%; range 45.45-63.64%);* for actives with adversative verbs and actives with non-adversative verbs, the performance was the same *(97.73%; range 90.91-100%).* A generalized linear model logistical regression analysis was conducted and a significant effect of the interaction between such variables was found *(p = 0.02).*

Discussion

Based on our findings, active (base) conditions were better comprehended than passive (derived) condition. This shows that, as predicted by the DOP-H and similar to the findings of the previous studies (Bastiaanse & Thompson, 2003; Bastiaanse & Van Zonneveld, 2005; 2006; Burchert, Meiner & De Bleser, 2008), performance is affected by word order. However, interestingly, within the passives, the adversative verbs are better preserved than the non-adversative verbs, where they are less frequently used in Thai. This finding is also in line with Gahl, S., Menn, L., Ramsberger, G., Jurafsky, D. S., Elder, E., Rewega, M., and Audrey, L. H. (2003) on the effect of lexical bias—the likelihood of a particular word's

occuring in a particular syntactic frame (Gahl et al., 2003). In the case of Thai, lexical bias protects passives with adversative verbs from being as impaired as passives with non-adversative verbs.

To conclude, the finding implies that it is not only the derived order that is a problem in Thai individuals with agrammatic aphasia, but also frequency and/or lexical bias—verb types—that play a role in sentence comprehension.

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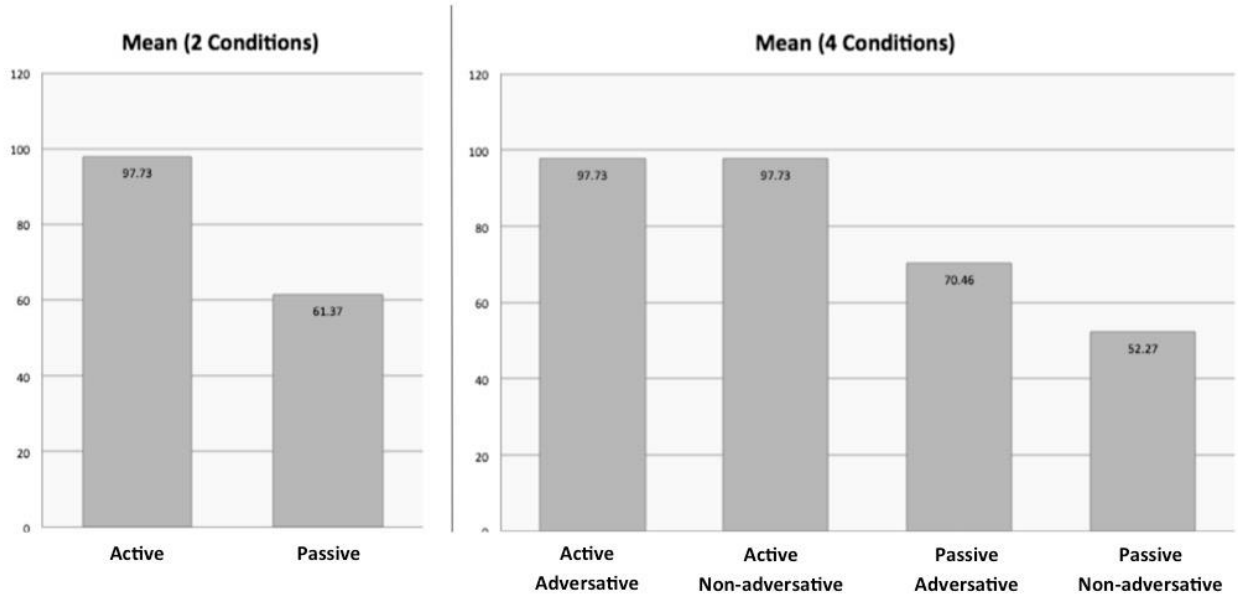
Figure 1 Mean scores of the performance by Thai agrammatic speakers; (left) two conditions–active, and passive; (right) four conditions–active with non-adversative verbs, active with adversative verbs, passive with with non-adversative verbs, and passive with adversative verbs.



Processing of evidentiality in Turkish: An ERP study

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Introduction

Evidentiality constitutes a grammatical category that marks information sources indicating how one has gained the knowledge regarding the event in his/her statement. That is, evidentiality signals whether a form of evidence is present for the statement uttered, through the speaker's direct personal experience (i.e. witnessing) or through an indirect information source, such as inferring or report from a third speaker. Different languages have distinct ways of expressing information sources (e.g. inflectional affixes, clitics or particles). In languages like English, evidential meanings are conveyed by the means of lexical elements, whereas in one-fourth of all the world languages, including Turkish, evidentiality is expressed as grammatical forms (Aikhenvald, 2004).

In Turkish, there are two distinct evidentiality markers inflected at the verb (suffix): the direct evidential (-DI) and the indirect evidential (–mIş), either of which is mandatorily used when referring to the past.

If one saw Sedat while he was washing the car, the direct evidential marker (-DI) is used (1).

(1). Sedat arabayı yıka**dı**.
Sedat car_{ACC} $wash_{direct\ evidential\ 3SG}$
*I have witnessed myself that **Sedat washed the car**.*

If one sees Sedat next to a wet and cleaned car holding some cleaning tools or someone else said that it was Sedat who washed the car, the indirect evidential marker (–mIş) is the appropriate one to use (2).

(2). Sedat arabayı yıka**mış**.
Sedat car_{ACC} $wash_{indirect\ evidential\ 3SG}$
*It has been reported to me or I infer it from the traces of the event that **Sedat washed the car**.*

Acquisition studies showed that the direct marker is acquired in natural speech slightly earlier than the indirect one. This acquisition profile suggests that children associate with the direct referential easier, as its the mental representation of a direct experience (Aksu-Koç, Ögel-Balaban, & Alp, 2009).

For agrammatic speakers, the direct evidential is more effortful and more prone to errors than the indirect evidential (Arslan, Aksu-Koç, Maviş, & Bastiaanse, 2014). The results were explained by the PAst DIscourse LInking Hypothesis (PADILIH; Bastiaanse, et al. 2011), which suggests discourse-linked elements referring to the discourse outside the sentence (that is the past time-window) requires an extra computational cost. The direct evidential requires discourse linking as it marks specific readings

(much like definite articles) while the indirect evidential lacks such a discourse linking relationship. Therefore, agrammatic speakers find the direct evidential form harder to parse (Arslan et al., 2014).

Investigation of evidentiality processing of Turkish monolingual and Turkish/German bilingual speakers in an eye-tracking experiment by Arslan, Bastiaanse, &Felser (2015) have shown that for direct evidentials Turkish speakers strongly fixated to the pictures depicting the in-progress version of an action before they turned to the target pictures (depicting the resultative state). Arslan et al. (2015) argued that Turkish native speakers are looking for an evidence to verify that action is indeed 'witnessed' (Arslan, Bastiaanse, & Felser, 2015). A timed sentence-verification task carried out with Turkish monolingual speakers has shown that native speakers of Turkish are more sensitive to violation of seen direct information when it's followed by an indirect evidential marker (Arslan, de Kok, & Bastiaanse, 2017).

Although several questions related to evidentiality have been answered, their precise neurolinguistic processing has been left unexplored. This is the topic of the current study. In order to explore the electrophysiological modulation of evidentiality in the brain, an EEG (electroencephalogram) experiment is being administered to a group of Turkish native speakers. By this it is aimed a) to investigate the moment-by-moment processing of these grammatical units and b) to understand how the brain activation affiliated with evidentiality modulated in Turkish speakers' online processing.

Methods

Participants

Thirty non-brain-damaged native speakers of Turkish, who completed their high school education in Turkey before coming to the Netherlands for a limited period of time have been recruited.

Materials

The experimental stimuli consist of 320 sentences constructed with 80 verbs that are used across four different conditions: a match between the information source (seen and heard/inferred) and the target verb that follows; and violation of the information source by presenting the mismatching evidential marker. Half of the 80 filler sentences consist of grammatical sentences referring to past and future, whereas the other half involves a tense mismatch.

Condition 1 – Seen Information – Direct Evidential

Condition 2 – Seen Information – Indirect Evidential*

Condition 3 – Heard Information – Indirect Evidential

Condition 4 – Heard Information – Direct Evidential*

The stimuli are distributed over four lists. Each participant is presented with 160 sentences; 80 target (twenty sentences per condition) and 80 filler sentences.

Evaluation of the material through an Offline-rating study

In order to understand how speakers of Turkish respond to evidentiality violations in an offline task without time constraints and to evaluate the experimental stimuli an offline sentence acceptability

judgment task has been administered to 75 Turkish speakers (35 females; mean age= 26) with via-the-web questionnaires. Analyzes have shown that the grammatical items are acceptable and that Turkish native speakers are sensitive to violation of the information source (Above 90% accuracy rate for all conditions).

Predictions & Discussion

Use of evidentiality markers in Turkish loads both morphosyntactic and semantic aspects to processing. This makes ERPs (Event Related Potentials) the most suitable way to decipher the per-millisecond time course of evidentiality processing. The distinct nature of direct and indirect evidentials is expected to evoke different brain activation. According to our hypothesis, it is expected the ungrammatical sentences elicit a P600, the component that is associated with morphosyntactic processing, accompanied by left anterior negativity (LAN). However, specifying the information source of an event also imposes pragmatic features to the sentence. Violating information sources, that is evidentiality, would be inappropriate for the semantic coherence of the context. That is why an N400 component on the verb that creates the violation is not a priori excluded.

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Morphological Decomposition in Primary Progressive Aphasia: Evidence from Greek

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Introduction

Morphological structure has been extensively studied in research on word recognition across many languages (Tsapkini et al., 2014; Wilson et al., 2014, Auclair-Ouellet et al., 2016). The main focus of those studies has been to comprehend the role of morphological decomposition in lexical access (Tsapkini, Jarema, & DiSciullo, 2004) and representation in the mental lexicon of people. This aim extended over the years to conditions such as Broca's aphasia (Peristeri & Tsapkini, 2011) and Primary Progressive Aphasia (PPA). Research on the latter is, however, scarce and for that reason, the present study investigates morphological decomposition in Greek-speaking patients with non-fluent/agrammatic PPA.

Methods

Participants

Ten Greek-speaking patients with non-fluent variant PPA participated in the study (mean age: 63;4 yrs., Standard Deviation (SD): 6.2), along with 11 age- and education-matched language unimpaired controls.

Task

The patients were administered a Lexical Decision Task that included high- and low-frequency prefixed (e.g. tri_{PREFIX}-$klino_{STEM}$ / 'three-bed room') and simple words. Both reaction times and accuracy were recorded through E-prime.

Results

RTs analyses indicate a slower performance of the PPA group, verified by a Crawford Singlims test, with higher RTs for both groups for the prefixed words. A repeated measures ANOVA with group as the between-subjects factor indicated a morphological deficit for the PPA participants (p= .001). A second ANOVA with the data split by groups verified the deficit for the PPA group and presented a high significance of both factors, namely word type (p= .000) and frequency (p= .000), as well as word type by frequency (p= .000), for the control group leading to a Paired sample T-test. Its results showed high significance of word frequency (HF, p= .006, LF, p= .001) for the PPA group and high significance both of frequency (p= .000) and word type by frequency (p= .000) for the control group. Overall, the PPA group indicated a morphological deficit in word recognition as an effect of word frequency.

Discussion

The present study's results indicate an overall normal performance for the control group, while the PPA participants present with an expected slower performance both on prefixed words in general and in simple words of lower frequency.

The recognition latencies can be accounted for by means of a left-to-right parsing orientation theory (Colé,Beauvillain, and Segui, 1989) that supports whole-word lexical representation and access in the mental lexicon. It also claims that morphological information plays no important role, but rather it is the full-form surface frequency that provides access to the complex word. This theory contrasts Taft and Forster's (1975) affix stripping model of morphological decomposition. It also presents contrasting claims to Tsapkini et al. (2014) and Laudanna, Burani, and Cermele (1994), in that it supports recognition latencies of prefixed words as a consequence of their surface frequency, while the before-mentioned studies present results in favour of quicker recognition of prefixed words due to their full-form access. A more practical account of why prefixed HF items that are considered to require lower RTs for their recognition present such high RTs for the PPA group in the present study, is the one provided by Schriefers, Zwitserlood, and Roelofs (1991) and by Tsapkini, Jarema, and DiSciullo (2004) that support a priority of importance for affixal over stem properties. More specifically, Schriefers, Zwitserlood, and Roelofs (1991) postulate that although complex words are processed in a left-to-right orientation, it seems that they are identified with respect to the specific properties assigned to their constituent elements. Tsapkini, Jarema, and DiSciullo (2004) delve further in the particular properties of affixes and present the configurational asymmetry of prefixes, namely whether they are internal or external to the verb, as the main influencing factor for either the full-form accessing or the decomposition of prefixed words. Thus, configurational asymmetry is reflected on RTs and is an influencing factor for lexical access.

This finding could account for the recognition latencies presented by the Greek-speaking nfvPPA patients, however further research would be required in order to differentiate between externally and internally prefixed stimuli employed in the study. Moreover, further research is required as regards the mean accuracy levels of the PPA participants in order to specify whether there are particular items that account for the recognition latencies of this group.

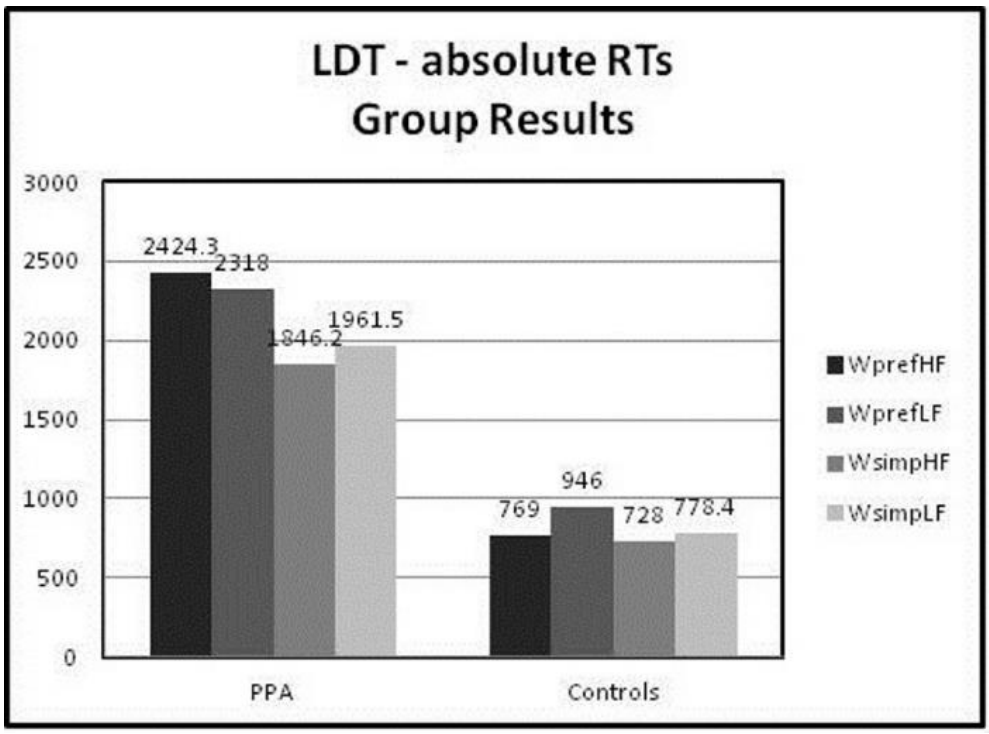

Table 1. *Reaction times (RTs) per condition per group.*

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Do you see what they mean?: An eye-tracking study on the attention for gestures produced by people with aphasia

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Introduction

People with aphasia (PWA) sometimes try to use alternative means of communication to convey their message. Studies have shown that they produce gestures when speaking, and, more importantly, these can convey information absent in their speech (Hogrefe et al., 2013; Mol et al., 2013). As such, gestures have the potential to contribute to the communication of PWA by helping interlocutors to understand their intended message. Studies on conversations by non-brain damaged participants (NBDP) have shown that interlocutors almost exclusively focus on the speaker's face while speaking (Beattie et al., 2010; Preisig et al., 2015). However, it remains unclear whether healthy interlocutors do the same when conversing with PWA. Therefore, the present paper investigates up to what degree people pay attention to the gestures produced by PWA.

Methods

Participants

Forty-six native speakers of Dutch (13 male) participated in our study. They were asked to watch videos of individuals (NBDP and PWA) explaining two scenarios. Participants were naïve to the purpose of this study.

Design

Stimuli were short videos of PWA (*n*=18) and NBDP (*n*=9) explaining two scenarios from the Scenario Test (van der Meulen et al., 2009). People in the videos explained one of two scenarios: a) buying a sweater, b) having witnessed an accident. The videos used were selected on the criteria that the participants used iconic gestures in their narrations. The videos lasted between 4 and 45 seconds. Participants watched all videos, of which the order was semi-randomized. Eye movements were recorded by means of a remote eye-tracker.

Results

We analyzed the time that participants looked at the gestures of NBDP and PWA. As the duration of the clips varied, we used proportions. An independent t-test showed that participants looked longer at gestures produced by PWA (M = 20.54, SD = 8.06) than at gestures produced by NBDP (M = 8.97, SD = 7.05), $t(25) = -3.67$, $p = .001$. Overall participants looked more at the face than at the gestures, but they looked less at the faces of PWA (M = 69.70, SD = 8.99) than at the faces of NBDP (M = 80.11, SD = 8.76), $t(25) = 2.83$, $p < .01$.

Discussion

Our study provided first evidence in the direction that interlocutors pay more attention to gestures of PWA than those of NBDP. This implies that the gestures produced by PWA are noted by the interlocutor and that they can pick up information conveyed by these gestures. Further research is desirable to determine if interlocutors also tend to understand the message better. At the conference we expect to present further analyses looking into the factors that guide people's attention to gestures, such as: a) the attention for the gesture by the speakers themselves, but also, b) the comprehensibility of the spoken message.

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Why this Now? A Genre analytic approach to mixed aphasic / non-aphasic interactive events

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Introduction

This study explores the hypothesis that communication problems in conversations with aphasia are in part related to the fact that an aphasic and a non-aphasic participant hold different expectations of the contextual, textual and linguistic options of the interactive event they are engaged in. This lack of shared ground hampers the coordination of their minds and actions and prevents optimal reception of already limited linguistic expression in the aphasic participant.

Methods

This is an empirical study of language use in three separate personal interviews that each include an aphasic and a non-aphasic participant. A qualitative method of analysis was used, specifically a 'genre analysis,' which is grounded in the tradition of ethnomethodology and discourse studies, and considered particularly apt for an integrated approach to discourse with aphasia.

Genre theory (Steen 2011) posits that when engaged in an interactive event, participants act from a so-called 'genre model': a specific experience-based cognitive projection of contextual, textual and linguistic know how. Aphasic and non-aphasic verbal structures in the data were examined as outcomes of particular genre projections. Thus, participants' shared and individual assumptions of what counted as relevant knowledge and behavior were reconstructed.

Results

The analysis showed that participants genre expectations diverged in each of the interviews and on all three levels of interaction. In general, the non-aphasic participants projected reduced models of personal interviewing, with a careful focus on equal participant relations and particularly literal and sober narrative schemas. Linguistic varieties – elliptical direct speech, topic-comment structures, and formulaic expressions – were appreciated as smart alternatives for descriptive reference. The aphasic participants projected more genuine models of personal interviewing, foregrounding complex personal stories. They challenged politeness relations to make co-participants aware of textual projections that involved evaluative accounts of traumatic experience. Linguistic choices, however elliptical, were used to indicate conventional narrative schemas of (illness) storytelling. However the co-participants did not always infer those schemas while they focused on contextual aspects like participant relations and conversational strategy.

Discussion

Conversation with aphasia may be vulnerable to confirmation bias when aphasic and non-aphasic participants have divergent discourse expectations without them being aware of it. Non-aphasic speakers should always appreciate aphasic speech, however limited, as serious verbal action in some referential framework (which is possibly not their own current perspective). Aphasic speakers themselves must assertively signal to their co-participant that shared ground may not be evident. Conversational success must not be mistaken for communicative success.

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Executive functions in patients with Broca's aphasia

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Introduction

Since the executive functions allow a person to successfully perform cognitive activities, including the production and understanding of language, there is an increasing awareness of the need for the research the relationship between executive functions and language disorders. In view of this, the number of studies focused on testing executive functions in aphasia has been published. Symptoms of the impairment of executive functions are described in different type of aphasia, but the nature of these disorders is still unexplored. In this paper, we have examined the executive functions in patients with Broca's aphasia.

Methods

Participants

A total of 17 patients with Broca's aphasia, aged 49 to 74 years (M = 63,45; SD= 7,45) participated in this study. All patients were right-handed, with a single left hemisphere CVA; they were at least six months post-onset without visual deficits and/or dementia. The control group consisted of 18 subjects, from 48 to 75 years which are equated according to their age with the aphasia group.

Instruments

The Boston Diagnostic Aphasia Examination (Goodglass, Kaplan Barresi, 2001) was used for diagnosis of presence the Broca's aphasia. In the assessment of the executive functions, the tests of phonemic and semantic verbal fluency, The Stroop test and Trail-Making Test - part A and part B were used.

Results

The obtained results showed significant differences between patients with Broca's aphasia (BA) and the control group. Patients with BA produced a significantly lower number of words on the phonemic and the semantic fluency task. The results of the Stroop test also showed differences between the patients with BA and the control group: patients with BA needed significantly more time to read the word list and to name the color-words. In addition, subjects with BA made significantly more errors on the Stroop test. The results on the Trail Making Test showed that patients with BA needed significantly more time to perform the part A and part B of the test.

Discussion

Our results showed that patients with Broca's aphasia have deficits in the all components of the executive functions. The deficits of executive functions are interpreted in the relation to language deficits. The assessment of executive functions can provide additional information in understanding of the nature of some communication difficulties in Broca's aphasia and can assist in patient management.

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The methodological quality of short-term/working memory treatments in post-stroke aphasia: A systematic review

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Introduction

Individuals with aphasia after stroke (IWA) often present with concomitant short-term memory and working memory (STM/WM) impairments (Martin, Minkina, Kohen, & Kalinyak-Fliszar, 2018). Moreover, research suggests a complex relationship between STM/WM and language processing in aphasia (Majerus, 2017; Salis, Kelly, & Code, 2015; Zakariás, Salis, & Wartenburger, 2018). Studies focusing on the relationship between STM/WM and language processing have led to the promising hypothesis that treatments of STM/WM would lead to improvements in language functioning as well, a phenomenon called generalisation (Kalinyak-Fliszar, Kohen, & Martin, 2011).

However, despite the growing number of STM/WM treatments in aphasia, little is known about their methodological rigour and quality, and whether treatment-related improvements of STM/WM generalize beyond STM/WM treatment tasks and to aspects of language (e.g., spoken sentence comprehension). To address this knowledge gap, the aims of the present study were: 1) to identify and describe STM/WM treatments in post-stroke aphasia through a systematic review of relevant literature; 2) to appraise the internal and external validity of these treatments; 3) to investigate whether STM/WM, language (e.g., spoken sentence comprehension, functional communication), and other activities of daily living can benefit from STM/WM treatments in stroke aphasia.

Methods

The systematic review was prepared in accordance with the International Prospective Register of Ongoing Systematic Reviews (PROSPERO) statement (registration number: CRD42017052334).

Literature Search, Screening and Eligibility

A systematic search of 13 databases was conducted in December 2016. Reference lists of included studies, conference abstracts and relevant reviews were also screened for potentially eligible studies. Inclusion criteria were studies that had been published in English and included: 1) adult participants presenting with non-progressive, post-stroke aphasia; 2) STM/WM tasks in their treatments; 3) STM/WM outcome data.

Data Extraction

For each study meeting the eligibility criteria, two review authors extracted data on: 1) study aims; 2) study method; 3) participants; 4) treatment procedure and setting; 5) outcome measures and their results.

Appraisal of Methodological Quality

Two review authors also independently rated the methodological quality of the included studies by using the Risk of Bias in N-of-1 Trials scale (RoBiNT; Tate et al., 2015). The RoBiNT scale evaluates studies with a single-case experimental design and has published psychometric properties, for example, excellent inter-rater reliability (ICC = .93-.95, Tate et al., 2015) and good construct validity (Tate et al., 2015). It comprises 15 items covering both internal (n = 7) and external (n = 8) validity, with items scored on a 3-point scale (range 0–2). The total score ranges from 0–30.

Results

The systematic search and inclusion/exclusion procedure yielded 17 included studies (mainly single case or case-series designs) with 37 participants in total. Table 1 summarizes the included studies (not included in the reference list), methodological quality scores, treatment procedures, and main outcomes. Nine of the treatments targeted auditory-verbal STM consisting of repetition and/or recognition tasks, whereas eight targeted WM and attention involving more complex treatment procedures. Treatment dosage and intensity varied greatly across studies, ranging from 12 to 360 hours (mean = 64 hours) and 0.7-5 therapy sessions per week (mean = 2.4 sessions per week), respectively.

Methodological Quality

The total quality score ranged from 4 to 17 (mean = 9.5) on the 0–30 RoBiNT scale, indicating high risk of bias in the reviewed studies. Internal validity was poor across the studies, mainly due to: (1) use of inappropriate design (in 16 studies out of the 17); (2) lack of randomization of study phases (17/17); (3) lack of blinding of participants (17/17) and/or assessors (13/17); and (4) insufficient sampling (14/17). External validity was generally but minimally higher than internal validity. This was mainly related to: (1) incomplete information on the setting (17/17); (2) lack of use of appropriate analysis (3/17) or justification for the suitability of the analysis procedure used (12/17); and (3) lack of replication across participants and/or behaviours (10/17).

Treatment Effects

Ninety-four percent of the studies (16/17) that investigated treatment effects on STM/WM reported improvements. Seventy-seven percent of the studies (7/9) that included outcome measures on spoken sentence comprehension reported improvements in these measures (e.g., Zakariás, Keresztes, Marton, & Wartenburger, 2018). Understanding of spoken paragraphs showed a subtle improvement in one study (Murray, Keeton, & Karcher, 2006). The two studies that assessed effects on reading comprehension reported promising results: Higher accuracy and increased reading rate in paragraph reading tasks following treatment (e.g., Lee & Sohlberg, 2013). Two studies reported nominal improvements in spoken discourse, using a picture description task (e.g., Koenig-Bruhin & Studer-Eichenberger, 2007). Among the four studies using a communication questionnaire, only two was successful in demonstrating improvements in some of their participants (e.g., Vallat et al., 2005). Results in measures of cognitive functioning in everyday life (i.e., WM and attention questionnaires) were variable across studies: Two

studies reported improvements in WM and attention (e.g., Peach, Nathan, & Beck, 2017), whereas two studies did not report any changes in these domains (e.g., Vallat-Azouvi, Pradat-Diehl, & Azouvi, 2014).

Discussion

Considering the reviewed studies, methodological limitations make it difficult, at present, to draw firm conclusions about the effects of STM/WM treatments in post-stroke aphasia. The methodological rigour of existing datasets is also questionable in light of threats to internal and external validity. Further studies with more rigorous methodology and stronger experimental control are needed to determine the beneficial effects of this type of intervention. To understand the underlying mechanisms of STM/WM treatment effects and how they relate to language functioning, a careful choice of outcome measures and specific hypotheses about potential improvements on these measures are required. Future studies need to include outcome measures of memory functioning in everyday life, communication, and psychosocial functioning to demonstrate clinically significant improvements after STM/WM treatments.

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Table 1. Summary of STM/WM treatment studies and methodological quality scores

Study	Number of participants included	RoBinT score: Internal validity (max. 14)	RoBinT score: External validity (max. 16)	RoBinT score: Total (max. 30)	Treatment procedure	Improvements noted
Berthier et al. (2014)	3	0	10	10	Repetition of sentences combined with cholinesterase inhibitor donepezil	Word, non-word, word pair and word triplet repetition, sentence repetition, aphasia severity, picture description
Eom and Sung (2016)	6	0	10	10	Repetition of sentences, reconstruction of sentences by using word cards, and reading sentences aloud	Digit span, word span, sentence repetition, aphasia severity, spoken sentence comprehension
Francis et al. (2003)	1	0	7	7	Repetition of sentences	Digits span, sentence repetition, spoken sentence comprehension
Harris et al. (2014)	2	0	10	10	Repetition and recognition of words and non-words	Word and non-word span, semantic and rhyming span, sentence repetition, spoken sentence comprehension
Kalinyak-Fliszar et al. (2011)	1	5	12	17	Repetition of words and non-words	Rhyme and synonym judgment, repetition of words, non-words, and sentences, spoken sentence comprehension
Koenig-Bruhin and Studer-Eichenberger (2007)	1	1	5	6	Repetition of compound nouns and sentences	Digit span, sentence repetition, rhyme and category recognition, picture description
Lee and Sohlberg (2013)	4	4	12	16	Attention Process Training-3 (APT-3; Sohlberg & Mateer, 2010)	Attention tasks, reading comprehension
Majerus et al. (2005)	1	0	4	4	Repetition of word and non-word pairs	Digit span, word and non-word span, rhyme judgment

Mayer and Murray (2002)	1	3	7	10	Modified reading span	Listening span, reading comprehension
Murray et al. (2006)	1	0	8	8	ATP-2	Attention tasks, listening span, comprehension of spoken paragraphs
Peach (1987)	1	0	6	6	Pointing to pictures after auditory presentation, repetition of words	Sentence repetition
Peach et al. (2017)	4	0	5	5	Language Specific Attention Treatment (L-SAT)	Attention tasks, aphasia severity, everyday attention functioning
Salis (2012)	1	3	8	11	Matching listening span	Digit span, spoken sentence comprehension
Salis et al. (2017)	5	3	8	11	Matching listening span	Everyday communication
Vallat et al. (2005)	1	0	7	7	Reconstruction of words from oral spelling and syllables, oral spelling, word sorting in alphabetic order, acronyms	Digit span, spoken sentence comprehension, everyday communication, everyday WM functioning
Vallat-Azouvi et al. (2014)	1	1	7	8	Reconstruction of words from oral spelling and syllables, oral spelling, word sorting in alphabetic order, acronyms, 2-D and 3-D mental imagery, visual n-back, n-back with words and questions, reading span	Digit span
Zakariás, Keresztes, et al. (2018)	3	8	8	16	Adaptive n-back with letters	N-back with letters, spoken sentence comprehension

Graph based measurements of the decline of syntactic complexity in speakers with dementia.

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Introduction

Individuals with dementia often experience a decline of their ability to use language. Language problems have been reported in individuals with dementia caused by Alzheimer's disease, Parkinson's disease or degeneration of the corticobasal or frontotemporal area. The clinical descriptions of progressive aphasia describe changes in spontaneous speech. Spontaneous speech is laborious to transcribe; the use of software can reduce the associated costs, but off-the-shelf speech processing systems are not good enough yet to transcribe speech at the level of detail required in this domain. It is still an open research question which software detectable features relevant for diagnosis can be easily obtained with a high degree of certainty.

Several previous studies (like Peintner *et al., 2008,* Pakhomov *et al*., 2010) have demonstrated that at least for English, machine learning systems trained on syntactic and acoustic features of dementia speech are able to predict a diagnosis better than chance, in some cases even with the accuracy of trained professionals (Jarrold *et al*., 2014). Most of these studies include measures of syntactic complexity, simple ones like utterance length (*MLU*), or complex tree based ones like counting complex syntactic structures (*number of embedded clauses,* etc.) and computing the depth of parsed syntactic trees (*Yngve depth*, etc.). Tree based complexity measures rely on building complete trees for a sentence ("deep parsing"). Although automatic deep parsers obtain high accuracy ratios for some types of language, their performance degrades quickly when applied to spontaneous pathological speech, which is irregular and atypical by definition.

In this study, we evaluate the usefulness of other measures of syntactic complexity to distinguish the speech of German speaking non-brain-damaged participants from speech of participants with dementia caused by Alzheimer's disease, or by frontotemporal lobar degeneration. We determine complexity based on partial (or shallow) analyses, which are simpler to obtain and more robust to irregular syntactic constructions than deep parses yet encode more information than utterance length variables. Instead of a tree (directed, acyclic), we use a graph (directed, cyclic) for representation (Rangel & Rosso, 2016). Graph structural complexity measures are well understood and relatively cheap to compute.

Given three groups (NBD: non-brain-damaged, AD: Alzheimer's Disease, PD: Parkinson's Disease), we expect a machine learning model trained with graph based measures to be sensitive to the difference between groups NBD and AD but not between NBD and PD, as Alzheimer's Disease is described as affecting syntax but Parkinson's Disease is not.

Methods

Participants

Three groups of German native speakers were included in this study. The first group served as non-brain-damaged control (NBD group) and included five age-matched subjects without neurodegenerative diseases. The second group (AD group) comprised nine individuals with Probable Alzheimer Disease (MMSE *mean* = 24, *sd* = 2.3). The third group (PD group) has five participants clinically diagnosed with idiopathic Parkinson's Disease. In all groups, spontaneous speech was recorded during conversations with a researcher about everyday topics.

Graph-based syntactic structural complexity measures

Participant speech was broadly transcribed by native German speakers. The transcription consists of a verbatim report of what was said, without further coding of any other morphosyntactic information. Each dialog was parsed using TreeTagger (Schmidt 1995), which resulted in both the addition of morphosyntactic information on the lexical level, and a dependency grammar parse on the phrasal level. Analyses were performed on a large number of samples from the resulting enriched transcripts.

Syntactical complexity was modeled as a graph that describes the relations between parts of speech, with each node representing a part of speech and each edge representing the adjacency relation between parts of speech. The resulting graph yields variables for the complexity of the graph (*nodes-edges ratio, degree of interconnectedness, diameter of the graph,* etc.) and variables for the structure of the graph (*betweenness* and *eigenvector,* Bonacich 1979). This model (augmented with lexico-semantic information) was successfully used for speaker profiling in a gender/age discrimination system (Rangel & Rosso, 2016), but its application in the domain of pathological speech is new.

Different clustering algorithms that each make different assumptions of the independence and distribution of variables (Support Vector Machines, Naive Bayes, Random Forests) are used to discriminate between the pathological classes based on the syntactic complexity measures, and evaluated for their accuracy using standard leave-one-out cross-validation. Models that include MLU are then compared to models that use the graph complexity and structure variables.

Results

Results indicate that models that include the graph measures predict the pathological class better than those with only simple utterance length measures, measured in terms of precision, recall (F1-score) and AUROC. Compared to the literature, the graph based measures predict on par with other variables of syntactic complexity, but a comparison against tree based complexity measures computed on our data remains to be done. Because the graph based measures are much simpler to compute than complex tree based ones, they may be preferred in situations where syntactic tree parsers are unavailable or when speech is highly irregular.

The contribution of this study is that measurements of syntactic complexity are proposed that are as informative yet simpler to compute than tree based complexity measurements. This improves the usability of syntactic complexity measurements in spontaneous language analysis of dementia speech.

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Functional connectivity brain networks and language functioning in low-grade glioma patients

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Introduction

Patients with a low-grade glioma (LGG; a slow-growing, infiltrative tumour) in eloquent brain areas frequently suffer from language deficits, which hinder communication in daily life (Satoer et al., 2016). Although language functions are intensely monitored during awake LGG surgery, 85% of the patients report (persisting or new) language problems after surgery, such as difficulties with word finding and language comprehension (Racine et al., 2015).

Language processes require simultaneous activation of multiple specialised brain areas that are integrated in a large-scale, functionally interacting network (Duffau, 2014). A relatively new way of studying the consequences of an LGG on brain functioning is analysing functional connectivity networks (Bartolomei et al., 2006). They represent the strength of functional interactions between brain regions and can be obtained from recordings of brain activity. It has already been shown that altered functional connectivity network characteristics are associated with cognitive dysfunction, such as memory and attention impairments (Bosma et al., 2009). For language, it has been found that functional connectivity is related to language improvement after surgery (Carreiras, 2017). Both studies used magnetoencephalography (MEG), an expensive functional imaging technique with limited availability.

In order to gain more insight into the underlying neural mechanisms of language functioning in LGG patients, we examined functional connectivity networks and their relation to language performance before, and language change after surgery. We used registrations of electroencephalography (EEG), a non-invasive, inexpensive and frequently applied technique in clinical practice for the diagnosis of epileptic seizures. A preliminary analysis of a larger, ongoing study (PLOTS: Predicting Language Outcome after brain Tumour Surgery) is presented.

Methods

Nine LGG patients (2 female; mean age= 42 years) underwent language assessments and an EEG recording. Tumours were situated in/near eloquent areas in the left hemisphere (combined with

right-handedness; n=7) or in the right hemisphere (combined with left-handedness; n=2), for which they underwent awake brain surgery.

Language was assessed preoperatively (T1) and 2-3 months postoperatively (T2) with five tests[1]: object naming, action naming (inflected verbs), Token Test (comprehension test and indication for severity of language impairment), category fluency and letter fluency. Z-scores were used, taking into account normative data of a healthy population. Language performance at T1 and language change after surgery (T2-T1) were analysed in relation to functional connectivity network characteristics.

EEG was recorded preoperatively during an eyes-closed, resting condition using 21 scalp electrodes. Five artefact-free segments of 8.19 seconds were carefully selected for analysis. Using BrainWave software (Stam, 2016), functional connectivity between electrode signals was calculated using a measure called 'phase lag index'. Only the alpha frequency band (8-13 Hz) was analysed, because brain activity in this band is most consistently present and easily ascertained by visual inspection. A weighted graph analysis was performed, described by network measures of local connectivity/clustering (clustering coefficient), global integration (average path length), and the extent to which the preceding two are in optimal balance (small-world index).

Results

At group level, pre and postoperative language scores of the LGG patients did not significantly differ from those of a healthy population. At individual level, four patients had a (mild) language deficit ($z < -1.5$) before surgery, affecting object naming (n=2), Token Test (n=2) and/or letter fluency (n=2) performance. After surgery, (mild) language deficits remained in three patients, one patient developed a language deficit and one patient recovered. Impairments were found on tests for object naming (n=2), action naming (n=1), Token Test (n=1), category fluency (n=2) and letter fluency (n=2).

The average functional connectivity network of all LGG patients is shown in figure 1. Network measures of local clustering and 'small-world'-ness (the optimal balance between local clustering and global integration) were related to language performance. That is, high local clustering was associated with high action naming scores before surgery ($r=.80$; $p=.017$); no effect was found for object naming or other language tests. Additionally, a more 'small-world'-like network configuration was related to improvement on the Token Test 2-3 months after surgery ($r=.75$; $p=.019$).

[1] For this preliminary analysis, we selected five tests from a larger neurolinguistic protocol.

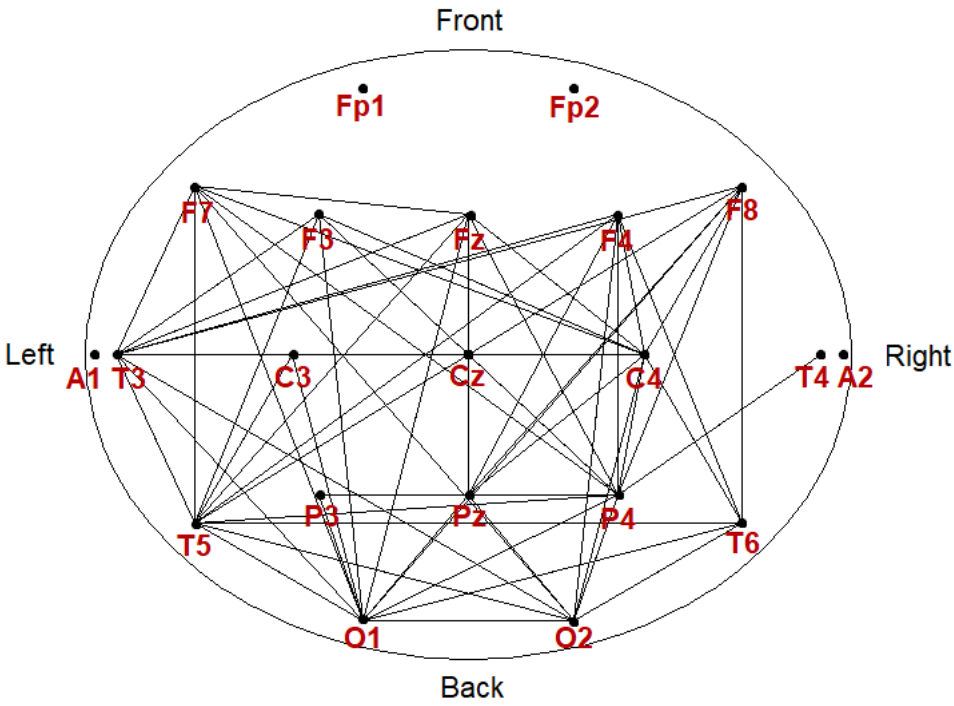

Figure 1. Schematic brain map with the average functional connectivity network in the alpha band of nine LGG patients, obtained from resting-state EEG recordings. Connecting lines between electrode positions indicate (strong) functional interactions between brain regions. This functional connectivity network was created in BrainWave software (Stam, 2016), using the phase lag index (functional connectivity measure) in a weighted graph analysis, which takes into account the strength of functional interactions. An arbitrarily chosen correlation threshold of 0.15 was applied for illustrational purposes, enabling that the stronger functional interactions are presented as connected lines. Note. Fp1, Fp2, A1 and A2 are not connected, because they were excluded from the analysis to avoid confounding effects of artefacts.

Discussion

The findings indicate that preoperative functional connectivity network characteristics in the alpha band, as measured with resting-state EEG, are related to preoperative language functioning, as well as postoperative language change. First, high local clustering is associated with better grammatical abilities presurgically, as assessed by an action naming test that elicits inflected verbs. Although object naming and verbal fluency tests are able to detect mild impairments in LGG patients, they are possibly not sufficiently sensitive to measure a relation with functional connectivity networks. Second, a more 'small-world'-like functional connectivity network, combining high local clustering and high global integration, seems to be beneficial for language improvement after surgery, as measured with a test representative for the severity of language impairment (Token Test). This suggests neural reorganisation of language functions in LGG patients. Our findings are in line with a previous study using resting-state MEG: a functional connectivity increase in the alpha band was related to larger language improvement (Carreiras, 2017). However, compared to MEG, the use of EEG for functional connectivity networks is less expensive and more easily applicable in clinical practice.

The potential for accurate preoperative predictions of language improvement or decline after surgery is promising, and may aid the perisurgical procedure. Future research can investigate other frequency bands and more language aspects in larger patient groups in order to optimally benefit from preoperative EEG registrations.

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Do lexical processing demands affect Jargon perseveration?

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Introduction

Perseveration is a term used to refer to repetitive, unintentional errors in actions (Albert & Sandson, 1986). People who have acquired language disorders such as Jargon Aphasia may perseverate on phonemes and produce both phonological and nonword errors (Buckingham & Buckingham, 2011). Perseveration in aphasia is particularly evident on tasks of single word production such as reading aloud, however there is limited documentation and quantification of the behavior in aphasia. Existing case studies imply that perseveration is a secondary symptom of the aphasia (Cohen & Dehaene, 1998; Hirsh, 1998), and thus suggest that perseveration in Jargon Aphasia occurs when deficient lexical-phonological activation enables non-target phonology to compete and intrude (Martin & Dell, 2007; Pilkington et al., 2017). However, the exact error loci of Jargon Aphasia is controversial, with case series evidence pointing towards separate lexical and phonological sources in some cases (Butterworth, 1979; Marshall, 2006).

In the current study, we manipulate lexical processing requirements on tasks of single word reading, whilst controlling for phonological and graphemic demands, to determine whether the nature of perseveration in Jargon Aphasia changes as a result of lexical processing demands. We hypothesise that Jargon perseveration will be more severe when words are lexically more demanding to process.

Methods

Participants

The current study reports eight individuals (one female; age $\bar{x}$ = 73 years, σ = 11.3; time post onset (months) $\bar{x}$ = 35, σ = 20.75) with nonword error as the dominant error type in word production. All participants gave informed consent to participate in the current study.

Materials

Two word sets of 60 items were generated using the MRC psycholinguistic database (Coltheart, 1981). One word set had significantly higher frequency, imageability, concreteness and familiarity ratings ($p \leq .001$) and is therefore labelled 'easy' in the current study. The remaining word set is termed 'hard' due to lower ratings on these lexical variables. The word sets were matched for phonological processing demands (phoneme and syllable length, $p \geq .230$) and graphemic requirements ($p \geq .320$).

Procedure

The 60 words in each list were presented individually on a laptop computer, consecutively without breaks. Participants were instructed to read the word out loud to the best of their ability, and no time pressure was applied. Participants were informed that they could stop at any time if they wished to do so. The hard and easy word sets were administered on different days and half the participants completed the easy word reading task first. Responses were transcribed in real time and checked against and audio recording before being entered electronically into DISC symbols for analysis.

Analysis

Perseveration was quantified using methods presented in Cohen & Deheane (1998). Every error phoneme was identified and then searched for across the previous ten responses. Where an error phoneme was first identified, the number of intervening trials was recorded. For example, if an error had occurred on trial X, and this error phoneme was also produced on trial X-1, a phoneme perseveration at lag 1 was recorded. If the error phoneme was not present in X-1, but was produced on the trial X - 9, a lag of 9 was recorded. This analysis was applied to the easy and hard word response sets separately, and the resultant data was compared using a chi square goodness of fit test, to determine whether phoneme perseveration patterns differed when lexical task demands were different.

Results

Participants E, G, H and I exhibited statistically different perseveration patterns across the word sets ($p \leq .004$), with E, H and I producing more phoneme perseveration in the hard condition (see Figure 1). Participant G produced more phoneme perseveration in the easy condition (see Figure 1G). The remaining four participants (B, D, F and J) produced similar perseveration patterns across the word sets ($p \geq .091$, see Figure 1).

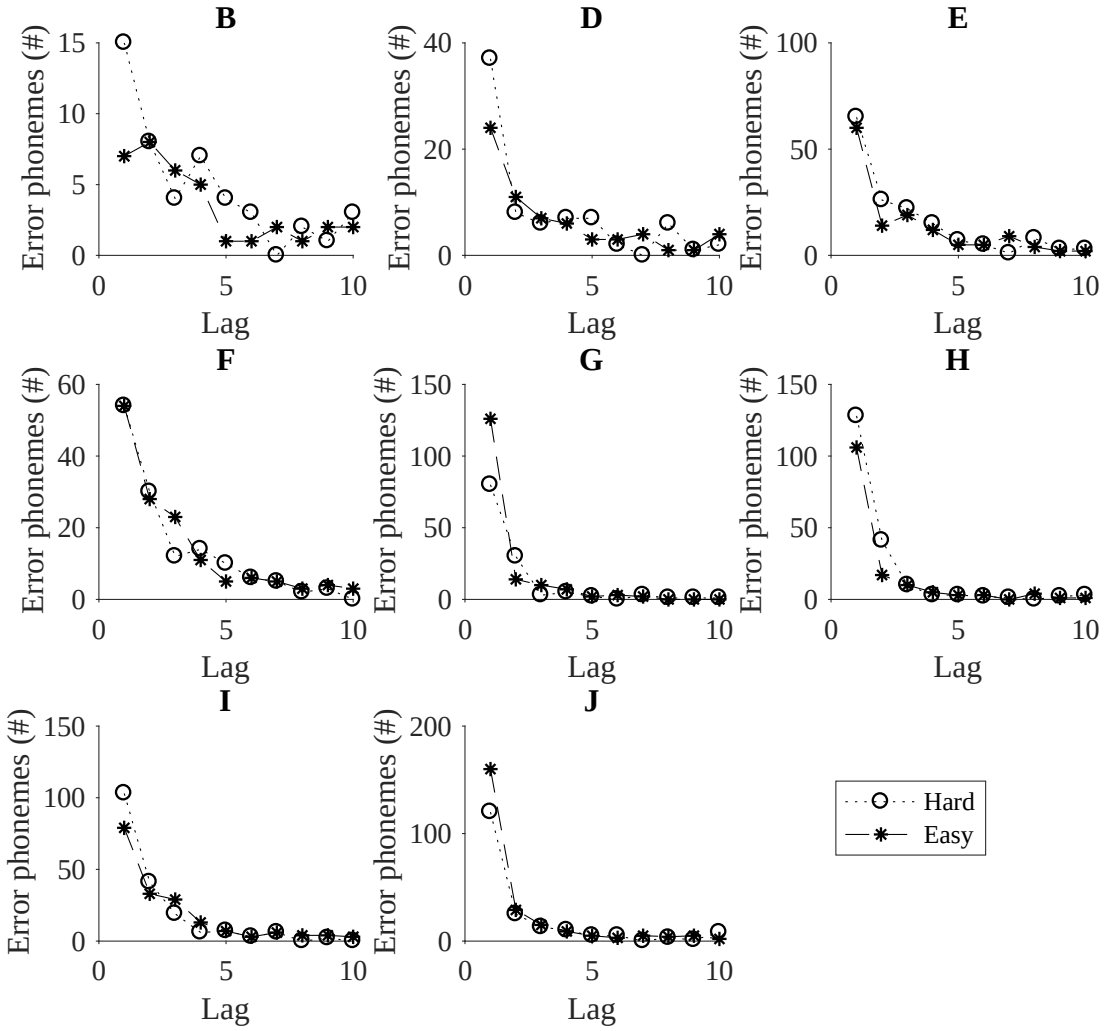

Figure 1: Phoneme perseveration error rates in easy and hard word reading tasks. Panels labelled in accordance with participant codes.

Discussion

Perseveration in Jargon Aphasia is hypothesised to arise from lexico-phonological processing breakdown as a secondary symptom of the Jargon impairment. The current study manipulated the lexical processing demands on tasks of word reading whilst controlling for phonological and graphemic processing requirements to determine whether lexical factors are influential in Jargon phoneme perseveration. The case series analyses showed that three individuals (E, H and I) exhibited greater phoneme perseveration on the hard word set, in support of the research hypothesis. The majority of the group (B, D, F and J) exhibited no difference in phoneme perseveration across the word sets and therefore do not support the research hypothesis, whilst participant G produced the reverse effect with greater perseveration in the easy word set. This indicates that the severity of

Jargon perseveration is susceptible to lexical processing requirements in some individuals, but this is not the case for everyone with Jargon Aphasia.

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Pragmatic impairment in patients with left- and right-hemisphere brain tumor

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Introduction

Brain tumor is a neurological condition that may cause both cognitive and behavioral impairments. The clinical manifestations of brain tumor depends from tumor location: e.g., it is likely that patient with tumor in occipital areas will show visual impairments, while patients with left frontal tumor will experience language impairments. Even if cognitive impairments in patients with brain tumor have been largely investigated and are a critical issue in presurgical inquiry, the domain of pragmatics is typically overlooked. In the current study we present some preliminary results from a study on the pragmatic skills of patients with brain tumor. The study has two main goals: i) to investigate if patients with brain tumor show a pragmatic impairment and to assess the frequency of impairment; ii) to investigate if the comparison between patients with unilateral brain tumor in left or right hemisphere supports a lateralized view of pragmatic abilities. The results of the investigation will contribute to elucidate the still on-going debate over the role of the right hemisphere in pragmatics (Weed, 2011, Stemmer, 2017).

Methods

Participants

We enrolled a sample of 27 with unilateral brain tumor (14 Left Hemisphere, and 13 Right Hemisphere damage) who underwent a clinical neuropsychological assessment as candidates to neurosurgery.

Materials

We administered 5 tasks from the APACS test (Assessment of Pragmatic Abilities and Cognitive Substrates; Arcara & Bambini, 2016): Interview, Narratives, Figurative Language 1, Humor, Figurative Language 2. The tasks assess several aspects of communicative/pragmatic abilities, mostly related to discourse and non-literal language comprehension. All patients underwent a clinical neuropsychological assessment which included also the following test: Token Test, Phonemic Fluency, Reading the Mind in the Eyes Test, Story-based Empathy Task, Trail Making Test – B, Weigl Test.

Statistical Analysis

We compared the mean APACS scores of brain tumor patients with those of a sample of 27 healthy controls, randomly selected from a wider pool of participants, matched for age, education, and

gender. We also compared the individual score of each participant in each APACS task against the normative cut-offs. To assess systematic differences between hemisphere lesion and pragmatic impairment, we performed a Chi-square test in a table that counted the number of patients, with either left- or right-hemisphere damage, who fell below cut-off in at least one APACS task. Finally, we used exploratory Pearson correlations to investigate the relationship between APACS scores and scores in other neuropsychological tests.

Results

Patients with brain tumor (when considered as a whole group) perform significantly worse in Figurative Language 1 and Figurative Language 2 tasks. A total of 44% of patients showed a performance below cut-offs in at least one APACS task. We did not observe significant differences in the patterns of performance below cut-offs associated with left or right hemisphere lesion (as assessed by the Chi-square test). Interestingly, a qualitative inspection of the results showed that only patients with left hemisphere lesion showed a performance below cut-offs in some pragmatic tasks (e.g., Humor), as shown in Figure 1. In the exploratory correlation analyses we found no evidence of significant correlations between the Token Test and the performance on APACS tasks, but we found significant correlation between APACS and Theory of Mind tests (mostly with Story-based Empathy task) and with tests tapping mostly on executive functions (e.g., Phonemic Fluency task and Trail Making-B).

We also performed a series of exploratory tests of equivalence (i.e., a test to assess the significance of no difference between groups) comparing Left and Right hemisphere patients. These additional analysis evidenced no differences between Right and Left hemisphere patients.

Discussion

In the present study we investigated the pragmatic profile of a sample of 27 patients with left or right hemisphere brain tumor. We found that, as a whole, brain tumor patients performed worse than healthy controls in tasks assessing the ability to understand figurative language, while no differences were observed for tasks assessing discourse production and comprehension. In the sample of patients included in the study, 44% (12 out of 27) showed impairment in at least one of the pragmatic tasks. Interestingly, we found evidence of no difference associated with tumor lateralization in figurative language processing and we found no significant correlation between figurative language tasks and a standard task on language comprehension (i.e., the Token Test). These results support the relevance of bi-lateral representation of figurative language processing, as in neuroimaging studies on figurative language comprehension (Bambini, Gentili, Ricciardi, Bertinetto, & Pietrini, 2011; Bohrn, Altmann, & Jacobs, 2012). Results also suggest that impairments in non-literal language understanding may surface as consequence of damage in any of the crucial areas involved in pragmatic abilities, not necessarily located in the right hemisphere. Moreover, the figurative language tasks performance was not correlated to the performance with a more basic test of language comprehension (i.e., the Token task), suggesting that figurative language damage is not simply the consequence of more basic language impairment.

We argue that the most fruitful approach to investigate pragmatic language disorder is to consider pragmatic abilities as arising from a network of bi-lateral fronto-temporo-parietal interconnected nodes in the brain, moving beyond the classic view of pragmatic impairment as associated

predominantly with right hemisphere damage. This might pave the way to a more serious consideration of communicative difficulties in a number of clinical populations, along with repercussions on the patients' quality of life.

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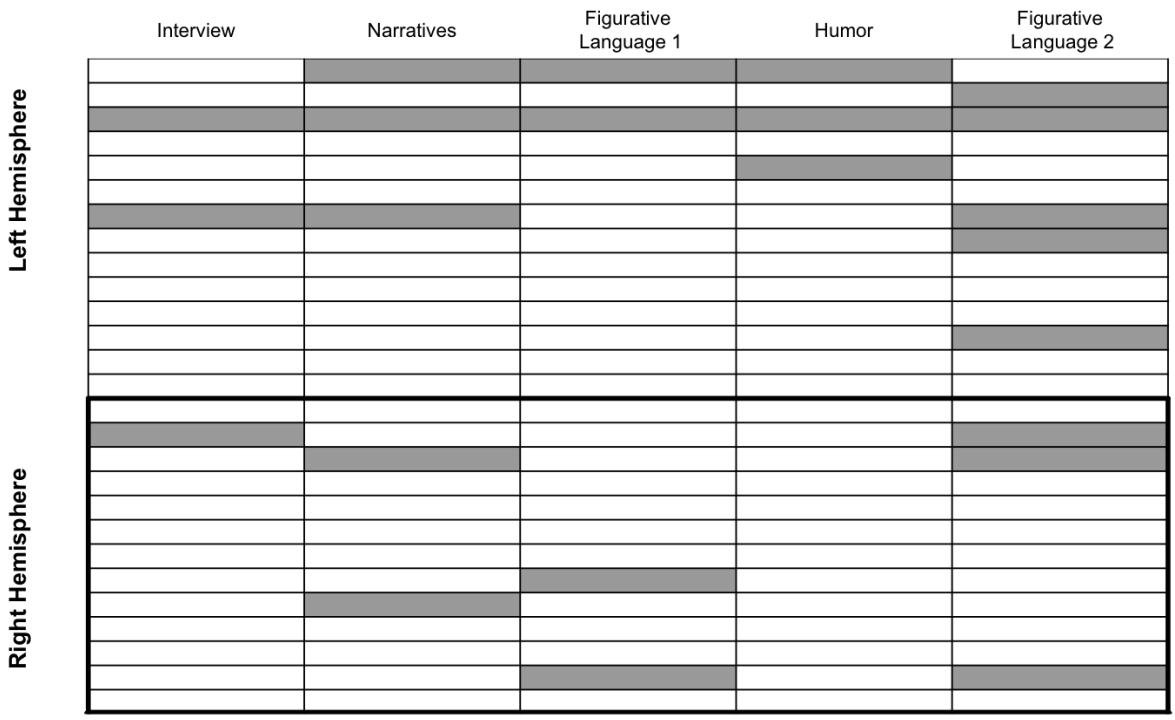

Figure 1 Impairment in pragmatic Tasks in Brain Tumor patients.

The figure shows the patients who scored below cut-off (i.e. below 5° percentile of healthy control data) in the pragmatic tasks. Each row denotes a patient.

Processing of time reference in agrammatic speakers of Akan: a language with grammatical tone.

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Introduction

Languages of the world have several ways of expressing time reference. Many languages such as those in the Indo-European group express time reference through tense. Asian languages such as Chinese express time reference through aspectual adverbs, while Akan does so through grammatical tone. Studies have shown that time reference, particularly reference to the past is more difficult than non-past time reference (Bastiaanse, 2013). The PAst DIscourse LInking Hypothesis (PADILIH: Bastiaanse et al., 2011) posits that past time reference is difficult because it requires discourse linking, whereas the non-past (present and future) are not discourse-linked, and hence, not difficult. However, it still remains unclear whether the impairment in past time reference is restricted to time reference or tense per se, since much of the data are from languages that use tense to mark time. Therefore, it is important to investigate other ways of expressing time reference such as the use of (grammatical) tone, in Akan.

Akan is a Kwa language spoken in sub-Saharan Africa, particularly Ghana. Akan is a tonal language which has both lexical and grammatical tone functions. Tense and aspects in Akan are expressed by the use of tones (Dolphyne, 1988). For example;

1. Habitual Aspect
   Peter gyìná hɔ
   Peter stand$_{\text{HABITUAL}}$ here
   Peter stands there

2. Simple Past Tense
   Peter gyìnàà hɔ
   Peter stand$_{\text{PAST}}$ there
   Peter stood there

3. Future Tense
   Peter bégyìná hɔ
   Peter $_{\text{FUTURE}}$stand there
   Peter will stand there

In the above Akan examples, the same verb '-gyina-' (to stand) is perceived as either habitual aspect (1) or past tense (2), depending on the syllabic tones of the verb. In the simple past (2), the tone on the final vowel 'a' is prolonged. For the Akan future tense (3), the verb has to be prefixed by 'bɛ́-/bé-', in addition to the tonal marking.

Methods

Materials and Design

Nine (9) agrammatic aphasic speakers of Akan who were recruited from the Korle Bu Teaching Hospital in Accra, Ghana, and ten (10) non-brain damaged (NBDs) Akan speakers, participated in this

study. Two (2) of the agrammatic speakers could not complete the production task. The Akan adapted version of the Test for Assessing Reference of Time (African TART: Abuom & Bastiaanse, 2010) was used for this experiment. Both the production and the comprehension tasks, a sentence completion and a sentence-picture matching task, respectively, had a total of 48 test items, consisting of 16 verbs inflected for the present, the past and the future time frames. Additionally, four of the agrammatic speakers were tested with a Tonal Screening Test (TST: Kayser, 2010), in which a pair of non-linguistic tones are judged either to be the same or different. The TST had 60 items in total.

Procedure

For the production task, the experimenter first reads aloud a sentence that describes the action in the left picture. The experimenter then continues to read the second sentence until he reaches the point where the participants will be prompted to produce the target verb and the object to complete the sentence. For the comprehension task, the experimenter reads aloud only one sentence and the participant is prompted to point to one of the two pictures that corresponds with the target time frame. For the TST items were presented via a headphone, and participants were asked to say whether the two tonal pairs are different or the same.

Results

An overall generalized linear mixed-effects regression model showed that the accuracy scores of the individuals with agrammatic aphasia was significantly lower than that of the NBDs (β = -3.30, SE = 0.28, z = -11.63, p = 0.001). In production, the errors they made affected the past time reference more than both the habitual and the future (β = -1.33, SE = 0.44, z = -3.03 and β = -2.05, SE = 0.48, z = -4.28, respectively). There was no significant difference between the habitual and the future (β = -0.72, SE = -0.50, z = 1.45). However, the comprehension data showed a significant difference between the habitual and the future (β = 1.91, SE = -0.46, z = 4.16). Similar to the production data, the agrammatic individuals were more accurate in comprehending the habitual and the future than the past (β = 3.52, SE = 0.47, z = 7.52 and β = 1.60, SE = 0.39, z = 4.13, respectively). Overall, when the agrammatic speakers made errors, these affected past time reference more than present and the future time references, as predicted by the PADILIH. Nonetheless, the four agrammatic speakers who did the TST were relatively better in discriminating the non-linguistic tonal test, with an average score of 90%.

Discussion

The conclusion is that when time reference is expressed by grammatical tone, past time reference is difficult for Akan agrammatic speakers, in both production and comprehension tasks. This is consistent with the predictions of the PADILIH (Bastiaanse et al., 2011): the past is more complex than non-past because it is discourse linked. Surprisingly, the comprehension data showed that the Akan future (even though not discourse-linked) was relatively difficult than the present habitual. Moreover, the fact that the agrammatic speakers could perceive the non-linguistic tonal differences demonstrates that it is not tone per se that is disrupted, but rather time reference, particularly reference to the past, as predicted by the PADILIH. This suggests that difficulties in non-linguistic prosody such as pitch discrimination may not be attributed to individuals with lesion sites that only result in agrammatic aphasia. This is in line with studies that have demonstrated that the processing

of non-linguistic prosody is right lateralized (Zatorre, Belin, Penhune, 2002; Friederici & Alter, 2004). Therefore, we recommend the inclusion of patients with right hemisphere lesion in future studies for lateralization effect comparison of (grammatical) tone processing.

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Treatment-induced improvements in communicative abilities and spontaneous speech in chronic aphasia

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Introduction

Aphasia adversely affects people with aphasia (PWA) quality of life due to the acquired communication limitations (Hilari et al., 2012). Improvement of quality of life correlates with improvements in language and communicative deficits (Spaccavento et al., 2013). While rehabilitation of PWA usually aims at decreasing their disability, the evaluation of spontaneous speech and communication abilities is a key tool to measure their real-life improvement. In this respect, the parameters-based analysis of spontaneous speech was proven to be more sensitive to post-treatment changes than spontaneous speech rating scales included in aphasia assessments (Grande et al., 2008). In the current study, we examine whether a verbal communicative abilities task and specific spontaneous speech parameters can be used as indicators of treatment-induced communication success in chronic aphasia.

Methods

Participants

Twenty monolingual Russian speakers (mean age: 54.5; SD = 10.1; 4 women) who suffered from a single left hemisphere stroke resulting in chronic aphasia (from 6 months post-onset) were included in the study. 12 participants were classified with nonfluent aphasia, 4 with fluent aphasia, and 4 with mixed aphasia. The patients were admitted to the Center for Speech Pathology and Neurorehabilitation (Moscow) for an intensive multidisciplinary treatment course. The frequency and the amount of received treatment were equal for all participants. For 6 weeks, 5 days per week each participant received 2 individual and 2 group therapy sessions by trained speech pathologists. The overall daily duration of speech therapy for a participant was equal to 160 minutes.

Linguistic assessment

For every participant, language was assessed four times. Two baseline tests (T1 - T2) four weeks apart were followed by six weeks of the therapy. The PWAs were testes directly after treatment (T3) and six weeks later (T4).

The severity of aphasia in participants was examined with the Token Test via App (Akinina et al., 2015). A 200-word sample was elicited from every participant by interview with open-ended questions referring to the present and the past. The interview was audio-recorded; the selected sample was orthographically transcribed. The transcription was used to quantify speech rate (words per minute), mean length of utterance (MLU) in words, percentage of correct sentences, percentage of sentences with embedded clauses, numbers of nouns and verbs types, numbers of produced nouns and lexical verbs (tokens), type-token ratios for nouns and verbs. The results of spontaneous speech analysis were also compared to the non-brain-damaged controls (NBD; n=5). The Amsterdam-Nijmegen Everyday

Language Test (ANELT) (Blomert et al., 1994; Russian adaptation: Akinina, 2017) was used to establish verbal communicative abilities in PWA.

Results

When compared to NBD, PWA demonstrated significantly lower values in MLU, percentage of correct sentences, percentage of sentences with embedded clauses, number of noun types, and overall number of produced nouns both for pre- and post-treatment conditions (see Figure 1b, c).

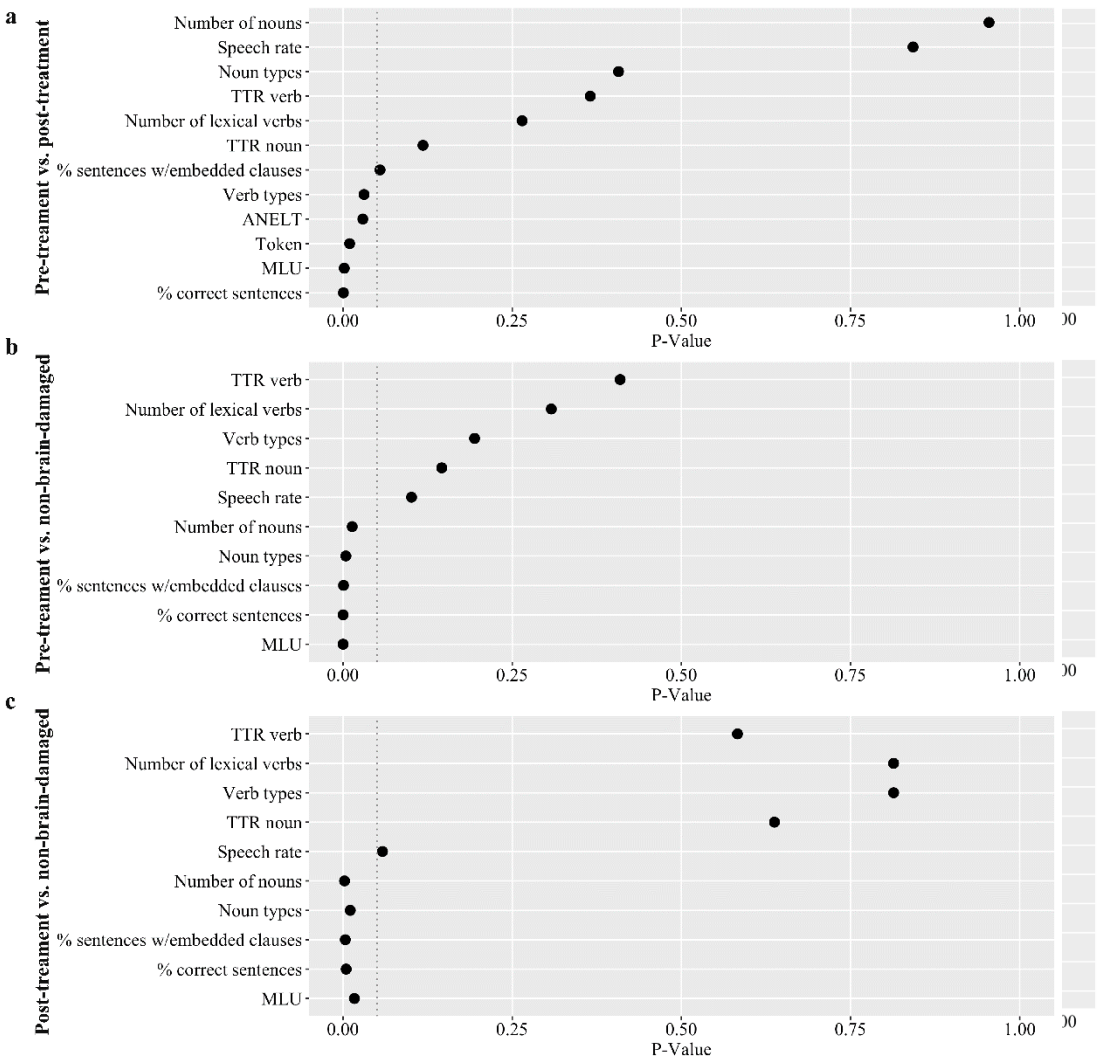

Figure 1. Significant difference in measured parameters. Parameters to the left of the dashed vertical line are potentially relevant and informative. Significance of parameters based on (a) the comparison between pre-treatment and post-treatment results; (b) the comparison between results for pre-treatment and non-brain-damaged; (c) the comparison between results for post-treatment and non-brain-damaged.

No significant difference was observed between two baseline tests (T1 and T2). Post-treatment (T3), an improvement was observed on the Token Test and the ANELT. In spontaneous speech, a

significant difference was found in MLU, percentage of correct sentences, and number of verb types (see Figure 1a).

Discussion

This study demonstrates that communicative abilities task and specific spontaneous speech parameters are sensitive to the treatment-induced changes in chronic aphasia. Despite the improvement on several parameters after the treatment, PWA still preserved spontaneous speech deficits, and did not enter the normal range in all the parameters that differed from NBD before the treatment. Therefore, the spontaneous speech analysis may be also used to distinguish speakers with aphasia from the healthy population. Although the number of verb types for PWA before the treatment was not lower than in NBDs, PWA demonstrated significant increase in this parameter after the treatment, which may be due to the training effect.

Measurements of communicative abilities and spontaneous speech analysis should be considered as valuable evaluation tools for recovery in aphasia, but further investigation on different aphasia types, populations and treatments is essential.

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Effects of Semantic Variables on Picture Naming in a Large Group of People with Aphasia

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Introduction

When we want to say a word, for example in a picture naming task, we first need to retrieve the word's meaning from the semantic system, before its abstract lexical representation can be activated. It is well established that this process is influenced by various linguistic variables, such as word frequency (e.g., Alario et al., 2002; Nickels, 1997). In addition, semantic variables (e.g., typicality, imageability) have been found to influence naming speed or accuracy of people with (e.g., Laiacona et al., 2001) and without aphasia (e.g., Alario et al., 2004; Rosch & Mervis, 1975).

Semantic feature norms (e.g., McRae et al., 2005) permit the calculation of several new semantic variables which describe aspects of the distribution of semantic features of a target word. So far, few studies have investigated the effects of such variables on word production. In healthy participants, picture naming was found to be facilitated by higher numbers of semantic features (Rabovsky et al., 2016), higher typicality (Dell'acqua et al., 2000; Holmes & Ellis, 2006), and higher distinctiveness (Taylor et al., 2012). Detrimental effects have been found for intercorrelational feature density (Rabovsky et al., 2016) and many near semantic neighbours (Mirman, 2011). In people with aphasia, typicality showed facilitative effects on accuracy (e.g., Rossiter & Best, 2013), higher numbers of near semantic neighbours led to less accurate responses and influenced the error pattern (e.g., Fieder et al., 2016; Mirman, 2011), and a strong first associate was found to reduce naming accuracy (Hameau, 2016). Other semantic variables have not yet been investigated in people with aphasia.

This study presents the first simultaneous examination of the effects of six semantic variables (number of near semantic neighbours, number of semantic features, typicality, distinctiveness, intercorrelational density, strength of the first associate) on picture naming in people with aphasia. We also investigated interactions between these variables and the semantic abilities of the participants with aphasia.

Methods

Participants

The data was taken from the Moss Aphasia Psycholinguistic Project Database (MAPPD) (Mirman et al., 2010), which provides naming responses from people with aphasia on the Philadelphia Naming Test (PNT) (Roach et al., 1996). Here, we analysed naming accuracy and response types of 175 people with aphasia.

Stimuli

89 MAPPD items were selected that also appeared in the McRae et al. (2005) feature norm database and the University of Florida Free Association Norms (Nelson et al., 2004). A number of psycholinguistic properties of the items were used as control variables: length in phonemes, word frequency, age of acquisition, concept familiarity, visual complexity, imageability, and name agreement.

McRae et al.'s (2005) database was used to derive five feature-based semantic predictor variables: number of near semantic neighbours, number of semantic features, typicality (calculated according to Rosch and Mervis' (1975) family resemblance score), distinctiveness, and intercorrelational density. The strength of the first associate was derived from Nelson et al. (2004).

Analyses

Generalised Linear Mixed Models were used to determine the effect of the control and semantic predictor variables on different dependent variables (naming accuracy, semantic errors vs. correct responses, semantic errors vs. omissions, omissions vs. correct responses) and to examine interactions between the participant's score on the Pyramids and Palm Trees test (PPT score; Howard & Patterson, 1992) as a measure of semantic impairment and the six semantic predictor variables. Bayesian statistics were used to determine if potential null-effects were due to there being no effect (evidence for the H_0) or if the data was not sensitive enough to detect possible effects.

Results

Naming accuracy increased for words that were shorter (p<.001), higher frequency (p=.012), acquired earlier in life (p=.005), and more familiar (p=.039). Moreover, participants with intact semantics (high PPT score) performed more accurately (p<.001).

Surprisingly, none of the semantic variables predicted naming accuracy, there was only a marginal effect of the number of semantic features (p=.094), with increased accuracy for items with many features. Bayesian correlations between the semantic variables and naming accuracy corroborated the null effects for the number of near semantic neighbours, typicality, distinctiveness, and intercorrelational density (BF_{01}>3). For the strength of the first associate (BF_{01}=1.370) and the number of semantic features (BF_{01}=0.357) we were unable to adjudicate between the H_1 that there was an effect of the variable on naming accuracy and the H_0 that there was no such effect.

In the error analyses we found that high typicality increased the probability of a semantic error over a correct response and an omission. Moreover, there were interactions between the PPT score and typicality: The probability of semantic errors over correct responses and omissions decreased for high typicality items in lower PPT score participants, while higher PPT score participants were unaffected by typicality when comparing semantic errors and correct responses and showed the opposite pattern of lower PPT score participants when contrasting semantic errors and omissions (Figure 1). No other semantic variables reached significance.

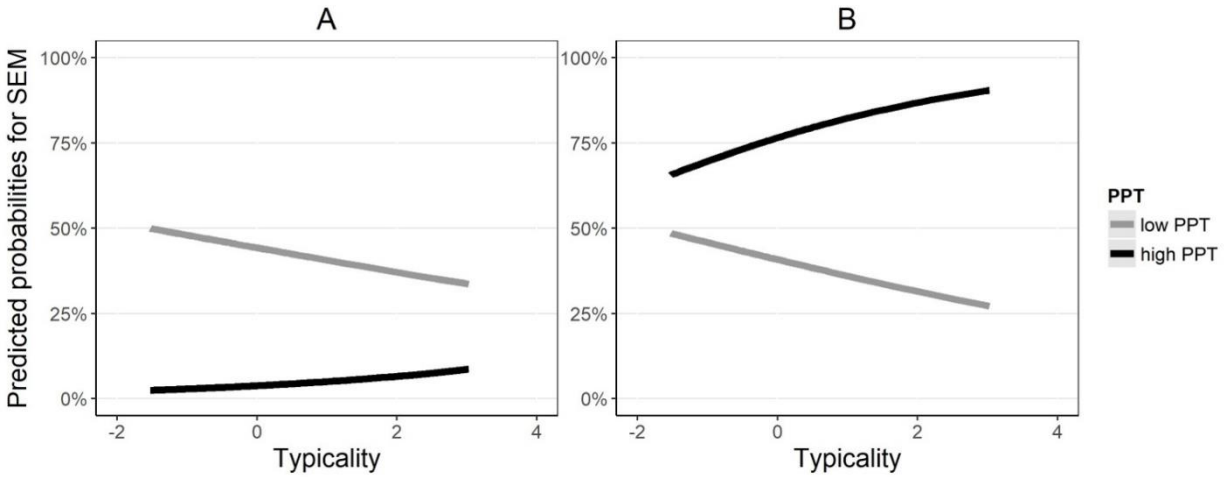

Figure 1. Interaction between performance on the Pyramids and Palm Trees test and typicality on probability of a semantic error over a correct response (Panel A) and of a semantic error over an omission (Panel B).
Note. Abbreviations: SEM – semantic error; PPT – Pyramids and Palm Trees test score.

Effects of the semantic variables will also be reported for a subgroup with a central semantic impairment.

Discussion

This was the first research to examine effects of six semantic predictor variables (number of near semantic neighbours, number of semantic features, typicality, distinctiveness, intercorrelational density, strength of the first associate) on the naming performance of a large group of people with aphasia. In contrast to previous research, we found no reliable main effects of these variables. Importantly, previous publications used smaller samples of participants, and not all studies analysed the data taking individual patient variation and a large number of control variables into account, which might have distorted their results.

The results for the clinical population examined here suggest that conceptualisation and lexical selection processes for word production were unaffected by the tested variables. However, the interactions of the PPT score and typicality in the error analyses suggest that patients with a semantic impairment could be more prone to such influences. These findings have implications for the architecture of the semantic system and the processing dynamics of lexical selection as well as for assessments of aphasia and its rehabilitation.

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Name it Again! Repetition Priming in People with Aphasia

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Introduction

Repetition priming refers to the fact that people are faster to name items when presented with them for a second time (e.g., Wheeldon & Monsell, 1992). This effect has been well established in the short term, with unimpaired speakers being quicker to respond to pictures repeated within the same session (e.g. Durso and Johnson, 1979; Wheeldon & Monsell, 1992). Previous studies have also found evidence of priming in the long term; for example, Mitchell and Brown (1988) found stable priming from one to six weeks and Cave (1997) found priming up to 48 weeks later.

It is well established that treatment can improve word retrieval in people with aphasia (e.g., Wisenburn & Mahoney, 2009). However, there is variability in response to word retrieval treatment and it can be hard to predict which people with aphasia are most likely to benefit (Best & Nickels, 2000). One possible mechanism underlying treatment-related improvements in word retrieval is repetition priming (Nickels, 2002). Consequently, it is possible that those individuals who fail to respond to treatment are those who have impaired repetition priming. Surprisingly, there is little research examining repetition priming in people with aphasia. Soni et al. (2012) examined very short-term priming in five people with aphasia (0, 1, or 7 intervening items). They found improved accuracy at all three delays but latency improvements were no longer present with 7 intervening items before the repetition. Critically, however, in this experiment, if the person with aphasia failed to produce the correct response, it was provided for them to repeat aloud. Heath et al (2015) found improvement in accuracy from multiple attempts at naming two to four days earlier, but with no effect on naming response latency.

Given the paucity of data in the literature, the aim of this study was to explore the extent of repetition priming in people with aphasia.

Methods

Participants were nine people with aphasia, recruited from an aphasia support group, ranging in age from 50-87 years (mean:69). All had suffered a stroke (2-16 years earlier) and had been diagnosed with aphasia, and impaired word retrieval. Naming accuracy on the Comprehensive Aphasia Test (Swinburn et al., 2004) object naming subtest ranged from 6-94% (mean:54%).

In each of three sessions, participants named sets of 165 coloured photographs of single objects presented on a white background. All pictures had name agreement of at least 90%. The pictures were divided into 6 sets, matched for name agreement, frequency, age of acquisition, length in phonemes, concreteness and visual complexity. Three sets comprised target items that were repeated for naming with a different depiction of the same item (to avoid visual priming) at one of three time delays: within the first session (minutes/50 intervening items); one day later; or one week later. In each of the three sessions one of the remaining three sets were also presented for naming as novel pictures (never repeated). The picture was displayed on the screen for up to 5000ms and was only scored correct if it was named within this time. Only the first attempt at a response was scored. Both accuracy and response times were recorded.

All analyses were conducted in R-Studio (RStudio Team, 2015), using mixed effects modelling with lme4 package (Bates et al, 2012). For analyses of the reaction time data, a linear mixed effects model was constructed. The dependent variable was log RT, with Condition (the time delay and presentation number, e.g., first presentation of day condition) as the fixed effect. The random effects structure included random intercepts for the Targets and random intercepts and slopes for Condition by Participant: (LogRT ~ Condition + (1 + Condition | Participant) + (1 | Target)). For accuracy data, a generalised linear model was fitted (Accuracy ~ Condition + (1 | Participant) + (1 | Target)). Contrast coding was then used for all analyses to compare the conditions of interest. Priming was evaluated by comparing the difference between first and second presentations of items, minus any difference between the two sets of control (unrepeated) stimuli from the same two sessions to control for effects of session.

Results

While repeated items at all three delays resulted in numerically faster naming of correctly produced items than unrepeated items controlling for session: Minutes: 461ms (SD=1087); Day: 199ms (SD=460); Week: 69ms (SD = 499) (see Figure 1 'Ave'), this was only significant for the Minutes delay condition (z=-2.58, p=.03). Model comparisons showed that the model with a random slope for participants was a better fit (a lower AIC value), indicating that there was individual variation between participants.

There was no significant difference in accuracy in any priming condition, although once again numerically the biggest difference was in the minutes condition with the average priming for accuracy being: Minutes: .12 (SD:.11); Day: .01(SD .13) Week: .03(SD:.14).

At an individual level, there were few significant effects on RT: P1 showed significant priming for Minutes and Week; and P5 for Day. P9 did not show a significant effect, most likely due to the small number of correct items (n=49(13%)) giving reduced power. P6 was excluded due to low accuracy (1% correct). No individual showed significant effects of priming on accuracy.

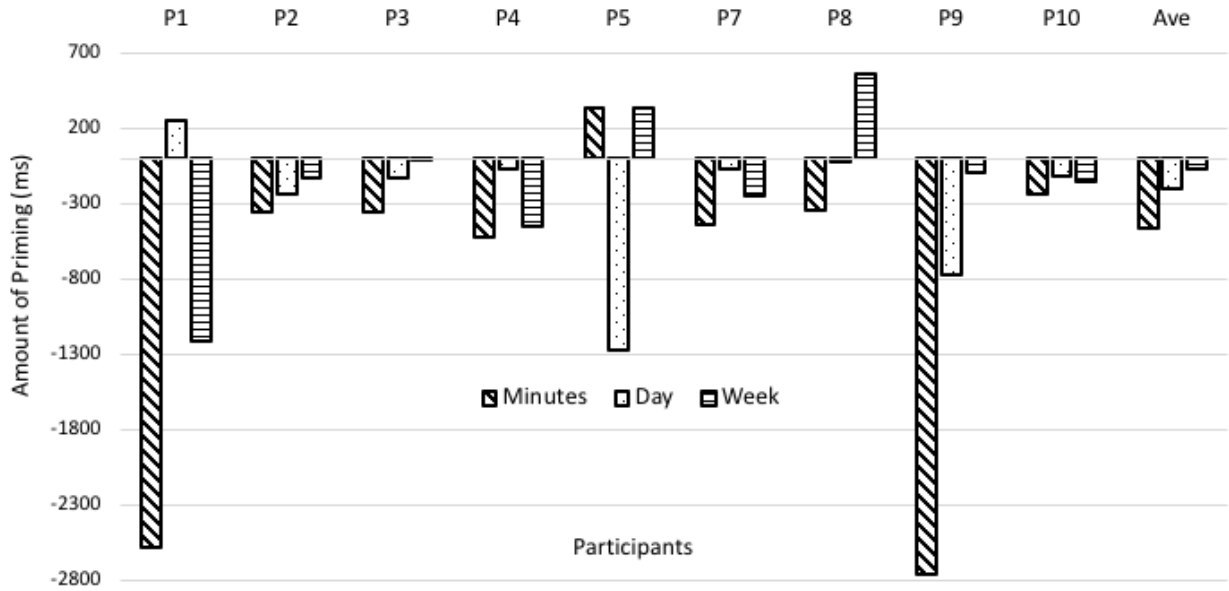

Figure 1. The amount of priming in milliseconds (controlling for session effects) for each delay condition. Presented for each participant with aphasia and as a group average. Negative values indicate faster response at the second attempt (priming). P6 is excluded from the analysis.

Discussion

At a group level, people with aphasia only showed significant priming at a lag of minutes. This contrasts with the patterns found in unimpaired speakers, where significant priming has been found well beyond one week (e.g., Cave, 1997; Mitchell & Brown, 1988). Consequently it appears that, on average, the decay of priming is much steeper in people with aphasia, with no significant priming at one day later. However, there was a great deal of individual variation (see Figure 1): Some people with aphasia appeared to show much greater priming than others. However, in order to explore this more thoroughly larger sets of items are required to provide sufficient power to examine individual patterns. Importantly, reliability of individual priming effects has not been examined in unimpaired participants. Nevertheless, the findings of this study have important implications for understanding treatment mechanisms and providing recommendations for treatment protocols.

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Revision and Adaptation of the Bilingual Aphasia Test in Brazilian Portuguese

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Introduction

The Bilingual Aphasia Test (BAT) is a battery tool aimed primarily at assessing language skills in different languages. It can be used for performance comparison between language pairs, and as a monolingual assessment tool for languages for which other standardized aphasia batteries are not available. The BAT allows the detection of dominance patterns among the languages of a speaker, which is beneficial for treatment planning (Paradis & Libben, 1987; Paradis, 2004). The BAT is divided in three parts. Part A is a language history background questionnaire. Part B comprises monolingual tests assessing many levels of language structure and use, as well as different modalities and units of analysis. Part C is the bilingual section, which tests two languages simultaneously and how they interact with and interfere on each other. The test is cross-linguistically standardized, and the answer sheet is the same in all languages.

The currently available Brazilian Portuguese (BP) version of the BAT only includes Part A and B, which are the monolingual sections. There were, prior to our adaptation, no bilingual sections (Part C) with BP as one of the languages. The current version also has significant issues: a) it is linguistically inadequate and outdated, containing infrequent and overly formal lexical constructions and syntactic structures; b) it has many errors of translation and proofreading, such as omissions of sentences and untranslated words and expressions in Spanish; and c) it does not follow all the methodological guidelines for standardization of the BAT, which are carefully built to ensure reliability of cross-linguistic performance comparison (Paradis & Libben, 1987; Paradis, 2004). Based on these, we revised the currently available BP version of the BAT and created tests for the Part C in two language pairs: Brazilian Portuguese-English and Brazilian Portuguese-Spanish.

Methods and results

Revision of Part A and B

The guidelines for the standardized creation of stimuli when adapting the BAT (Paradis & Libben, 1987; Paradis, 2004) were thoroughly followed to evaluate the current BP version. Corrections were made when there were errors in the instructions of tasks and when stimuli to elicit a specific answer from patients (e.g. “correct” or “incorrect”) were not distributed in the same patterns as in other languages.

Some stimuli were rebuilt based on recent literature on BP. In the Syntactic Comprehension subtest, for instance, patients listen to sentences and choose which pictures depict the meaning of each sentence. There are standardized guidelines as to which types of syntactic structures must be used. For the sentences in items 71-76 and 105-110, for instance, distinctions in pronoun gender for inanimate objects must be used if such distinctions exist in the language in question. Although such distinction exists in BP, speakers of BP perceive the use of pronouns to refer to inanimate entities in both subject and object positions in a given sentence as highly artificial (Creus & Menuzzi, 2004). This would be the case for a sentence such as "Ela segue ele" from the current BAT, which literally translates to "She follows him", where "ela" refers to a motorcycle and "ele" to a car. Therefore, we created sentences directed at the use of reflexive pronouns instead, following the BAT instruction for the creation of stimuli for languages in which pronoun gender distinction for inanimate objects does not exist (Paradis & Libben, 1987).

Another major adaptation, used for many tasks, was the substitution of enclisis (1) by tonic object pronouns (2)

(1) Ela o_{PRO} empurra

She him pushes
"She pushes him"

(2) Ela empurra ele_{PRO}

She pushes he
"She pushes him"

This decision was based on evidence that the enclitic pronoun form is highly falling out of use in BP and is systematically being replaced by the tonic object form, a trend which has been observed throughout all levels of discourse formality and in speakers of all levels of education (Wink, Finkenauer & Othero, 2012).

In instances for which there were no specifications from the standard guidelines of the BAT, translation comparisons were made in regards to aspects such as level of formality and phrasing of instructions. The BAT in Germanic and Romance languages were consulted and compared to the current BP BAT. This method was used to model the Brazilian version in a broad cross-linguistically equivalent manner.

New adaptation of Part C

The BP-English and BP-Spanish tests were adapted from the currently available tests in European Portuguese, which were carefully evaluated according to the guidelines (Paradis & Libben, 1987). The recognition of translation equivalents and production of translation equivalents subtests went through few modifications. Since stimuli are single words, changes were made to control the words for frequency (Davies, 2016). As a translation for donkey, for instance, we opted for using "jumento" instead of "asno", as the former is much more frequently used in BP.

For the translation of sentences and grammaticality judgement subtests, which evaluate language transfer, stimuli were created anew, since the original creators had not followed the standardized

instructions in Paradis and Libben (1987) for neither language pairs. A list of structural differences between the languages of each pair was created to help build the new sentences.

Discussion

A thorough revision of the monolingual and two new adaptations of the bilingual BAT sections were conducted in BP. This resulted in a test that is more complete, linguistically up-to-date and suitable for the Brazilian population, and less prone to deviations from the BAT standardized guidelines for cross-linguistical validity.

We trust we have significantly contributed to improving the BP version of the test. By correcting mistakes and improving the adequacy to the standardized guidelines, we believe the tool is now more reliable for both monolingual and cross-linguistic assessment. As a next step in this project, we plan to obtain normative data from non-brain-damaged individuals and validate this new version of the BP BAT.

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Past perfective in stroke aphasia and semantic dementia: the effect of temporal and aspectual marking

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Introduction

Many studies in aphasia have shown a deficit in the production of past tense (Bastiaanse, 2013). Greek distinguishes between two past tenses: past perfective, which denotes that an event is completed and past imperfective, which denotes duration. Concerning Greek some studies have shown that Past Perfective (henceforth PastPerf) is more impaired than both Past Imperfective (PastImp) and Present (Nanousi et al., 2006; Stavrakaki & Kouvava, 2003), while others have shown a similar performance in PastPerf and PastImp (Varlokosta et al., 2006). It is, thus, unclear whether the deficit is due to reference to the past and/or to the production of perfective aspect. Furthermore, tense has been shown to interact with lexical aspect in aphasia. Dragoy & Bastiaanse (2013) found that perfective verbs were easier to produce in the past, whereas imperfective verbs were easier to produce in the non-past, which suggests a sensitivity to marked combinations of tense and lexical aspect. Past tense production deficit in semantic dementia (henceforth SD), on the other hand, has been shown mainly for irregular verbs (see Auclair-Ouellet, 2015 for a review), suggesting a morphological/lexical deficit rather than a general inflection deficit. Auclair-Ouellet et al. (2016), however, provide evidence that SD patients cannot exploit the semantic information of temporal adverbs, in order to produce the correct inflection. The present study addressed the production of past perfective and in particular the effects of temporal and aspectual marking in stroke aphasia and SD.

Methods

Participants

30 native speakers of Greek participated in the study: 10 patients with aphasia (henceforth PwA, 6 anomic, 2 Wernicke and 2 agrammatic), 5 SD patients and 15 matched controls.

Materials

The material consisted of 36 regular verbs. 20 were telic, i.e. with an inherent endpoint and 16 were atelic, without such a point. The target sentences, thus, included either the standard ummarked combination ([+telic] verbs in past perfective and [–telic] verbs in present/past imperfective) or the marked one ([+telic] verbs in present/past imperfective and [–telic] in past perfective).

Procedure

Participants were presented with a sentence and then with an adverbial phrase. They were instructed to complete the sentence by repeating the original one modifying it in order to make it compatible with the adverbial phrase. The source sentences for Present and PastImp were in

PastPerf. For PastPerf the source sentences were either in Present or in PastImp. In the former case the modification involved both reference to the past and aspectual marking and in the latter only aspectual marking.

Predictions

Concerning PwA, we expected: 1) marked sentences to be more difficult than unmarked ones (cf. Dragoy & Bastiaanse, 2013), 2) PastPerf to be more difficult than Present and/or PastImp, and 3) the difference between PastPerf and Present to be larger than the difference between PastPerf and PastImp, since in the former case a twofold change is involved but in the latter only one. If the deficit in SD is morphological/lexical, production of PastPerf should not be impaired, since all verbs are regular. If their deficit is of semantic nature, however, we expect impaired performance across the board and probably a markedness effect, i.e. that marked sentences are more difficult to produce than unmarked ones.

Results

Control participants performed at ceiling. PwA performed worse than SD and controls. PwA manifested a markedness effect ($p<0$), a tense effect ($p<0.01$), and a marginally significant tense by markedness interaction ($p=0.05$). These results reflect a general difficulty with marked sentences, a difference between PastPerf and Present in both marked and unmarked sentences, and a significant difference between PastPerf and PastImp only in the marked ones. SD participants manifested a markedness effect ($p<0$), which points to a difficulty with marked sentences and a tense effect ($p<0.05$), which indicated that PastPerf was more preserved than PastImp and Present.

Discussion

The findings suggest that the twofold modification (temporal and aspectual) is computationally demanding for PwA, whereas the aspectual modification is difficult only in marked target sentences. This finding provides support for the psychological reality of morphological operations. The findings for the SD patients challenge both hypotheses concerning inflectional deficit in this dementia type. A morphological/lexical deficit account does not accord with a dissociation within regular verbs and especially with the selective preservation of the marked perfective forms compared to the unmarked imperfective ones. On the other hand, a semantic deficit account cannot explain a selective tense impairment in SD which affects imperfective tenses. We discuss the implications of these findings for the language profiles of stroke aphasia and semantic dementia.

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Influence of semantic association networks on the speed of word production across the Lifespan

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Introduction

Word production is an every-day activity that allows a person to express concepts by transforming them into lexical forms. This task can be influenced by different psycholinguistic factors as well as by the age of the speakers. Studies usually show lower performance in elderly and children when compared to young adults ([1,2]) in the picture naming task, in term of accuracy or production speed.

Among variables which are likely to underpin age-related changes in word production ([3,4,5,6,7]) changes in lexical-semantic processes may constitute a key point. There is however no unique consensus on which psycho-linguistic variable has the largest influence on word production and on age-related changes in picture naming ([8,9,10,11,12,13]). Semantic association has long been recognized as crucial for determining the conformation of semantic representations ([14,15]). To elucidate the role of semantic association networks on word production, in the present study we investigate whether the lexical-semantic organisation predicts the speed of word production at different ages, from school-age children to older adults.

Methods

Preliminary collection of associative norms

120 French native speakers aged from 10 to 80 years-old and divided into 6 age-groups (10-13; 16-18; 20-30; 40-50; 59-68; 69-80), participated in this data collection. Subjects had 10 seconds to give all associate words that came to mind for each of the 204 stimuli that the experimenter read them aloud (lexical-semantic fluency task). Mean number and density of free associates given for each cue word, will be calculated for each age-group.

Picture naming task

120 other French native speakers aged from 10 to 80 years-old and divided into the same 6 age-groups (10-13; 16-18; 20-30; 40-50; 59-68; 69-80), participated in a picture naming task involving 120 pictures and their corresponding modal names for which classical psycholinguistic variables were available from two French databases ([16, 17]) in addition to the age-related associative norms collected for this study. Subjects were asked to overtly produce the word corresponding to each of the 120 black and white drawings images. Reaction Times (RT) and Accuracy were calculated for each trial and entered in mixed models with as predictors the semantic variables and the classical psycholinguistic variables.

Results

Density and distribution of the lexical-semantic association network changes across ages. More crucially, age-related semantic association norms predict naming latencies better than semantic associations, or semantic features as usually collected in young adults ([18]). Beyond that, words with a higher number and a greater density of associates are named faster.

Discussion

Preliminary results seem to suggest that the evolution in the "semantic network", depending on age of the speaker, influences word production latencies in picture naming tasks. In fact, "semantic network" also evolves in terms of size and density, depending on age groups.

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Functional brain activity in task switching in persons with aphasia (an fMRI study)

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Introduction

A lot of studies indicate that aphasia co-occurs with other types of different non-linguistic deficits one of which is executive functions (EF) impairments (Nicholasa & Connorb, 2016; Murray, 2017). One of the EF that can influence the ability to readily and efficiently adopt rehabilitation programs is task switching (TS). At the moment the issue how brain areas are reorganized after brain damage for performing of TS has been poorly studied, the same goes to the question which brain areas take over the implementation of the impaired TS in patients with aphasia as well as functional cerebral reorganization of TS after intensive cognitive therapy. These questions were the aim of our interest.

Methods

Participants

Twenty five healthy individuals (mean age: 38±12.2; 6 men), out of which nineteen performed the same task after 1.5 months. Eighteen patients with aphasia and TS impairment (ten fluent and eight non-fluent; mean age: 45±9.6; 8 men; 15 after left hemisphere CVA, 3 after TBI with left hemisphere damage; ranging from moderate to mild severity of aphasia). All the participants were right-handed native speakers of Russian.

Each patient received two individual lessons with speech therapist and one with neuropsychologist five times a week for five weeks. After the intensive therapy targeting at recovery of language and executive functions, all the patients were discharged from the hospital with either good or pronounced improvements.

TS task

In the experimental condition for the fMRI task, the participants had to shift their attention between two objectives (classifying figures according to their form (circle/square) or number (one/two)) and press appropriate buttons. In the control condition, a triangle was presented, the participants had to press the button to which the angle of the triangle pointed. Patients performed this fMRI task at the beginning and at the end of the rehabilitation. The study was conducted on the Siemens Avanto 1.5 T scanner. fMRI data analysis was performed in SPM8.

Results

In healthy individuals the fMRI study revealed that a neuronal network controlling TS includes the dorsolateral prefrontal and inferior parietal cortical areas, as well as the secondary areas of the visual cortex, the supplementary motor area in the left hemisphere (LH) and the right hemisphere (RH) and cortical areas of the cerebellum bilateral. This is consistent with our previous studies in which the results of 140 healthy individuals were analyzed depending on age and sex and also differences in

functional and behavioral data of TS were discussed in detail (Kuptsova et al, 2015; Kuptsova et al, 2016). No significant differences between first and second (after 1.5 month) fMRI test runs for healthy subjects were revealed.

Since the patients had large variety of brain damages in different parts of LH and a lot of them also had the damages of subcortical areas and the forms of aphasia didn't depend on them, so it was very difficult to place such patients into different groups. Therefore the individual data of each patient was compared to those of equivalent age and sex healthy subjects and an attempt was made to group the patients according to their patterns of activation resulting in patients divided into three groups.

Group 1. An asymmetric activation (strong activation in one hemisphere as compared to the other) in frontal and parietal areas. Also activations of additional brain areas were observed which didn't exist in healthy subjects. This group consisted of four patients after LH CVA (two had fluent aphasia, three men), two patients had dominant activation in LH and the other in RH. At the end of the rehabilitation, there was a general decrease in activation but LH activation became more similar to that of healthy individuals.

Group 2. A very low activation of the brain, mainly in the frontal areas, and also activation of additional brain areas missing in healthy subjects were observed. This group consisted of eight patients after LH CVA (four had fluent aphasia, three men). After rehabilitation the activation primarily in frontal areas became more consistent with that of healthy subjects.

Group 3. A very high and diffuse activation in most parts of brain with additional activation in various brain areas. This group consisted of six patients: three after LH CVA and three after TBI (four had fluent aphasia, two men). After rehabilitation a decrease of activation primarily in frontal areas was observed.

Discussion

The repeated fMRI study of healthy individuals showed no significant difference which supports the reliability of fMRI study and allows using this method to assess the impact of rehabilitation programs on patients with cerebral pathology.

Comparison of fMRI data of each patient with a comparable norm group revealed three patterns of activation in patients with aphasia. These patterns didn't depend on localizations of brain damages, type of aphasia, age, the amount of brain damage time onset. The difference between the patients was only observed in the etiology of the disease: the patients with CVA were in all three groups whereas the patients with TBI were only in the diffuse activation group which can be explained by the specificity and pathomorphological reactions of the brain typical for these disorders (Skoromets et al, 2014).

All patients from three groups showed additional activation (non-existent in healthy subjects). One of the reasons may be that the TS task for patients is very difficult and additional brain resources are engaged. On the other hand, this may reflect an unproductive brain work during performance of this task and can lead to impairment in this function and affect other functions. During positive rehabilitation the activation of brain became more consistent with that of healthy individuals. All this indicates that the brain has optimal and most functionally successful patterns of activations which are involved in performing the task.

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The interplay between syntax and phonology in the resolution of resumptive pronouns in Akan agrammatic speakers

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Introduction

Studies on agrammatism have revealed that the comprehension of object relative clauses and object clefts is impaired in agrammatic speakers compared to their subject counterparts (Burchert, et al., 2003; Hickok & Avrutin, 1995). Among the most influential theories proposed to explain deficits are the; Trace Deletion Hypothesis (TDH: Grodzinsky, 1995), Derived Order Problem Hypothesis (DOP-H; Bastiaanse and Van Zonneveld, 2005), Discourse Linking Hypothesis (Hickok and Avrutin, 1996) and the Complexity Limitation Hypothesis (Frazier and Friederici, 1991).

Sentence production is identified with difficulties in producing free and bound grammatical morphemes (Caramazza & Berndt, 1985; Goodglass, 1968), complex argument structure (Thompson 2003) and sentences in derived order (Bastiaanse and Zonneveld 2005). Theories like the Tree Pruning Hypothesis (Friedmann and Grodzinsky, 1997) the Argument Structure Complexity Hypothesis (Thompson, 2003) and the Derived Order Problem Hypothesis (Bastiaanse and Van Zonneveld, 2005) account for production deficits observed.

Agrammatic speakers show difficulty processing binding constructions, like reflexives and personal pronouns (Grodzinsky et al., 1993; Edwards & Varlokosta, 2007). However, the phenomenon of pronominal resumption has not been investigated in agrammatism.

The present study explores the interplay of syntax and phonology in Akan pronominal resumption. Akan is a Kwa language spoken in Ghana. Akan helps us assess the processing of pronominal resolution and resumption in agrammatism and adds a phonological dimension to the discourse, because Akan is a tone language and tone is used to make both lexical and grammatical distinctions.

In syntax, resumption is defined as the movement of a nominal element to construct focus, topic, relative, and question structures, which allows a pronoun that refers to the moved nominal element to fill its original position (McCloskey, 2006). See example below.

1. [Who$_{1}$ did [the man push ***t***$_{1}$]]?

The original position of the *wh*-word in (1) is marked ***t*** but this is not phonetically produced. Languages like English do not replace the moved element with a pronominal form. In languages like Akan however, the moved element is replaced with a resumptive pronoun (RP) like ***nò*** in (2), which matches the morpho-syntactic features of the moved element (Saah 1994). The accent on the vowel means ***nò*** is pronounced with a low tone.

Interestingly, the resumptive pronoun ***nò*** in (2) can be replaced with a clause determiner (CD), that only differs in tone from the resumptive pronoun: ***nó*** (see 2). The difference between the RP and the CD is the tone on them. A combination of both is also possible. Notice that neither the resumptive pronoun nor the clause determiner is obligatory. In these structural variations, semantics is left intact.

2. *Hena na papa no e-pia* ***(nò)*** ***(nó)*** ?
   Who FOC man the PROG.push **RP**(him/her) **CD**
   'Who is the man pushing?'

The questions that arise are: 1. how do Akan agrammatic speakers comprehend and produce the variations in the formation of resumption? 2. Does the presence or absence of the RP or CD or both make processing easy or difficult?

Methods

Participants and Design

We recruited 5 individuals with aphasia from the Korle Bu Teaching Hospital, Ghana, and 5 non-brain damage speakers of Akan. We tested two language modalities, comprehension and production. In both modalities, we investigated Akan *who*-questions and clefts.

Both the *who*-questions and the clefts had 5 target conditions: a baseline condition and 4 object conditions with the same meaning but with different structural formation. For the object conditions, we had conditions with:

i) only a resumptive pronoun

ii) only a clause determiner

iii) both a resumptive pronoun and a clause determiner

iv) neither a resumptive pronoun nor a clause determiner

Procedure

We administered a picture pointing task and a sentence-picture-matching task to investigate the comprehension of *who*-questions and clefts respectively. An elicitation task was administered for the production test.

Results

Generalized linear mixed-effects modeling was performed using the *lme4* package (Bates, et al., 2015) and the multcomp package (Hothorn, et al., 2008) in R. See mean accuracy scores of patients in Table 1.

In the comprehension of the *who*-questions, there was no statistical difference between the baseline condition and the object conditions at the group level. However, some patients showed a dissociation. On the other hand, the comprehension of clefts at the individual and group levels showed a dissociation between the baseline condition and object clefts, but there was no effect of the presence or absence of either resumptive pronoun or the clause determiner.

For the production data, the object clefts were more difficult to produce than the subject clefts both at the group and individual level. In the *who*-questions condition, the performance on the baseline condition was not different from the other object conditions at the group level even though we observed a dissociation in some patients.

Table 1: Mean accuracy score on *who*-questions and clefts for both comprehension and production tests

Comprehension of *who*-Questions and Clefts										
	Baseline		**Object condition ending with:**							
Target Conditions			**Resumptive Pronoun**		**Clause Determiner**		**Res. Pro. & Claus. Det**		**Empty**	
Test Items	***Obj.Who-Question In situ***	***Subj. Cleft***	***Who-*** **Ques**	**Cleft**	***Who-*** **Ques**	**Cleft**	***Who-*** **Ques**	**Cleft**	***Who-*** **Ques**	**Cleft**
Mean Accuracy Score(%)	86	86	80	52	82	64	80	68	82	60
Production of *who*-Questions and Clefts										
	Baseline		**Object condition ending with:**							
Target Conditions			**Resumptive Pronoun**		**Clause Determiner**		**Res. Pro & Claus. Det.**		**Empty**	
Test items	***Obj.Who-Question In situ***	***Subj. Cleft***	***Who-*** **Ques**	**Cleft**	***Who-*** **Ques**	**Cleft**	***Who-*** **Ques**	**Cleft**	***Who-*** **Ques**	**Cleft**
Mean Accuracy Score(%)	*85*	*85*	75	40	75	37.5	77.5	37.5	85	32.5

Discussion

The TDH (Grodzinsky, 1995) and the DOP-H (Bastiaanse and Van Zonneveld, 2005) perfectly explain our observations on cleft comprehension. However, they are unable to explain why comprehension of the object *who*-questions was not problematic.

The DOP-H accounts for the deficiency observed in the production of the object clefts but it is unclear why objects *who*-questions were spared. In addition, the TPH (Friedmann and Grodzinsky, 1997) and its assertions are not in line with our findings on the *who*-questions.

The current work explored two major language modalities, investigating the phenomenon of resumption. The presence or absence of the resumptive pronoun or the clause determiner or both had no effect on the processing of clefts and *who*-questions at the group level even though this made a difference in some patients.

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Cross-linguistic normative study of the neighbor fluency task: A novel instrument for clinical assessment

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Introduction

Verbal fluency is a task widely used in neuropsychological batteries, that tests language and executive control through word retrieval. Participants are asked to produce as many words as possible within one minute, that either starts with a given letter in the phonemic fluency task, or belongs to a given category in the semantic fluency task. The number of correct and unrepeated responses generated is the test score (Luo, Luk, & Bialystok, 2010). During the task, participants access and retrieve lexical items from their language network. Both phonemic and semantic fluency tasks are components of major assessment protocols for aphasia (Benton, Hamsher, & Sivan, 1994), communicative disorders (Werkgroep CCS AfasieNet, 2016), and psychosis (Becker, Nieman, Dingemans, van de Fliert, de Haan, & Linszen, 2010).

In non-clinical literature, it is well-established that phonological and semantic priming influence lexical retrieval. While the productions in the letter fluency task share the same onset, words that sound similar in rime but not in the onset are also activated, though not overtly produced. Words that sound differently by only one phoneme are called phonological neighbors, and the neighboring relationships build up small-world mental lexicon networks (Vitevitch, 2008). Phonological neighborhood affects both word production and recognition. Existing neighbor production tasks required only one response of a phonological neighbor per item as quickly as possible (Luce & Large, 2011; Vitevitch, Goldstein, & Johnson, 2016), not allowing broader searches during a longer period. Therefore, if the neighbor production task is turned into a fluency task, richer data, more diversified results, and strategies are expected than with a letter fluency task. Moreover, clinical assessments usually involve only one score per test, while academic literature provides network measurements such as clustering coefficient and average path length (Vitevitch, 2008), which can potentially be useful variables in assessing language-disturbed language users as well.

Therefore, to better assess how the mental lexicon is accessed phonologically through a network approach, we present a novel verbal fluency task of phonological neighbor production, and we first perform this task on Dutch and Mandarin-speaking participants without neurological disturbances.

Methods

Participants

Because the neighbor fluency task is a new test, we plan to test healthy controls at this stage before applying it on a clinical population. Ten Dutch university students aged 19-24 (M = 21.7, SD = 1.79) and ninety-five participants from mainland China aged 18-38 (M = 23.4, SD = 4.14) without language or neurological disorders participated in the experiment.

Materials

Dutch and Mandarin monosyllabic content words with high numbers of phonological neighbors are used as stimuli, prompting the production of similar-sounding words in one minute. Dutch stimuli were selected from the Dutch Lexicon Project 2 stimulus characteristics database (Brysbaert, Stevens, Mandera, & Keuleers, 2016), and phonological neighborhood information was checked with CLEARPOND-NL (Marian, Bartolotti, Chabal, & Shook, 2012). Mandarin stimuli were selected from the database of Mandarin neighborhood statistics (Neergaard, Xu, & Huang, 2016). Stimuli have similar frequency and age of acquisition, and are different by syllable structure. The lists of stimuli are presented in the table below. For both tasks, stimuli are presented to participants in video format. Videos were recorded by one native speaker of each language aged around 20.

Table 1: List of Dutch and Mandarin stimuli

Word	IPA	Syllable structure	Phonological neighborhood density
Dutch			
ei	/ɛi̯/	V	28
oor	/oːr/	VC	19
gat	/ɣɑt/	CVC	31
bord	/bɔrt/	CVCC	26
krant	/krɑnt/	CCVCC	12
Mandarin (words are presented as pinyin + tone)			
an3	/an/	VC	29
ye1	/jɛ/	CV	19
tu2	/tʰu/	CV	23
ceng1	/t͡sʰɤŋ/	CVC	23
kuo4	/kʰuɔ/	CVV	22
wai4	/uaɪ/	VVC	28

Procedure

Participants perform this task through automated computer programs. They watch a video that contains the stimuli, and then produce as many similar-sounding words as possible within one minute. Order of stimuli presentation is randomized for each participant. Language background is asked with the LEAP questionnaire (Marian, Blumenfeld, & Kaushanskaya, 2007).

Results

Preliminary analyses on the Dutch data showed that the number of unique words produced ranged from 3 to 17 (M = 9.76, SD = 3.46), and the number of phonological neighbors ranged from 1 to 12 (M = 5.86, SD = 2.51). Preliminary analyses showed that different syllable structures of the stimuli triggered different numbers of responses. Further regression analyses are still in progress. We plan to use the Generalized Additive Models, in which the outcome variables are number of words, number of non-words and repetitions, and clustering coefficient of the network formed by the one-minute productions. Fixed effects are: phoneme length, syllable structure, and phonological neighborhood density by item, and digit span (for the Dutch study) and language background (for the Mandarin study) by subject.

Discussion

According to current analyses, we argue that participants without language or neurological disturbances would be able to produce around ten unique words and five phonological neighbors for each trial of the test, which will set a baseline for later comparison with clinical population. We predict that the numbers of productions made by individuals with aphasia or communicative disorders will produce significantly lower numbers of words compared to non-clinical individuals. As Chinese has a smaller syllable inventory with the presence of lexical tones, cross-linguistic differences are expected. This study proposes the neighbor fluency task as a new measurement tool for clinical assessments, and by testing it on healthy controls of two distinct languages, we also hope to validate the task on multilingual clinical population in the future.

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Development in language production in chronic aphasia: a longitudinal case study of a bilingual individual

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Introduction

Treatment studies in bilingual individuals with chronic aphasia (IWAs) show positive outcomes and selective cross-language generalization of treatment gains (Abutalebi, Rosa, Tettamanti, Green, & Cappa, 2009; Goral, Rosas, Conner, Maul, & Obler, 2012). These studies also suggest that treatment effects might benefit from support of language use within the environment.

Language use is one of the main factors for language recovery in aphasia (Green, 2008). Beyond its therapeutic role, extensive research recognizes the importance of (semi-) spontaneous speech observation in the assessment of IWAs, as a valuable method to approach the language-related challenges patients have to overcome in daily verbal communication (Goodglass & Kaplan, 1983; Menn & Obler, 1990). Spontaneous speech also allows for the in-depth exploration of microstructural aspects of spontaneous discourse at the individual level, and results from this type of analysis overall converge with previous findings obtained through structured tasks (Martínez-Ferreiro, Vares González, Rosell Clari, & Bastiaanse, 2017).

Currently, little is known about the effect of language use without language treatment in chronic aphasias. Here, we aim at exploring the relationship between language use and language recovery in a case of bilingual non-fluent chronic aphasia to discover whether spontaneous language use can lead to improvements in language production in individuals with aphasia. To that end, we analyzed the longitudinal development across different free speech samples and oral production tasks in a chronic Spanish-Basque bilingual individual with aphasia. Based on previous findings, we predict a greater improvement in the language the patient uses most frequently, i.e. Spanish, across different measurements.

Methods

Participants

We report data from a chronic Spanish-Basque bilingual individual with aphasia (AF) who showed non-parallel recovery of her two languages (5 years post onset). Although premorbidly she was a balanced bilingual, AF received therapy only in Spanish and, after the stroke, this became her preferred language. Spanish is also the dominant language in her environment. An extensive assessment of AF's performance in the two languages revealed similar qualitative difficulties though remarkable quantitative differences in fluency (i.e. number of dysfluencies, speech rate), at the lexical level, and at the phonetic-phonological levels. In general, AF's command of Spanish was better recovered than Basque (Munarriz, 2017). The baseline was established after the results of a non-brain damaged bilingual participant matched in gender, age, education and language background.

Tasks and procedure

To evaluate the effect of language use, elicited production and spontaneous speech was recorded over time to measure the development in AF's production in Spanish and Basque. Speech rate and disfluencies were measured by means of two elicitation tasks: reading aloud (two texts in each language) and picture description (two tasks). These tasks were repeated after 3 years. The order of presentation of languages was kept constant. For the analysis of spontaneous speech, 300-word samples were selected in the two languages. Different indices at the sentence and the word level were calculated. Those included the MLU, percentage of grammatical utterances, percentage of finite clauses, and percentage of embedded clauses. Words (in Spanish) and morphemes (in Basque) were further classified according to word/morpheme class and type/token ratios were calculated (see Martínez-Ferreiro et al., 2017 and references therein).

Results

Figure 1 illustrates the results obtained from the analysis of speech rate in the picture description and reading aloud tasks. Overall, these results indicate that AF's speech rate was faster in Spanish than in Basque both in T1 and T2. The mean scores for AF were higher in T2 in comparison to T1 in both tasks and languages, though no remarkable differences were observed for the control. In contrast, no such difference was observed in the number of disfluencies produced, that is, no statistical differences were observed between T1 and T2 neither in picture description (in Spanish $\chi^2 = 0.76$, $p = 0.3833$; in Basque $\chi^2 = 0.87$, $p = 0.351$) nor in the reading aloud task (in Spanish $\chi^2 = 0.63$, $p = 0.4274$; in Basque $\chi^2 = 1.24$, $p = 0.2655$).

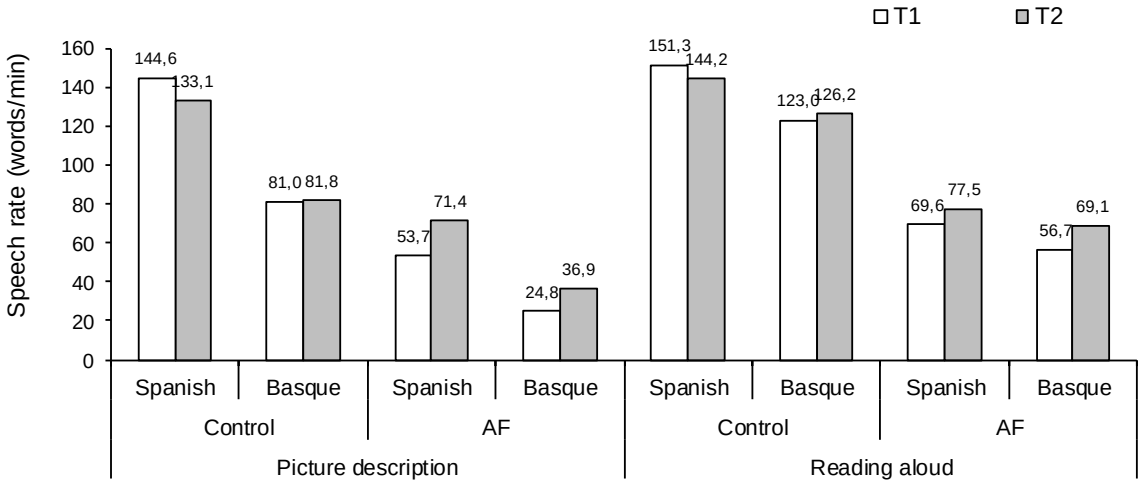

Figure 1. Speech rate in picture description and reading aloud tasks.

Regarding spontaneous speech, the analysis of T1 revealed a similar pattern to that observed for speech rate. At the sentence level, in Spanish, we found a longer MLU, and a higher finiteness and embedding index than in Basque (Finiteness: $\chi^2 = 6.14$, $p = 0.0132$; Embeddings: $\chi^2 = 3.13$, $p = 0.0769$). At the word level, we observed a reduction in the number of pronouns and adjectives in Basque and a higher number of modal and aspectual verbs. The latter is attributed to the particularities of the verbal system in Basque. Additionally, AF was found to code-switch in the Basque samples while no transfer

from this language are observed in the Spanish samples. Spontaneous speech samples corresponding to T2 are currently under analysis.

Discussion

The results available so far suggest a positive impact of therapy and language use in T1, in line with previous findings (e.g. Goral et al., 2010). Five years post-stroke (T1), recovery was more significant in Spanish, both in free speech and in the structured tasks. This is observable in the higher speech rate and the finiteness and embedding ratios, among other factors. When retested after 3 years (T2), AF showed cross-language generalization for speech rate in the absence of formal therapy in Basque, although differences remain across languages. We expect that the analysis of spontaneous speech in T2 will provide a more fine-grained pattern to evaluate the longitudinal recovery and to compare the performance across languages.

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Modulating the left inferior frontal cortex in chronic aphasic stroke patients

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Introduction

Broca's area is considered a critical brain region for speech production. However, cognitive control and language networks overlap considerably in the frontal lobes [1]. Accordingly, recent works suggest that what has often been interpreted as language-specific activity in frontal cortices in aphasic patients may not reflect language recovery, but rather be due to task difficulty [2-3]. In fact, activity in the inferior frontal cortex (IFC) might be attributable to an involvement of intact components of the domain-general system. To test this, we investigated anomic patients' residual frontal brain function during low- and high-challenging versions of both language-specific and domain-general cognitive tasks with fMRI. By pairing fMRI with transcranial direct current stimulation (tDCS) targeting each patient's residual structurally intact LIFC, we were also able to test whether modulating activity in this region changed patients' behavioural performance, and whether this was localised within language-specific networks.

Methods

Here we present preliminary data from eight right-handed chronic aphasic patients with anomia (6M, 58±8 years old, 10±5 years post stroke, 30/48±10 naming score on CAT). All patients had spared (or partially spared) LIFC and underwent a concurrent fMRI-tDCS study in which we manipulated: Task, Cognitive Challenge, Sensory Modality, tDCS. Patients were asked to perform both a linguistic (picture Naming) and a non-linguistic (size Judgement) Task. Stimuli were 480 B/W pictures of monosyllabic objects accompanied by auditory cues. Cognitive challenge (Low, High) was manipulated in two Sensory Modalities by varying: Visually, the amount of noise overlapping the picture (5 vs. 15 squiggly lines); Aurally, the type of cue delivered concurrently with the picture (initial phoneme vs. noise-vocoded phoneme). Patients received both Anodal (2mA; 20 mins) and Sham tDCS stimulation targeting the LIFC in two separate fMRI sessions one week apart (counterbalancing across subjects). Overt spoken responses (object names, and "yes/no" replies for size judgement) were recorded online, and reaction times (RT) computed. Behaviourally, we analysed RT data by task with two 2x2x2 ANOVAs, and response patterns (correct, incorrect and missing responses) in the Naming task. Given the small sample size, we report whole-brain fMRI results with a statistical threshold of $p<.001$ uncorrected at voxel-level, $p<.05$ FWE-corrected at cluster-level. We also report results of a region-of-interest (ROI) analysis in a-priori defined areas within the IFC [4].

Results

Behavioural results

RT data (Figure 1A). The two tasks were behaviourally matched (p=.583) consistent with healthy controls [4]. There was a significant main effect of Visual Challenge in both the Naming (p=.044) and the Judgement (p=.010) tasks, with slower RT (150 msec) for High- vs. Low-challenge levels. A main effect of Auditory Challenge was found in the Naming (p<.001) but not in the Judgement (p=.290) task, with slower RT (230 msec) for High- vs. Low-challenge levels. Finally, a main effect of tDCS was found only in the Naming (p=.042) but not in the Judgement (p=.149) task, showing slower RT (80 msec) for Anodal vs. Sham tDCS, irrespective of challenge levels. The change in profile of naming response types across conditions is shown in Figure 1B.

Imaging results

Whole-brain data (Figure 1C). Both tasks recruited a common neural network including bilateral visual and premotor cortices, the left supplementary motor area, auditory and posterior parietal cortices, and the RIFC. The main effect of Task showed significantly more activation in the Naming than in the Judgement task bilaterally in the supplementary motor areas and anterior cingulate cortices, and in the right premotor and auditory cortices. We observed no significant activation in the LIFC for either task, despite it being structurally intact. There was no main effect for Challenge in either Modality, but a significant Task x Auditory Challenge interaction in bilateral supplementary motor areas and anterior cingulate cortices, showing greater activity in High- vs. Low-challenge levels in the Naming task, with the opposite pattern in the Judgement task. ROI analysis (Figure 1D). We found a significant Task x Auditory Challenge interaction showing that activity in the RIFC (p<.05) increased during High- vs. Low-challenge levels in the Naming task, but decreased in the Judgement task. There was no main effect of tDCS, but a significant tDCS x Task interaction. During Anodal tDCS there was increased BOLD response in the LIFC (p<.001), selectively during the Naming task. No interaction of tDCS with Sensory Modality and/or Cognitive Challenge was found.

Discussion

Here, we show in a group of chronic aphasic stroke patients – whose performance is matched on a language-specific and domain-general cognitive task – no recruitment of the LIFC, despite it being structurally intact. Both tasks activated the same bilateral neural network, including the RIFC, which was significantly modulated by phonemic cues selectively during the Naming task [6]. Anodal tDCS targeting the LIFC enhanced local regional activity (increased BOLD signal) selectively during the Naming task, and modulated patients' naming performance [5]. Anodal tDCS resulted in significantly slower naming RT overall, but increased the number of naming attempts (decreased number of missing responses) in High-challenge naming trials. Taken together, these preliminary data suggest that: 1) the LIFC may be structurally intact but functionally disconnected in chronic anomic patients; 2) both LIFC/RIFC may play a key language-specific role in the functional reorganisation of the damaged speech production network. Data collection in a larger group of patients is ongoing to test whether the LIFC might represent a candidate area for targeted intervention to enhance neural activity and aid speech recovery [4-6].

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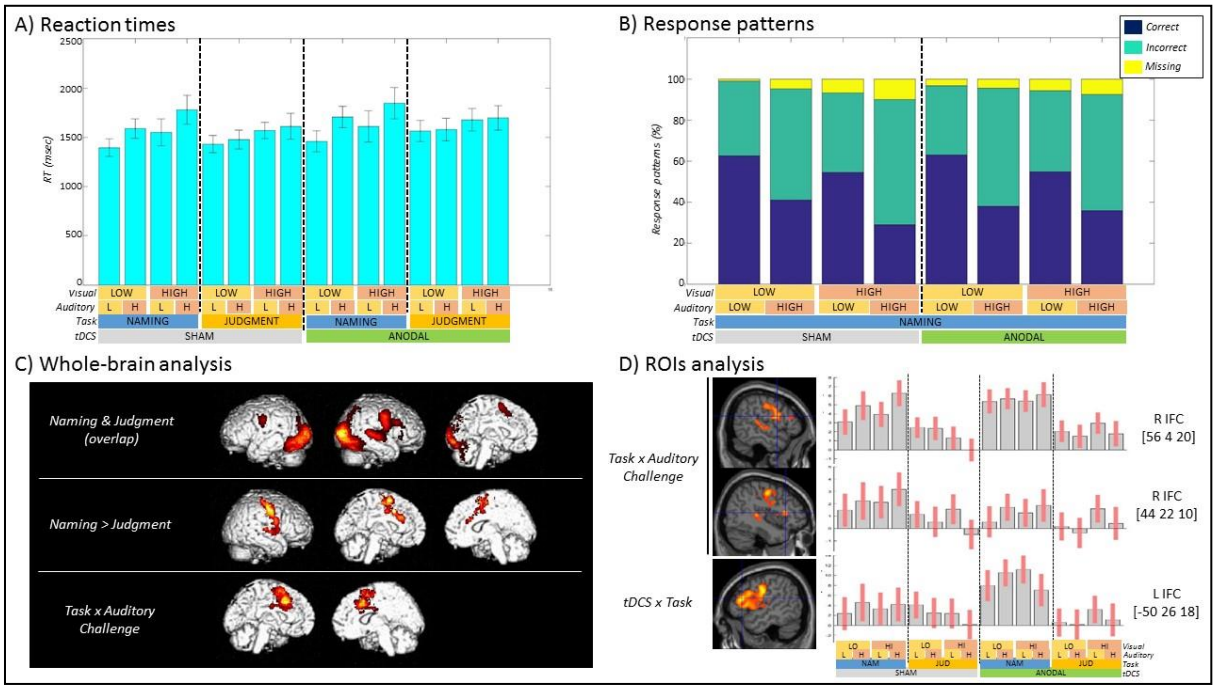
Figure 1 – Results. A) Reaction times (RT) data. B) Response patterns data. C) Whole-brain fMRI data. D) ROI-analysis fMRI data. Legend: L/LO/LOW = Low-challenge level; H/HI/HIGH = High-challenge level; LIFC/RIFC = left/right inferior frontal cortex; [x y z] = MNI coordinates.



Assessing spontaneous and automatic language production by sentence completion task in aphasia

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Introduction

In aphasiology, "grammar" means the sentence structure; consequently, agrammatism refers to the pattern of sentence production that reflects an absence of some grammatical structures (Mehri & Jalaie, 2014). The grammar assessment in aphasia has been done by standard tests though these tests cannot evaluate sentence production precisely (Wilshire et al., 2014). Therefore, researchers begin to make individual tasks to evaluate sentence production. Hence, in this study, the sentence production has been studied in a sentence completion task design. The hypothesis is in favor of the better production of the automatic sentence completions instead of novel sentence completions. This task can be a good way to show patients' word retrieval ability or inability on sentence production when tested with automatic and novel sentence completions.

Method

In the present study, the primary aim is to assess sentence production in nonfluent aphasias through the responses to incomplete sentences to be filled with content words or phrases in either automatic or novel sentence types. The automatic sentences include stereotypes, common sayings, nursery rhymes, song lyrics, lengthy chunks of memorized material like prayers, formulaic utterances (Sidtis et al, 2009) such as idioms, slang, sayings, expletives, clichés, maxims, slogans, and proverbs and the like. In the end, implications about production of content and function words are intended in patients of aphasia. In addition, what kind of grammatical elements has been removed is determined.

Material

A sentence completion task is presented orally to the aphasic and the control group and they are expected to produce the missing word. The task consists of 40 items, which are supposed to be completed orally with nouns, verbs, adjectives or adverbs either with words or phrases. If the patients use gestures, writing or any other communication style, it would be noted. Automatic sentence completion sentences are also included in the task.

Participants

Twenty non-fluent aphasic patients and twenty control subjects participated in this study. The control subjects were selected to match an average group of aphasic patients for age and sex. Their auditory comprehension is good enough to participate this study.

Results

Literature contrary findings were obtained; Turkish nonfluent aphasic patients had difficulties recalling the word, however when they did, they often produced words either with expected inflections or with the stem words. Error analysis was done for the paraphasic words or few inflection misuses. Yet again, in the existing study, contrary to literature findings, production of verbs is better preserved than nouns in Turkish nonfluent aphasic patients. Production of adverbs, nouns and adjectives follow verb category in production sequence. The findings have also led researchers think that grammatic errors related to inflection use has not been a functional problem for the nonfluent aphasic Turkish participants. At last, participants had the highest performance while conducting automatic sentence completion task. It is assumed that retrieving a memorized phrase or word showed activation in frontal locations.

Discussion

The tasks in testing sentence production are useful tools for aphasia patients. These tools can help clinicians in the early diagnosis of the problems so they will not lose golden time of treatment. The correct selection of tasks can be very important based on the content and its quality, testing time and the scoring methods. In this study, we, as SLPs, developed a brief and quick task to see the extension of grammatical word errors and naming retrieval in patients to be used in initial assessments.

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Verb and Sentence Impairment in Aphasia: Insights from Cluster Analysis

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Introduction

Verb and sentence processing is often impaired in aphasia, at the single word and sentence level in both comprehension and production. The impairments can be manifest in non-fluent as well as in fluent aphasia (Bastiaanse et al., 2003; Cho-Reyes & Thompson, 2012). In our study, we used the Verb and Sentence Test (Bastiaanse et al., 2000; 2003; 2015) adapted to Russian (VAST-ru) to investigate what the patterns of verb and sentence impairments in aphasia are and how these patterns correspond to aphasia classification.

To address these questions, we use cluster analysis - an exploratory statistical method that allows to discover groupings of observations by maximizing similarities between observations in the same group and minimizing similarities between observations in different groups (Jain, 2010). Cluster analysis techniques have been widely applied in studies of primary progressive aphasia (e.g., Hoffman et al., 2017), but are rare in the field of stoke aphasia. In this study, we present preliminary results of *k*-means cluster analysis in 32 individuals with post-stroke aphasia (IWA) who performed an auditory discrimination and three comprehension subtests of VAST-ru.

Methods

Participants

Thirty-two IWA (13 female) with various etiology participated in the study. Mean age was 56.47 yo (±11.66, range 26 – 73), mean time post onset was 31.44 m (± 35.18, range = 2.07 – 114.17; data missing for two participants), and education levels varied from secondary school to university degree. All participants were recruited at the Center for Speech Pathology and Neurorehabilitation, Moscow. Twelve were diagnosed with fluent, 17 with non-fluent aphasia, and three had mixed (fluent and non-fluent) aphasia.

Materials and Procedure

The experimental subtests of the VAST-ru were Minimal Pairs, Verb Comprehension, Sentence Comprehension and Plausibility Judgement.

The Minimal Pairs subtest assesses vowel discrimination at the end of the word which in Russian is crucial for case, and consequently for morpho-syntactic processing, using an oral same-different judgment task. The Verb Comprehension subtest assesses comprehension of single verbs in a word-to-picture matching task. The Sentence Comprehension subtest assesses comprehension of semantically reversible sentences in a sentence-to-picture matching task. The Plausibility Judgment subtest estimates the ability of morpho-syntactic parsing of semantically irreversible sentences in an oral plausible-implausible judgment task.

All the subtests were presented via a tablet application (Ivanova et al., 2016); the responses were registered automatically.

Severity of aphasia was evaluated with a standard clinical battery Quantitative Assessment of Speech in Aphasia (Tsvetkova, Akhutina, & Pylaeva, 1981). It consists of several subtests on production and comprehension modalities and results in an overall severity score ranging from 0 to 300.

Data analysis

To group the patients' results in the four experimental subtests, we used the *k*-means clustering method. This is an algorithm that minimizes the squared error between the empirical mean of a cluster and the points of a cluster in a multi-dimensional space. The number of clusters is user-specified (Jain, 2010). For this preliminary analysis, we chose three clusters in order to reflect three-fold partitioning of our patient sample into fluent, non-fluent and mixed group.

Four VAST-ru subtests were entered in the analysis; the severity score was not included in the cluster analysis but was used later to investigate the relationship between verb and sentence and overall language impairment.

Results

Three clusters of different sizes were identified. Cluster 1 consisted of three patients; two fluent and one non-fluent. Cluster 2 consisted of 22 patients; eight fluent, 12 non-fluent and two mixed. Cluster 3 consisted of seven patients, two fluent, four non-fluent and one mixed. The descriptive statistics of the subtests and severity score for each cluster are presented in Table 1.

Table 1. VAST-ru subtest scores (percent correct) and raw severity scores for each cluster

Cluster	*N* patients	Minimal Pairs, *Mean* (*SD*)	Verb Comprehension, *Mean* (*SD*)	Sentence Comprehension, *Mean* (*SD*)	Plausibility Judgment, *Mean* (*SD*)	Severity, *Mean* (*SD*)
1	3	0.92 (0.02)	0.72 (0.27)	0.46 (0.08)	0.68 (0.14)	185.75 (1.77)
2	22	0.96 (0.08)	0.97 (0.04)	0.94 (0.06)	0.91 (0.07)	234.44 (35.65)
3	7	0.97 (0.05)	0.9 (0.09)	0.68 (0.13)	0.73 (0.16)	220.5 (33.88)

Discussion

The three identified clusters show different patterns regarding verb and sentence comprehension scores. In cluster 1, the scores of all the subtests are lower, and comprehension is impaired at both single word and sentence levels. In cluster 2, the scores of all subtests are relatively high. In cluster 3, the scores of subtests are relatively high except for the two sentence comprehension subtests. This ranking of impairment is also reflected in the mean severity scores for each cluster: the score in cluster 1 is the lowest and the score in cluster 2 is the highest. All three clusters include both fluent and non-fluent patients.

We can draw several conclusions based on this preliminary analysis. First, our results confirm that verb and sentence impairments are not restricted to a specific aphasia type and are manifest in both fluent and non-fluent aphasia. Second, the degree of impairment seems to be related to the overall

severity of aphasia. Finally, we can interpret our results as evidence of a hierarchy of verb and sentence impairment in comprehension. That is, verb impairment at the comprehension level is unlikely without sentence impairment, and sentence impairment can occur without verb impairment (see clusters 1 and 3). This result can be explained by overall complexity of sentence processing compared to the single word processing or by impaired morpho-syntactic analysis involved at the sentence level. These conclusions, however, must be treated with caution at this stage, since the sample sizes in the clusters are too small for definitive conclusions.

The analysis will be further extended by adding VAST-ru results of more IWA, refining the cluster analysis technique (e.g. by using data-driven specification of the number of clusters) and by analyzing data from production subtests of VAST-ru.

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The influence of sensorimotor stereotypes on the comprehension of spatial constructions in Dutch and Russian

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Introduction

In psychology, one of the central concepts is embodied cognition, which explores the interaction of different cognitive modalities, such as the interaction between visual and motor modalities (Tucker & Ellis, 1998). Similar ideas underlie a functional approach in which language is considered as a part of general processes of communication, including a wide external and inner context. Evidence of the connection between language and physiological functioning of humans was obtained from some neurovisualization studies. For example, Pulvermüller (2005) showed that reading certain verbs (lick, pick, kick) activates the primary motor cortex. In another study, Richardson and colleagues (2003) suggest that spatial representations support language comprehension through visuospatial imagery. In line with these studies, we might wonder whether sensorimotor stereotypes (the most natural and frequent sequence of actions with objects in the surrounding world) also have an influence on language comprehension. It is possible that the match between the sequence of objects in a sentence (which is reflected in the word order) and the order of actions in the physical the world (sequence of actions) may help to understand spatial constructions. The aim of this work was to investigate the role of sensorimotor stereotype in language comprehension. In this study, we test a control group of speakers of Dutch and Russian without any language disorders. We used two types of spatial constructions: i) prepositional (sensorimotor stereotype matches with the canonical word order) and ii) instrumental (sensorimotor stereotype does not match with the canonical word order). In this project, we aim to collect data from control speakers and speakers with aphasia, For the current study, we will provide the data of a control group of speakers of Dutch and Russian languages.

Method

Participants

Data collection is in progress. Our aim is to test 30 healthy speakers of both Russian and Dutch. The speakers should not have any neurological or psychiatric conditions, or speech and language production.

Stimuli

A sentence comprehension task with Dutch (for Dutch speakers) and Russian sentences (for Russian speakers) will be administered. Two different types of spatial constructions were included:

1. Prepositional constructions (e.g. *The boy is putting the book on the newspaper*).

2. Instrumental constructions (e.g. *The boy is covering the hat with the scarf*).

Four conditions were included in the study to test the hypothesis whether sentence comprehension would be facilitated by a match between the order of the verb and its arguments in a sentence and

the order of the actual sensorimotor interaction. The conditions were based on whether there was a match between constituent order and order of the action or not (MS+/-), whether the word order was canonical or not (WO +/-), and whether a constituent was topicalized or not (SC +/-). The outcome were the following conditions (Literal translations from Dutch or Russian into English):

- Prepositionals:

1. MS +, WO +, SC - *'The woman is putting the cup on the saucer.'*
2. MS -, WO -, SC - *'The woman is putting on the saucer the cup.'*
3. MS +, WO -, SC + *'The cup the woman is putting on the saucer.'*
4. MS -, WO -, SC + *'On the saucer the woman is putting the cup.'*

- Instrumentals:

1. MS -, WO +, SC - *'The man is touching the knife with the fork.'*
2. MS +, WO -, SC - *'The man is touching with the fork the knife.'*
3. MS +, WO -, SC + *'With the fork the man is touching the knife.'*
4. MS -, WO -, SC + *'The knife the man is touching with the fork.'*

The conditions differ across the two sentence types, because in prepositional sentences, the word order matches the order of the action in real life in the canonical sentences, whereas this is not the case for the instrumental sentences. For each of the items, four sentences with different constituent orders according to the four conditions were constructed. The items were randomly assigned to four different lists and 24 filler items were randomly interspersed between the items. Each list contained a total of 70 sentences per list (plus two practice items). Participants are randomly assigned to one of the four lists.

Study Design

In the sentence comprehension task, participants hear a sentence and subsequently see two videos of 4 seconds each. They got the task to choose the video belonging to the heard sentence by pressing a button on the keyboard.

Data Analysis

Both accuracy and reaction times are included in the analysis. A linear mixed effects model will be used to compare the four conditions within each of the sentence types (prepositional and instrumental). Fillers will be excluded.

Discussion

Data collection is still in progress. We hypothesize that comprehension of the spatial construction in the sentence may be facilitated by a match between the order of the verb and its arguments (word

order) and the order of the actual sensorimotor interaction. We investigate an independent impact of the canonical and non-canonical word order and the match or mismatch of the word order with the motor stereotype. We expect that comprehension will be facilitated by a match between the word order and the order of the sensorimotor interaction, and more difficult when this is not the case. At the same time, the responses to the constructions where the conditions of word order and motor stereotype do not directly match (for example, constructions with a canonical word order which do not match with the sensorimotor stereotype and vice versa) should demonstrate which of these two factors play a main role in the understanding of spatial relationships.

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C

omprehension of control structures in German individuals with aphasia

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Introduction

Which factors influence sentence processing in individuals with aphasia (IWA)? One well studied factor is *canonicity*, inducing processing advantages for, e.g., subject compared to object relative clauses. We investigate the processing of control structures, i.e., sentences in which the argument of a matrix clause has to be identified with the subject of an embedded clause (Stiebels, 2007) as indicated in (1) by the indices. Two factors are the focus of the present study: *control type* comparing subject (1a) and object control structures (1b), and *argument similarity* comparing pronoun resolution when two matrix arguments have the same (1c) or a different (1d) gender.

(1) a. Peter$_i$ promises Thomas$_j$ PRO$_i$ to read the abstract.
b. Peter$_i$ allows Thomas$_j$ PRO$_j$ to read the abstract.
c. Peter$_i$ promises Thomas$_j$ that he$_i$ will read the abstract.
d. Peter$_i$ promises Mary$_j$ that he$_i$ will read the abstract.

So far, the influence of the *control type* on the online sentence processing in healthy adults has only been investigated in a few studies (Kwon & Sturt, 2016). With respect to IWA, the evidence is limited to nine single cases that were reported by Caplan & Hildebrandt (1988, chap. 5). For healthy adults and IWA, a processing advantage was found for object control structures compared to subject control structures (Betancort, Carreiras & Acuña-Fariña, 2005; Caplan & Hildebrandt, 1988; Kwon & Sturt, 2016). The authors ascribe this result to a recency effect: At the subject position of the embedded clause, the recently encountered object of the matrix clause is easier to retrieve than the more distant subject (Kwon & Sturt, 2016). We aim to replicate and extend the findings of Caplan & Hildebrandt (1988) for English IWA by testing German IWA and a group of control participants with the offline and online tasks described below. With respect to the online data, we hypothesize that the recency effect occurs in the region immediately following the embedded subject and is reflected in shorter processing times for object control structures (cf. Betancort et al., 2005).

To investigate the factor *argument similarity*, we will use sentences with pronouns as overt embedded subjects. In healthy adults, pronoun resolution in sentences with two accessible arguments was found to be faster when the target argument and the intervening argument had a different grammatical gender than when they had the same gender (e.g. Stewart, Pickering & Sanford, 2000; Schroeder, 2007). IWA also produced fewer errors in pronoun resolution when the two arguments of a matrix clause differed in gender (Grober & Kellar, 1981). The results can be explained by interference effects during retrieval of the target that are higher if both arguments match with the gender cue of the pronoun (Schroeder, 2007). We aim to replicate the results of Grober & Kellar (1981) for IWA and extend the findings with online processing data using the methods described below. Based on the findings of Schroeder (2007), we expect to find a processing advantage for the different gender condition emerging at the region following the pronoun and continuing throughout the embedded

clause.

Methods

Participants

Five German IWA and a group of control participants without a history of neurological or language impairment are participating in the study. IWA are in their chronic phase and suffered from a single unilateral lesion in the dominant hemisphere. None of the IWA exhibit severe auditory comprehension deficits at the single word level.

Material

The stimuli consist of 20 sentences with a covert embedded subject (as in (1a/b)), 20 sentences with an overt embedded subject (as in (1c/d), and 40 filler sentences resulting in a total of 80 sentences. All sentences consist of a matrix clause introducing two people and an embedded clause with an animal and an action that is carried out by one of the people. As illustrated in (1a) and (1b), the factor *control type* is varied by exchanging the verb of the matrix clause. Pairs of verbs are matched for written word frequency (dlexDB, Heister et al., 2011). As illustrated in (1c) and (1d), the *argument similarity* is varied by exchanging one of the proper names in the matrix clause.

Procedure

The sentences are presented auditorily. In total two different task are administered: (1) Object manipulation in which participants are displayed with toy figures (two persons and an animal) and asked to act out the action of the second part of the sentence (i.e. by moving the actor); (2) Sentence-picture matching, in which participants have to select from two pictures the one picture that matches with the meaning of the second part of the sentence. The target pictures show the correct person of the matrix clause interacting with the animal while the distractor picture shows the incorrect person in the interaction. This task is administered in two different manners, either as an eye tracking or a self-paced listening experiment. Eye-tracking data are collected with a SMI REDm eye tracker. The participants are instructed to listen to the sentence while looking at the pictures and select one picture by pressing one of two buttons. In the self-paced listening experiment, matrix clauses are presented word by word while the noun phrase and the infinitive of the embedded clause are presented as two units. The participants pace themselves through the sentence by pressing the space bar. Outcome measures are listening times and proportions of looks to the target.

Data collection is currently going on. Results will be available by September and discussed on the poster.

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