Jaargang 20, Supplement, September 2015

Stem-, Spraak- en Taalpathologie

16th International Science of Aphasia Conference

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Stem- Spraak- en Taalpathologie

Supplement, 17-22 September 2015

16th International Science of Aphasia Conference

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PREFACE

Dear participants,

We are very pleased to welcome you to the 16th Science of Aphasia conference, being held from September 17 till September 22, 2015 at the University of Aveiro in Portugal.

The 2015 program theme is: **Neuroplasticity and Language**

Invited speakers are: Argye Hillis (Johns Hopkins University, USA), Hugues Duffau (CHU Montpellier, France), Cathy Price (UCL, UK), Alexandre Castro Caldas (UCP, Portugal) Alexandra Reis (UAlg, Portugal), Uri Hasson (Università Degli Studi di Trento, Italy) Jenny Crinion (UCL, UK), Brenda Rapp (Johns Hopkins University, USA) David Poeppel (Max Planck Institute, Germany), Dan Bub (University of Victoria, Canada), and David Caplan (Harvard Medical School, USA

The SoA conferences are intended to bring together senior and junior scientists working in the multidisciplinary field *Neurocognition of language* and to deal with normal function as well as disorders. The size of the conference has a maximum of about 150 participants to ensure direct interaction between the participants. The focus of this year's conference is on Neuroplasticity and Language
The University of Aveiro is a public institution with a mission to provide and develop graduate and postgraduate education, research and cooperation with society. Founded in 1973, it is now an exponent of quality and progress, occupying an outstanding place in the field of higher education.
Part of the University's success lies in the fact that it offers innovative courses that are closely allied with regional and national productivity, and as yet unexplored by the traditional Portuguese institutions of higher education.
National and international exchange has also been one of the University's main goals. The University sustains the idea that all its students shall have extramural training or some kind of Erasmus-like experience in a national or foreign university. For this reason, the University strongly supports student mobility and training courses, participating in many European Union, Education, Science and Technology Programmes.

Aveiro is located on the shore of the Atlantic Ocean. It is an industrial city with an important seaport. The city of Aveiro is also the capital of the District of Aveiro, and the largest city in the Baixo Vouga intermunicipal community subregion. Aveiro is also known as "The Portuguese Venice", due to its system of canals and boats similar to the Italian city of Venice. The city dates back at least to the 10th century when it was known by its first Latin name of *Alavarium et Salinas*, literally, "a gathering place or preserve of birds and of great salt."

We wish you a pleasant conference!
The organizing committee of SoA.

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Organization

The 16th International Science of Aphasia Conference is held in Aveiro, Portugal, September 17-22, 2015.

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Local Chair: Luís M. T. Jesus, University of Aveiro, Portugal

The 2015 scientific committee is composed of:

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Conference Program

16th Science of Aphasia Conference University of Aveiro, Portugal 17-22 September 2015

Friday, September 17, 2015

Reception and registration

Saturday, September 18, 2015

8.30 – 9.15 Registration

9.15 – 9.30 Opening ceremony

9.30 – 10.15 Keynote 1

Argye Hillis, Johns Hopkins University, USA – Modulations of the language network in the first year after stroke

10.15 – 11.00 Keynote 2

Hugues Duffau, CHU Montpellier, France – The brain functional connectivity revisited by stimulation mapping: a new window to the potentials and limitations of neuroplasticity

11.00 - 11.30 Coffee break

11.30 –13.10 Contributed papers oral session 1

Seçkin Arslan, Elif Bamyacı, Roelien Bastiaanse - Verbs in Turkish agrammatic narrative speech

Vânia de Aguiar, Roelien Bastiaanse, Rita Capasso, Marialuisa Gandolfi, Eloisa Iellici, Nicola Smania and Gabriele Miceli - Effects of tDCS and morpho-syntactic therapy in lexical retrieval of treated and untreated verbs

Elke De Witte, Djaina Satoer, Evy Visch-Brink, Peter Mariën - Cognitive outcome after awake surgery for left and right hemisphere tumours

Frank Domahs, Grit Mallien, Astrid Richter, Ulrike Domahs & Veronika Motzko - Representational Dysprosody: Evidence from word stress processing in Parkinson's Disease

Adrià Rofes, Andrea Talacchi, Barbara Santini, Giovanna Cappelletti, and Gabriele Miceli - Intraoperative language mapping: a two-task approach

13.10 – 14.30 Lunch

14.30 – 15.15 Keynote 3

Cathy Price, UCL, UK – Predicting Language Outcome and Recovery After Stroke (PLORAS)

15.15h–16.00h Keynote 4

David Caplan, Harvard Medical School, USA

16.00 - 16.30 Coffee break

16.30 – 17.00 Short presentations poster session 1

17.00 – 18.00 Contributed papers poster session 1

Oscar Aguilar, Martina Callaghan, Rachel Holland, Zoe Woodhead, Alex Leff, & Jenny Crinion: Anatomical changes in the brain macrostructure and microstructure of the right hemisphere in chronic aphasic stroke patients

Yulia S. Akinina, Mira B. Bergelson, Mariya V. Khudyakova, Ekaterina V. Iskra, Olga V. Dragoy: Verbs in aphasic discourse: data from the Russian Clinical Pear Stories Corpus

Polly Barr, Britta Biedermann, Saskia Kohnen, Marie-Josèphe Tainturier, Lyndsey Nickels: An investigation of generalisation following treatment of written homophones in aphasia

Ana Cristina Ferreira, Ana Rita Bastos, Ângela Marina Jesus, Carla Pereira, Joana Gaspar: Development of a supportive programme for informal carers of stroke survivors with aphasia

Ingrid Behrns: Book Talk and Aphasia

L. Chatziantoniou, D. Kasselimis, A. Kyrozis, A. Ghika, P. Kourtidou, Ch. Peppas, I. Evdokimidis, C. Potagas: Lesion size and initial severity as predictors of aphasia outcome

Denise Ren da Fontoura, Ana Monção, Jerusa Salles: The Adapted Melodic Intonation Therapy in Expressive Aphasia Patients

Ana Cristina Ferreira, Ana Rita Bastos, Ângela Marina de Jesus, Joana Gaspar: Communication group for people with stroke sequels

Nora Fieder, Lyndsey Nickels, Britta Biedermann & Wendy Best: Effects of semantic number information on grammatical processing of mass nouns

Fleming, V., Brownsett, S.L.E, Crinion, J., Howard, D,. Leech, R., Ong, Y., Robson, H., Leff, A.P.: Listen-In: The development and testing of a tablet-based therapy application for patients with impaired speech comprehension caused by stroke. Phase 1: Development and consultation.

Kopke, B.: Establishing criterion validity of the French version of the Screening BAT: a comparison of 30 aphasic patient's performance on the Screening BAT and the MT86-alpha and beta

Cheng-Hung Hsin, Laurie Stowe - Priming of Word Level Tone in Native Mandarin Chinese Speakers by Musical Pitch: An ERP Study

Marlene Cristina Neves Rosa, Alda Marques, Sara Demain, Cheryl D. Metcalf: Mobility and communication impairments and reintegration in the community in early walkers post-stroke

Jossie Nóbrega, Marisa Lousada, Daniela Figueiredo: The clinical practice of speech language therapists on neurocognitive disorders: a cross-sectional survey v

Sunday, September 19, 2015

9.30 – 10.15 Keynote 5
Alexandre Castro Caldas, UCP, Portugal

10.15 – 11.00 Keynote 6
Alexandra Reis, UAlg, Portugal – Reading skills or reading strategies: What matters for the brain?

11.00 - 11.30 Coffee break

11.30 – 12.00 Short presentations poster session 2

12.00 – 13.00 Contributed papers poster session 2:
Polly Barr, Britta Biedermann, Lyndsey Nickels, Marie-Josèphe Tainturier : An investigation of cognate generalisation across language in written aphasia treatment
Byurakn Ishkhanya, Eva Theilgaard Brink, Halima Sahraoui, Kasper Boye - Dissociating the grammatical versus lexical status of pronouns in agrammatic connected discourse: A study of French and Danish corpora
Johansson, Hartelius, Wengelin & Behrns - Writing personal narratives with aphasia
Kendrick, Luke, Sandars, Margaret, Volke, Elisabeth, Woolams, Anna, and Robson, Holly - Patterns of auditory comprehension impairments in aphasia
Stefanie Keulen, Jo Verhoeven, Roelien Bastiaanse, Peter Mariën, Roel Jonkers, Nicolas Mavroudakis, Philippe Paquier - A new case of psychogenic Foreign Accent Syndrome
Vasiliki Koukoulioti & Stavroula Stavrakaki - Light verbs revisited: A comparative perspective from impaired language development and dementia
Kuptsova S.V., Soloukhina O.A., Dragoy O.V., Akinina Y.S., Akhutina T.V., Ivanova M.V A new Russian Aphasia Test: development and standardization of single-word comprehension subtests
Evelina Leivada - Aphasic grammar: Why are some parts (un)impaired?
Maria Cecilia Devers, David Howard, Janet Webster - Analysis of Pronominal Word Comprehension
Amaia Munarriz - The organisation of languages in the bilingual brain: evidence from Spanish-Basque bilingual aphasia
Michaela Nerantzini, Valantis Fyndanis, Arhonto Terzi and Spyridoula Varlokosta: Case and agreement in Greek aphasia: Evidence from comprehension
Karel Neubauer – The signification of comparison tests BNVR and TT for appreciation of associated cognitive deficits of Chech aphasic persons
Beatriz Ornelas Martins - The Influence of Motivation on the Recovery of the People with Aphasia: a case study
P. Pellet Cheneval, G. Python, L. Blosch, M. Laganaro - Impact of the modality of the phonological cue in healthy and aphasic speakers

13.00 – 14.30 Lunch

14.30 – 16.00 Contributed papers oral session 2

M. Laganaro: How many origins of omission errors in aphasia?

Anastasia Linnik, Manfred Stede, Roelien Bastiaanse, Mariya Khudyakova - What contributes to discourse coherence? Evidence from Russian speakers with and without aphasia

Martínez-Ferreiro, Silvia, and Bastiaanse, Roelien - Verbs in aphasia: 10 years of Spanish studies

Lyndsey Nickels, Shiree Heath & Nora Fieder - Word Learning in aphasia and the influence of cognition

Karin van Nispen, Miranda Rose - The added value of gesture for communication of people with aphasia.

16.00 – 16.30 Coffee break

16.30 – 18.30 Contributed papers oral session 3

Vânia de Aguiar and Gabriele Miceli - Can pre-treatment scores predict treatment success and failure? The case of verb therapies

Cristina Romani, Dinesh Ramoo and Andrew Olson - Buffer/resource limitation in phonological encoding: Consequences for word production

Valantis Fyndanis, Carlo Semenza, Rita Capasso, Marialuisa Gandolfi, Nicola Smania, Francesca Burgio, Giorgio Arcara, Serena de Pellegrin, Gabriele Miceli - Morphosyntactic and syntactic production in Italian-speaking agrammatic aphasia

SJ. Kerry, Y. Ong, O. Aguilar, J. Crinion, V. Fleming, W. Penny, J. Hogan, AP. Leff & Z. Woodhead - iReadMore: Computer-based rehabilitation for reading impairments in aphasia

Judith Kistner, Jane Marshall, Lucy Dipper - The role of semantically rich gestures in aphasic conversation

Hazel-Zeynep Kurada, Özgür Aydın, M. Didem Türkyılmaz, Tuba Yarbay Duman - Reference to the Past in Broca's Aphasia: Inflectional and Semantic Complexity

Monday, September 20,2015

9.30 – 10.15 Keynote 7:

Jenny Crinion, UCL, UK

10.15 – 11.00 Keynote 8:

Brenda Rapp, Johns Hopkins University, USA

11.00 - 11.30 Coffee break

11.30 – 12.15 Keynote 9:

Uri Hasson, Università Degli Studi di Trento, Italy

12.30 – 14.00 Lunch

14.00 – 23.00 social event and social dinner

Tuesday, September 21, 2015

9.30 – 10.15 Short presentations poster session 3

10.15 – 11.00 Contributed papers poster session 3:

Claudia Peñaloza, Matti Laine, Pedro Cardona, Monserrat Juncadella, Nadine Martin, Antoni-Rodríguez Fornells - Speech segmentation in chronic left hemisphere stroke

Srđan Popov, Roelien Bastiaanse, Gabriele Miceli - Electrophysiological correlates of grammatical and semantic gender processing

Marie Pourquié - Testing the lexical/functional divide in aphasia

Python, G., Pellet Cheneval, P., Fargier, R., Laganaro, M. - How do categorical & associative primes affect picture naming in aphasia?

Djaina Satoer, Elke De Witte, Roelien Bastiaanse, Peter Mariën, Evy Visch-Brink - The shortened DuLIP protocol: pre- and postoperative language assessment in brain tumor patients

Edward R. Shi, Elizabeth Q. Zhang, Silvia Martínez-Ferreiro, & Cedric Boeckx - Help Mr. X along, so say it with a beautiful song

Joanna Sierpowska, Andreu Gabarrós, Alejandro Fernandez-Coello, Ángels Camins, Sara Castañer, Montserrat Juncadella, Antoni Rodríguez-Fornells - The involvement of prefrontal cortex in language switching: intraoperative electrical stimulation evidence

K. Spielmann, W.M.E van de Sandt-Koenderman & G.M. Ribbers - The Additional Effect of Transcranial Direct Current Stimulation (tDCS) in Post-stroke Sub-acute Aphasia: A Pilot Study

Constantina Theofanopoulou, Elizabeth Q. Zhang, Saleh Alamri, Gonzalo Castillo, Edward R. Shi, Pedro Tiago Martins, Silvia Martinez Ferreiro, and Cedric Boeckx - Subcortical structures and language disruption

Frank Tsiwah, Silvia Martínez Ferreiro, Roelien Bastiaanse - Production and comprehension of time reference in Akan speakers with aphasia.

Clémence Verhaegen, Véronique Delvaux, Kathy Huet, Myriam Piccaluga, Bernard Harmegnies - Phonetic and/or phonological errors and phonetic flexibility abilities: A case study of two non-fluent aphasic patients

Roza M. Vlasova - The role of paradigmatic and syntagmatic relations in noun-verb dissociation

Tae Woong Choi, Sung-Bom Pyun, Sun Young Choi, Yoon Kyoo Kang, Hee Kyu Kwon - Neural substrate of apraxia in stroke patients: Voxel-based lesion symptom mapping (VLSM)

11.00 - 11.30 Coffee break

11.30 - 13.10 Contributed papers oral session 4:

Robson, Holly, Specht, Karsten, Beaumont, Helen, Parkes, Laura M., Sage, Karen, Lambon Ralph, Matthew A., Zahn, Roland - Cortico-cortico diaschisis in chronic Wernicke's aphasia

Adrià Rofes, Barbara Santini, Giuseppe Ricciardi, Andrea Talacchi, Giannantonio Pinna, Lyndsey Nickels, and Gabriele Miceli- Nouns and verbs: perioperative comparisons in brain tumors

Djaina Satoer, Elke De Witte, Roelien Bastiaanse, Arnaud Vincent, Peter Mariën, Evy Visch-Brink - Plasticity of cognitive functions before and after awake brain tumor surgery

Anna Stielow & Eva Belke - Interaction of Executive Functions and Word Retrieval in aphasic patients and healthy controls - a Psycholinguistic Investigation

Inês Tello Rodrigues, Miguel Castelo-Branco & Alexandre Castro-Caldas - "To talk or not to talk"- an rTMS study about naming during stimulation

13.10 – 14.30 Lunch

14.30 – 15.15 Keynote 10

David Poeppel, Max Planck Institute, Germany

15.15 – 16.00 Keynote 11 –

Dan Bub, University of Victoria, Canada

16.00 – 17.00 Contributed papers oral session 5:

Kim van Dun, Elke De Witte, Wendy Van Daele, Wim Van Hecke, Mario Manto, Peter Mariën - Atypical cerebral and cerebellar language organisation: A case study

Woodhead, Z.V.J., Teki, S., Penny, W., Fleming, V., Iverson, P., Crinion, J., Leff, A.P. - Investigating phonological and cholinergic therapies for speech comprehension deficits in chronic aphasia: What works and why?

Chiara Zanini, Giorgio Arcara, Francesca Peressotti, Carlo Semenza & Francesca Franzon - Don't count on this Number. Exploring mismatches between referential numerosity and morphological encoding.

17.00 – 17.30 Closing ceremony

Wednesday, September 22, 2015

Breakfast and departure

Verbs in Turkish agrammatic narrative speech

Seçkin Arslan[1, 2], Elif Bamyacı[3], Roelien Bastiaanse[2]

[1]International Doctorate for Experimental Approaches to Language and Brain (IDEALAB), Universities of Groningen (NL), Newcastle (UK), Potsdam (DE), Trento (IT) and Macquarie University Sydney (Australia)· [2]Center for Language and Cognition Groningen (CLCG), University of Groningen (NL), [3]Institute of German Language and Literature I, University of Cologne (DE)

Introduction

Narrative speech production in agrammatic speakers has often been characterized by simple sentences with affected verb morphology (e.g. Abuom & Bastiaanse, 2012; Bastiaanse & Jonkers, 1998; Menn & Obler, 1990; Saffran, Berndt, & Schwartz, 1989). However, the proportion of finite verbs and the diversity of lexical verbs have been shown to be related: Dutch agrammatic speakers who use a normal diversity of lexical verbs are poor in verb inflection and the other way around (Bastiaanse & Jonkers 1998). It was suggested that there is a trade-off here: agrammatic speakers who focus on the content of their message (and use a normal variety of lexical verbs) use relatively many non-finite verb forms, whereas agrammatic speakers who focus on grammaticality have little variation in the verbs that they produce. Bastiaanse (2013) formulated it more precisely: to retrieve the name of an event and to express the time frame in which the event took place are hard for agrammatic speakers.

Turkish is a language that has an extensive verb inflection paradigm. Turkish finite verbs require inflections for tense and evidentiality. Evidentiality expresses the information source of how the event is known to the speaker. A direct evidential conveys that the speaker has witnessed the event, while an indirect evidential expresses that the speaker knows about the event by either hearsay or inference. Experimental studies have showed that Turkish agrammatic speakers are poor in producing and comprehending direct evidential verb forms compared to present and future tense (Bastiaanse, Bamyaci, Hsu, Lee, Yarbay-Duman, & Thompson, 2011; Yarbay-Duman and Bastiaanse, 2009) and to indirect evidential verb forms (Arslan, Aksu-Koç, Maviş, & Bastiaanse, 2014). Narrative speech in Turkish agrammatic aphasia has not been studied before.

The research questions were whether (1) Turkish agrammatic speech can be characterized morphosyntactically in the same way as in languages with a simpler (verb) inflection paradigm; (2) the trade-off pattern that was found for Dutch is also present in Turkish agrammatic speech.

Methods

Participants

A group of 10 agrammatic speakers (6 males, age = 58.6, mean-post-onset = 7.9 months) and a control group of 10 non-brain-damaged speakers (age = 51.7) were recruited.

Materials & Analysis

Participants were interviewed with open-end questions, and were asked to tell a story on the basis of two pictures, similar to the methods of Abuom and Bastiaanse (2012); Olness (2006). Each narrative was recorded, orthographically transcribed, and a 200-word sample from each participant was used for the analysis of the following variables:

- Speech rate (words per minute)
- Mean length of utterances (MLU)
- Percentage of correct sentences
- Percentage of embedded clauses
- Number and diversity of lexical verbs
- Number and percentage of finite lexical verbs and nominal predicates
- Tense inflection for past tense/direct evidential, past tense/indirect evidential, present progressive, and future

Results

Table 1 shows an overview of variables in Turkish agrammatic and NBD speakers' narratives. Turkish agrammatic speakers have slower speech rate ($t(18)=8.539$; $p<.001$), shorter MLU ($t(18)=7.166$; $p<.001$), a lower percentage of correct sentences ($t(18)=6.007$; $p<.001$), and fewer embeddings with non-finite verbs ($t(18)=-2.330$; $p=0.032$), but not with finite verbs ($t(18)=-1.019$; $p=.322$) as compared to the NBDs. The diversity of lexical verbs (TTR; $t(18)=2.604$; $p<.05$) and the number of verbs per utterance ($t(18)=5.02$; $p<.001$) were lower for agrammatic speakers than for NBDs.

The number of finite verbs ($t(18)=-0.47$; $p=.64$) and the proportion of finite verbs (on all verbs, including non-finite verbs) ($t(18)=1.42$; $p=.17$) are similar in agrammatic and NBD speakers. The agrammatic speakers produced fewer participles than NBDs ($t(18)=-2.717$; $p<.05$), however.

In terms of verb inflection for tense and evidentiality, there is no group-difference for direct and indirect evidentials, present progressive and future tense (all $p>.09$). Within the produced direct evidentials, however, a trade-off pattern is found. Agrammatic speakers who produce a high number of direct evidentials show little diversity of the lexical verbs inflected for direct evidential, or those who produce larger diversity of lexical verbs produce fewer direct evidentials.

Discussion

Turkish agrammatic speech is impaired along similar lines as in other languages: it is slow, and grammatically simple. Like in other languages, the diversity of the produced verbs is lower than normal. The proportion of finite verbs is not reduced, implying that the trade-off pattern that was found in Dutch is not perceived in Turkish. However, a trade-off pattern is observed when direct evidentials are considered – a verb form that is known to be impaired in Turkish agrammatic production. The agrammatic speakers who produce relatively many direct evidentials show relatively low diversity of direct evidential verb forms whereas the agrammatic speakers who produce many different verbs (high diversity) use direct evidential less frequently. This is in line with Bastiaanse (2013) who suggests that the processes that are relevant to retrieving the name of an event and inflecting it for the time frame in which the event took place require a high processing load. This makes finite verbs effortful for agrammatic speakers in narrative speech. The current study suggests that for agrammatic speakers of Turkish this is only true for verb forms that need to be linked to 'witnessed' events.

References

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Table 1. General and verb-specific variables in narrative speech of Turkish agrammatic and NBD speakers

	Speech rate	MLU	Correct sentences (%)	# embeddings		Verbs per utterance	finite verbs (#)	Partici-ples (#)	direct evidential		indirect evidential		present prog.	
				with finite verbs	with non-finite verbs				#	TTR	#	TTR	#	TTR
Agrammatic s.														
mean	33.70	2.52	48.40	1.10	5.60	0.61	42.8	1.10	20.5	0.72	4.0	0.68	11.6	0.71
sd	11.63	0.50	20.37	1.44	4.00	0.23	9.78	1.44	11.3	0.14	3.06	0.32	5.82	0.19
NBDs														
mean	82.80	5.06	92.60	1.80	11.10	1.16	41.2	4.60	12.8	0.86	3.4	0.86	15.0	0.83
sd	13.98	1.00	10.23	1.61	6.29	0.27	9.53	3.80	8.0	0.13	2.59	0.31	7.51	0.16

Effects of tDCS and morpho-syntactic therapy in lexical retrieval of treated and untreated verbs

Vânia de Aguiar[1,2,3], Roelien Bastiaanse[3], Rita Capasso[4], Marialuisa Gandolfi[5,6], Eloisa Iellici[2], Nicola Smania[5,6] and Gabriele Miceli[2]

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Introduction

There is an increasing interest in the rehabilitation of verb production. One reason is that, while verbs can be treated with similar techniques as nouns (Webster & Withworth, 2012), some aspects of therapy outcome differ. For example, generalization has been reported for noun treatment that targets semantic processing by analysis of semantic features (e.g., Boyle & Coelho, 1995), but not following Semantic Feature Analysis for the treatment for verbs (Wambaugh & Ferguson, 2007; Wambaugh, Mauszycki, & Wright, 2014). By contrast, improvement of lexical retrieval was restricted to treated items in noun training (Miceli et al., 1996), whereas in verb training it extended to untreated items when therapy was provided at the sentence level and patients were explicitly made aware of the grammatical properties of verbs and sentences (Bastiaanse et al., 2006; Links, Hurkmans, & Bastiaanse, 2010; Thompson et al., 2013).

Recently, aphasia treatment studies investigated the effect of transcranial direct current stimulation (tDCS) when administered simultaneously to treatments for action naming (Marangolo et al., 2013a) and conversational therapy (Marangolo et al. 2013b, 2014). Anodal tDCS to Broca's area yielded enhanced improvement for treated verbs in these studies. In addition, transfer to spontaneous speech was observed (Marangolo et al., 2014) and generalization to untreated verbs was documented when the untreated videos of actions were described (Marangolo et al., 2013b). However, these studies did not include pre-treatment testing with multiple baselines, nor control measures. Therefore, improvement of untreated items may have been due to generalization, but it may also be a product of task practice or spontaneous recovery (Howard, Best, & Nickels, 2015).

In the current study, we tested the efficacy of concurrently administered tDCS and training with an Italian adaptation of ACTION (a treatment program for Dutch, developed by Bastiaanse, Jonkers, Quak, & Varela Put, 1997) in promoting both item-specific improvement and generalization. Preliminary data were reported in de Aguiar, Bastiaanse, and Miceli (2014), and here we report the outcome of treatment for a larger sample.

Methods

Participants

Nine patients with post-stroke aphasia and difficulties in retrieving verbs and building sentences participated. Both fluent (N=3) and non-fluent aphasic speakers (n=6) were included. Three had impaired semantic processing, and all presented with impairment at the level of the phonological output lexicon, poor grammatical encoding and impaired phoneme-to-phoneme conversion. Output deficits were length-sensitive, suggesting damage to the phonological output buffer.

Procedure

A double-blind, Sham-controlled study was conducted, using a cross-over design. Each participant was treated in two phases, using the Italian adaptation of ACTION. Verb retrieval and inflection production were treated at the sentence level. The cueing strategy included cues for both lexical verb retrieval and inflection, and included explicit discussion of the grammatical properties of treated sentences and of verb inflections. In addition, participants received either Sham in phase 1 and tDCS in phase 2 (n=5), or both treatments in the reverse order (n=4). Treatment order was randomized across subjects. In each session, patients received 20 minutes of either bi-cephalic 1mA tDCS or Sham, with the anode over peri-lesional left hemisphere areas, and the cathode over right hemisphere areas. Electrode placement was determined individually after inspection of patient's MRI scans.

Pre-treatment stability was established for each phase by three baseline assessments, administered over a two-week period. Pre- and post-treatment assessment included three tests (production of infinitives, finite verbs and sentence construction) and non-word repetition. Verb production in the three tests was scored for lexical accuracy (an answer was considered correct if the target verb was retrieved, disregarding phonological paraphasias and morphological errors). Two sets of verbs were prepared for each patient, one to-be-treated, the other not-to-be-treated, prior to the beginning of each treatment phase. Items were balanced for pre-treatment accuracy and for 17 linguistic variables.

Results

Group data were analyzed using a linear mixed-effects model for logistic data in R. Baseline performance was stable, and no significant changes were observed in non-word repetition in either phase. We used model comparison to assess the need to include each factor (Jaeger, 2008). The main effects of Time (Pre and Post-treatment), Phase (1 and 2), Stimulation (tDCS, Sham), and Verb Test (Infinitives, Finite Verbs, Sentence Construction) were significant. The main effect of Set (Treated, Untreated Verbs) was not significant. The interactions of Time*Phase, Time*Set, and Time*Stimulation were significant, denoting larger improvement in phase 1, for treated verbs and in the tDCS condition. Though the slope of improvement was steeper for the tDCS condition, tDCS and Sham scores differed mainly in the pre-treatment assessment. Significant main effects and interactions are illustrated in Figure 1.

Individual data analyses revealed that 9/9 patients improved in phase 1 and 8/9 improved in both phases, for treated verbs. The null effect coincided with the tDCS phase for one patient.

Generalization was present in both phases for two patients. The remaining seven patients showed generalization effects only in phase 1, coinciding with Sham for five patients and with tDCS for two patients.

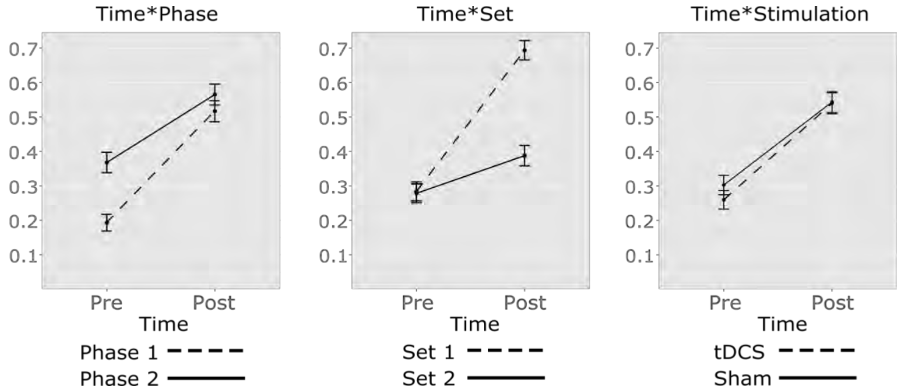

Figure 1. Effects of treatment in verb lexical accuracy

Discussion

The ACTION treatment improved verb retrieval, for both treated and untreated verbs, regardless of whether it was administered with Sham or with tDCS. Generalization had been reported previously with the Dutch version of this treatment protocol (Bastiaanse et al., 2006; Links, Hurkmans, & Bastiaanse, 2010). These results highlight the importance of engaging explicit knowledge of the linguistic properties of the materials being treated.

tDCS resulted in a steeper slope of improvement when compared with Sham. The observation that scores before and after the tDCS and Sham phases differed more in the pre-treatment than in the post-treatment assessments renders the effect of stimulation difficult to interpret. On one hand, variable difference between the two stimulation conditions may reflect a ceiling effect. On the other hand, the possibility that the effect is genuine must also be considered. The amount of improvement is indeed larger in the tDCS condition, which is consistent with findings previously reported for treated verbs (Marangolo 2013a, 2013b, 2014). The present study confirms and expands those results, showing that tDCS may enhance both item-specific improvement and generalization.

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Cognitive outcome after awake surgery for left and right hemisphere tumours

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Introduction

Awake surgery in eloquent brain regions is performed to preserve motor, language and other cognitive functions located in the dominant hemisphere. However, more recently, non-dominant tumours are also operated awake to map visual and visuospatial functions [1,2]. Although in general, no major permanent cognitive deficits are found after awake brain surgery, clinically relevant impairments are detected and cognitive recovery takes longer than generally assumed (3 months). Between 3 months and 1 year postsurgery improvement on language performance (object naming and letter fluency) was found [3]. However, as there is a lack of repeated and extensive cognitive follow-up data, it is unknown when recovery exactly takes place. In addition, the influence of critical language sites identified by direct electrical stimulation (DES) on long-term cognitive outcome assessed with an extensive protocol remains still unclear.

Methods

Subjects

40 consecutive brain tumour patients underwent awake brain surgery. Inclusion criteria were a tumoural mass in or adjacent to eloquent cortex of the language, motor or visuo(spatial) system. The majority of tumours was located in the left hemisphere (n = 29; 72.5%) of which 24 (82.8%) were associated with left hemispheric (LH) language dominance and 5 (17.2%) with bilateral hemispheric language dominance. Eleven patients (27.5%) with right hemispheric (RH) brain tumours were included of which 8 (72.7%) showed left language dominance and 3 (27.3%) showed bilateral dominance. Postoperative anatomopathological analyses revealed that most brain tumours were gliomas (n = 32; 80%), 6 were metastatic tumours (15%) and 2 were meningeomas (5%). 50% of the gliomas (n = 16) appeared to be high-grade after pathological examination. After surgery 32 patients (80%) received adjuvant treatment (radio- and/or chemotherapy).

Neuropsychological test-protocol

Cognitive functioning was assessed in the preoperative phase and at 6 weeks (short-term) and 6 months postsurgery (long-term) with an extensive neuropsychological test-protocol: Language: Object naming, action naming, semantic fluency, phonological fluency and Token Test. Memory: 15 word test (imprinting, recall), digit span. Attentional and executive functions: Trail Making Test A, B, Stroop Color Word Test I-III. Visuospatial functions: line orientation and figure copy. Based on the tumour location and patients' characteristics, a selection of tasks from The Dutch Linguistic Intraoperative Protocol (DuLIP) [4] was administered in the pre- and intraoperative phase during corticosubcortical DES. Non-language tasks were selected if relevant for the tumour location and patient's daily life activities (e.g. line bisection in the right posterior region for professional dancer, calculation in angular gyrus for architect).

Statistical analyses

Pre- and post-operative mean z-scores of the patients were compared to normal population. Within the patient group, we made comparisons between T1 and T2 (the short term effect of surgery), between T2 and T3 (the recovery course of recovery) and between T1 and T3 (the long term effect of surgery) Finally, the effect of functional areas identified by DES, tumour location, hemispheric dominance, tumour grade and extent of resection was investigated on significant cognitive change scores.

Results

Both pre- and postoperatively, the mean performance of the patients was worse than normals in the domains of language, memory, and the attentional and executive functions ($p < .05$), but not in the visuospatial domain.
Awake surgery negatively affected language, attentional and executive functions ($p < .05$) but did not affect memory and visuospatial skills.
Cortical DES revealed critical language areas in 21 patients with LH tumours and in 4 patients with RH tumours (2 non-dominant, 2 bilateral activation according to fMRI). These 4 RH patients presented with both pre- and postoperative language deficits. At short term (T2), tumour resection in critical language area(s) identified by DES appeared to be a risk factor for postoperative decline in all language tasks: object naming, action naming, phonological fluency, semantic fluency, language comprehension (Token test) and for attention/reading rate (Stroop I).
At long-term (T3), a critical language area identified by DES was a risk factor for decline of semantic fluency and attention/reading rate (Stroop I). The short- and long-term decrease was only observed in the patients with brain tumours in critical language areas (LH and RH).
At short-term (T2), performance on all language, attentional and executive tasks deteriorated (object/ action naming, semantic/ phonological fluency, Token test; Trail

Making Test A & B, Stroop I, II, & III). At T3, recovery to normal or to the preoperative level was found for all but 1 language task (semantic fluency). By contrast, a 'long-term' decline remained present for most attentional and executive tasks (Trail Making Test A & B, Stroop I & II).
No influence was found of left/right tumour location, hemispheric dominance, glioma grade, extent of resection, or adjuvant treatment on cognitive change.

Discussion

A tumour resection near or within a critical language area was a risk factor for short- and long-term postoperative decline in language and partly attentional functions, and not left/right tumour location or hemispheric language dominance. These results confirm that fMRI data do not reliably detect patients at risk of postoperative language impairment. Although a decline short-term after surgery was observed for all language, attentional and executive tasks, performance on all language tasks, except for semantic fluency, recovered to preoperative level between 6 weeks and 6 months postsurgery. However, at 6 months posoperatively, the performance on attentional and executive test scores (TMT, Stroop I, II) were still impaired. As Satoer et al. [3] revealed that language improves between 3 months 12 months and that the attentional/executive functions recover at 12 months, we can conclude that language recovers faster (i.e. between 6 weeks - 3 months) than the attentional/executive functions (i.e. between 6 – 12 months). Different postoperative plasticity mechanisms could be responsible, recruiting corticosubcortical networks involving language, attention and/or executive functions at shorter or longer distance [1].
As language, attentional and executive functions are most at risk after awake surgery, intraoperative mapping of these functions is of crucial importance to avoid postoperative deficits and to preserve quality of life. As at long-term follow-up, semantic fluency, TMT and Stroop I and II test results were still deviant, these tasks should be used pre- and postoperatively with 3 months, 6 months and 1 year postsurgery as essential test moments to detect cognitive change. Intraoperatively, the use of multimodal tests such as the Quick Mixed Test [5] might be valuable to assess concept shifting, attentional and executive functions besides language.
Future research with regard to intraoperative cognitive test protocols would contribute to a better and improved evaluation of patients' cognitive functions. Finally, non-invasive brain stimulation techniques could promote brain reorganisation and may improve cognitive outcome leading to a better quality of life.

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Representational Dysprosody: Evidence from word stress processing in Parkinson's Disease

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Introduction

Van Lancker-Sidtis et al. (2006) predicted three levels of prosodic processing – perception, representation, and production – which can be separately impaired. Only two of them (perception and production) have been typically investigated in Parkinson's Disease (PD). Concerning perception, there is evidence for impaired basal auditory processing of relevant parameters (e.g., frequency, intensity) in English speaking PD patients (Troche et al., 2010). However, there are apparently no perceptual deficits at the word level (Darkins et al., 1988). Concerning production, PD patients typically develop a dysarthria including symptoms of dysprosody (e.g., Skodda et al., 2008).

So far, the representational level of prosodic processing has been largely ignored. It may consist of two sub-components – lexical and rule-based knowledge. Following Ullman (2004), in Parkinson's Disease rule-based knowledge may be impaired, whereas lexical knowledge may be preserved.

Methods

Participants

We examined twelve patients with Parkinson's Disease (mean age = 68.8 years, mean disease duration = 11.3 years, mean disease severity [Hoehn & Yahr score] = 2.2) and eight control participants matched for age, education, and gender.

Tasks

The following tasks were used to assess the three different levels of prosodic processing:

- Perception: tone discrimination (distinctive features: duration, frequency, skewness) and word discrimination (minimal pairs of existing words and pseudowords, distinctive feature: stress position)
- Production: reading aloud (words, pseudowords; perceptual analysis)
- Representation: sequence reproduction task (pseudoword minimal pairs with consonant or stress contrasts; Dupoux et al., 2001), reading aloud (phonological analysis)

In addition, we used a digit span task to examine the participants' working memory.

Results

With respect to the perceptual level, we observed a tendency of impaired basic auditory processing (duration p = .062; skewness p = .063; frequency p = .128) and no evidence for impaired stress perception in words or pseudowords ($p \geq .325$). Concerning production, a dysprosody due to dysarthria became apparent in significantly inferior inter-rater agreement on the stress pattern realized by patients compared to control participants ($p \leq .0001$). There was no significant group difference in working memory performance ($p = .312$). Crucially, PD patients showed significantly inferior performance in the tasks examining the representational level of stress processing. In the sequence reproduction task, there was a main effect of group ($p = .009$) and – in contrast to the control participants – the patient group showed significantly worse performance with the stress contrasts than with the consonant contrasts ($p = .012$). Moreover, the patients produced significantly less expected stress patterns for pseudowords with expected penultimate stress (< 90%) than control participants ($p = .020$), who produced this pattern at 100%. This stress pattern is completely predictable by prosodic rules. However, no group difference was observed for existing words, including those with penultimate stress.

Discussion

In addition to their expected dysarthric dysprosody (e.g., Darkins et al., 1988) and, possibly, perceptual deficits (e.g., Troche et al., 2010), patients with Parkinson's Disease showed a representational disorder affecting word stress processing. Given that this disorder affected rule-based processing with pseudowords, while stress assignment to existing words remained unimpaired, we conclude that patients with Parkinson's Disease show a dissociation between rule-based and lexical knowledge, as has also been claimed for the morphological domain (Ullman, 2004).

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Intraoperative language mapping: a two-task approach

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Introduction

Gross tumor resection and diminution of postoperative morbidity allow surgical teams to attain greater patient survival and to better preserve the patient's quality of life (De Witt Hamer et al., 2012). These advances are partly due to tailoring the resection of the tumor to each individual subject by detecting language-specific areas with intraoperative language mapping; a technique that is used to trigger language errors (e.g., anomia, latency, paraphasia) by pairing the administration of language tests with short trains of electrical stimulation (Desmurget et al., 2013; cf. Borchers et al, 2011).

The choice of tasks to be used during language mapping is debated. Object-naming has been traditionally used and it is recommended in current protocols (Duffau et al., 1999; Kayama 2012; Miceli et al., 2012). Producing the name of an action with an inflected verb, an infinitive, or other verb tasks has been used, although to a lesser extent (Rofes & Miceli, 2014; for a review). Regardless of whether these or different tasks are preferable, we argue that probing lexico-semantic and grammatical processes by administering both object-naming tasks and finite action naming tasks may allow surgical teams to avoid damage in everyday language usage (Goodglass & Wingfield, 1997; Moritz-Gasser et al., 2012), and to detect and to spare brain areas and language processes that cannot be assessed by either task alone (Rofes et al., in press).

To assess the validity of these claims, we asked whether subjects produce more errors (1) when stimulation is used compared to a non-stimulation condition; (2) when they respond to object-naming and/or to action-naming, regardless of the area that is stimulated; and (3) when they respond to any of the two tasks, and stimulation is applied to specific brain areas in the periphery of the tumor. Overall, we expect subjects to produce more errors when electrical stimulation is applied, compared to when it is not applied (Desmurget et al., 2007). Based on lesion studies, we also expect that patients produce more errors in the task that uses verbs when stimulation is applied in the prefrontal cortex and parietal lobe, compared to object-naming, which may be more sensitive in the temporal lobe (e.g., Miceli et al., 1988; Mätzig et al., 2009 for a review).

Methods

Participants

Three Italian-speaking subjects with a supratentorial tumor participated. These were two female and one male ranging in age between 39-70 years and in education between 8-12 years. Two subjects had a glioma in the prefrontal cortex: subject OS was reoperated for a WHO II in the inferior-frontal gyrus (IFG) and the middle-frontal gyrus (MFG); and CRO for a WHO IV in the posterior MFG. The third subject (CAR) had a WHO II glioma in the parieto-occipital cortex.

Materials and procedure

All subjects were assessed with two overt naming tasks designed for awake surgery (Rofes et al., in press): an action-naming task requiring subjects to read a pronoun and produce the verb in its correct inflected form (i.e., “she runs”), and an object-naming task requiring participants to produce a noun together with its corresponding determiner (i.e., "the apple"). Items were presented for 4 seconds as proposed in current surgical protocols (Kayama 2012). A bipolar electrode was used to provide 4-second trains of electrical stimulation (50Hz, 0.2msec). The amperage of the stimulator varied for each participant and ranged from 6-10 mA.

Results

Subject CRO produced a greater number of errors in the cortical stimulation condition vs the non-stimulation condition (p=0.013). Subjects CAR and OS produced a significant amount of errors when stimulation was delivered at subcortical sites (p<0.05). Subject CRO produced a significant number of errors when stimulation was administered during object-naming at the cortical level (p=0.004), particularly in the posterior part of the MFG (p=0.002) and in the middle segment of the IFG (p=0.002). Subjects CAR and OS produced more errors when stimulation was applied during the finite verb naming task. CAR produced errors during cortical stimulation (p=0.016), and specifically in two sites in the inferior part of the parietal lobe (p<0.05); and during subcortical stimulation (p=0.017) in a site corresponding to the inferior parietal lobe (p=0.026). Subject OS produced more errors on verbs during subcortical stimulation (p=0.002). In subject CAR, errors were elicited only be the finite verb task during stimulation of the posterior part of the inferior parietal lobe (p=0.033)**.**

Discussion

Administration of an object and of an action naming task is feasible and useful for intraoperative language mapping. The three subjects produced more errors during the stimulation vs non-stimulation condition. Subject CRO produced a significant number of errors during stimulation mapping with nouns, when stimulation was delivered in the prefrontal cortex (but no differences between nouns and verbs were observed). These results do not fully agree with the fact that the prefrontal cortex is more involved in the processing of actions than in the processing of objects (Mätzig et al., 2009), although the original claims do not exclude that some processes necessary for naming objects may require prefrontal cortex integrity. Subjects CRO and OS produced more errors during action-naming with finite verbs, regardless of whether the lesion was in prefontal or parieto-occipital areas. These findings support the fact that the processes necessary for action processing, may have a further representation in those areas. The fact that in CAR only action-naming allowed the detection of a critical area in the parietal lobe, indicates that considering these two tasks together may enhance the sensitivity of intraoperative language mapping.

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Anatomical changes in the brain macrostructure and microstructure of the right hemisphere in chronic aphasic stroke patients

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Introduction

The anatomical underpinning of aphasia is related generally to damage of perisylvian regions in the left hemisphere. However recent studies illustrate that the right hemisphere also has a role to play in language recovery (Turkeltaub, Messing, Norise & Hamilton, 2011).
Studies regarding brain regions and volume of tissue loss that underlie aphasia traditionally use voxel–based morphometry (VBM) analyses of T1 images. Novel quantitative MRI methods have emerged increasing the sensitivity and specificity of analyses at tissue and cellular level (Callaghan, et al., 2014). Multiparameter mapping (MPM) is a quantitative MRI method that provides neuroimaging biomarkers for myelination and iron content. This enables in vivo voxel- based quantitative analyses (VBQ) of macrostructural and microstructural measure of grey matter (GM) and white matter (WM). The aim of this study was to investigate for the first time whether the MPM approach is valid and feasible in chronic aphasia post-stroke populations.

Methods

Participants and data acquisition

29 anomic patients following left MCA lesions (18 males, age range 19 – 73 years, mean 52 years) and 22 healthy volunteers (8 males, age range 50 – 81 years; mean 66 years) took part. Scanning used a 3.0T whole body MR systems (Magnetom TIM Trio, Siemens Healthcare, Erlangen, Germany) and a standard 32 channel transmitter-receive headcoil.
The whole-brain quantitative MPM protocol (Weiskopf et al .2013) involved 3 FLASH volumes using magnetization transfer (MT), proton density (PD) and T1-weighting (Repetition time and flip angle respectively: MT and PD= 23.7ms/6°; T1= 18.7ms and 20°).

VBM and VBQ image processing and analyses

All data were preprocessed and analysed in the SPM12 framework (http://www.fil.ion.ucl.ac.uk/spm/, UK) using Matlab 2013b tools (The Math- Works Inc.; Natick, MA, USA). For VBM MT maps were segmented into GM, WM, cerebrospinal fluid (CSF) and an extra lesion tissue-class using Automatic Lesion Identification toolbox (ALI) (Seghier et al. 2008).

For VBQ tissue –specific parameter maps (i.e. PD: effective proton density; MT: magnetization transfer; R1: longitudinal relaxation rate; and R2*: effective transverse relaxation rate) using the same method as (Draganski et al., 2011).

Modulated GM and WM tissue classes and 6mm FWHM isotropic smoothing kernel were used to get the VBM and VBQ normalized maps.

Full-factorial between-group models with subjects' age and gender as regressors of no interest were used to analyze the resulting GM and WM images separately. Voxel- based two-tailed T-statistics were computed to detect whole brain effects between the patient and control groups. Statistical thresholds of p=0.05 (family-wise error (FWE) correction) for multiple comparisons across the whole brain volume were used throughout.

Results

VBM – Gray matter analyses

Controls > Patients:

3 main regions in the left hemisphere were found with significantly less gray matter in the patient group compared to the control group. Peak co-ordinates were in left 1) caudate nuclei (x, y, z = -18, -20, 20; Z=6.28); 2) postcentral gyrus (x, y, z = -66, -6, 24; Z=6.15); and 3) posterior insula (x, y, z = -40, -6, -2; Z= 5.30). See Figure 1a.
Nothing was detected for the reverse contrast of patients > controls

VBM- White matter analyses

Controls > Patients:

There was a significant loss of WM in patients in the left hemisphere, reflecting areas most commonly damaged by their strokes. These were primarily in the vicinity of the longitudinal and arcuate fasciculi in the left hemisphere. Peak co-ordinates were 1)(x, y, z = -32, -18, 6; Z=7.08); 2) (x, y, z = -34, -2, 6; Z=6.60); and 3) (x, y, z = -30, 14, -6; Z= 6.40). See Figure 1b.

Patients> Controls:

As a group, patients had significantly greater WM volume compared to controls along the length of the superior longitudinal fasciculus and arcuate fasciculus in the right hemisphere. Peak co-ordinates were 1) (x, y, z = 14, -20, 62; Z=5.96); 2) (x, y, z = 38, -28, 4; Z=5.68); 3) (x, y, z = 34, -62, -2; Z= 5.57). Bilateral differences were detected in in the inferior cerebellar peduncle 4) (peak left x, y, z = -16, -38, -34; Z=5.70 and peak right x, y, z = 2, -30, -18; Z=5.61). See Figure 1c.

*VBQ analyses of MT, PD, R1 and, R2**

Controls>Patients

WM results from the VBM analyses were replicated in the VBQ analyses. Peak co-ordinates: **MT**: x, y, z = -34, -2, 6 (Z =7); **PD** x, y, z = -34, -2, 6 (Z=7.02); **R1** x, y, z = -34, -2, 6 (Z=6.76); and, **R2*** x, y, z = -30, 14, -6 (Z=6.15).

Patients > Controls

An additional WM region in the right hemisphere was detected in analysis of the R1 images. Here patients as a group had significantly greater value compared to controls in right inferior frontal gyrus, ventral to right Broca's area (peak co-ordinate x, y, z = 32, 28, 0; Z=4.76). See Figure 1d.

Discussion

Our results illustrate for the first time that the MPM approach was valid and sensitive to GM and WM differences between our chronic aphasic patient and healthy control groups. It also provides a set of neuroimaging biomarkers for WM brain microstructure underlying our chronic aphasic patients post stroke.

Using this quantitative volumetric method we detected significant differences in right hemisphere WM for the patient group compared to controls. These were primarily in the right arcuate fasciculus and inferior longitudinal fasciculus. Changes in the same WM tracts have been previously reported using fractional anisotrophy methods (Wan et al 2014). In addition we found WM differences in bilateral inferior cerebellar peduncle and right IFG ventral to Broca's area. MPM methods are optimizing to prevent imaging susceptibility artifacts in these regions. MT and R1 sequences are measures of macromolecules and iron content that in turn reflect WM myelination. Further analyses will investigate the functional correlations between these right hemisphere WM values and language function within the same aphasic patients.

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Controls > Patients

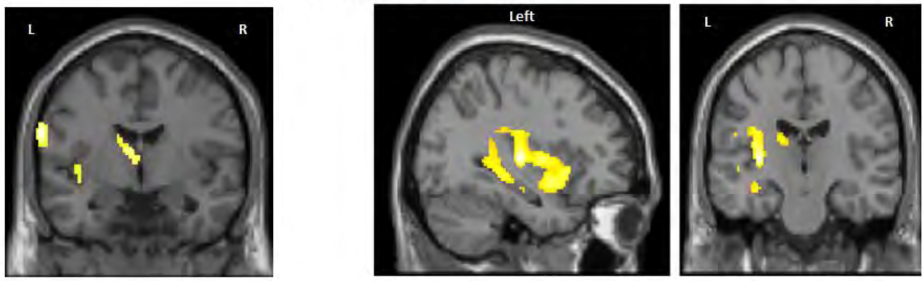

Fig. 1a. VBM-GM

Figure 1a. shows significant less GM in the patient group **in the left hemisphere.** From left to right: Postcentral Gyrus, Posterior Insula and Caudate Nucleus

Fig. 1b VBM - WM

Figure 1b. shows significantly less WM in the arcuate and inferior longitudinal fascicules in the patient group **in the left hemisphere**

Patients > Controls

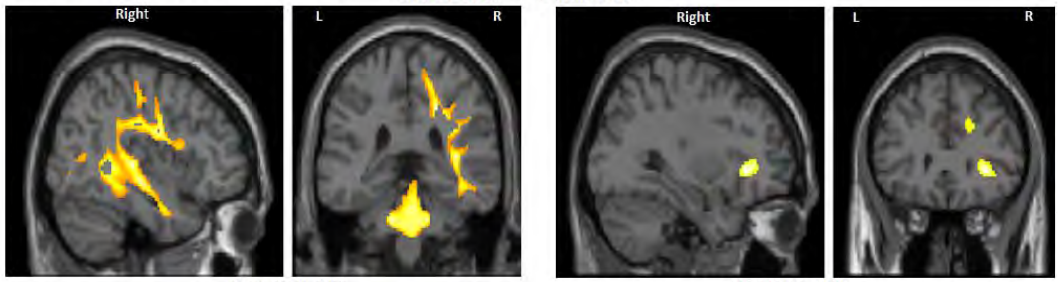

Fig. 1c VBM - WM

Fig. 1d VBQ - WM

Figure 1c. shows significant increases in WM volume in the patient group **in the right hemisphere.** From left to right: Arcuate fasciculi, inferior cerebellar peduncle (bilateral), superior longitudinal fasciculi and. **Figure 1d** shows higher values in the R1 quantitative map in the patient group **in the right inferior frontal gyrus.** These results were reported at FWE .05 but for illustration purposes these images are thresholded at p = 0.001 uncorrected

Verbs in aphasic discourse: data from the Russian Clinical Pear Stories Corpus

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Introduction

Methods of collecting discourse samples for analysis can be divided into two broad types: recording spontaneous discourse (interactions or monologues) and eliciting discourse with a stimulus (usually a picture or sequence of pictures, or a movie). Though stimuli-elicited discourse lacks in ecological validity as compared to spontaneous discourse, it has certain advantages for linguistic analysis. Since all speakers base their discourse on the same stimulus, the produced speech samples are of similar size and are genre consistent (though picture stimuli can elicit both narratives and descriptions) (Armstrong, 2000; Fergadiotis & Wright, 2011; Olness, 2006).

In the current study we present interim results of verb use analysis in two aphasic groups based on Russian CliPS (Clinical Pear Stories) data. Russian CliPS is a multimedia corpus of narratives produced by speakers with aphasia and right hemisphere damage, as well as neurologically healthy speakers of Russian. The corpus contains retellings of the “Pear story” movie (Chafe, 1980), which was created in 1975 with a specific purpose to elicit comparable speech samples with a clear story line and to study the flow of discourse. The nature of the narratives in the corpus allows for a comparative investigation of grammatical and lexical phenomena, as well as such suprasentential phenomena as discourse structure, coherence, and cohesion.

Methods

Participants

In the present study, samples from 17 people with aphasia were analyzed. Fluent group consisted of 8 participants (mean age = 53.4; 6 females), and non-fluent group consisted of 9 participants (mean age = 52.2; 4 females); with various etiology and time post-onset. The groups did not differ significantly in mean severity scores.

Procedure

The participants watched the “Pear story” movie and then were asked to retell it to another person (experimenter’s partner) with as many details as he could remember, so that another person “could retell it him/herself”. The retellings were audio and (partially) video recorded.

Analysis

The recordings of the narratives were annotated for lexemes, and the verbs were marked. Only complete words were included in the analysis (false starts were not taken into account). Mean length in minutes and in words, words and verbs per minute were counted for two groups. Then, the auxiliaries were excluded from analysis, and the content verbs were categorized as light or heavy (Berndt et al., 1997), and by Halliday's main semantic categories: material, mental, relational, verbal, behavioral, or existential (Halliday, 1985). Also each verb was counted as referring to the narrative plane (the content of the film) or to the narration plane (the situation of retelling, which includes interaction with the collocutor) (Bergelson et al., 2014): for instance, in an utterance "*I think he just stole them*" the verb *think* would be annotated as an interaction verb, and the verb *stole* – as a narrative verb. For each sample, verb type-token ratio (TTR) and mean verb lemma frequency (Lyashevskaya & Sharov, 2009) was counted for all verbs, all verb types, all narrative verbs and all narrative verb types.

Results

Expected differences between fluent and non-fluent groups in length in minutes and words per minute were found: non-fluent group produced significantly longer narratives with less words per minute than the fluent group. No significant differences were found for verb ratio per words, verb lemma frequency, TTR or light and heavy verb proportions. The correlation analysis of all participants' data revealed negative correlation between TTR and verb lemma frequency, both when overall verb frequency and only unique verb types were taken into account. The significance of the correlation increased when interaction verb usages were excluded from analysis. None of the parameters correlated significantly with the severity of aphasia.

The qualitative analysis of semantic categories (Halliday, 1985) revealed the prevalence of material verbs in both groups. The comparison by categories between the fluent and non-fluent groups did not reveal significant differences, although there was a tendency approaching significance in fluent group to use more predicates of verbal category than in non-fluent group when interaction clauses were excluded from analysis.

Discussion

The negative correlation between verb frequency and TTR in aphasic patients indicates that people with aphasia who demonstrate less verb diversity tend to rely on more frequent verbs, and the persistence of this correlation with verb type frequencies suggests that is not just due to repeating of frequent verbs. A comparison with a neurologically healthy group is required to draw conclusions about the pathological nature of this dissociation.

Also, it is noteworthy that distinction between narrative and narration planes can affect the results of verb use analysis. We assume that excluding interaction verb usages from analysis makes the samples more homogenous; since it is possible that the variations in the switching between narration and narrative planes are due to a participant's premorbid storytelling style (Bergelson et al., 2014). Thus, excluding interaction verb usages from semantic category analysis revealed a trend in usage discrepancy of verbal category between fluent and non-fluent group; although the nature of this discrepancy is unclear at this stage and may be related to syntactic as well as semantic properties of these verbs.

Collecting samples from more people with aphasia and a comparison with a neurologically healthy control group may be a fruitful direction of further investigation.

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An investigation of generalisation following treatment of written homophones in aphasia .

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Introduction

Since the 1990s it has been debated whether words that share a pronunciation but have distinct meanings (homophones) also share a phonological representation (e.g. Dell, 1990; Levelt, Roelofs, & Meyer, 1999) or rather have independent phonological representations (e.g. Caramazza, Costa, Miozzo, & Bi, 2001) at the word-form level. Treatment of spoken homophone retrieval in speakers with anomia has been shown to result in not only improvement for naming of treated homophones, but also generalisation to the naming of untreated homophones but not to phonologically related controls (e.g., Biedermann & Nickels, 2008a; Biedermann & Nickels, 2008b). Biedermann and Nickels proposed that homophones share a phonological word-form as suggested by the Two-Stage model (Levelt et al., 1999) and the Interactive Activation model (Dell, 1990). However, it has been suggested that generalisation to the untreated homophones could also be explained by feedback from the phoneme level to separate phonological word form representations, as proposed in the Independent Network model (Caramazza et al., 2001), if this model was adapted to include feedback. However, this cannot explain why phonologically related items do not also benefit from treatment.

If homophones do share phonological representations, it seems plausible that they also share an orthographic representation, at least for those homophones spelled the same (homographic homophones, e.g., bank (the institution) vs. bank (the edge of a river)). To date, there has been little research on written homophone treatment in aphasia and research thus far has only investigated homophones spelled differently (heterographic homophones, e.g., flower vs. flour). Behrmann, (1987) treated homophone spelling by matching and contrasting a picture to two different heterographs (e.g. flower and flour with a picture of flour) and written sentence completion (*the baker used self-raising* ____). No generalization to the untreated homophone was found- however; as heterographic homophones are spelled differently they would require separate orthographic representations.

There is no research on whether generalisation would occur to untreated homographic homophones. This study aims to both address this issue and unpack whether generalisation from homophones is due to shared representations at the word form level or feedback from phonemes/graphemes to separate word-form representations. In order to do this we will investigate treatment generalisation to untreated heterographic and homographic homophone partners of treated items as well as to direct and indirect orthographic neighbours (words that share letters with the target). Previous work investigating developmental spelling treatment has found improvement can generalise dependent on orthographic neighbourhood size. Kohnen, Nickels, Coltheart and Brunsdon,(2008) suggested that words with larger orthographic neighbourhoods receive feedback to word-form representations from graphemes that have been activated by treated word-forms.

Methods

Procedure

Participants will be people with aphasia and impaired written naming. Specifically they will have impaired access to the orthographic output lexicon but relatively spared semantic processing and post-lexical processing. Written and spoken naming of treatment and control items will be assessed in three baseline sessions; each session will be 3 weeks apart to match the treatment period. A written naming treatment will be administered 3 times a week for 3 weeks and followed up with 2 post-treatment assessments also 3 weeks apart. During baselines and post-tests participants will be asked to write the name of a picture presented along with a short definition. After written naming of the stimuli participants will be asked to name the stimuli orally. Treatment will be a copy and recall treatment (e.g...Beeson, 1999)

Stimuli

Stimuli will consist of 8 sets of 20 items: a) homographic homophones (e.g. bank), b) heterographic homophones (e.g. pair) c) names with high orthographic neighbourhoods (e.g. bath), d) homographic homophone partners (e.g. bank), e) heterographic homophone partners (e.g. pear), f) direct neighbours of items in set c (e.g. path), g) names with high orthographic neighbourhoods which are not direct neighbours of any treated item (e.g. gold), h) words with low orthographic neighbourhoods (e.g. cheese). All items from each set will be presented in baselines and post-tests however only one out of the homophones pair (set a and b) and the words with high orthographic neighbourhoods (set c) will be treated.

Results

Improvement from baselines to post-tests will be investigated using Weighted Statistics (Howard, Best, & Nickels, 2015) to establish whether there are effects of treatment on the treated sets (a, b and c) and the untreated sets (d,e,f,g) in order to investigate generalisation. If treatment improves written production of the treated sets, then we can attribute this to strengthening lexical representation and investigate generalisation to untreated sets. If generalisation occurs from the treated to the un-treated homophones but not to direct neighbours we can attribute this to shared-representations at the orthographic word form (in line with Biedermann & Nickels, 2008). However, we will also investigate how generalisation is dependent on the number of graphemes that an untreated word shares with the treated set. If number of shared graphemes is a significant predictor of generalisation then we can attribute that to a feedback account. If we find that homography has an independent effect over and above any effect of number of shared graphemes, we can suggest homographs have shared representations but there is also feedback from graphemes to orthographic word-forms. We will investigate any generalisation from written treatment of heterographs to spoken production to investigate the interaction between phonological and orthographic levels.

Discussion

Results from this study will further the understanding of homophone representation in the orthographic lexicon and will be discussed in relation to the three theoretical accounts outlined in the introduction; the Two-Stage Model (Levelt et al., 1999), the Interactive Activation Model (Dell, 1990) and the Independent Network model (Caramazza et al., 2001).

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Development of a supportive programme for informal carers of stroke survivors with aphasia

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Introduction

The occurrence of a stroke may result in the individual and respective family challenges and complex personal experiences. The changes of the family dynamics are a part of the stroke consequences(1, 4, 5, 11). Investigations about the impact of stroke highlights the loss of control over their lives as it was reported by patients, as well as the difficulty of adapting to its consequences, especially during the transition from the hospital to home(3, 12, 14). Stroke can also have profound implications for family and social relationships, with significant changes in roles and responsibilities. Studies have shown that informal caregivers report specific needs of necessary care for the patient, both before and after hospital discharge(7, 9, 11). The support provided by caregivers is associated with a better quality of life of the individuals with aphasia, making it important to reduce the impact of the challenges resulting from stroke(7). According to the recommendations of the Portuguese Health Plan 2012-16, measures are needed to support caregivers, looking to the development of knowledge and skills to take care of their family and, consequently restructuring and adapting to the physical, social and emotional patient's needs and family contexts(4, 11, 12).

There is also the need to ensure that individuals with complex communication needs are provided of communicative partners to effectively interact with them, because the ability to interact with these patients is a process that needs to be developed(11). This is essential to understand how the process of change occurs in the life of both the patients and informal caregivers, especially as they learn to deal with the situation in the transition from the hospital.

Methods

Objectives

To assess the impact of define and implement an interdisciplinary program of support for informal caregivers of stroke survivors with aphasia (functional autonomy and complex communication needs (NCC)). The program aimed to decrease the perception of burden for the caregiver and increase the self-efficacy level for the patient, with the main goal of minimizing the impact on returning home. According to the theory of social cognition, principles of adult education and educational strategies, counseling and the skills development program intended to: a) Improve the knowledge about stroke and its consequences of the informal caregivers in relation to stroke and care to be developed with the individuals with aphasia; b) Empowering informal caregivers on the care to be provided with the patients who have had a stroke; c) Decrease the level of burden for the informal caregiver; d) Improving the life quality for the family.

Methodology

The study is part of a community type project, implemented since 2011 in the *Escola Superior de Saúde do Instituto Politécnico de Setúbal* (ESS-IPS), an initiative of Physiotherapy and Speech Language Therapy Departments. This project has had as partners the institutions of the *Centro Hospitalar de Setúbal - Hospital São Bernardo* (CHS-HSB), the *Liga dos Amigos da Terceira Idade* (LATI) and the *Hospital do Litoral Alentejano*. The project involved 19 families, focused on individuals who have clinically diagnosed with stroke and informal caregivers who need support in the hospital's transition to home. The project is based on an ecological perspective to the family, having been implemented in domiciliary context.

This project has three phases: Pre-program Assessment; Program Implementation and Post-program Assessment.

In the pre-program assessment the following outcomes were assessed with the aim of identifying the families' needs:

1) The process of change in the family's life during transition to home, exploring the communicative and functional needs through semi-structured interviews;

2) The knowledge about stroke and its consequences, though the *Teste sobre o conhecimento do Acidente Vascular Cerebral*[6];

3) The impact of the situation from the informal caregivers' perspective, including the physical, communicative, emotional and social implications, resulting from the care process. It was used the *Questionário de Avaliação da Sobrecarga do Cuidador Informal* (QASCI)[13];

4) The quality of life of the patients, through the *Escala de Qualidade de Vida Específica para Utentes que Sofreram um Acidente Vascular Cerebral* (SS-QoL) [10].

In the second phase it was defined and implemented an individualized program, based on the needs reported by the participants. Each program plan seeks to respond to the specific needs of each family through the use of educational strategies, counseling and development skills, which were selected according to their needs and characteristics.

Finally, in the post-program phase it was carried out an assessment with the tools previously used in the first phase. Additionally a satisfaction questionnaire was used to assess the satisfaction of the families regarding their participation in the program developed.

Results

Along the three years of implementation of this community project has been found that there are benefits in the implementation of individualized programs, based on the results obtained in the post-program phase compared to initial assessment. In general, it is observed a reduction of the burden of informal caregivers; an increase in the satisfaction with the caring role; an increase of knowledge about stroke; an improvement of the self-efficacy level in caring and satisfaction with the program developed.

Discussion

The implementation of an interdisciplinary educational program, geared to the needs of informal caregivers of patients with aphasia, has contributed to the increase of self-efficacy in care and to

reduce the caregiver perception of burden, which seems to support their adaptation and minimize the impact of stroke on returning home.
The results obtained with the program implemented are similar with those obtained by other authors in similar interventions. The results demonstrated that education, counseling and development of practical skills are effective strategies in reducing the burden of the caregiver and increase the quality of life of the patient after stroke. The increase in knowledge allows a better understanding of the condition by the family, which facilitates the development of strategies to resolve their needs autonomously, simultaneously strengthening in the intra-family relationships(1, 2, 5, 14). Thus, clarifying questions and the developing practical skills has been promoting the increasing functionality and life quality of the families (4, 9, 12, 14).

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Book Talk and Aphasia

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Introduction

The ability to read is important to people in a great many ways. For example, reading – of books, magazines, newspapers, websites, etc. – may mean relaxation, pleasure and entertainment. In addition, reading books opens up new worlds and gives rise to reading experiences that can be shared with others who have read the same books (Chambers, 2011). Reading difficulties are usually one of the integral symptoms of aphasia (Ellis, 1993; Hatfield, 1989). Partial or complete loss of the ability to read may have a major impact on an individual (Behrns, 2009; 2013; Kjellén et al., in preparation). It has been found that people with aphasia want to be more included in social activities and that they want to be able to take part in cultural activities (Worrall et al., 2011). In fact, research has identified a positive relationship between cultural activity on the one hand and health and rehabilitation progress on the other (Bjursell & Vahlne Westerhäll, 2008). The beneficial impact of culture is partly explained as an effect of a shift of focus from the impairment to something else. The cultural experience may become a creative resource for the individual and – which is of great importance – takes part in a social environment that promotes health (Sigurdson, 2014). The aim of this pilot project was to enable participation in cultural experiences and to promote reading, despite language difficulties following aphasia.

Methods

Participants

Three men and one woman aged 52, 54, 63 and 66 years, respectively, were recruited from a local aphasia association in Sweden. Their reading difficulties ranged from extensive to mild.

Procedures

The group had a total of ten weekly meetings which were led by a librarian. The participants selected a book together, read 2–4 pages in it at home and then met to discuss the plot, the characters and their personal views on the book. The participants could choose either to read the text themselves or listen to someone else reading it on a digital device. The group also visited the city library on one occasion to familiarise themselves with its general organisation but with a special focus on adapted texts with easier syntax or texts available in a digital format. The project was evaluated on the basis of documentation of the conversations among the participants and on the basis of individual interviews with the participants and the librarian performed after the last group meeting.

Results

During the project, the librarian and the group jointly found a strategy for work on the book and for text reading ahead of each meeting. The librarian found it challenging to base the meetings on the content of only 2–4 pages of the book (book talks are in fact usually based on a whole book that participants have finished). However, the discussions did involve all four participants, who made personal associations from the content of the book. The participants also encouraged each other to engage in further reading, suggesting other books and texts to each other during the project. The participants and the librarian all emphasised the importance of having a shared reading experience as opposed to reading on one's own. At the end of the project, they all characterised the book talks as very fruitful and interesting. All participants reported more frequent reading after the project, and the visit to the city library made one of the participants go there on a regular basis.

Discussion

Meeting to discuss books is a well-known and well-established phenomenon. Friends meet spontaneously to do so, and groups are organised for that purpose by schools, libraries, educational associations, etc. However, the literature review carried out prior to the project indicated that book talks specifically for people with aphasia have not been described earlier. Libraries know a great deal about how to organise book talks, but usually for skilled readers only. In the present pilot project, the participants with aphasia experienced the activity as very rewarding despite their language difficulties. Some of them had had aphasia for a very long time but still felt that this way of approaching language and reading was something new. Earlier research has found that a cultural experience could shift the focus away from the illness, and this seems to have been the case for the participants in the present study as well. Here it must be pointed out that this was so even though the project concerned something that was very difficult to the participants: reading. Even so, perhaps because the focus was on the content of the book and on the group's associations from it, the participants described the book talks as very positive and encouraging. Each individual's ability to read was probably of secondary importance – what yielded the positive experience were the joint literary discussions.

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Lesion size and initial severity as predictors of aphasia outcome

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Introduction

The problem of aphasia prognosis after stroke has been the central issue of a number of studies. There is a growing body of evidence suggesting that lesion characteristics (including lesion volume) is the crucial predictor with regard to aphasia recovery (Plowman, Hentz, & Ellis, 2012; Maas et al., 2012; Hope et al., 2013). However, several contemporary studies point to initial severity as the most powerful predicting factor (Laska et al., 2001, Lazar et al., 2010).The aim of the present study is to investigate the effect of the two aforementioned variables on aphasia outcome.

Methods

24 left stroke patients were assessed in the acute (mean time post onset = 10,67 days, SD=7,51 days) and chronic (mean time post onset = 252, 58 days, SD=257,87 days) phase with the Boston Diagnostic Aphasia Examination-short form (BDAE-SF) (Goodglass and Kaplan, 1972), adapted in Greek (Tsapkini, Vlahou, and Potagas, 2009). On the basis of performance on specific BDAE-SF subscales an Aphasia Score (henceforth AS) was calculated according to Potagas, Kasselimis, and Evdokimidis (2011). MRI/CT scans were obtained for each patient and lesion loci were identified by two independent neuroradiologists. The total number of affected sites served as an index of lesion volume (henceforth lesion score).

Results

Paired sample t-test revealed significant difference between AS1 (acute phase) and AS2 (chronic phase) ($t=,-5,736$, $df=23$, $p<0.005$), thus indicating a satisfying degree of recovery. Possible relationships between AS1, AS2, and lesion score were initially investigated through Pearson r correlation analyses. Results indicated significant correlations between AS1 and AS2 ($r=0.81$, $p<0.001$), AS1 and lesion score ($r=-0.50$, $p<0.05$), and AS2 and lesion score ($r=-0.59$, $p<0.005$). Two subsequent partial correlations analyses were conducted: first, between AS1 and AS2 with lesion score as control variable, and then between AS2 and lesion score with AS1 as control variable. Results revealed that correlation between AS2 and lesion score does not reach significance, when AS1 is entered as control variable. In contrast, correlation between AS1 and AS2 remained significant, with lesion score serving as control variable. Finally, regression analysis with AS2 as the dependent and AS1 and lesion score as predictors, provided a statistically significant model ($F_{4,17}=11,031$, $p<0.005$) which explained 66% of the predicted variable's variance (Adjusted R Square = .656). However, it was only AS1 that served as a significant predictor ($beta=.669$, $p<0.005$).

Discussion

There is an ongoing debate in the aphasia literature with regard to the relevant importance of specific prognostic factors. Our findings demonstrate that even though the extent of lesion seems to be related with severity in the chronic phase, it is initial aphasia severity that strongly predicts outcome. It should be however noted that our sample was small; therefore these results should be interpreted with caution. Further studies with larger samples investigating a larger number of possible predicting factors could elucidate the complex issue of predicting the evolution of aphasic symptoms right from the acute phase.

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The Adapted Melodic Intonation Therapy in Expressive Aphasia Patients

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Introduction

The preservation of the singing ability has been used since 1973 to promote language recovery in aphasic patients with primarily expressive deficits, being designated as melodic-intonation therapy (MIT) (Bonakdarpour, Eftekharzadeh & Ashayeri, 2000; Racette, Bard & Peretz, 2006). It is a rehabilitation technique aimed to develop verbal fluency and prosody through specific steps: phrases/sentences are sung to the patient who is asked to repeat them, with increase in task difficulty level according to individual patient progress (Racette, Bard & Peretz, 2006).
In the MIT the musical elements of speech (melody and rhythm) are used to improve other aspects of expressive language, through the preserved singing ability, which is supposed to be associated to regions of the brain's right hemisphere (Norton et al, 2009). Therefore, patients without right hemisphere lesions, with non-fluent speech or severely restriction of speech, articulation difficulties, difficulty in repeating words, language understanding preserved or moderately impaired, ability to evoke some intelligible words during the singing of familiar songs, who have motivation and emotional stability are indicated to participate in the program with MIT (Helm-Estabrooks & Albert, 2004).
The objective of this study is to present an adaptation of the MIT using Brazilian popular music to rehabilitate speech and neuropsychological functions of aphasic people, and also to demonstrate the therapeutic efficacy of the Adapted MIT in a patient with predominantly expressive aphasia.

Methods

The adaptation process of the MIT followed four steps: 1) analysis of the original treatment (Helms-Estabrooks, Nicholas e Morgan, 1989) and construction of the MIT preliminary adapted version; 2) analysis of expert judges in the health area, 3) analysis of expert judges in the neuropsychology rehabilitation area and 4) a pilot study (a case study used the methodology of AB single case experimental design with multiple baselines) (Fontoura et al., 2014). The speech therapy (pilot study) lasted three months, in two weekly meetings, with an average duration of 45 minutes each, totaling 24 sessions.

Results

In Adapted MIT, the patient goes through the same steps of the traditional MIT. However, the stimuli used are not highly familiar and desirable words and phrases, but lyrics of popular Brazilian songs containing simple words and sentences. The songs are selected with the patient, taking into consideration him or her musical preferences. In order to facilitate lexical access in the song, the

therapy began with slow tempo music, with the aid of reading and illustrative figures.
After the Adapted MIT, the patient that has participated on this case study showed a significant improvement in verbal fluency, with an increased number of words produced per minute during conversational speech, anomia reduction, improved syntax and reduction of speech dyspraxia. Regarding neuropsychological functions, improvements were observed in the following functions: attention, working memory, verbal episodic semantic memory (recognition), naming, reading sentences aloud, identifying words and repeating words. The neuropsychological functions which were not trained in the Adapted MIT process, such as temporal and spatial orientation, arithmetic skills and visual memory, praxias, among others, remained the same before and after therapy. This indicates that improvements in the trained functions occurred due to intervention. Thus, it can be concluded that the Adapted MIT has proven effective in this case.

Discussion

The main purpose of this study was to present an adaptation of the MIT and also to demonstrate the therapeutic efficacy of adapted MIT in a patient with predominantly expressive aphasia. The adaptation of the therapy aimed to adjust it to the cultural context of the patient. There was improvement in significant aspects of expressive and comprehensive language (structural and functional aspects), as well as of the working memory and the semantic and episodic verbal memory (recognition) of the patient. Progress on extra linguistic skills demonstrated the relevance of different cognitive skills for communication. A neuropsycholinguistic assessment that goes beyond language should be performed, since the speech rehabilitation process involves a wide variety of cognitive functions.
The goal of this therapy, besides the obvious linguistic and cognitive improvement, is to provide the patient a pleasant time and effectiveness for him or her rehabilitation. It is believed that the entire therapeutic process should not stop being pleasurable to the patient. Because, if so, the result will certainly be rewarding. It is known that a more motivated patient tends to has good adherence to the treatment and obtain the benefits needed for recovery.

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Communication group for people with stroke sequels

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Introduction

In Portugal, the stroke is identified as the major cause of death and disability. Patients who survive the acute phase can manifest deficits at both the communicative and psychosocial level, resulting in changes in their quality of life and in their psychological well-being (1, 8). The social model pays special attention to the quality of life of individuals, since this model is intended to retrieve the person's personal relationships and their levels of participation(7). As such, the intervention focuses not only on the individual, but also on several contexts where he is inserted and in his communication partners(3, 7). Group therapy is an excellent example of the application of the social model. This type of therapy has a number of advantages compared to individual therapy, such as: a greater variety of functions and communicative partners; the encouragement to transfer the gains for the family context and the community; the use of natural communication situations; the increase in psychosocial functions and the cost-benefit(2, 4). The interaction between members with similar difficulties promotes greater help in the language "improvisation" and the construction of a new and more positive identity(2).

Methods

Problem

The issues related to quality of life and psychological well-being are considered increasingly important in the therapeutic process. These are the starting point and the ultimate goal of rehabilitation(9).

Stroke sequels can cause difficulties in terms of autonomy, control of emotions and negative feelings that are reflected in the individual's well-being, self-image and self-esteem (1, 8). Thus, group therapy can be very relevant, since it provides better conditions for the development and adaptation of psychosocial skills compared to the individual context(2). On the other hand, the trend towards an increase in the demand for Speech Therapy leads to the need to improve the

effectiveness of patient care. Referrals for Speech Therapy in post-acute and chronic stages, after a period of rehabilitation, combined with the knowledge of aphasia characteristics and its specific markers, both visible and invisible, leads to the need to implement appropriate rehabilitation models.

Objectives

The communication group for individuals with stroke sequelae is a community project that has been developed with patients from Speech Therapy in Physical Medicine and Rehabilitation Service of

Centro Hospitalar de Setúbal (CHS) – Hospital São Bernardo (HSB). The objectives of this project are: I) to promote interaction between peers; II) to improve communicative skills; III) to improve psychosocial features; IV) to contribute to individuals' satisfaction regarding participation in group sessions.

Methodology

We conducted a research-action study, with six individuals with post-stroke communicative sequelae, which attained the communication group of CHS-HSB.

This project had three distinct stages: Situational Assessment, Implementation of the intervention and Final evaluation.

In the situational assessment stage we performed a survey concerning participants' needs and expectations through a semi-structured interview. In addition, we used *Escala de Funcionalidade para Afásicos* (EFA)(5), in order to assess the impact of stroke on patients' daily lives in the following areas: communication, interaction, organization, behavior and autonomy. Finally, we applied the Portuguese version of *Stroke and Aphasia Quality of Life Scale*-39 (SAQOL-39)(6) to evaluate the participants' communicative and psychosocial characteristics.

Project implementation was carried out in 20 sessions, through an intervention based on a social approach focused on the functional aspects of communication, improving quality of life and psychological well-being. During implementation, we also conducted an intermediate evaluation in order to determine the degree of satisfaction of participants and their respective family.

The final stage aimed to identify and quantify the project-related gains, through the application of the same instruments used in the situational assessment.

Results

By comparing the results obtained in the situational assessment and the final stage, we found that all participants showed significant improvements in functional communication, autonomy and psychosocial features. Thus, in relation to the EFA(5), there were increases in all items of the scale. Regarding SAQOL-39(6), the communicative scores increased by 24% and psychosocial scores increased 37%, between the two evaluation moments. In addition, through the interviews, participants demonstrated their satisfaction with the participation in group sessions, and expressed the importance that the sessions had in their rehabilitation process.

Discussion

The results obtained in this study were in accordance with what is described in the literature. As demonstrated in previous works(2, 3, 4), we found improvements in autonomy, attitude and motivation, since the individuals who participated in group therapy reported more confidence to interact and to admit their difficulties. Regarding this initiative, we found that group sessions promote interaction between members and hence increase the communicative initiative (2). Group therapy also allows a feeling of equality and understanding of the difficulties felt and greater mutual support on language "improvisation", providing greater communication opportunities(2,3).

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Effects of semantic number information on grammatical processing of mass nouns

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Introduction

This presentation will focus on the lexical-syntactic and semantic processing of countability, a grammatical attribute which classifies nouns into mass (e.g., garlic, milk) and count (e.g., cat, apple). Specifically it will address the influence of semantic number information, in other words, how the number of 'to be expressed' items affects mass and count noun processing.

To our knowledge, only a few case studies (Herbert and Best, 2009; Semenza, Mondini and Marinelli, 2000; Semenza, Mondini and Cappelletti, 1997) have been published in which countability has been investigated. It is generally agreed that mass and count nouns differ grammatically. For example, count nouns can form a singular and plural (cat, cats) and can be combined with count noun specific determiners (a cat, many cats), while mass nouns cannot form a plural (*garlics) and are combined with mass noun specific determiners (much garlic, little milk). To date, it remains unclear whether this distinction is purely grammatical or partially derived from/influenced by semantic information.

Consequently, we used a series of picture naming tasks and determiner decision tasks to investigate the influence of semantic number information on lexical-syntactic processing of mass nouns in two individuals with aphasia (RAP and DEH). Both tasks required grammatical processing of countability information for the selection of mass/count specific determiners. In order to investigate whether there was a semantic influence on processing, conceptual-semantic number was manipulated: In each task, mass and count nouns were presented once as single objects (e.g. a single cat, a single bulb of garlic) and once as multiple objects (e.g. three cats, two bulbs of garlic).

For count nouns, number processing is transparent with conceptual-semantic and grammatical number information converging (singular determiner for one object, plural determiner for two objects): For a single object, the semantic feature SINGLE maps onto the grammatical feature [singular], while for multiple objects, the semantic feature MULTIPLE maps onto the grammatical feature [plural]. This grammatical-semantic transparency for number information does not exist for mass nouns. Mass nouns can be combined with determiners which are used with singular (e.g. this) or plural (e.g. some) count nouns irrespective of their semantic number information (SINGLE or MULTIPLE). For example, two bulbs of garlic can be described using a 'singular' determiner as in 'this garlic' (cf this cat) or using a plural determiner 'some garlic' (cf some cats).

Methods

Participants

RAP and DEH, two Australian-English speakers with chronic aphasia are compared to a group of language unimpaired participants (n=10). RAP and DEH were selected on the basis of lexical-syntactic difficulties suggesting the possibility of a countability impairment. Each participant was given a comprehensive set of language assessments to identify their level of language impairments.

Countability Material

Stimuli to test participants' mass and count processing consisted of 16 singular count, 16 plural count and 16 mass noun pictures (presented once as single and once as multiple objects). In order to identify an influence of semantic number information at the lexical-syntactic level, processing of the same stimuli was tested in different modalities (language production and comprehension). Each task was tested with different mass/count noun specific determiners to ensure consistency and reliability. Each mass noun object was presented in a semantic number congruent and incongruent condition. In the number congruent condition, the semantic number of the noun and the target determiner matched (e.g., multiple depictions of the mass noun object for the target determiner 'some'). In the number incongruent condition, the semantic number information of the noun and the target determiner did not match (e.g., single depiction of the mass noun object for the target determiner 'some').

Tasks

<u>Spoken picture naming using a noun phrase</u>: participants were presented with a picture and the beginning of a written sentence (e.g., 'This is __ __.') to elicit the free production of a countability specific noun phrase including the picture's name and a countability appropriate determiner (e.g., 'This is a bag', 'This is some gold').
<u>Determiner decisions</u>: participants were presented with a picture and two written determiners Participants were asked to decide on the determiner that best matched the picture.
In order to investigate the effects of semantic number congruency, RAP and DEH's accuracy with single mass noun depictions was compared with that of multiple mass noun depictions (Wilcoxon matched pairs). We further compared whether this difference was significantly greater than any difference shown by the control group (Revised Standardized Difference Test, RSDT; Crawford & Garthwaite, 2005).

Results and Discussion

RAP and DEH showed a semantic number congruency effect across both picture naming and determiner decision tasks. RAP and DEH selected determiners for mass nouns based on the semantic number of the depicted object(s) and its congruency with the number information of the determiner. For example, both individuals would more often choose the (correct) determiner 'enough$_{plural/mass}$' for the mass noun 'garlic' when the mass noun was presented as multiple objects (three bulbs of garlic) ('P' determiner tasks because mass nouns require determiners used for plural count nouns),

while the determiner ‘$a_{singular}$’ was chosen when mass nouns were presented as single objects (one bulb of garlic) (see Table 1). The same number congruency effect was found for the determiners ‘this’ and ‘that’ (‘S’ determiner tasks because mass nouns require determiners used for singular count nouns) where single depictions of mass nouns led to correct choice of ‘this’ and ‘that’ and multiple depictions to the incorrect choice of ‘these’ ‘those’. This effect of number congruency led to the production of (or acceptance of) ungrammatical mass noun phrases, such as ‘*a garlic’ or ‘*these butter’ in both types of tasks. The control group showed a similar semantic number congruency effect in the determiner decision, but not the picture naming tasks.
The results provide evidence for an influence of semantic number information on lexical-syntactic processing in language impaired and unimpaired participants. This influence was more prominent for RAP and DEH possibly due to their lexical-syntactic impairment. The restricted number congruency effect for the control group, suggests that the processing and selection of mass specific determiners is predominantly based on lexical-syntactic information.

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Table 1 *Proportion of Correct Responses in the Picture Naming Tasks with Noun Phrases and the Determiner Decision tasks.*

Tasks	Mass single n=16	Mass multiple n=16	Mass single vs. Mass multiple (pvalue)[c]	Mass single vs. Mass multiple RSDT (pvalue)[e]
DEH				-
Picture naming tasks-NP accuracy				
'P' task: 'a' vs. 'some'	0.63	0.94	.073	.001*
'P' task: 'a' vs. 'enough'	0.19	0.69	.006*	.001*
'S' task: 'this' vs. 'these'	0.63	0	.002*	.567
'S' task: 'that' vs. 'those'	0.63	0.19	.011*	.001*
Determiner decision tasks				
'P' task: 'a' vs. 'some'	0.25	1	.001*	.003*
'P' task: 'a' vs. 'enough'	0.13	1	.001*	.001*
'S' task: 'this' vs. 'these'	0.69	0	.001*	.180
'S' task: 'that' vs. 'those'	0.88	0	.001*	.011*
RAP				-
Picture naming tasks-NP accuracy				
'P' task: 'a' vs. 'some'	0.38	0.94	.008*	.001*
'P' task: 'a' vs. 'enough'	0.56	0.94	.020*	.001*
'S' task: 'this' vs. 'these'	0.75	0.06	.003*	.014*
'S' task: 'that' vs. 'those'	0.38	0	.020*	.001*
Determiner decision tasks				
'P' task: 'a' vs. 'some'	0.63	0.94	.037*	.879
'P' task: 'a' vs. 'enough'	0.50	1	.006*	.010*
'S' task: 'this' vs. 'these'	0.88	0	.001*	.006*
'S' task: 'that' vs. 'those'	0.38	0	.019*	.867
Controls				-
Picture naming tasks-NP accuracy				
'P' task: 'a' vs. 'some'	0.96 (0.05)	0.95 (0.06)	.914	
'P' task: 'a' vs. 'enough'	0.94 (0.08)	0.95 (0.08)	.773	
'S' task: 'this' vs. 'these'	0.99 (0.03)	0.96 (0.07)	.174	
'S' task: 'that' vs. 'those'	0.96 (0.07)	0.95 (0.06)	.586	
Determiner decision tasks				
'P' task: 'a' vs. 'some'	0.89 (0.09)	0.99 (0.02)	.013*	
'P' task: 'a' vs. 'enough'	0.90 (0.08)	0.98 (0.04)	.020*	
'S' task: 'this' vs. 'these'	0.93 (0.06)	0.83 (0.14)	.041*	
'S' task: 'that' vs. 'those'	0.87 (0.15)	0.79 (0.14)	.068	

Listen-In: The development and testing of a tablet-based therapy application for patients with impaired speech comprehension caused by stroke.

Phase 1: Development and consultation.

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Introduction

Most aphasia rehabilitation has not provided sufficient dose to allow for a reliable critique of its effectiveness, both in scientific research (Brady et al, 2012; Bhogal et al, 2003) and in clinical practice (Code, 2003). Patient feedback from our previous studies has found that a barrier to maximizing dosage is often the mundane nature of the tasks. We have utilized gamification to address this barrier. Gamification is new to the field of aphasia therapy and so necessitates the involvement of patients in its development.

Listen-In aims to provide an effective speech comprehension therapy that patients can use independently. Importantly, it aims to provide a sufficient dose through maximizing user engagement. Two key processes are therefore involved: development of the therapy by the scientific team, and the development of a parallel game in which the therapy is embedded, produced in collaboration with game industry experts and patients.

The study has three phases. Phase 1 involves development of the diagnostic and therapeutic components, driven by patient-user's feedback (alpha and beta testing) and the development of the 'game', which includes a social, between-subject, interactive component. This will be followed by a cross-over trial (Phase 2) and finally a roll-out across the internet for a pragmatic trial (Phase 3). This abstract will focus on two key components of Phase 1: consultation with patients in the developmental stage, and collaboration with experts in the field of gamification.

Methods

Gamification

A key feature of the development stage is developing an engaging and motivating 'game' in which to embed therapy. To achieve this, gamification was outsourced to a team of external professional game developers. This has included a series of face-to-face, email, and telephone consultations, involving all of the wider team at various stages including the gaming team, patient expert, and scientific team.

Consultation

A patient expert has been involved from the beginning stages of this project, including application for funding and development of the research proposal (funder: NIHR i4i stream). This was achieved through a series of face-to-face team meetings.

In order to gather qualitative feedback from people with Aphasia, focus groups with a well-known Aphasia charity, Connect, were established. A series of focus groups were planned at the prototype stage, in order to actively use feedback to drive further developments and refinements before completion of the final therapy.
Engaging the services of Connect for a series of focus groups provided a platform for engagement with specifically recruited patient experts. From this we aim to gather constructive criticism and feedback. We liaised with facilitators to balance our own research goals with the needs of participants with aphasia. Focus groups were planned as follows:

Consultation 1
Explain the purpose of the research study to the group. Presentation of the prototype to gauge initial reactions and identify any significant barriers to game use. Following this, a discussion regarding further developments and/or changes.

Consultation 2
Presentation of the second revised prototype. The aim of this session may also include dissemination of the prototypes for home-based use to gain feedback on its use in an ecologically valid setting. This would entail initial training to ensure focus group members are able to use the therapy independently

Consultation 3
A subset of patients will regularly use the therapy at home over a specified number of days, to gauge accessibility, useability, and engagement. Individual consultation will be carried out and feed into prototype 3.

Consultation 4
Presentation of prototype 3 following changes implemented from Consultation 3. A discussion regarding further development and changes will then determine whether further consultations are required.

Results

Outcomes of the gamification process

Numerous face-to-face and email consultations took place within the period of approximately 12 months. The main outcomes of the gamification process were as follows:

The structure of a game was developed consisting of individual challenges, levels, and chapters.

A reward system with virtual coins, to ‘spend’ in a mini-game following a therapy level. Players then win jigsaw pieces to complete a chapter.

Social aspects will be incorporated (e.g. patients can earn tokens during therapy and gift these to other ‘connected’ users).

Results of user consultation

The patient expert drew on his personal experience participating in a considerable number of research trials, and professional knowledge of software options, to provide insight into the user experience. This insight contributed to the subsequent prioritization of gaming as an essential component to the therapy.

Collaboration with the expert patient resulted in a patient-led agenda being formulated for the initial planning meeting with Connect. This consisted of a set of key discussion points, feedback requirements, and research goals. This agenda was then taken to the focus group facilitator, prior to the initial focus group meeting, in order to discuss practicalities (e.g. meeting length, number of members) and the research goals (collection of qualitative data).

Discussion

During the gamification process significant barriers to communication became apparent due to the diverse terminologies used (gaming, scientific and rehabilitation). To overcome these barriers, a considerable amount of time was spent in both groups establishing a common terminology, through presentations and informal conversations.

Due to the disparate priorities of the scientific and gaming team, a number of limitations in game development were identified. This led to adaptations in the gaming structure and interface, in order to maintain suitability for a population of ‘gamers’ with aphasia. The planning process for the user consultation benefitted from involving the patient expert. His personal experience of digital therapies provided insight into priorities in therapy delivery from a user’s point of view; for example, making the therapy ‘fun’ and engaging.

Additionally, the patient expert provided key considerations for how to present our therapy to focus groups of people with aphasia, and what areas to consider. For example, the need to liaise with users about the visual challenges of the proposed interface.

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Establishing criterion validity for the French version of the Screening BAT:

A comparison of 30 aphasic patient's performance on the Screening BAT and the MT86-alpha and bêta

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Introduction

While there is no doubt that multilingual aphasic patients need to be assessed in all their languages, testing two, three or more languages remains not only difficult to realize but also exhausting for the patients. It has been stressed that the use of tests that are strictly equivalent across languages is essential for getting a precise appreciation of the specific impairment of each language in a bilingual or multilingual patient (Kiran & Roberts, 2013). The Bilingual Aphasia Test (BAT) (Paradis & Libben, 1987) is the only test that offers a complete linguistically and culturally adapted assessment for more than 65 languages and dialects. As for any comprehensive test battery, administration of the complete BAT takes at least one and a half hours per language in healthy subjects. For aphasic patients, assessment of the BAT involves at least two sessions for each language and even more for patients suffering from degenerative diseases. Occasionally, researchers report having used only parts of the BAT in order to avoid tiring the patient.
Since comprehensive aphasia batteries — and even their short versions if they exist — are generally too long for assessment with patients in the acute phase, many speech therapists in neurological units develop “home-made” screening versions of standardised test batteries to use with those patients. Unfortunately, most of these screening tests are not published and little is known about validity and reliability across different versions of the same test. Moreover, it has been stressed that it is not recommended to use home-made tools consisting of bribes of different validated tools (Mazaux et al., 2007) since validity of the standardisation can not been guaranteed when isolated sub-test are extracted from a standardized test battery. This demonstrates clearly the need for more validated screening tools for aphasic patients. This is even more the case for multilingual patients, for whom screening tests may not only be useful in the acute phase but also for a first screening of any patient speaking three or four languages.

Methods

Aims of the study

The Screening BAT, currently available in nine languages, is a simple and user-friendly test developed to allow for an efficient assessment of multilingual aphasic patients (Guihem et al, 2013). It is short enough to be used with patients in the acute phase or for quick screening in multilingual patients, but still comprehensive enough to allow for the elaboration of the patient's linguistic profile. In order to achieve this, the distribution of linguistic skills and the levels of linguistic structures tested as proposed by Paradis & Libben (14: 212-213) for the realisation of the patients' linguistic profiles was taken into account. Sufficient sub-tests for the realisation of such a profile were maintained — 17 subtests out of 32 — in order to provide a basis for the establishment of the clinical report of the speech therapist. Despite the strong reduction of the number of items from 472 in the BAT to 117 items in the Screening BAT, items with increasing complexity were also maintained. A Screening BAT can easily be adapted on the basis of the material that has been standardised for the BAT (Paradis & Libben, 1987). Eleven languages are freely available for the moment: Arabic, Catalan, English, French, German, Italian, Korean, Portuguese, Russian, Spanish and Turkish.
However, for efficient use in clinical practice, more information is needed on the validity of a new test. For speech therapists who use a more established test on a daily basis, empirical validity obtained through the comparison of the new test with the established test serving as criterion are particularly interesting. Ivanova & Hallowell (2013) state that criterion validity is evidenced through high correlations between the scores on a new test and on a previously validated test. Indeed, the establishment of correlations between a new tests in need of validation and an established test are common in aphasiology (e.g., Flamand-Roze et al., 2011 ; Peristeri et Tspakini, 2011 ; Ozaeta et Kong, 2012) and inspired the present study.
The aim of the present study was to provide data on the validity of the Screening BAT through the comparison of the scores of 30 French aphasic patients on the French version of the Screening BAT with the scores obtained on the Montreal-Toulouse Protocol (MT86) in its long and short version (M1-alpha and M1-bêta). The MT86-alpha is a short version which has been standardised with 60 healthy participants (Dordain et al. 1983). The MT86-bêta is a more detailed test battery and has been standardised in several steps between 1990 and 1993 (Béland & Lecours, 1990; Béland et al, 1993). The M1-bêta still is the standard for aphasia assessment in large parts of France, Belgium and francophone Canada, while the M1-alpha is frequently used with patients in the acute phase. Both tests are based on a large choice of task involving all linguistic levels and modalities, very similar to the BAT and the Screening BAT.

Procedure

For the present study, 30 aphasic patients in the chronic phase (without specific knowledge of other languages) were recruited in order to be able to respond to the long version of the MT-86-bêta. Patients had a mean age of 66,4 years (ranging from 49-88, SD 12,89), there were 17 men and 13 women and most of them (except 4) had more than 9 years of education. 22 were affected by non-fluent aphasia, 8 by fluent aphasia. Mean onset of aphasia was 5 years (ranging from 8 month to 25 years and one month). All patients responded to the French version of the Screening BAT and the M1-alpha in one session, to the M1-beta in another session. Sessions 1 and 2 were counterbalanced across participants and conducted with an interval of minimum 2 and maximum 8 weeks.

Results

We will present correlations obtained between the three tests and between the subtests included in each. The discussion will focus on the patients' linguistic profile established with the three tests.

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Priming of Word Level Tone in Native Mandarin Chinese Speakers by Musical Pitch: An ERP Study

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Introduction

This study aims to investigate whether musical pitches have a facilitative effect on lexical tone processing at the word level in healthy native speakers of Mandarin Chinese. Mandarin Chinese is a tonal language and the tone distinguishes between different words. Mandarin Chinese speakers have to manipulate pitches to create the appropriate tone when speaking. Pitch recognition therefore plays a major role in comprehending Mandarin Chinese.

Much research has shown that music and language processing share similar cognitive resources in the brain (Koelsch et al., 2002; Patel, 2003; Brown et al., 2006; Fedorenko et al., 2009; Chandrasekaran, 2009; Ahken et al., 2012; Sammler et al., 2011; Perrachione et al., 2013). Specifically, it has been found that enhanced pitch sensitivity from musical training could be transferred to the language domain (Schön et al., 2004; Wong et al., 2007; Lee and Hung, 2008; Lee et al., 2014). On the other hand, it was also found that enhanced abilities in pitch recognition in the language domain could be transferred to the music domain (Krishnan et al, 2005; Pfordresher and Brown, 2009; Giuliano et al., 2011). Neuroimaging research has provided further evidence of shared neural resources across the two domains (Bidelman et al., 2011; Nan and Friederici, 2012; Bidelman et al., 2013). In sum, the results of current research have provided solid evidence for the close neural interrelation between music and language processing.

Although there is much evidence suggesting that music and language processing make use of the same neural substrates, cross-domain pitch research at the word level remains largely to be investigated. Lexical tone with its dual linguistic and musical properties provides a solid ground for cross-domain pitch research. Moreover, making use of the same system does not necessarily show that the two sorts of processing interact with each other during on-line processing. It still remains to be seen to what extent pitch information in the linguistic and musical domains interact. Hence this study is designed to investigate whether musical pitches have priming effects on phonological processing in Mandarin Chinese.

Methods

Participants

Participants were 21 well-educated, right-handed, and healthy native speakers of Mandarin Chinese who were not trained musicians with limited knowledge in music and minimal skills at musical instruments. In addition, only participants without vision and hearing problems, and history of brain injuries were qualified.

Materials and Design

A musical pitch priming experiment and a lexical tone priming experiment were conducted. The materials for the musical pitch priming experiment were recorded speech word samples of Mandarin Chinese and their converted musical pitches. The converted pitches were used as the congruent and incongruent pitch primes to the target words. Regarding the lexical tone priming experiment, the primes were real words in Mandarin Chinese with congruent or incongruent tones. All target words in the respective experiments were real words in Mandarin Chinese. Each experiment includes 240 words, of which 80 words were paired with pitch/tone congruent primes (congruent condition), 80 words were paired with pitch/tone incongruent primes (incongruent condition), and 80 words were paired with a preceding noise (control condition shared in both experiments). All words used in this study were high-frequency disyllabic words with the same tones on every syllable (e.g. T1-T1 書包 /shū bāo/ “book bag”). Test items were randomized with additional audio fillers as distractors.

Procedure

This research was an ERP study, in which the neural activities of participants were measured using electroencephalography (EEG). The experiment adopted a passive listening task to investigate the automaticity of the use of musical pitch in lexical tone processing. During this experiment, the participants first saw a fixation (500ms) and then heard a pitch/tone prime or non-prime (1,500ms) followed by a gap (500ms) before they heard a target word (1,500ms). All stimuli and fillers were presented in a serial fashion.

Results

The ERP N400 component has been well-established as a neural index for phonological priming effects (Rugg, 1984; Praamstra and Stegeman, 1993; Praamstra et al., 1994; Radeau et al., 1998; Dumay et al., 2001; Perrin and Garcia-Larrea, 2003). Based on previous studies, we anticipate to find the ‘pitch priming effects’. Hence, a more attenuated N400 amplitude is expected in the congruent condition and less attenuated N400 amplitude to no effect in the incongruent condition, as compared to the control condition. Repeated measures ANOVA is performed to compare the effect size of each condition and their interaction with scalp distribution

Discussion

This study investigates the relation between music and language processing at a fine-grained level that will reveal the nature of tone processing in Mandarin Chinese. Upon the completion of the study, assuming there is a phonological priming effect, as reflected by reduced ERP N400 amplitudes, it can be concluded that musical pitches have a facilitative effect on tone processing in native speakers of Mandarin Chinese. Furthermore, it would be consistent with the view that musical pitch and linguistic pitch are processed similarly or pitch processing could be domain-general at least in native speakers of Mandarin Chinese. If the priming effect is found, then future research will continue to investigate if there is a similar effect in native speakers of Mandarin Chinese with aphasia and it will provide more insight into the treatment of music therapy for this target group and aphasia research.

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Mobility and communication impairments and reintegration in the community in early walkers post-stroke

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Introduction

Patients who start walking early after stroke (early walkers) demonstrate the wish to return to meaningful social and vocational activities [1]. Poor community reintegration is common post-stroke: it is often associated with mobility impairments, such as walking deficits [2, 3] and most researchers have focused on understanding problems associated with reduced walking efficiency, i.e., balance, speed or distance impairments [4-6]. However, other impairments such as communication disorders, which affect 19% of patients [7], create additional barriers to successful socialisation and limit community participation[8]. Despite its importance, the impact of communication disorders on community participation in early walkers after stroke has received little attention. This study therefore aimed to describe mobility difficulties, communication and participation in the community and their relationship to recovery post-stroke.

Methods

Study Design and Participants

Following ethical approval from each institution, a preliminary descriptive study was conducted in four hospitals of the Central Region of Portugal. People with stroke were included if they (i) had a first ischemic stroke within the previous 3 months; (ii) were able to walk at least 5 meters without a walking aid but with human assistance, if required; (iii) had lower limb hemiparesis ((scoring <34 on the Fugl-Meyer); and (iv) had no previous history of other severe cardiovascular diseases. Patients were excluded if they had (i) involvement of the brainstem or cerebellum, identified via computed tomography and (ii) cognitive impairment (scoring <27 in the Mini-Mental State Examination)[10]. Patients were assessed when they were first able to walk after stroke (T0) and were re-evaluated at 6 months post-stroke onset (T1).

Data Collection

Eligible patients were identified by their physician who introduced the study and invited them to participate. The researcher contacted interested participants, provided further study information and obtained their informed consent. Socio-demographic characteristics (age, gender), body mass index and side of hemiparesis were obtained. WHO Disability Assessment Schedule (WHODAS) 2.0 [11] (5-point Likert scale ranging from '1 = none' to '5 = extreme/cannot do') was then applied.

Data Analysis

Two subtopics on communication (D1.5.- "Generally understand what people say"; D1.6. - "Starting and maintaining a conversation"), two on mobility (D2.4. - "Getting out of your home"; D2.5. -

"Walking a long distance-1km") and two on community participation (D6.1. - "Problems in joining in community activities"; D6.8. "Doing things by yourself for relaxation or pleasure") domains from WHOODAS 2.0 were analysed. The number of patients that presented moderate (level 3 in the Likert scale) to extreme (level 5) difficulties in each subtopic at T0 (baseline) and/or T1 (follow-up) was collected. Descriptive statistics were calculated for each WHODAS subtopic and paired t-tests were used to assess differences between T0 to T1. A linear regression was used to explore the variance in community participation explained by mobility and communication difficulties.

Results

Thirty patients (70.47±11.14yrs; 25.46±3.32kg/m^2; 20 males; 17 right hemiparesis) were included.
At T0, 10% (n=3) of patients had moderate/extreme difficulties in the communication subtopic D1.5. "Generally understand what people say" and 27% (n=8) in D1.6. "Starting and maintaining a conversation"; at T1, 16.7% (n=5) of patients demonstrated this level of difficulties in D1.5 and 33% (n=10) in D1.6. Mean scores for communication subtopics showed a non significant decrease from T0 to T1 (p=0.48).
At T0, 70% of patients (n=21) had moderate/extreme difficulties in D2.4." Getting out of your home" and 83% (n=25) in D2.5."Walking a long distance"; at T1, 30% (n=9) of patients had the same level of difficulties in D2.4. and 67% (n=20) in D2.5. Mean mobility scores decreased significantly (p=0.01) over time.
At T0, 83% (n=25) of patients had moderate/extreme difficulties in D6.1."Doing things for yourself for relaxation or pleasure" and 83% (n=25) of patients in D6.8. "Problems in joining in community activities"; at T1, 53% (n=16) of patients had this level of difficulties in D6.1. and 77% (n=23) in D6.8.Only the score for D6.1."Doing things for yourself for relaxation or pleasure" decreased significantly from T0 to T1 (p=0.05).
Figure 1 presents the mean WHODAS scores for communication, mobility and community participation at T0 and T1.
Mobility subtopics alone (D2.4 and D2.5) were unable to explain variance in community participation at T0 (D6.1 subtopic (p=0.91); D6.8 subtopic (p=0.80)); a model that included D1.5 and D2.4 was able to explain 22% of variance in community participation (D6.1). However, at T1, 48% of variance was explained by D6.8 mobility-subtopic (p=0.02).

Discussion

More than 50% of patients in this study had moderate to severe difficulties in community participation (WHODAS ≥ 3) at 6 months post-stroke, corroborating the low success of community reintegration after stroke [5, 12]. Exploring the key factors for this low success has been a priority in stroke care because it seriously decreases patients' satisfaction with daily life [13].
Mobility scores improved significantly from T0 to T1. However, mobility alone did not explain community participation at an early stage post-stroke. Only when mobility and communication variables were combined was 22% of the variance in "Doing things for yourself for relaxation or pleasure" explained. Hence, as in previous research mobility alone was insufficient to explain the level of participation in community after stroke [13].
No significant change in mean communication scores was seen; surprisingly however, more people reported moderate to severe communication difficulties at 6 months suggesting that while many

patiens improved some also deteriorated over time. Regarding the importance of communication for community reintegration after a stroke [8], future research should confirm this trend and explore the possible reasons for this decline in communication recovery in early walkers post-stroke.
Based on these results, rehabilitation of mobility alone is unlikely to be sufficient for promoting community reintegration of early walkers post-stroke. Further research is needed, with a larger sample size, to confirm these results.

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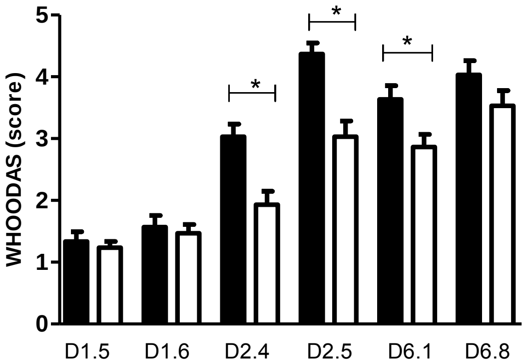
Figure 1. Mean WHOODAS II scores at T0 and T1 for communication, mobility and community participation subtopics of (0 "no difficulty" to 5 "extreme difficulty").



D1.5.- "Generally understand what people say"; D1.6. - "Starting and maintaining a conversation"; D2.4. - "Getting out of your home"; D2.5. - "Walking a long distance-1km"; D6.1. - "Doing things by yourself for relaxation or pleasure"; D6.8.- " Problems in joining in community activities";

The clinical practice of speech language therapists on neurocognitive disorders: a cross---sectional survey

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Introduction

Adults with acquired communication and swallowing disorders secondary to neurodegenerative conditions such as dementia can benefit from Speech and Language Therapy [1, 2]. However, there is limited information regarding the role of speech and language therapists (SLTs) in the treatment of adults suffering from dementia. Therefore, this study aimed to analyze the general clinical practice of SLTs with adults with dementia in Portugal.

Methods

A cross---sectional survey using a web---based questionnaire was conducted between June and September 2014. Based on the literature review, the questionnaire was designed specifically for this study and covered the following dimensions: sociodemographic information, professional experience, training in and intervention in dementia. The two main Portuguese associations of SLTs were contacted and asked permission to collaborate and spread the online questionnaire. According to the official Portuguese governmental data, there were 2048 SLTs in Portugal in 2014. Of these, 234 have participated, however 4 were excluded due to missing data. A final sample of 230 participants was obtained representing 11,2% of the total population. Descriptive statistical analysis were performed using the SPSS version 21 software.

Results

A total of 230 SLTs, with a mean age of 29,3±6,6 years old, have participated. Most of them (n=221; 96,1%) were female and have more than 3 years (n=139; 67,5%) of professional experience.

Thirty five percent (n=75) were currently working with the elderly population (≥ 65 years old), 29,1% with adults with speech and language disorders and 26,7% with swallowing disorders.

Most of the participants (n=120; 52,2%) had limited clinical practice with people with dementia, with only 14,3% (n=33) having treated more than 10 cases.

Thirty three percent (n=76) have responded that the referral to Speech and Language Therapy was made by a medical neurologist. Twenty two percent (n=51) of the cases were referred at the later stages of dementia. SLTs' clinical practice with people with dementia included mainly assessment (language and communication abilities --- 40% --- and swallowing --- 38,7%), intervention (language --- 37,4% --- and communication --- 40,4%), and counseling (37,4%).

The need of education and training in dementia was reported by almost all the SLTs (96,1%; n=221), most specifically in terms of assessment and intervention skills.

Discussion

The clinical practice of Portuguese SLTs in dementia is scarce and mostly limited to assessment of language, communication and swallowing. The absence of educational training on neurocognitive disorders can explain some of these findings. Thus, urgent consideration of current graduate and post---graduate programs must be addressed.

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An investigation of cognate generalisation across language in written aphasia treatment.

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Introduction

The representation of language in a bilingual's mind is highly debated, particularly with respect with the degree of selectivity and possible interactions between lexical representations. Cognate words, that share meaning and have close phonology/orthography across languages (e.g. the Welsh for cat is *cath*), are interesting cases in terms of informing this debate as they should be particularly susceptible to cross-linguistic interactions. There are several ways to investigate this special status of cognateness. Previous psycholinguistic research has found that pictures of cognates are named faster than non-cognates suggesting interactivity (Costa, Caramazza, & Sebastian-Galles, 2000). Another method of investigating the cognate facilitation effect is to conduct treatment within one language with a participant with aphasia and investigate any generalisation to the un-treated language. Despite increasing literature investigating bilingual aphasia, the majority of previous treatment of aphasia has dealt with the spoken modality. Treatment of dysgraphia has been limited. Previous cognate treatment research has found some evidence on generalisation across languages only for cognates. (e.g. Kohnert, 2004). To date there has only been a few across language written treatment studies but neither of these have investigated cognates (Roberts, 2011; Tainturier, Roberts, & Roberts, 2011). These written treatment studies have shown some evidence of generalisation across language although this has been limited to improving sublexical phoneme to grapheme conversions or specific lexical entries but without a specific focus on cognates. It remains unknown if written treatment of cognates will also result in a cognate facilitation effect. The purpose of this study is to investigate written picture naming treatment in bilingual patients with aphasia. Written picture naming of cognates and non-cognates will increase the likelihood of accesses the semantic system prior to spelling, and of co-activation of lexical entries in both languages and therefore of cross-linguistic transfer of treatment. We will also be investigating the role of homophony in cognate generalisation. It is unknown if cognates that have exactly the same phonology (e.g. both the English and Welsh pronunciation for the cognate *fig/ffig* is /fIg/) will benefit from generalisation the same as words that differ in phonology (e.g. the Welsh pronunciation of the cognate *cat/cath* is /kæθ/).

Methods

Procedure

Participants are 3 individuals with acquired dysgraphia and impaired written naming who were fully proficient in English and Welsh prior to injury. Specifically, they have impaired access to the orthographic output lexicon but relatively spared semantic processing and post-lexical processing. Written naming of treatment and control items will be assessed in three baseline sessions in each language. The baselines in English and Welsh will be conducted 1 week apart with different researchers. During the English baselines Welsh will never be spoken between the patient and the researcher and vice versa in the welsh baselines. Each same language baselines will be conducted 3 weeks apart to match the treatment period. A written naming treatment will be administered 3 times a week for 3 weeks and followed up with 2 post-treatment assessments also 3 weeks apart. If criterion has not been reached after these baselines treatment will continue until it is. During baselines and post-tests participants will be asked to write the name of a picture presented along with a short definition. Treatment will be a copy and recall treatment (e.g. Beeson, 1999)

Stimuli

Stimuli will consist of 8 sets of 20 items: a) treated English cognates that have exactly the same phonology (e.g. fig/ffig), b) treated English cognates with slightly differing phonology (e.g. cat/cath) c)
treated English non-cognates (e.g. cow), d) untreated English non-cognates (e.g. table) e) untreated Welsh translations of *a* (e.g. ffig) f) untreated Welsh translations of *b* (e.g. cath) g) untreated Welsh translations of *c* (e.g. bwch) h) un-treated welsh translations of *d* (e.g. bawd). Treatment will be conducted in English and only on sets a,b,c All items from each set will be presented in baselines and post-tests.

Results

Weighted Statistics (Howard, Best, & Nickels, 2015) will be used to investigate improvement from baselines to post-tests. This will establish whether there are effects of English treatment on the treated sets (a, b and c) and the untreated English and Welsh sets (d,e,f,g). If treatment improves written production of the treated sets, then we can attribute this to strengthening lexical representation and investigate generalisation to untreated sets. We will specifically be looking at whether cognates when treated in English improve in Welsh compared to non-cognates, but also if any inhibition occurs if cognates share exactly the same phonology (sets a and e) compared to if cognates have slightly differing phonology (sets c and f).

Discussion

The results of the study will be used to inform bilingual language models on interconnectivity between languages and the special status of cognates as well as inform us of cost and time effective aphasia therapy. The results of the study will also inform us on the role that phonology can play in generalisation of spelling.

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Dissociating the grammatical versus lexical status of pronouns in agrammatic connected discourse: A study of French and Danish corpora

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Introduction

Pronouns are traditionally defined as grammatical expressions. Therefore, pronoun processing is expected to be impaired in agrammatic speech production. Previous studies have shown that patients with agrammatism indeed produce fewer pronouns or use them with difficulties (Nespoulous, Dordain, Perron, Jarema & Chazal, 1990).Besides, it has been shown that anaphoric clitic object pronouns are particularly affected in agrammatism (Sanchez-Alonso, Martinez Ferreiro & Bastiaanse, 2011; Stavrakaki & Kouvava, 2003). One account of this phenomenon is based on the theory of "weak syntax", according to which the processing of clitics requires more resource load, as they highly depend on discourse linking (Avrutin, 2006), and therefore they are affected in agrammatic aphasia as a consequence of the resource limitation (Kolk, 2006).

A recent theory of the grammar-lexicon distinction suggests new insight to account for this phenomenon. According to Boye & Harder (2012), grammar consists of expressions (morphemes, words, constructions) that are conventionalized as discursively secondary. In contrast, lexical expressions have the potential of being discursively primary (i.e. carriers of the main point of an utterance). This theory is intended to account for the whole inventory of what are traditionally considered as grammatical expressions. In some cases, however, the theory suggests a classification, which differs from traditional ones. In particular, pronouns are traditionally classified only as grammatical *en bloc*, but Boye and Harder (2012) argue that some pronouns are lexical. Boye & Harder's argumentation is based on focus criteria: since grammatical expressions are conventionalized as discursively secondary, they cannot (outside metalinguistic contexts) be focalized, i.e. marked as the main point of the utterance. In contrast, lexical expressions being potentially discursively primary can be focalized and thus marked as primary in actual discourse.

Based on this, the present paper hypothesizes that pronouns that are grammatical according to Boye & Harder's focus criteria are more impaired in agrammatic production than lexical ones. This hypothesis is tested on both French and Danish. In French, for instance, the "weak", potentially proclitic personal pronouns (e.g. *je*, *tu*, *il*) qualify as grammatical, while the "strong" ones (e.g. *moi*, *toi*, *lui*) qualify as lexical. In Danish, grammatical pronouns include *man* 'one', *hver* 'each', while pronouns such as *jeg* 'I', *du* 'you', *han* 'he' qualify as lexical.

Methods

Data 1 (French pronouns): We used agrammatic and control speech data from Sahraoui (2009) and Sahraoui & Nespoulous (2012) were used. We performed further analyses on a subset of these data comprising connected discourse from two patients with agrammatism and two non-brain damaged matched control participants: spontaneous speech (autobiographical), narrative speech (fairytales *Cinderella* and *The Little Red Riding Hood*) and narrative/descriptive speech (unknown short story telling using pictures). .

The total number of pronouns was calculated using CLAN software (MacWhinney, 2003) commands. Each pronoun was classified as either grammatical or lexical, based on Boye & Harder's (2012) theory. For each participant, a grammatical pronoun index (grammatical pronouns divided by total number of pronouns) was calculated.

Data 2 (Danish pronouns): Spontaneous speech data from a native speaker of Danish with agrammatism covering 2-16 years post onset were used (Brink, 2014). The participant was a female, right-handed person, aged 36-50 years. She had 6 years of education after junior high school. The data consists partly of picture description (Cookie Theft Picture (Goodglass & Kaplan, 1983), Picnic picture (Kertesz, 1982), Frog, where are you? (Mayer, 1969)), and partly of autobiography/interviews dealing with the patient's story of illness. The picture description was compared with 19 non-brain damaged control speakers describing the *Cookie Theft Picture* (data from Jensen (2004), all participants had 6 years of education after junior high). The autobiography and the interviews were compared with interviews of 19 non-brain damaged controls (with 6 years of education after junior high school) from the Danish speech corpus *BySoc*.

The total number of pronouns was calculated, and each pronoun was classified as either grammatical or lexical according to Boye & Harder (2012).

Results

First considering the pronouns analysis in the French connected speech data, the grammatical pronoun index for patient 1 was 0.05 and for patient 2 was 0.42, while both control 1 and control 2 scored 0.81 on the same measurement. A Fisher's Exact Test was applied between each pair of participants and in both cases significant differences were revealed between grammatical and lexical pronoun production ($p<0.0001$).

As a second result considering the Danish agrammatic and control data, a Fisher's Exact Test applied between each pair of participants, and in all four cases showed significant differences between grammatical and lexical pronoun production (picture description: $p<0.0001$, interviews: $p<0.0001$).

Discussion

The results for both languages indicate that indeed patients with agrammatism produce fewer grammatical pronouns than their matched controls. These results support Boye and Harder's theory since pronouns categorized as grammatical according to the theory are more impaired than pronouns categorized as lexical. However, in order to further investigate this question, we first need to analyze a larger collection of data in other languages in combination with a test to elicit specifically grammatical and lexical pronouns. Also, we need to perform further qualitative analyses to see how many of these pronouns are produced within fixed expressions, such as French *il y a* 'there is/are'. Because of resource limitations, the patients with agrammatism may develop strategies for coping with additional load by relying more frequently on fixed expressions which require less processing demand.

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Writing personal narratives with aphasia

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Introduction

Aphasia is an acquired language disorder most often caused by stroke. It can entail difficulties finding words, formulating sentences and understanding spoken language. In most individuals with aphasia, the ability to read and write is affected. Given the increasing importance of reading and writing in modern society, both professionally and socially, this significantly reduces their quality of life and their participation in daily life. Most research into aphasia and writing has examined writing and spelling at word level only. Since writing is a complex activity involving many cognitive and linguistic abilities, there is a need for further research. To obtain a full picture of someone's writing ability, not only the final text but also the process leading up to it must be studied. Keystroke-logging software allows text production to be studied as it unfolds in real time. This makes it possible to analyse writing behaviour based on, for example, patterns of pauses and revisions. The present study is part of a larger study to investigate aphasia and the writing process with a focus on syntax in written narratives.

Methods

Participants

The participants were 18 adults (fourteen men and four women aged 53–92) with post-stroke aphasia, recruited through speech and language pathologists and local aphasia associations. Besides the presence of post-stroke aphasia, the criteria for inclusion were for the participants to be adults with Swedish as their first language. The exclusion criterion was a history of developmental reading and writing impairment or any other neurological disabilities that could affect participation in the study.

There was also a reference group whose participants did not suffer from stroke or aphasia but were otherwise selected using the same inclusion and exclusion criteria as the participants in the aphasia group.

Keystroke logging of narrative writing

The participants wrote their personal narratives on computers. Data were collected using the ScriptLog keystroke-logging software (Strömqvist & Karlsson, 2002). The topic for the narrative was, 'The last time I made someone happy', which was written on the screen as memory support. There was no time limit for the writing task. A researcher was present during the writing but did not in any way elicit or influence the writing or typing. The subsequent analyses were based on the following parameters: total time on task; active writing time as a percentage of total time on task; number of pauses within words; number of words in the final text; and number of spelling mistakes. The results were compared with the (preliminary) results of the reference group.

Ethical approval was obtained from the Ethics Committee for the Västra Götaland Region.

Results

The analysis of 18 participants' narratives showed that writing is a far more time-consuming task for the participants with aphasia than for those without.

The participants with aphasia produced significantly shorter narratives but spent significantly more time on the task, meaning that their percentage of active writing time was significantly lower than that of the reference group.

Further, the number of pauses within words was significantly higher for the participants with aphasia. Frequent pausing within words may indicate that a writer lacks automatised spelling ability.

The writers with aphasia made few revisions, or none at all, and they made mainly local revisions (where the cursor is not moved across several words, sentences or paragraphs). The participants in the reference group, by contrast, made more revisions, and these were more likely to be long-distance ones.

Finally, the narratives produced by the participants with aphasia contained few spelling mistakes.

Figure 1 shows an example of raw data (in a linear format) from one participant's personal narrative. What this participant wrote is, '*Jag gjorde någon glad när jag kom till arbetet. Arbets kam*' (English*: 'I made someone happy when I came to work. My co-work*'). The total time on task was 13 minutes and 27 seconds. What is shown here is an extract representing the production of the first few words: '*Jag gjorde någon glad*' ('*I made someone happy*').
Insert figure 1 here.

Discussion

The results illustrate the difficulties faced by people with aphasia when writing narratives. To them, this is a time-consuming and effortful task. The narratives written by the participants with aphasia are conspicuously short compared with those of the reference group.

The finding that the narratives produced by the people with aphasia generally have good spelling further emphasises the importance of examining the entire writing process rather than just the final text when it comes to people with aphasia. It should be added that a dictation task (which has been used in earlier research) does not seem to reveal the difficulties with functional writing that are apparent in a narrative task.

Many of the participants commented themselves that spelling took so much effort that they tended to 'lose track' and found it difficult to complete the narrative task. Further studies will be carried out to investigate whether, and if so how, the text processes behind such narratives change when writers with aphasia reduce the amount of cognitive effort devoted to spelling by using a computer-based writing aid such as a spellchecker. This should be reflected to some extent in the duration and distribution of pauses.

In the main study, of which the present one is a part, results from tests regarding participants' aphasia type, reading and writing ability, typing speed, grammatical ability, phonological ability and working-memory status will be related to the writing-process data from their personal narratives. An additional picture-elicited narrative was also collected, and both narratives were also told orally for comparison with the written narratives.

In summary, there is a need to further investigate the complex interaction between the cognitive and linguistic processes that are involved in narrative writing by people with aphasia.

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{10295}Jag·{20925}gl[BACK]{3345}l{13848}[LEFT][LEFT]{5225}gö{8718}[RIGHT][RIGHT][BACK][BACK][BACK]g[BACK]{2501}j{2
598

}o{7110}r{12051}[LEFT][LEFT][LEFT][LEFT]{13238}[RETURN][BACK][RETURN][BACK][BACK]·[RIGHT][RIGHT][RIGHT][RIGHT]{2
664}

d{2081}r[BACK]{2917}e{7983}[LEFT][LEFT][LEFT][LEFT][LEFT][LEFT]{7139}s{3243}[BACK]{2466}[RIGHT][RIGHT][RIGHT][RIGH
T][

RIGHT][RIGHT]·{5680}n{8941}ä{2194}[BACK]åggo[BACK][BACK]u[BACK]{5814}o{3366}n·{23324}gl{3447}a{2885}d·{12726}

Figure 1. The numbers indicate pause durations in milliseconds. The red text represents the letter keys pressed. BACK indicates the deletion of one or several letters or spaces. LEFT and RIGHT refer to cursor movements. RETURN indicates a move of the cursor to a new line.

Patterns of auditory comprehension impairments in aphasia

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Introduction

Factors affecting speech production in aphasia (e.g., psycholinguistic status or grammatical class) are well researched. Conversely, there are only limited investigations exploring patterns of auditory comprehension impairments and the influence of psycholinguistic variables on comprehension. Single word comprehension experiments with acute and chronic aphasia participants indicate that errors of both a phonological (e.g., selecting/confirming a cape is a "cake") and semantic (e.g., selecting/confirming a dolphin is a "shark") nature occur, with semantic errors occurring more frequently (Rogalsky et al., 2008; Baker, Blumstein & Goodglass, 1981). These results are consistent with the neurobiological organization of the comprehension network which is distributed over peri- and extra-sylvian regions but with the phonological input network being somewhat more circumscribed than the semantic network (Vigneau et al., 2006). Similarly, psycholinguistic features thought to interact with the phonological and semantic systems, such as word length and imageability, have been observed to impact word comprehension in fluent aphasia, with longer and higher imageability items being easier to comprehend (Franklin, 1989; Howard & Franklin, 1988). This study extends these previous findings by exploring patterns of spoken and written single word comprehension during word-picture matching (WPM) in individuals with chronic fluent and non-fluent aphasia. Target items were manipulated by a semantic property—typicality—and a phonological property—syllable length. We investigated the relationship between group (fluent, non-fluent), error type (phonological, semantic), and the psycholinguistic variable(s).

Methods

Participants

Eleven individuals with non-fluent aphasia and eleven individuals with fluent aphasia were recruited from the NHS and panels of research volunteers in the north and south of England. All participants were in the chronic stage post-stroke (>6 months post onset).

Data Collection

All participants were assessed on a battery of assessments including a spoken word-picture naming (sWPM) and written word-picture matching (wWPM) test. These tests consisted of 48 items grouped into high and low typicality and "high" (2+) and "low" (single) syllable length meaning each test consisted of 12 items each for HTyp-HSyl, HTyp-LSyl, LTyp-HSyl, and LTyp-LSyl. Typicality ratings were obtained from Morrow and Duffy (2005). High typicality items were considered to be those with a rating of 5.5 and above (total typicality range 2.78 – 6.98). There were no frequency, imageability or age of acquisition differences between item sets.

On each trial the word was presented with six pictures: a target, semantic foil, phonological foil, a foil semantically related to the phonological foil (mixed) and two unrelated foils which were semantically related to each other.

Statistical Analysis

In order to investigate the interaction between error type, group, and the psycholinguistic variables, we performed preliminary analyses in the form of two (one for each task version) 2x2x2x2 ANOVAs with group (fluent, non-fluent) as between group variables, and syllable length (high, low), typicality (high, low), and error type (semantic, phonological) as within group variables.

Results

All participants produced at least one error on each of the sWPM or wWPM tasks. The overall proportion of unrelated and mixed foils selected was low (4.17% of responses) so these results were excluded from further analysis. This left an overall error rate of 16.86% and 10.8% for the fluent and non-fluent aphasia groups respectively. The fluent aphasia group produced a similar number of phonological and semantic errors on both tasks (8.81% vs. 8.05% errors), whereas the non-fluent group produced more semantic than phonological errors (7.39% vs. 3.41% errors).

ANOVA results revealed a main effect of syllable length for the wWPM task ($F(1,20) = 4.42$, $p = .048$, $\eta^2 = .181$) with a higher number of errors on low syllable length items. There were also significant three-way interactions for typicality x syllable length x error type for both the sWPM ($F(1,20) = 7.44$, $p = .013$, $\eta^2 = .27$) and wWPM ($F(1,20) = 6.09$, $p = .023$, $\eta^2 = .23$). This interaction was generated by a greater number of phonological errors being produced in the conditions of low syllable length and low typicality. When syllable length was high, a greater number of semantic errors were produced in the low typicality condition (see Figure 1).

Additional analyses will investigate the relationship between error pattern and lesion profile.

Discussion

The fluent and non-fluent groups produced a similar number of semantic errors in both sWPM and wWPM tasks; however, a numerically greater proportion of phonological errors was observed in the fluent group. These results are consistent with the presumed distinction in lesion location between the groups. Fluent participants are predicted to have greater lesion involvement in posterior brain regions, potentially including both phonological input regions in the superior temporal lobe and semantic regions in middle and inferior temporal, inferior parietal and temporo-occipital regions. Non-fluent participants are predicted to have lesions with a more frontal distribution, affecting frontal semantic areas but more often sparing posterior phonological input areas. Future lesion analysis will investigate the relationship between lesion and error pattern in this group of participants.

At the trial level both typicality and syllable length had an impact on accuracy and error type. Items with low syllable length produced a greater number of errors overall on the wWPM task and produced disproportionately more phonological errors when typicality was low. These results replicate those of Howard and Franklin (1988) and indicates that more phonological information and a reduced number of phonological competitors is beneficial for comprehension. Our results indicate that when both item syllable length and typicality is low phonological errors are more likely to be produced. One interpretation of this is that phonological processing impairments are particularly vulnerable in conditions of high input competition and low semantic top-down support. Conversely, as syllable length increases, phonological errors become less likely as competition reduces and more information becomes available. Comprehension errors of high syllable length items are more likely to be semantic, particularly in low typicality conditions where there is greater competition within the semantic system.

Overall these results emphasise the interactivity of the phonological and semantic system during single word comprehension tests and indicate that error type can be manipulated by providing more or less support to the semantic and phonological systems.

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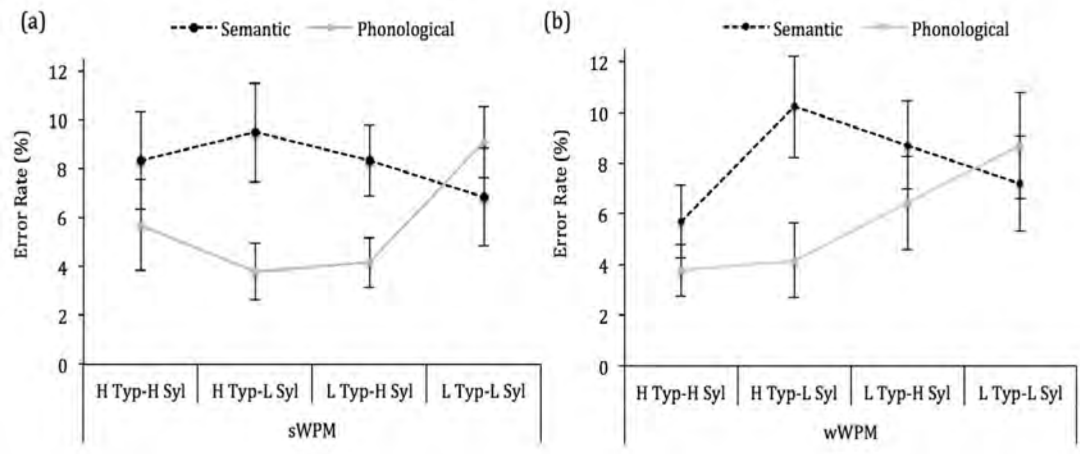

Figure 1. Percentage of semantic and phonological errors for (a) sWPM and (b) wWPM tasks across typicality (Typ) and syllable length (Syl) variables. Error bars represent standard error.

A new case of psychogenic Foreign Accent Syndrome

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Introduction

Foreign Accent Syndrome (FAS) is a motor speech output disorder that causes patients to speak their native language with an accent that is perceived as 'foreign' by listeners due to several segmental (e.g. substitutions and omissions of phonemes) and suprasegmental alterations (e.g. slow speech rate, wrongfully placed word accent) affecting speech. Three different subtypes of FAS have been described: (i) a neurogenic variant (including developmental cases), (ii) a psychogenic variant and (iii) a 'mixed' type [1]. Here we present a patient with FAS, agrammatism and stuttering. The hypothesis of a psychogenic etiology is argued here.

Methods

Medical history

The patient is a 40-year-old, right-handed, polyglot Belgian woman (L1: French, L2: Dutch, L3: English) with 13 years of education. She had suffered from a severe addiction to multiple opiates and psychoactive substances for a period of twelve years (1988-2001). In February 2010, the patient was hospitalized with acute speech problems: telegraphic speech, stuttering and an accent change (Eastern European-like accent), especially when speaking French. Between 2010 and 2012, she was repeatedly hospitalized with diffuse complaints concerning speech, language, gait and balance, nuchal pains, arthralgia, sudden immobility of lower limbs, as well as psychiatric problems, including behavioral regression. Neurological, neuroradiological (MRI, CT), neurophysiological (EEG) and laboratory exams were always normal, and no neurological explanation could be provided for the symptomatology. In 2012, the foreign accent was suddenly lost after 'general anesthesia for appendectomy'.

Neuropsychological, psychodiagnostic testing (2010) and neurolinguistic testing (2010-2012)

Neurocognitive work-up in 2010 consisted of the Wechsler Memory Scale (verbal span, logical memory and word pairs) [2], the Raven Standard Progressive Matrices [3], Corsi Block-Tapping Task [4], Benton Drawings [5], Rey Complex Figure [6], Violon Beehive Test [7], 15 words of Rey [8], the Beauregard Test of Verbal Automatisms [9], and the similarities subtest of the Wechsler Adult

Intelligence Scale (WAIS) [10]. Constructional praxis was tested via the Rey Complex Figure (copying) [6]. Attention, concentration, mental flexibility and executive functioning were tested via the coding subtest of the WAIS, written and mental calculation and the Trail Making Task [11]. Psychodiagnostic testing was protracted via a structured interview, the Rorschach Test [12] and the Object Relations Technique [13]. Neurolinguistic testing consisted of the Boston Diagnostic Aphasia Examination (BDAE – French version) [14], the Bachy-36 items test [15], and Token Test [16].

Segmental and suprasegmental alterations

Segmental and suprasegmental alterations affecting the patient's speech were investigated, as it was esteemed that she spoke with a foreign accent. To this purpose, we analyzed five minutes of spontaneous speech.

Results

Neuropsychology and psychodiagnostics

The patient had an average pre-morbid IQ (92) [9], which corresponded to her scores on the RPM (91) [3]. Defective scores were found for memory (Corsi Block-Tapping Task: 4, mean: 5.11, SD: +/- 1.01), delayed memory (Benton Drawings; recall: 3/10), learning capacities – especially when verbally mediated (15 words of Rey; recall: 42; pc. <25) – and praxis (Rey Complex Figure: 14, pc. <10). Psychodiagnostic assessment revealed a passive self-reflection and infantile/juvenile tendencies in thought. There was no sign of psychological dissociation. The Rorschach test results indicated the patient had regressed to an 'archaic' stadium (in 2011, she started using a pacifier, wore diapers, and took cuddly toys to assessments).

Neurolinguistic test results

In 2010, the patient obtained normal results on comprehension tasks (except for Token Test: 27/36). Expressive deficits were retained: the verbal and non-verbal agility subtests were abnormal. For repetition, the patient scored below cut-off on *all* tasks administered (see Table 1). The patient had difficulties with the anlaut of words in word and sentence repetition and displayed a form of synkinesia (pinching eyes when initiating a word). Agrammatism was especially apparent during sentence repetition and reading. An Eastern-European-like accent was discerned, and the patient stuttered throughout testing. She was asked to give a written description of the Cookie Theft picture (BDAE), but the text contained several omissions and substitutions (of especially articles). In 2011, the foreign accent, stuttering and articulation problems had diminished and fluency increased. Agrammatism remained present. The patient underperformed on the Token Test (27/36), and verbal agility task (6/14). Phrase repetition was low for items with low probability (2/8). Errors consisted of both omissions and substitutions. The patient obtained low scores on the Bachy Naming task (31/36). Score for verbal fluency (1 min.) was low in comparison to 2010: <pc. 10 in 2011 (2010: 18; pc. 25). The patient performed worse on word reading than in 2010 (omissions), but better on phrase reading. Phrase reading was marked by (literal) omissions, vowel and consonant substitutions. The written description of the Cookie Theft picture was agrammatic. By August 2012, the patient had lost the accent, stuttering and agrammatism in spontaneous speech. The patient performed worse on the Bachy 36-items (29/36), verbal fluency, and phrases/texts comprehension task (6/10) than previous years. Written description of the Cookie Theft picture was still severely agrammatic.

Segmental and suprasegmental characteristics

In 2010, the patient pronounced the French uvular /R/ in the word '*faire'* as /feəʳ/, on other occasions she used excessive trill (*parle*). Other segmental errors consisted of additions of [r] (devoir→devroir) and schwa (plus→pelus) (epenthesis). The patient on one occasion used a voiced velar fricative instead of the voiced velar plosive /g/ (*g*ramme). Moreover, she produced ejectives in for instance '*comme'* '*breakdance'*, '*bégayer'*. Speech rate for both the 2010 and 2011 sample were much too slow. She initially (2010) produced 58.7 words per minute (wpm). In 2011, speech rate rose to 81.5 wpm, whereas in 2012 it amounted to 151.3 wpm (normal French speech rate: 130–220 wpm [17]). Word accent was sometimes wrongfully placed (e.g. *'beau*coup'). Melody of speech was equally altered in 2010, and there were sudden excursions of speech intensity.

Discussion and conclusion

The accent change in current patient is likely consistent with a diagnosis of psychogenic FAS. First, the medical history included a complex set of diffuse symptoms, inexplicable from a neurological standpoint. Second, the patient had a psychiatric history. Psychodiagnostic indicated a regression of behavior, which was established soon thereafter by the medical staff. Moreover, the neurolinguistic profile fluctuated substantially over the period of three years. Finally, there was incongruence in the resolution of the accompanying agrammatism and the sudden remission of the FAS after anesthesia for appendectomy. We argue that the amalgam of the aforementioned arguments suffices to state that our patient developed FAS on a psychogenic basis.

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Table 1. Overview of the neurolinguistic test results obtained between 2010 and 2012

TEST	SCORES 2010	SCORES 2011	SCORES 2012	CUTT-OFF
Oral comprehension				
Word discrimination BDAE (/72)	70	68.5	71	67
Body part identification BDAE (/20)	18	18	18	18
Commands BDAE (/15)	14	15	15	13
Token Test (/36)	27	27	31	29
Oral expression				
Non verbal agility BDAE (/12)	6	NA	7	9
Verbal agility BDAE (/14)	6	6	11	11
Automatized sequences BDAE (/8)	8	6	NA	6
Repetition BDAE				
- Words (/20)	15	18	20	18
- High probability repetition (/8)	3	3	8	6
- Low probability repetition (/8)	2	2	8	6
Responsive naming BDAE (/30)	29	30	30	27
Naming Bachy 36 items (/36)	27	31	29	35
Body part naming BDAE (/30)	30	27	30	24
Verbal Fluency (animals) (1 min.)	18 (pct. 25)	15 (<pct. 10)	11(<pct. 10)	16.5 (x= 21.9)*
(2 min.)	26	22	17	18.7 (x= 30.14)*
Reading				
Word reading BDAE (/30)	27	24	30	30
Sentence reading BDAE (/10)	1	4	10	8
Symbol and Word Discrimination BDAE (/10)	NA	8	NA	10
Word recognition BDAE (/8)	NA	8	NA	6
Comprehension of oral spelling BDAE (/8)	NA	8	NA	6
Word/picture matching BDAE (/10)	10	NA	NA	10
Reading sentences and paragraphs BDAE (/10)	9	8	6	7
Writing				
Writing Mechanics BDAE (/5)	5	5	NA	5
Serial writing BDAE (/47)	NA	46	NA	47
Primer-level dictation BDAE (/15)	NA	15	15	15
Spelling to dictation BDAE (/10)	8	8	8	6
Sentences to dictation BDAE (/12)	NA	NA	NA	10
Written confrontation naming BDAE (/10)	8	10	NA	7
Narrative writing BDAE (/5)	3	3	3	4
BELOW CUT-OFF:	10/23 (=**43,5%**)	10/26 (=**38,5%**)	6/21 (=**28,6%**)	

Light verbs revisited: A comparative perspective from impaired language development and dementia

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Introduction

Light verbs (LV), like *get*, *make*, *do*, are considered to be verbs with full morphological paradigm but with underspecified semantic representation. These verbs are also very frequent and constitute the core semantic primitives of lexical verbs. Their use has been recently the focus of studies on language impairment. Studies on developmental disorders, in particular Specific Language Impairment (SLI), as well as studies on acquired disorders, such as types of primary progressive aphasia (PPA), highlight the overuse of such verbs by individuals with either SLI or types of PPA (Watkins, Rice & Molz, 1993; Franco, Zampieri, & Meneghello, 2012). Findings from Greek speaking individuals with SLI and Semantic Dementia (SD), a type of PPA confirm that the production of LV or LV constructions constitute a hallmark for the lexicon of both populations (Stavrakaki, 2000; Koukoulioti, 2013; Koukoulioti, Stavrakaki, Konstantinopoulou & Ioannidis, 2015).

Building on our previous studies on Greek speaking population with language impairment (Stavrakaki, 2000; Koukoulioti et al., 2015), this study focuses on the comparison of the LV constructions produced by children with SLI and individuals with SD. By means of this comparison, we aim to find out why persons of these different populations resort to the use of LV. We pay special attention to the properties of the deviant (non-adult) uses of LVs and argue that LV production in these individuals is caused by impairment in a different level of the verbal production.

Methods

Participants

The participants with SLI were 4 children (mean age: 6.1, 2 females) diagnosed with SLI on the basis of their performance in verbal and non-verbal tests. The SD group consisted of 7 individuals (mean age: 68.1, 6 females) diagnosed with SD by two experienced neurologists on the basis of neuropsychological data and clinical examination. The control group of the SLI participants were 12 age-matched typically developing children, whereas the control group for the SD participants consisted of 7 age- and education matched healthy adults.

Procedures

The SLI group performed a picture description task with 39 items, whereas the SD group performed a video description task with 18 items. In both tasks participants had to describe the depicted action by answering the question “What is happening here?”.

Results

Quantitative analysis

To a large extent (12.8%) the participants with SLI produced a LV or LV construction instead of the main verb in their final response. The total number of verbs produced (i.e., the number of verbs in the several attempts to name the target verb) was analyzed. This analysis indicated that out of the total number of verbs produced by children with SLI 40.5% were LV (and 59.5% lexical verbs). 47% out of the total LV responses were deviant uses of *kano* (=do/make), not attested in adult language, contrary to the age matched controls whose responses consisted mainly of lexical verbs (79.6%) and a small proportion of LV (20.4%). 20% of the SD responses for agentive verbs consisted of LV/LV constructions, with 35% of the LV responses being deviant uses of *kano*.

Qualitative analysis

Both groups produced the verb *kano* in cases of agentive target verbs and in a non-adult fashion. Further qualitative analysis indicated that two non-adult fashion categories of LV constructions have been identified in the SLI population:

(i) *Kano* precedes an agentive predicate:

Kanune.. *kanune*.. petane (Target response: ta pulia petane)
Do-3rd plural do-3rd plural fly-3rd plural (Target: the birds are flying)

(ii) *Kano* substitutes for an agentive predicate. The following main subcategories were classified into this category:

a. *Kano* fully replaces an agentive predicate

Ekane micky maous (Target response: o Donalt trakare)
did-3rd sign. mickey mouse (Target response: Donalt *crashed*)

b. *Kano* + a complement resulting in neologism instead of a fully specified verb

Kani ta luludia (Target response: Potizi ta luludia)
Do-3rd sing. the-flowers-acc (Target response: He is watering the flowers)

c. Kano + a non-specific adverb

Kani *etsi* tin kuverta (Target response: Tinazi tin kuverta)
Do-3rd-sing like that the-blanket-acc (Target response: She is shaking the blanket)

While in the SLI data both response types were found, in the SD data only response type (ii) was attested.

Discussion

Summing up, we observe similarities between the two groups concerning the use of LV and in particular of *kano (=do/make)*. Both groups show difficulties in verb production and resort to a great extent to LV which are semantically underspecified to compensate with their difficulties. In addition, LV constructions that substitute for lexical verbs (error type ii) are non-adult but still they obey the rules for LV constructions formation in Greek (Stavrakaki, 1999, 2000). This means that both populations do possess the unimpaired adult rules of the formation of LV constructions.

However, a significant between-group difference was found. In the responses of participants with SLI, the LV *kano* precedes the agentive predicate and seems to support the correct verb retrieval (error type i). This pattern indicates impairment in the verb retrieval processes and strikingly does not appear at all in the SD data. Rather SD patients used *kano* exclusively substituting for agentive verbs. This pattern suggests that SD patients still possess the semantic frame of the verbs, whereas the idiosyncratic meaning is decayed, pointing, thus, to a selective impairment in semantic representations.

Concluding, while both individuals with SLI and SD resort to the use of LV to cope with their difficulties in verb production, only for the former there is evidence that this strategy indicates a pure retrieval problem. This evinces for the potentiality of lexical development in SLI in contrast to the semantic impairment in the SD.

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A new Russian Aphasia Test: development and standardization of single-word comprehension subtests

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Introduction

There is great need for modern quantitative neuropsychological tests for language assessment in Russian, that would incorporate both neuropsychological and psychometric traditions, be based on contemporary models of language processing and allow to specify the type of linguistic deficits in individuals with aphasia. In response to these clinical and research needs a novel standardized aphasia test – the Russian Aphasia Test (RAT) – is being developed. In development of this test, we take into account the assessment traditions of the Russian neuropsychological school, materials and structure of existing standardized tests for assessment of language in aphasia (CAT, BDAE, PALPA, Discourse comprehension test), the latest linguistics and psycholinguistics achievements, as well as the structural and phonetic specifics of the Russian language. The RAT will be composed of the subtests targeting auditory comprehension (discrimination of phonemes, lexical decision (discrimination of words from pseudowords), single-word to picture matching (for nouns and verbs), comprehension of various syntactic constructions, comprehension of oral discourse) and oral production (repetition of words and pseudo-words, confrontation naming of nouns and verbs, constructing and completing sentences, picture-elicited production of oral discourse, repetition and completion of automated and desautomated series). Here we provide data on standardization of the subtests for comprehension of single words: verbs and nouns.

Methods

Participants

Thirty healthy individuals without neurological and psychiatric disorders (mean age: 44,2; 13 men) and forty five individuals with aphasia (mean age: 45,4; 27 men; 25 non-fluent and 20 fluent) completed the subtest for verb comprehension. Thirty healthy individuals (mean age: 47,5; 16 men) and thirty individuals with aphasia (mean age: 51,6; 18 men; 12 non-fluent and 18 fluent) completed the subtest for noun comprehension. 30 individuals with aphasia performed both tasks. All the participants were right-handed native speakers of Russian.

Tasks

For the single-word comprehension subtests participants were required to listen to a spoken word and match it to an appropriate picture in an array of four pictures that contained a target, a semantic distractor, a phonological distractor, and an irrelevant distractor.

Stimulus materials for the verb comprehension subtest were taken from the Russian database "Verb and action" (Akinina et al., 2014 http://neuroling.ru/ru/details.htm; http://neuroling.ru/ru/db.htm) containing 375 verbs and corresponding pictures of actions and information on the following psycholinguistic parameters: name agreement (NA), conceptual familiarity, subjective visual complexity, age of acquisition, imageability, image agreement (IA), objective visual complexity, frequency, length, argument structure, instrumentality, name relation. 197 verbs were selected for this subtest according to NA (from 70% or higher) and IA (from 3.5 and higher) criteria. Materials for the noun comprehension subtest were taken from the Russian database "Noun and object" (http://www.nounobject.ru) containing 416 nouns and corresponding object pictures and similar to the verbs psycholinguistic parameters. From this database 217 nouns were selected according to NA (80% and up) and IA (>4) criteria.
Each visual array included pictorial representations of the target word, phonological distractor differing from the target word by 1-2 phonemes (possible alternations included substitution of one sound for another, adding phonemes without removal, substitution of two phonemes for two in one place, substitution one phoneme for two in one place), semantic distractor (actions and objects close in meaning but not synonymous to the target words) and one irrelevant distractor (not associated with the target word, but semantically related to the phonological distractor). For example: target stimulus - zebra (in English - zebra); distractors: phonological - kobra (cobra); semantic - zhiraf (giraffe); irrelevant - yasheritsa (lizard). The difference in frequency between the target word and the distractors did not exceed 100 ipm. No common nominations for distractors and target words were allowed (i.e. all stimulus pictures which could be named both by the target and distractor words were excluded). 66 sets for verbs and 67 sets for nouns that matched these criteria were formed.

Based on these items two presentations were created, each including instructions with training items and an experimental set. The location of target images on the screen was pseudorandomized. The order of presentation of verbs and nouns subtests was alternated across participants.

Results

Non-parametric Mann-Whitney test was used for comparison between groups. The aphasia and the control group did not differ significantly in age. Healthy participants performed significantly better than individuals with aphasia in the verb and noun comprehension subtests. Both individuals with and without aphasia performed significantly better on noun comprehension compared to verb comprehension. No significant differences between individuals with fluent and non-fluent aphasia were found.

Discussion

Significant differences between individuals with and without aphasia in performing both tasks, allow to conclude that the selected sets of stimuli for both subtests identify deficits in single word comprehension of actions and objects. The trials in which mistakes were made in the group of healthy participants are not valid for the examination of individuals with aphasia. The trials in which participants with aphasia made mistakes, in contrast, demonstrate sensitivity to difficulties in the comprehension of verbs and nouns and help identify semantic and phonological disorders. Both groups performed better on comprehension of nouns than of verbs. Probably this is a consequence of a more complex structure of verbs and subsequently overall lower naming and image agreement.

Based on the current results final sets of stimuli were selected. The trials in which the individuals with aphasia did not make any mistakes and those where more than two healthy participants made mistakes were excluded from the final set. This resulted in the final set of 30 diagnostic trails for each subtest that will be included in the final version of the RAT.

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Aphasic grammar: Why are some parts (un)impaired?

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Introduction

Variation across impaired cognitive phenotypes can be manifested in various forms. The first aim of this work is to delimit variation in aphasic grammar by identifying the possible loci of impairment. It will be shown that certain components of the language faculty (FL) are particularly susceptible to impairment in aphasia, while other components are consistently preserved across aphasic populations. Conducting a meta-analysis, Drai & Grodzinsky (2006) argued that variability in aphasia exists, but so do regularities in the performance of Broca's aphasics. It is the aim of this work to identify these regularities in a specific language: Greek. The second aim is to offer an explanation as to why certain components of FL are more preserved than others in aphasic grammar.

Methods

The loci of impairment sketched out in this paper have been identified on the basis of an extensive literature review of the comprehension and performance abilities of Greek-speaking aphasics. The search was not constrained by any time frame. A total of 14 studies are reviewed (see table 1). All participants are monolingual speakers of Greek. Table 1 indicates the administered tasks. Different target structures are examined in these tasks including aspect, tense, agreement, mood, negation, wh-questions and clitics.

Results

After reviewing the findings of studies in Greek aphasia obtained through a wide variety of tasks, the picture of variation that emerges is that the nature of the impairment is either extragrammatical —boiling down to retrieval issues of morphological markers— or related to the semantics-pragmatics interface. Discourse-related markers that make the processing more 'costly' are more susceptible to impairment. Syntax appears to be unimpaired and access to syntactic operations such as Merge and Agree remains intact. In this context, structural accounts of the nature of the attested linguistic impairment in aphasia such as the Tree-Pruning Hypothesis (TPH; Friedmann & Grodzinsky 1997) cannot explain the attested variation. TPH assumes a truncation model according to which an element is more susceptible to impairment depending on its position in the syntactic structure. Nodes lower than the pruning site remain intact, whereas patients cannot construct syntactic trees higher than the pruning site. However, Nanousi et al. (2006) found that, in Greek, aspect and tense were more impaired than agreement. Since agreement is located higher than aspect and tense in the syntactic clause in Greek, Nanousi et al. (2006) took their findings to not support the predictions of the TPH.

The conclusion of Nanousi et al. (2006) that findings coming from Greek-speaking aphasics do not support structural/syntactic accounts of the deficit, such as the TPH, is in agreement with what has been pointed out in Plakouda (2001) and Stavrakaki & Kouvava (2003). Plakouda (2001) found that aspect was the most problematic category, whereas tense and agreement were relatively intact. The percentage of correct responses was 60% for aspect, 95% for tense and 87% for agreement (Varlokosta et al. 2006). Similarly, Stavrakaki & Kouvava (2003) argued that high degree of grammatical sensitivity was found even for those structures associated with the highest projections of the syntactic tree, such as CP, and that are hardly found in spontaneous speech. The attested difficulties "were attributed to impaired access to grammatical representations, rather than to impaired grammatical representations" (Stavrakaki & Kouvava 2003).

Varlokosta et al. (2006) examined patients with different types of aphasia (including Broca's and Wernicke's aphasia) and agreed with the previous studies in finding a dissociation between impaired agreement, on the one hand, and more preserved tense and/or aspect, on the other hand. Once more, these findings did not support a structural account of the deficit along the lines of TPH. The findings reported in Fyndanis (2009) and Fyndanis et al. (2012) largely agree with this pattern. In both studies, it was found that aspect is the most problematic category, followed by tense and then by agreement which is the least impaired of the three categories. It has been argued that the increased processing demands of tense and aspect render them more vulnerable than agreement, which bears an uninterpretable feature and relies on a grammatical operation (Fyndanis et al. 2012 in line with Nanousi et al. 2006). In this context, one cannot argue in favor of a syntactic deficit in Greek aphasia.

Discussion

Reflecting on the picture that emerges once all studies of table 1 are comparatively reviewed, it can be argued that the best hypotheses to explain the nature of the attested deficit in aphasic grammar are Avrutin's (2000) Discourse-Linking Hypothesis and Dickey's (2008) Distributed Morphology Account. The range of results presented in the studies of table 1 can be explained by the predictions of these two accounts. The reason that core syntactic operations are preserved across individuals has to do with the fact that certain mechanisms are more novel than others. As Benítez-Burraco & Boeckx (2014) notice, some cognitive processes are more vulnerable than others to damage because they rely on less resilient neural networks and this entails less robust compensatory mechanisms. In this context, the argument put forth on the basis of the reviewed studies is that the observation that syntax is consistently preserved in Greek aphasics is neither an accident, nor it is restricted to Greek-speaking populations. Future work will likely support the same conclusion for findings obtained for other languages and different pathologies.

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Study	Task(s)
Kehayia et al. (1990)	repetition, comprehension, production
Tsapkini et al. (2001)	repetition, comprehension, production, reading
Plakouda (2001)	sentence completion
Stavrakaki & Kouvava (2003)	spontaneous speech, picture description, acceptability judgment
Varlokosta et al. (2006)	interview, picture description, acceptability judgment, sentence completion
Nanousi et al. (2006)	production, acceptability judgment, sentence and word repetition
Kambanaros (2007)	picture-naming
Fyndanis (2009)	sentence completion, acceptability judgment
Fyndanis et al. (2010)	elicitation, picture-pointing
Koukoulioti (2010)	elicitation
Nerantzini et al. (2010)	production, acceptability judgment
Fyndanis et al. (2012)	sentence completion
Fyndanis et al. (2013)	sentence-picture matching, acceptability judgment, picture-pointing
Nerantzini et al. (2014)	elicitation, picture-pointing

Table 1: List of reviewed studies

Analysis of Pronominal Word Comprehension

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Introduction

The purpose of this experimental study was to investigate pronoun and reflexive comprehension at the single-word level in people with aphasia. The evaluation of these closed-class structures enabled a closer look at the isolated syntactic processing of pronoun feature markers (e.g. number, gender, person, case), and the consideration of a feasible selective syntactic impairment as an underlying factor of their deficit. While pronoun structures are not naturally encountered on their own—without contextual support—this experiment defines a way to overcome that challenge in order to evaluate what underlying representational remains intact in the aphasic linguistic system. In this experiment, we hypothesize that (i) people with aphasia have higher comprehension processing for number and gender feature markers, (ii) lower comprehension processing for person and case feature markers, and (iii) will perform equally in pronoun word triads and in reflexive word triads. These hypotheses were based on the theoretical position that number and gender feature markers behave more semantically than its person and case correlates, which are more syntactic. The research questions presented were investigated using a function-word triad task, which was designed to evaluate the syntactic relationship of pronoun forms in terms of their feature marking. Furthermore, the experiment results suggest the integral accessibility of grammatical representation pathways necessary for successful pronominal comprehension. A study group consisting of 20 people with aphasia was used in this experiment. The results were compared to a control group consisting of 10 healthy adults.

Methods

Participants

A study group of 20 people with aphasia (aged 50 to 80 years) participated in this single-word comprehension experiment. All people with aphasia were administered the Boston Diagnostic Aphasia Examination Short Form (3rd Edition) prior to the experiment stimuli; had a minimum of 8 months post onset of injury (considered stable); had English as their native language of communication; and, had provided informed voluntary consent. Moreover, people with aphasia did not have an acquired language disorder not due to aphasia; nor have any other neurologic or cognitive conditions likely to affect language or speech (e.g. Parkinson's Disease), or any previous history of language disorder prior to the onset of aphasia. A control group of 10 healthy adult speakers was also used, and matched appropriately to the study group.

Materials and method

The materials used for this experiment consisted of 77 noun and pronoun word triads. The syntactic information measured on the pronoun word triads consisted of number, person, and case feature marking. All word triads were assigned to 10 different categorical groups. Group1 (noun-to-noun) and Group2 (noun-to-pronoun) were designed with gender feature marking, and served as an introduction to the triads to enable the participant to familiarize themselves with the nature of the task. Group3 through Group10 were designed as either pronoun-to-pronoun, reflexive-to-reflexive, or a combination of these two functor words, depending on different English pronoun feature marking (e.g. case, number, gender, and person).

Results

A general linear mixed model (GLMM) fit by maximum likelihood (Laplace Approximation), coded using R (version 0.98.1091) software, was used in the data analysis of this experiment. Additionally, a Tukey's HSD Post-hoc pairwise comparison test, with adjusted p-value at confidence level 0.95 (family of 3 means), was incorporated.

For hypothesis (i) and (ii), the study group performance between the pronoun number triad group (G3) and the pronoun person triad group (G4) was non-significant (ß=0.776, SE=0.606, z-value=-1.281, p<0.200), and between the pronoun number triad group (G3) and the pronoun case triad group (G5) was significantly different with lower performance for pronouns triads marked for syntactic case (ß=0.947, SE=0.473, z-value=-2.002, p<0.045*).

For hypothesis (iii), the study group performance difference between the pronoun number condition (G3) and the reflexive number condition (G6) was not significant (ß=0.202, SE=0.581, z-value=0.348, p<0.728); not significant in the pronoun person condition (G4) with the reflexive person condition (G7) (ß=0.145, SE=0.437, z-value=0.331, p<0.741); and, not significant in the pronoun case condition with referencing forward and backward within discourse (G8) to the reflexive case condition with the same reference points (G9/G10) (ß=0.283, SE=0.505, z.ratio=0.561, p<0.841 / ß=-0.436, SE=0.510, z.ratio=-0.854, p<0.670).

Overall, the performance of the study group showed a significant difference (ß=0.920, SE=0.294, z-value=3.131, p<0.002**) when compared to the overall performance of the control group for all target pronoun and reflexive word triad conditions.

Discussion

The findings from this experiment showed mixed results regarding the comprehension of pronominal word forms at the single-word level. The results supported the original hypothesis (i) and (ii) in that pronoun word triads marked for number would yield a higher comprehension accuracy performance than the pronoun word triads marked for person and case. Additionally, the results also supported the hypothesis (iii) in that no difference was found between the comprehension of pronoun word triads and reflexive word triads. The results showed a general sensitivity to closed-class word types, specifically pronoun words in this instance, in-line with previous research findings in the evaluation of closed-class word processing at the single-word level (Garret, 1980; Schwartz, Saffran, & Marin, 1980; Gordon & Caramazza, 1983; Biassou, Obler, Nespoulous, Dordain, & Harris, 1997; Friederici, 1985, 1999). However, these results are not necessarily commensurate with the findings from literature authors who found an impairment in accessibility to syntactic information at the single-word level (Friederici, 1982), which thus supported the theoretical position of a separate syntactic processing system (Caramazza & Zurif, 1976) singularly impaired (Bradley, 1978; Bradley, Garrett, & Zurif, 1980); rather, these findings suggest mixed information in that people with aphasia are able to access and interpret the grammatical information necessary in order to successfully comprehend pronouns in isolation, as exhibited by the high performance in pronoun gender and number marking comprehension, and reflexive number marking comprehension and the low performance in pronoun person and case marking comprehension.

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The organisation of languages in the bilingual brain: evidence from Spanish-Basque bilingual aphasia

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Introduction

Neuroimaging and behavioural data from bilinguals with aphasia have contributed notably in the knowledge of how language is represented and processed in the brain (Paradis, 2004; Abutalebi et al., 2009; Green et al., 2010). Two interrelated questions surface when wondering about the organisation of the languages in the bilingual brain. First, whether the bilingual mind has shared / separate representations for the two languages. Second, the influence that variables such as age of acquisition and exposure to the language(s), use of language, proficiency, language of the therapy and typological distance between the languages might have on such representation(s). Moreover, studies about the representation of the languages in the bilingual brain suggest the convenience of making distinctions between levels of representations (Gollan & Kroll, 2001).
Overall, cross-linguistic transfer of therapy benefits is considered to provide support in favor of the shared representation of the languages in the bilingual brain (Faroqi-Shah et al., 2010), whereas non-parallel impairment and recovery patterns in bilinguals with aphasia (Adrover-Roig et al., 2011; Kambanaros & Grohmann, 2012; Venkatesh et al., 2012) support the neurofunctional separation of the two languages in the brain. In addition, among the factors that are claimed to have an effect in the potential cross-linguistic transfer and in the performance of aphasic bilinguals (Paradis, 1993) typological and structural distance plays a major role. The more similar the structures are in the two languages, the more probable it is that cross-language effects surface (Diéguez-Vide et al., 2012; Goral et al., 2006; Kohnert, 2004) and consequently, that parallel impairment and recovery patterns are attested (De Diego Balaguer et al., 2004; Sasanuma & Park, 1995). Conversely, the bigger the differences between languages and structures, the less likely it is for cross-language effects to surface (Goral et al., 2012) and the more likely for non-parallel impairment and recovery patterns to be attested (Kambanaros & Grohmann, 2012; Venkatesh et al., 2012).
The main goal of this paper is to get closer to an understanding of how linguistic components and languages are organised in the brain through the study of Spanish-Basque bilinguals with chronic aphasia. Language difficulties arising in both languages are examined in order to describe the language abilities of the bilinguals. The specific research questions addressed in the present study are the following: a) do language difficulties in bilinguals affect both languages similarly?, and b) does the structural distance have any effect in the patterns observed?

Methods

Participants

Three early Spanish-Basque bilinguals with aphasia participated in the study, and three unimpaired participants matched in gender, age, education and language background acted as controls. The aphasic bilinguals were highly proficient in their two languages premorbidly, and used them on a daily basis. They received therapy (mainly) in Spanish.

Procedure

Lexical, phonetic/phonological and morphosyntactic performance of the bilingual participants was assessed in Spanish and Basque by means of general neuropsychological batteries (CNL, BAT), semi-spontaneous speech and experimental controlled tasks. As for the experimental tasks, in order to systematically assess difficulties arising at the lexical and phonetic/phonological levels and to evaluate the possible influence of several factors (e.g. length, frequency, cognate status) in production a picture naming tasks was carried out. Second, the comprehension and production of movement-derived structures was studied by means of sentence-to-picture matching and picture description tasks, respectively.

Results

Differences and similarities in the impairment were observed across modalities, linguistic domains, languages and participants. Overall, qualitative similarities were found in the linguistic levels more similar between Spanish and Basque, namely, the lexical and post lexical phonological levels, impaired in both languages across participants, and with different results for cognate and non-cognate words. However, in general the impairment is more severe in Basque in terms of fluency and number of errors arising at the lexical phonological (in the case of non-cognates) and post-lexical phonological levels. In addition, differences were observed in morphosyntactic comprehension (and production in some participants): selective language-specific difficulties were attested, and such difficulties do not affect both languages to a similar extent in the three bilinguals with aphasia.

Discussion

Qualitative differences observed across languages in the bilinguals under study might be related to the structural distance of each linguistic component, which confirms that typological distance plays a crucial role in the performance of aphasic bilinguals (Paradis, 1993). First, qualitative similarities in the phonetic-phonological and lexical impairment point towards the cross-linguistic transfer of either or both therapy gains and spontaneous recovery (Goral et al., 2012; Kohnert, 2004; Verreyt, De Letter et al., 2013) due to the typological proximity of the Spanish and Basque phonological systems (similar phonological inventories) and high amount of cognates. Second, regarding the morphosyntactic level, the differences found at some specific structures and participants make it difficult to sustain any cross-linguistic influence. Rather, the structural distance between Spanish and Basque morphosyntactic cues (due to different case systems and opposite head-directionality) seems to be the reason for the lack of evidence of any cross-linguistic transfer in this domain (cf. Venkatesh et al., 2012; Munarriz et all, 2014). In addition, the role of language distance and other extralinguistic factors such as language use and sociolinguistic status of the languages in the performance of the bilinguals is discussed. Overall, the differential impairment observed in the early Spanish-Basque bilinguals is a questionable argument for approaches which assume shared grammatical representations in early bilinguals (i.e. Ullman, 2001), and instead provides evidence in favor of the neurofunctional separation of the languages and linguistic components in the bilingual brain (Paradis, 2004).

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Case and agreement in Greek aphasia: Evidence from comprehension

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Introduction

Cross-linguistic studies in agrammatism have revealed contradicting evidence on the ability of agrammatic speakers to comprehend structural case and agreement relations in nominal complements. With respect to structural case, in languages with overt case-marking, case is either correctly computed (Lamers & Ruigendijk, 2008; De Bleser et al., 1988; Heeschen, 1980) or is less accessible to agrammatic speakers at sentence level (Burchert et al., 2003; De Bleser et al., 2005; Friedman & Shapiro, 2003; Hanne et al., 2014). Evidence from Greek suggests that morphological case does not facilitate agrammatic speakers' comprehension of non-canonical sentences (Varlokosta et al., 2014). With respect to agreement, in the verbal domain, subject-verb agreement violations are shown to be easily detected by agrammatic speakers (Friedmann & Grodzinsky, 1997; Wenzlaff and Clahsen, 2004; Protopapas et al., 2014; but see Haarmann & Kolk, 1994), although most studies suggest that agrammatic performance is determined by structural complexity (Garaffa, 2008).

In the present study we shed light on the relationship between agreement relations and case assignment in aphasia, given that both structural case and agreement aremorphological manifestations of ϕ-feature matching and both are linked via a single syntactic process, called Agree (Chomsky, 2001). Hanne et al. (2014) have recently shown that agrammatic speakers rely more on agreement (e.g., gender, person or number-agreement) than on case cues (see also De Bleser & Bayer, 1988) while establishing clause-level relations, suggesting that these two operations might differ. Against this background, and given that the nominal ϕ-features of both agreement and case are non-interpretable (Pesetsky & Torrego, 2001), we would predict similar performance across tasks for the agrammatic participants. Alternatively, a difference across tasks would be in line with accounts that do not treat case as a by-product of ϕ-feature agreement (e.g., Marantz, 1991).

Methods

Participants

Eight Greek-speaking non-fluent agrammatic individuals (mean age: 57.5, SD: 12.3), and eight age-matched control speakers participated in the study. All agrammatic participants had suffered a single left CVA at least 16 months prior testing.

Materials

Three off-line comprehension tasks were developed: two were used to access the ability of agrammatic speakers to comprehend structural case (a grammaticality judgment and a truth-value judgment task), while one was used to investigate speakers' ability to comprehend agreement relations (a grammaticality judgment task).

With respect to structural case, the grammaticality judgment task (CGJT) consisted of 96 sentences, half ungrammatical, all of which included a transitive two-place verb in active voice. In the grammatical sentences, the external argument was marked for nominative and the internal for accusative case, while in the ungrammatical sentences both arguments were either marked for nominative or for accusative case. Participants were auditorily presented with the sentences and were instructed to judge their grammaticality. The truth-value judgment task (CTVT) consisted of 40 semantically reversible, non-canonical sentences with a transitive two-place verb in active voice, accompanied by pictures. In half of the sentences the picture didn't match the given sentence. Participants were instructed to judge whether the sentence matched the picture.
The agreement grammaticality judgment task (AGJT) consisted of 160 sentences that assessed verbal agreement, half ungrammatical, in active voice. Ungrammatical sentences with pre- and post-verbal subjects were included, which differed in number or person features. Participants were auditorily presented with the sentences and were instructed to judge their grammaticality.

Results

The control participants performed at ceiling across tasks, so their performance will not be further discussed here. The agrammatic participants (see Table 1) performed significantly better on the AGJT compared to both structural case tasks (for CGJT: χ^2 =13.564, p=.000; for CTVT: χ^2 =26.224, p= .000), although a difference in performance was attested between the CGJT and the CTVT as well (χ^2 =4.817, p=.028) with the CTVT to be the hardest.
Our data from the AGJT revealed that agrammatic speakers had difficulties identifying agreement errors in the verbal domain. Further analysis within this domain showed no difference in agrammatic participants' ability to recognize number and person agreement errors (χ^2 =1.827, p=.177).
Additionally, to investigate the interaction between Agree(ment) and nominative case, we compared the overall agrammatic performance on the AGJT with that on CGJT. The difference between Agreement and ACC-ACC reached significance (χ^2 =10.596, p=.001), while the difference between Agreement and NOM-NOM did not (χ^2 =.046, p=.830), suggesting an interaction between the two.

Discussion

Our data revealed impairments in the agrammatic speakers' ability to comprehend structural case and agreement relations, although a better performance was attested in the latter. This finding is thus more in line with Marantz's (1991) account, which suggest that case and agreement are differentially licensed and they are not similar manifestations of Agree. This implies that the errors in the two conditions do not have the same source.

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Table 1. Agrammatic participants' accuracy scores

Task	P1	P2	P3	P4	P5	P6	P7	P8	Sum
CGJT (total)	60.4%	70.8%	59.3%	70.8%	60.4%	47%	59%	65%	475/768 (61.8%)
CTVT (total)	35%	72.5%	47.5%	55%	72.5%	45%	50%	60%	175/320 (54.6%)
AGJT(total) Verbal Domain	79%	70%	63%	67%	72%	67%	86%	51%	893/1280 (69.7%)
Number Agr.	72%	40%	40%	32%	45%	32%	75%	40%	151/320 (47.1%)
Person Agr.	69%	51%	28%	48%	58%	41%	76%	46%	164/312 (52.5%)

The Signification of Comparison Tests BNVR and TT for Appreciation of Associated Cognitive Deficits of Czech Aphasic Persons

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Introduction

The study includes results of the two periods of a comparative study, include group of handicapped people - 30 people with aphasia after CVA, and control group of 20 people without communication deficits. The study includes comparative results evaluation of the BNVR test and Token test (TT, rev.). The results of the study prove very inspiring spread of results of diagnosed people and necessary development of this type of diagnostics in Czech language environment.

Methods

Subheading

The contemporary realized stage of the research study was led especially by the effort to answer these primary research questions:

- Is the use of the test BNVR possible in the original version in the Czech linguistic environment, or will it be necessary to create Czech experimental version of a diagnostic material?
- Will the use of original picture material of the test pose any specific difficulties for respondents from the Czech linguistic environment?
- What dispersion will be registered in comparison to the results of a comparable diagnostic material which has already been used in the Czech linguistic environment?

Subheading

The necessity to evaluate cognitive and perception abilities regarding people with aphasia on the orientation level for the needs of logopaedics clinical diagnostics and therapy leads to the attitude which is calls "mapping of cognitive deficits". Among a range of diagnostic guidelines and scales, the use of two test materials we can prefer: *Token Test* (TT, rev.), *The Butt Non-Verbal Reasoning Test* (BNVR, Butt, Bucks, 2009). BNVR is a highly inspiring representative of this orientated diagnostics. The form of a test with two sets of photographs enables fast (15 min.) and effective examination with minimal verbal entry and high validity for multicultural and multilingual implementation. The TT represents understanding of word and sentence instructions and level of short-term verbal memory. It is based on recognition and manipulation with colour circles and squares. In a shortened version with the possibility of finer evaluation of moderate, medium and serious level of disorders, it is a fast (10–15 min.) and a very popular diagnostic tool. The task and instructions to the test have been repeatedly translated into Czech (Preiss, 1998, Neubauer, Dobias, 2014).

Results

The research study of people with aphasia was done within the workplace of clinical logopedic of the neurological rehabilitation centre in the central Czech region. According to the current rehabilitation programme, 30 people with diagnosed aphasia after cerebrovascular or traumautic lesion of cerebral tissue were randomly chosen. The control group included 20 healthy people, randomly chosen from a town community in the Central Bohemian region. The average age of the research group was 62 years old (34 years as the youngest and 73 years as the oldest) and consisted of 10 women and 20 men. The test group included 12 women and 8 men. The average age was 62 years old (42 years as the youngest and 65 years as the oldest). The group of people with aphasia proved full spread of the TT result from the boundary intact result up to the inability to finish the text. All these people were more successful in BNVR than in TT. The only exception was a person with a low result because of aphasia presence and a worse result in BNVR. 19 people proved a significantly better result (2–3 degrees), 6 people had a slightly better result in BNVR (1 degree) and 5 people proved the same result in both tests on the given work scale. The result of the control group of healthy people which reached an intact result in all used tests.

Discussion

The tests BNVR and TT prove screening, orientation value, in particular, for short clinical examination, their mutual aim is to understand the specific form of instruction and effort to minimize the connection of the result in the test with word production of an examined person. With regard to the character of instructions, it can be stated that people with expressive phatic disorder, who do not show cognitive deficit, profit from the aim of BNVR by a significantly better result in the test proving their good orientation in the solution of life situations and understanding of rehabilitation process demands. The people with a perceptional form of aphasia or more often people with cognitive strain can prove a symmetric result in both tests or dominance of difficulties in the solution of BNVR similar to demands of the TT fifth set of tasks. However, according to the gained results, it can be assumed that divergent value of both diagnostic materials is dominant, therefore, the result in BNVR is in the cognitive area. Nevertheless, BNVR minimizes the connection of the test result with word production of an examined person in contrast to MMSE and similarly focused scales. This is essentially important for the area of people with aphasia.

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The Influence of Motivation on the Recovery of the People with Aphasia: a case study

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Introduction

Plasticity is defined as the brain's capacity to make structural and functional adaptations in response to sensory experience. Recently this term has also encompassed the addition of new neurons to the adult brain as a possible substrate for learning and memory. However, there is a paradox that needs to be addressed: all these changes in the nerve cells need to be preserved in order to retain the acquired information (Rakic, 2002). As the individual is exposed to various sensory stimuli in the environment, brain plasticity allows adaptation and underlies learning and memory (Oberman & Pascual-Leone, 2013). The phenomena of neural plasticity is defined as the ability of the central nervous system to adapt in response to changes in the environment or injuries. The study of neuroplasticity has wide-reaching implications for understanding reorganization of action and cognition in the healthy and damaged brain (Sharma, Classen, & Cohen, 2013). Aphasia is an acquired language disorder with a diverse set of symptoms that can affect virtually any linguistic modality across both the comprehension and production of spoken language (Pasley & Knight, 2013). Rehabilitation strategies focus on behavioral training to induce plasticity in underlying neural circuits to maximize linguistic recovery (Pasley & Knight, 2013). The major traditional approaches to rehabilitation include the stimulation, the behavior modification, the Luria's, the pragmatic and the neurolinguistic approaches (Basso, Forbes, & Boller, 2013). Conduction Aphasia can be viewed as a syndrome resulting from damaging the speech perception systems in the left hemisphere (Hickok, 2000).

Methods

Case History

DM had a severe Global's Aphasia (Benson, 1988) following a spontaneous internal bleeding in 2009, was performed a left frontal temporal craniotomy. He was unable to name or repeat, follow only simple instructions. The spontaneous speech had a normal debit, as well as the articulation, length of sentences (5-8 words per sentence) and prosody; however contained limited content words and paraphasias, mainly phonological. In the formal evaluation he was not able to name (2/16), repeat (0/10), to read or write; could identify (8/8). With a fluent speech, relatively preserved comprehension, disturbed naming and repetition, DM progressed to a Conduction Aphasia.

Treatment

Treatment consisted of 1 session once a week, for 20 weeks. Sessions lasted 30-45 minutes, and comprised a social approach. According Cruice, Worrall & Hickson (2010), the primary objective is the improvement of the quality of life of the person with aphasia, focusing his interest in communicative participation in the contexts in which it operates (Oliveira, 2009). It aims to improve the communicative functionality by removing barriers and increasing facilitators within your routine. As strategies were employed structured waiting, modeling, corrective feedback, visual and verbal cues, reinforcement, promotion of direct and effective eye contact, repetition and responsive-naming.

Results

From the revaluation was possible to notice that DM has a fluent speech, occasionally with some anomic breaks or paraphasias. In the test speech characteristics colloquial DM presented prosody, length of phrases, articulation and words evocation close to normality; there is also a slight difficulty in grammatical structure. He is capable of identify objects, however, occasionally, shows difficulty in naming; he can explain the function of objects, he uses that strategy in the spontaneous speech. If given a phonetic clue he is capable of naming. Concerning the comprehension, including complex orders, he can fulfill all tasks; relatively to reading and writing, DM is capable of interpret a text and spontaneous writing in general, yet has difficulty with the use of joints in phrases, however the other can understand the message. DM learned to write with his left hand, having lost the dexterity and fine motor skills in his right hand. In tasks of orofacial praxis DM can perform all the guidelines. DM still attends Speech and Language Therapy, three times a week and achieved a very significant development in the area of language. DM is totally independent and autonomous, is able to drive his own car and returned to active life.

Discussion

This case study presents data showing that an individual with severe expressive difficulties can be trained. DM initially had a severe Global Aphasia, which progressed to a Conduction Aphasia, showing that the subject has reached improvements in his oral communication capacities.

Considering DM's recovery, this is a successful case. The individual has been adapting his communication skills according to the context, being an effective communicator. This improvement brought DM a better quality of life, translated in work and personal life: has opened his own footwear company; is responsible for selling the products directly to other companies where needs to be commutatively functional. Concerning the prognosis, hemorrhagic stroke shows worst results than ischemic; Conduction Aphasia with no severe disruption of repeatability tends to evolve into an Anomic Aphasia which is not the case; the stroke was extensive in terms of neurological damage, severe considering the location, committing the motor programming of speech: repetition, naming and evocation (Pound, Parr, Lindsay, & Celia, 2000). The prognosis of aphasia depends on several factors. Studies made in the last decades showed that there are some factors which are associated with a good or bad prognosis. The extent of the injury is one of them: the greater the impairment, more difficulties the individual will present in the communication level and therefore the recovery will be longer (Maas et al., 2012). DM, additionally, has some characteristics that lead to a bad prognosis, such as smoking habits and family history of hemorrhagic stroke. However there are some factors to corroborate a good prognosis, such as DM's age, the early Speech and Language Therapy intervention and its frequency, the support his family provides and his personality and psychological condition, as DM is highly motivated, being an active participant on his recovery. Everyone has different reactions face the condition and relates to a very specific social and family environment that will condition the intervention approach (Peña-Casanova & Pamies, 2005).

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Impact of the modality of the phonological cue in healthy and aphasic speakers

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Introduction

Phonological cueing is often used in aphasia therapy and several studies showed a positive outcome of this method on word retrieval in anomic patients (Hickin, Best, Herbert, Howard, & Osborne, 2002; Nickels, 2002). However some authors (Wilshire & Saffran, 2005; Wunderlich & Ziegler, 2011) observed that the response to phonological cue treatment vary across anomic speakers. The modality used to deliver the cues could partly explain this variability in patients with different underlying impairments and/or ability to integrate the cues. Bimodal (*audio* (acoustic signal) and *visual* (mouth shape) channels) cueing treatment delivery is the most common approach (Wunderlich & Ziegler, 2011). Intuitively, bimodal cues should be the most effective as they provide the richest input. However, the *audio-visual* integration has been shown to be costly under challenging conditions (Fraser, Gagné, Alepins, & Dubois, 2010) and may therefore be costly in some patients for whom single modality cueing may be more effective.
The purpose of this work is to investigate the effect of the modality of the phonological cues in aphasic participants and in healthy speakers in a picture-naming task.

Methods

Participants

The group of healthy subjects was composed of 19 French-speaking undergraduate students aged 18 to 35 years (mean=23.8). They were all right-handed. Six aphasic participants have been enrolled up to now. They were 21 to 60 years-old (mean=46.33) and suffered from aphasia following a focal left hemisphere damage. All participants had good oral comprehension. Three of them presented with conduction aphasia, the other three had only residual anomia.

Material and task

Participants were tested in a picture naming task with black and white line drawings of common objects preceded by a phonological cue. The cues consisted of video clips with a person pronouncing the first phoneme of the picture to name (a C with a schwa, eg. [pə] for pencil). It was delivered in four conditions: *Bimodal cueing*: audio-visual video clip - *Audio uni-modal cueing*: a static face presented simultaneously with the sound of the phonemic cue - *Visual uni-modal cueing*: silent video-clip with visible articulatory movements - *Control condition*: static face presented with a 200ms white noise. Incongruent cues were provided only on filler items. A total of 108 stimuli were administered to the healthy participants and a shorter version (30 stimuli per condition) was used with the aphasic participants.

Results

The results of the mixed effects regression model on healthy speakers data revealed a main effect of the experimental condition on naming latencies ($F(3, 3767)=26.97$; $p<.0001$). *Audio* and *audio-visual* phonological cueing conditions reduced naming latency compared to the *control* condition (control vs. audio-visual: $\beta = -5.675e-02$, $t = -5.939$, $p < 0.001$; control versus audio $\beta = -5.320e-02$, $t = -5.538$, $p < 0.001$) and no significant difference was observed between the *audio-visual* cue and the *audio* cue nor between the *visual* condition and the *control* condition.

Preliminary results on aphasic patients show that the three conduction aphasic subjects with a rate of errors above 3%, present a tendency to produce more errors in the uni-modal conditions compared to the bimodal one. This observation is particularly visible in the results of the most severe patient with significantly more errors in the *audio* and *visual* conditions than in the *audio-visual* condition.

Contrary to healthy speakers, most aphasic patients showed a trend towards shorter latencies in all the experimental conditions relative to the *control* condition. Some participants also displayed longer reaction times in the *audio-visual* condition compared to the uni-modal *audio* condition (*audio-visual* versus *audio* $\beta = -31.7$, $t = -1.756$, $p = 0.07$).

Discussion

These results suggest similar effects of uni- and bi-modal cues in healthy speakers and most aphasic speakers, while others display a somehow paradoxical result with better accuracy but longer latencies in the multi-modal condition. This latter result will to be further investigated by including other participants.

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How many origins of omission errors in aphasia?

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Introduction

Word finding difficulties (word omission errors) are observed both in spontaneous speech and in picture naming tasks in aphasic speakers along with other kinds of errors such as semantic and phonological paraphasias. The absence of any production in omission errors represents a challenge for models of word production much more than other types of error, where the kind of transformation represents a hint towards their origin. Different theoretical accounts have been proposed for omission errors in aphasia, either in the framework of a connectionist production model (Laine, Tikkala, & Juhola, 1998; Dell et al. 2004) or in serial models (Bormann et al 2008). However, omission errors may have different origins associated with different anomic patterns. Here we test the hypothesis that omission errors can have (at least) two different origins by combining behavioral and event-related potential analyses to omission errors produced by aphasic speakers in picture naming.

Method

Participants

Nine participants with anomia among other aphasic symptoms following a left hemispheric stroke or TBI were selected among a larger group of patients based on the rate of omission errors in picture naming. They produced a rate of omission errors in picture naming tasks which was comparable or higher than their rate of lexical or phonological errors and had spared or only mildly impaired comprehension and.
Nine healthy control subjects were matched to the 9 aphasic participants.

Task and analyses

Participants underwent a 144 items picture-naming task twice while EEG was continuously recorded. A delayed overt picture naming allowed us to compare no-responses to other error-types within the first 500 ms. To identify which psycholinguistic factors predict omission errors, error data was fitted with a generalized linear mixed model for binomially distributed outcomes, with the R-software. Single trial ERP epochs were extracted according to the response type (correct, omission, semantic, phonological errors) and compared to controls (as in Laganaro et al., 2011; 2013) in order to determine the time-windows of divergences according to error-type and error distribution.

Results

Three sub-groups of aphasic participants were identified: 3 patients produced omission errors and a high rate of phonological paraphasias (group OM-PH); 3 patients produced omission errors along with a high rate of lexical-semantic errors (group OM-SEM); 3 participants produced omission errors without other kinds of errors (group OM-O).

The 3 subgroups displayed different psycholinguistic predictors of omission errors: familiarity predicted omission errors only in the OM-O group; lexical frequency predicted omission errors in the OM-O and OM-SEM sub-groups, but not in the OM-PH group, for whom the main predictors were name agreement and word length. The time windows in which amplitudes of ERPs corresponding to omission errors diverged from those of the control group was also different across sub-groups. Two time-windows of divergences (from ~100 to ~250 ms after stimulus presentation and a second one after 300ms) appeared in the OM-O and OM-SEM groups; only late ERP divergences (after 300 ms) were observed in the OM-PH group. ERPs corresponding to no-response errors differed from those corresponding to lexical-semantic errors in the late time-window, after 400 ms, whereas no differences appeared between omission and phonological errors.

Discussion

The co-occurrence of omission errors with other kinds of errors allowed us to highlight different patterns of psycholinguistic predictors of omission errors and different time-windows of diverging ERPs. We suggest that the observed patterns correspond to different origins of omission errors. Omission errors predicted by concept familiarity and corresponding to ERP modulations in an early time-window are likely associated with a lexical-semantic origin; those affected by name-agreement and word length and corresponding to ERP modulations in a late time-window may be due to post-lexical processes and/or to monitoring and inhibition of an incorrect response.

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What contributes to discourse coherence? Evidence from Russian speakers with and without aphasia

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Introduction

The quality of language which transforms several sentences into a discourse is called coherence. The way it is established is largely unclear. In this study two approaches were used to investigate coherence in discourse. Nine Russian native speakers with aphasia and nine control participant without language impairments were asked to retell the content of a short movie. First, the retellings were assessed with a method commonly used in aphasiology to evaluate connected speech, namely, human coherence ratings (e.g., Ulatowska et al., 1981, 1990, Glosser & Deser, 1990). Despite the usefulness of coherence ratings, for example, for diagnostic purposes, they are prone to rater-dependent fluctuations. However, the subjectivity can be partially eliminated through standardization.

In the second phase the retellings were annotated using Rhetorical Structure Theory (RST, Mann & Thompson, 1988), an approach formalizing the idea of an inner organization of discourse. This framework has been extensively tested on large collections of written, as well as spoken discourse. According to RST, coherence is established through the creation of discourse structure. Micro-linguistic data, including TTR, MLU, and error counts, were also collected for every sample.

In order to find out which micro- and macro-linguistic features contribute to the perception of coherence, a regression analysis was performed using Random Forests (RFs). By using this algorithm we attempted to imitate he choice between 'coherent' and 'incoherent' that listeners who rate the discourse samples have to make. One of the advantages of RF is its ability to select those parameters which are the most important for making a choice, in this case, between 'coherent' and 'incoherent'. This way the parameters from the quantitative analysis were then contrasted against the qualitative human ratings.

Methods

Participants

Nine people with aphasia (PWA) and nine non-brain-damaged native Russian speakers matched in age, gender, and education level participated in the study. Five of the PWAs diagnosed with fluent, others with non-fluent aphasia using Luria's Neuropsychological Investigation (Luria, 1966). None of the control participants had any language or memory impairment history. The data represent a part of the Russian CliPS (Clinical Pear Stories) corpus.

Materials

The Pear Film (Chafe, 1980), a six-minute silent movie was used to elicit spoken discourse samples. The participants were instructed to tell what was going on in the movie to someone who had not seen it before. The discourse samples were transcribed using the Codes for the Human Analysis of Transcripts (CHAT) format (MacWhinney et al., 2000).

Procedure

Coherence ratings

Twenty naïve listeners, all native speakers of Russian, listened to 5 discourse samples each. The rating scale included four parameters, namely clarity, or understandability, on a scale from 1 to 9, connectedness, completeness, and the order of events as binary variables. The obtained ratings were transformed into standard scores and averaged out. This study focuses on the first two variables. An instruction and an example were provided to the raters.

Rhetorical Structure Theory

RST annotations were performed using Daniel Marcu's extension of the RSTTool (Marcu et al., 1999) by the first author. A second annotator analyzed the annotations, and problematic cases were resolved in thorough discussions. The extended set of relations suggested by Marcu and colleagues was used; all the annotations were performed following the guidelines developed by the group (Carlson & Marcu, 2001). The samples were segmented into elementary discourse units (EDUs), syntactically and semantically complete 'building blocks' of discourse. After that EDUs and spans consisting of several EDUs were connected to each other with a set of semantic, also called discourse or rhetorical, relations (e.g., 'Cause', 'Elaboration', 'Consequence', etc.). A number of parameters were calculated from the resulting discourse structures, including, for example, the number of different types of relations used to build the structure, its depth and length.

Random Forests

Regression analyses with different sets of parameters were performed in R ('caret' package, Kuhn et al., 2012) using Random Forests (RFs), a robust machine learning technique (Breiman, 2001).

Results

The accuracy of the group prediction (control vs. aphasic) reached 95%. Out of possible 15 variables the following were identified as critical for the distinction: number of errors (100%), ungrammatical EDUs (92%), number of discourse relations (88%), and percentage of EDUs with a missing syntactic constituent (80%). Accuracy of the understandability prediction based on the micro-linguistic predictors was at chance level, and slightly lower for the structural parameters, around 40%. All of the parameters taken into account, the accuracy improved to 60%. Selected features were the number of errors (100%), number of relations (72%), syntactically incomplete EDUs (64%), and TTR (64%). The connectedness prediction accuracy with all variables was up to 60%, however the feature selection was unsuccessful.

Discussion

The results of this study demonstrate that neither the micro-linguistic features, nor the structural characteristics of a discourse can account for it being perceived and rated as coherent or incoherent. Based on a combination of both micro- and macro-structural parameters one can rather accurately identify whether a speaker who produced the discourse has aphasia or not, but not whether the discourse is coherent or not. Discourse of people with aphasia is less understandable, but not less connected than that of healthy speakers. The concept of coherence, a perceived feature of discourse co-created by a speaker and a listener, is thus only partially grasped by the correlates, such as clarity and connectedness, often chosen for its assessment. Moreover, these qualities are rather spectral than binary (see Fig. 1). Exploring the components of coherence perception, and investigating qualitative differences in organization of aphasic and unimpaired spoken language could advance our understanding of this complex phenomenon.

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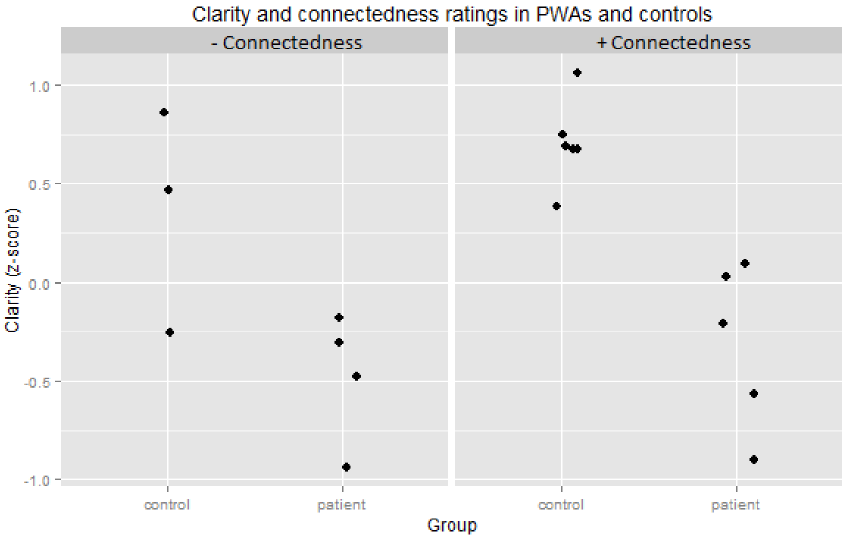

Figure 1. Clarity and connectedness ratings for the control and aphasic groups.

Verbs in aphasia: 10 years of Spanish studies.

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Introduction

Verbs are low imagineable complex concepts that constitute a heterogeneous category. In addition to their reference forms, which contain specifications on the number of arguments and their roles, verbs in most Indoeuropean languages tend to host morphological markers such as tense, agreement, and/or aspect (1).

(1)	*andar* 'to walk'	*perd-ió* 's/he lost' (Spanish)
Category:	verb	verb
Argument structure:	[X]	[X, Y]
Thematic roles:	agent	agent, theme
Finiteness:	ø	✓ (*simple past, indicative, perfective, past time reference, 3rd pers sg.*)

Such a complexity has brought about contradictory experimental results. Already in the 80s, Miceli, Silveri, Villa and Caramazza (1984) reported that individuals with Broca's aphasia had problems with action naming, while in individuals with anomia, deficits were more prominent in object naming tasks. However, Williams and Canter (1987) found action naming leading to higher error rates than object naming both in individuals with Broca's aphasia and with anomia, and, in a later study by Basso, Razzano, Faglioni and Zanobio (1990), no differences across tasks or populations were found. These contradictions and the addition of a profusion of data focusing on morphology, argument structure, and thematic information (Friedmann and Grodzinsky, 1997; Thompson et al., 1997; Kiss, 2000; Thompson, 2003; Wenzlaff and Clahsen, 2004; Burchert et al., 2005; Bastiaanse and Van Zonneveld, 2005; Faroqi-Shah and Thompson, 2007; Fyndanis et al., 2010; Bastiaanse et al., 2011; among many other authors) gave room to a variety of theories trying to capture verb retrieval and grammatical encoding difficulties in aphasia.

In this work, we analyze the performance of 49 Spanish speaking individuals with aphasia (IWAs) evaluated over the past 10 years, and explore the predictions of the Past Discourse Linking Hypothesis (PADILIH; Bastiaanse et al., 2011), the Argument Structure Complexity Hypothesis (ASCH; Thompson, 2003), and the Derived Order Problem Hypothesis (DOP-H; Bastiaanse & Van Zonneveld, 2005). We conclude with the proposal of a unified explanation that can capture all the Spanish data.

Methods

Structured Tasks

The results for naming, delayed repetion, sentence completion, elicitation, and forced-choice tasks in 39 IWAs of a non-fluent type and reported in 6 different studies were included in the evaluation (Martínez-Ferreiro, de Aguiar & Rofes, 2015).

Spontaneous Speech

The analysis of the spontaneous speech of 10 additional Spanish-speaking IWAs (7 non-fluent and 3 fluent) from the Rosell (2005) corpus was also carried out. The protocol for data collection included semi-standardized interviews, in which participants were asked about their last job, holidays, and future plans, as well as their hobbies. 300 words per participant were included in the final analysis.

Results

Verbs were found to be impaired across the board. Regarding verbal morphology, tense was more severely damaged than agreement (15% tense vs. 4.5% agreement errors; nº of participants = 38). See Figure 1a. However, analysis focusing on time reference revealed that past time reference may be held responsible for most of these errors (39.5% past reference vs. 21.8% non-past reference errors; n = 8 - elicitation, sentence completion and forced choice tasks).

The performance of 17 participants on different structured tasks also indicated a strong effect of argument structure, confirmed by the spontaneous speech results of 10 additional IWAs. Based on accuracy, a complexity scale emerged across studies and tasks: Unergatives < Transitives-Alternating verbs (transitive reading) < Unaccusatives-Alternating verbs (intransitive reading). See Figure 1b. However, the comprehension of psych verbs (n=5) showed a dissociation between constructions such as *A Juan le paga María* 'John is paid by Mary' and *A Juan le gusta María* 'John likes Mary', with the latter leading to 62% (vs. 10%) errors, and suggesting that thematic roles also set demands on performance.

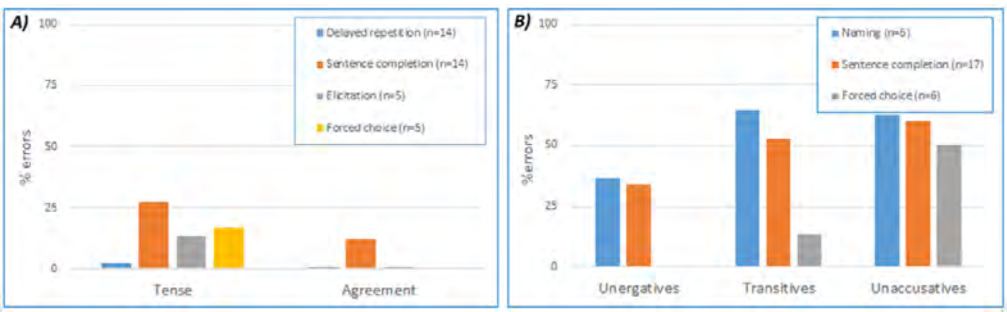

Figure 1: Errors in the performance of Spanish-speaking IWAs - VERBS

Discussion

The following picture emerges:

a. Deficits with tense were found, more especifically with past (vs. non-past) referring forms as predicted by the PADILIH (Bastiaanse et al., 2011). Reference to the past requires discourse linking, which is problematic in aphasia, while reference to the present and future does not.

b. Deficits with verbs with a more complex thematic grid, more especifically unaccusatives (vs. unergatives and transitives) are explained by increased number of arguments (ASCH, Thompson, 2003) and presence of moved constituents (DOP-H; Bastiaanse & Van Zonneveld, 2005).

c. Deficits with "less frequent" thematic roles, more especifically experiencers (vs. agents) are still unexplained except if taken as a violation of the *Uniformity of Theta Assignment* (Baker, 1988).

To capture the whole picture, we propose that complexity relates to the violation of the SVO – agent-patient pattern (unaccusatives/psych verbs) and the need of establishing long distant relations like discourse linking (past-reference).

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Word Learning in aphasia and the influence of cognition

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Introduction

The acquisition of new vocabulary is generally associated with second language learning. However, it has been estimated that up to 8,500 new words enter the English language every year (Michel et al., 2011), meaning we are constantly required to learn new words. Acquisition of new vocabulary can occur either explicitly in a direct learning situation, or occur incidentally through passive repeated exposure. However, regardless of method, acquisition relies upon an associative learning process, so that one must learn to associate a phonological representation with a semantic concept. For example, when learning the name of a previously unknown breed of dog, an individual may already possess some existing conceptual information regarding dogs but must explicitly learn to identify distinguishing features of the novel breed and associate that information with its name.

People with aphasia have the same need to acquire new vocabulary as their peers. However, understanding the mechanisms underlying word learning may also be important in the treatment of anomia. While some authors suggest treatment for anomia is effective through a priming mechanism (e.g. Nickels, 2002), others suggest that it is a learning mechanism at play (e.g. Basso, Marangolo, Piras, & Galluzi, 2001; Lambon Ralph & Fillingham, 2007). Here we investigate learning of novel vocabulary and the factors affecting learning in people with aphasia and older adults. Identification of the underlying mechanism responsible for positive effects, and any factors influencing those effects may guide decisions regarding treatment for people with aphasia.

Methods

16 older adult controls without language impairment and 14 individuals with chronic aphasia were recruited to participate. A range of aphasia types and severities were represented, with all participants at least 12 months post-onset.

All participants were assessed on a range of cognitive and linguistic tasks: Cognitive measures included the Birmingham Rule Finding and Switching subtest of the Birmingham Cognitive Screen (Humphreys, Bickerton, Samson, & Riddoch, 2012), the cognitive sections (attention, memory, executive functions, visuospatial skills) of the Cognitive Linguistic Quick Test (Helm-Estabrooks, 2001), forward and backwards digit span, abbreviated Raven's Coloured Progressive Matrices (forming part of the Western Aphasia Battery-Revised, Kertesz, 2006), and a non-linguistic paired associate learning task.

Linguistic measures for all participants included the Boston Naming Test (BNT) (Kaplan, Goodglass, & Weintraub, 1983) and subtest 8 (nonword repetition) from Psycholinguistic Assessments of Language Processing in Aphasia (PALPA) (Kay, Lesser, & Coltheart, 1992). Participants with aphasia were further tested on word repetition (PALPA subtest 9), auditory and written synonym judgements (PALPA subtests 29 & 50), the Comprehensive Aphasia Test (CAT) (Swinburn, Porter, &

Howard, 2004) and the three picture version of the Pyramids and Palm Trees test (P&PT) (Howard & Patterson, 1992).

Experimental task: New word learning

Nine different picture stimuli were sourced from three semantic categories. Three pictures were of rare breeds of dogs, three of rare flowers and three of unusual musical instruments. Two pictures of each category made up the target stimuli to be learned (six items), with an additional picture of each category used as replacement stimuli (three items) in the event that a participant was familiar with any of the targets and knew the name prior to training.

Learning sessions involved presentation of the six target pictures simultaneously with their auditory names and participants were required to overtly repeat each name once. Subsequently, the same pictures were presented in different random order without their auditory names and participants were required to recall each name. Regardless of participants' ability to produce the name, an auditory cue of the onset and vowel (CV, or CCV) was then heard and participants given a further opportunity to respond with the full name of the item. Again, regardless of response, the full auditory name was provided and participants were required to overtly repeat the name. Both stages were then repeated twice, providing three opportunities to learn and recall the names of all items.

Three days later a second learning session was conducted. Immediately prior to the main learning task, participants were required to perform confrontation naming. Regardless of participants' ability to produce the name, an auditory cue of the onset and vowel (CV, or CCV) was provided. The procedure for the second learning session was exactly the same as for the first session, with three consecutive learning and recall phases.

Seven days later, a follow-up session was conducted to determine the extent to which names had been learned, comprising naming and recognition tasks.

Results

There was considerable variability in the learning performance of both controls and people with aphasia. Figure 1 illustrates this, showing two controls and two participants with aphasia. More detailed analyses are being completed and will be reported.

Correlations between cognition and learning performance for controls showed strong and significant correlations with Boston Naming Test, CLQT attention and smaller, but significant, correlations with CLQT memory and executive function. There was no significant association with nonlinguistic paired associate learning. Full analysis of the data for the people with aphasia are underway and will be reported.

Discussion

Data from controls suggests that learning mappings between novel word forms and elaborations of existing semantics (e.g. new breeds of dog, new species of plant) relies on skills which are at least partially independent of those used for nonlinguistic paired associate learning. However, these skills are, perhaps unsurprisingly, closely related to those underpinning vocabulary skills more generally as measured by the Boston naming test. The implications of these results and those of the people with aphasia will be discussed in relation to theories of learning and the treatment of anomia.

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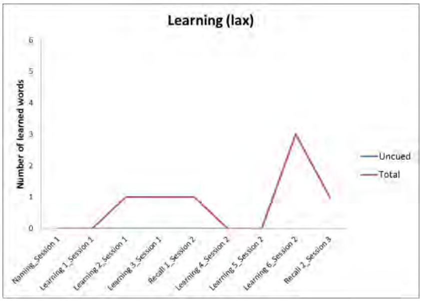
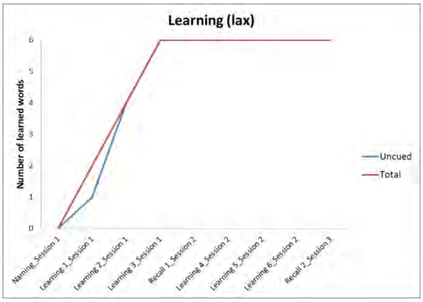
Figure 1: Examples of learning profiles for controls (CO) and people with aphasia (PWA)

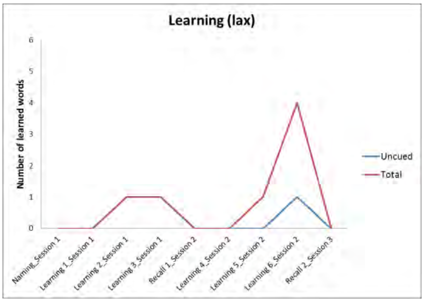
CO3



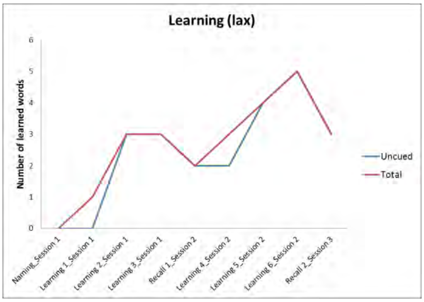
CO12



PWA14



PWA06



The added value of gesture for communication of people with aphasia.

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Introduction

Gestures can convey information in situations where speech is difficult. For instance, in a bar, where the music is very loud, one could make a drinking gesture in order to ask whether someone wants a drink. As such, gesture seems a useful tool for people with aphasia (PWA) to compensate for their speech difficulties. Various studies have shown that PWA use gestures (Cocks et al., 2013; Rose & Douglas, 2003) and that these gestures may add to their comprehensibility (Hogrefe et al., 2013; Mol et al., 2013; van Nispen et al., 2014). These latter studies though looked at experimental conditions (naming pictures or retelling a story). The present study aims to determine whether gestures used by PWA during spontaneous conversation add to their comprehensibility.

It is difficult to objectively determine the communicativeness of a gesture in a setting such as conversation in which no knowledge is available on the communicative intent of a speaker. A second aim of the present study is to determine whether a coding scheme, used to determine how information in gesture relates to information in speech, is useful in assessing the communicative value of gestures by PWA.

Methods

Participants

This study uses data from an online database; AphasiaBank (MacWhinney et al., 2011), also analyzed in two earlier studies by Sekine and colleagues (2013; 2013). The present paper reports on 5 non-brain damaged participants (NBDP) (1 male, age 36-84) and 34 PWA (19 male, age 34-73), who had various types of aphasia (based on the Western Aphasia Battery, WAB Shewan & Kertesz, 1980); Broca (n=6), Wernicke (n=8), Anomic (n=8), Transmotor (n=4) and Conduction (n=8).

Design

Participants were videotaped during a semi-structured interview. An experimenter asked four questions about the patients' recovery and an important event in their lives following a strict protocol (see www.aphasiabank.com). Questions for NBDP were comparable. Here the interviewer asked whether a participant could tell about an illness or medical condition that they had and whether they had experiences with people with language difficulties.

Coding & Analyses

All gestures used were coded based on a coding scheme developed by Colletta et al. (2009). These codings reflect the relation of a gesture to the corresponding speech; 1) information in gesture is similar to information in speech, 2) gesture adds information to information conveyed in speech and 3) gesture conveys information absent in speech which is essential for understanding a message.

Results

In an ANOVA, no significant differences were found between NBDP and PWA for the total number of gestures used or the different gesture categories (number and proportion). There were also no differences found for Aphasia type. We did observe large standard deviations, which indicate substantial individual differences.

A qualitative analysis revealed that PWA use essential gestures during instances of speech break down. Example 1 clearly illustrates an individual experiencing a speech break down, pausing for a second to come up with alternative strategies and then switching to the gesture modality. Importantly, gesture is not only used compensatorily in the absence of speech. Particularly in PWA, speech break down may not necessarily result in moments of silence. Example 2 illustrates an individual who has 'semi' fluent speech, but did experience complete speech break down. The repetition of words ("slowly, slowly"), low speech rate and a short interruption ("uhm") indicates that he struggled to find a word ('improving'). There may be two reasons for the use of gesture in this instance. First, similarly as in example 1, this individual may be aware of the fact that he is not able to produce the verb 'improving' and compensates for this by using a gesture. Another possibility is that the information for this message has been correctly planned in both speech and gesture, but the production of speech has failed (because of difficulties in retrieving or uttering the verb 'improving'). The production of gesture may not be intended compensatorily, but is essential for communication under these circumstances nevertheless.

Example	1	2
"Speech"	"Hunting and uhm ……………………………………………………."	"Slowly, slowy, uhm, just a tiny bit"
Gesture	*Swinging the hand as if casting a fishing rod*	*Hand gradually moving upwards*

Discussion

We did not find significant differences for the use of gestures between NBDP and PWA, or between PWA with different Aphasia types. This is a surprising finding, considering that their (information in) speech does differ. The large standard deviations observed suggest a need for a more detailed analysis. In doing so, we could determine more precise profiles of PWA that use a lot of compensatory gestures as opposed to PWA that do not.

Despite the fact that we did not find differences between NBDP and PWA, our findings do suggest that gesture adds to the comprehensibility of PWA. This can be an unconscious process in which speech and gesture are planned together, but speech is not produced as a result of language difficulties. It may also be the result of conscious compensation by PWA.

Our study aimed to shed more light on the communicative value of spontaneous gestures by PWA. At the conference we will present a more detailed analysis of individual differences and we will discuss how these findings are in contrast with other studies suggesting that people (NBDP) do not use gesture compensatorily. Finally, we will discuss the usefulness of this coding scheme for this population, based on studies of inter- and intra-rater reliability. Hereby, we hope to inform clinicians on how they can interpret and assess the use of spontaneous gestures by PWA.

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Can pre-treatment scores predict treatment success and failure? The case of verb therapies

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Introduction

The prognosis of aphasia rehabilitation depends on age and education (El Hachioui et al., 2013), lesion severity (Pedersen, Vinter, & Olsen, 2003), lesion site and size (Kertesz, Harlock, & Coates, 1979; Maas et al., 2012), stroke type (El Hachioui et al., 2013), severity of language impairment (Pedersen, Vinter, & Olsen, 2003), and degree of phonological impairment (El Hachioui et al., 2013). These factors were identified in observational studies, in which therapy type was not considered. Jacquemot et al. (2012) observed that tasks that engaged the phonological output lexicon (POL) and those that required overt production were the most effective in improving word production. This points to a specificity of treatment effects to processes that are necessary for completing the treatment task.

A recent review has noted that verb production deficits in aphasia can be treated using the same techniques as those used for the treatment of nouns deficits, but verb improvement is more difficult to achieve (Webster & Withworth, 2013). In fact, verbs differ from nouns in semantic, lexical, phonological and morpho-syntactic aspects (Conroy, Sage, & Ralph, 2003). It is possible that these different processes are not engaged when verbs are treated with tasks designed for noun retrieval. For instance, verb representations contain information about argument structure (e.g., Saffran, Schwartz & Marin, 1980). Consequently, it was argued that it is appropriate to treat verb production in sentence context, to engage the processing of verb's argument structure (e.g., Bastiaanse, Hurkmans, & Links, 2006).

The role of severity as a predictor of recovery (Pedersen, Vinter, & Olsen, 2003) may indicate that some degree of preservation of key cognitive skills is necessary for the recovery of associated cognitive functions (e.g., relative preservation of POL processing relates to better naming recovery; Hachioui et al., 2013). The outcome of verb therapy may then depend on the preservation of cognitive skills related to the properties of verbs. In this study, we examined the predictive value of pre-treatment scores in patients who underwent verb therapy, in relation to the outcome of treatment.

Methods

Procedure

A web search was conducted to identify studies of aphasia recovery, using the main article search engines (Medline, Google Scholar, Web Of Science). Articles in which: (1) therapy required patients to overtly produce verbs and (2) outcome was reported for each participant were included. This search yielded 30 articles, for a total of 163 patients.

Scores from the diagnostic assessment reported in each study were collected, including tests for noun production, verb production, word repetition, non-word repetition, verb comprehension, noun comprehension, sentence production and sentence comprehension. In addition, we extracted the information reported in each study on the probable functional locus of impairment responsible for the language deficit. When this was not explicitly mentioned, but sufficient information was provided, we generated a diagnosis for fluency, semantic, phonological output lexicon (POL), segmental and grammatical impairment.

Statistical analyses

Patients were assigned to two groups, depending on therapy success (patients who improved and patients who did not improve). The criterion for identification of significant improvement was the one defined by each study, but we only included data in which this criterion was reached on the basis of statistical analyses. The two groups were compared in their pre-treatment assessment scores using Wilcoxon rank sum test. In addition, the Pearson's Chi-squared test was used to assess whether patients differed in fluency and in the proportion of cases diagnosed with impairments at the semantic, lexical, segmental and grammatical levels. P-values were corrected using the FDR (False Discovery Rate) method. We ran each comparison including only the cases for which the relevant information was available.

Results

Patients who significantly improved with verb therapy presented higher pre-treatment scores than patients who did not improve in tests for noun comprehension ($U=398.5$, $p<0.001$), noun production ($U=1025.5$, $p=0.004$), verb comprehension ($U=686.5$, $p=0.001$), verb production ($U=1247.5$, $p=0.039$), word repetition ($U=385$, $p=0.002$), and sentence production ($U=112.5$, $p=0.039$). Concerning the levels of language impairment, we observed a larger proportion of individuals with semantic impairment in the group of patients who did not improve significantly in comparison to those who improved ($X2=18.606$, $p<0.0001$). In addition, the proportion of individuals with POL impairment was larger in the group of patients who improved significantly ($X2=8.004$, $p=0.010$). Relevant results are represented in Figure 1.

Discussion

Analyses of pre-treatment assessment scores support the predictive value of severity (Pedersen, Vinter, & Olsen, 2003). Accuracy in verb production and comprehension and in sentence production showed significant between-group differences. Higher scores in these tasks reflect partial preservation of knowledge important for verb use. Even though we selected only verb treatment studies, pre-treatment noun production and comprehension and word repetition accuracy also differ between the two groups, possibly reflecting the overlap of some processing levels for nouns and verbs. Pre-treatment scores in non-word repetition did not differ between groups. This is often used as a control measure, to verify treatment specificity, and exclude that improvements are merely due to task exposure (e.g., Bastiaanse, Hurkmans, & Links, 2006). Even though there were no between-group differences in sentence comprehension, it is not possible to specify which aspects of it may be (ir)relevant for improvement, due to the variability in the tasks used across studies.

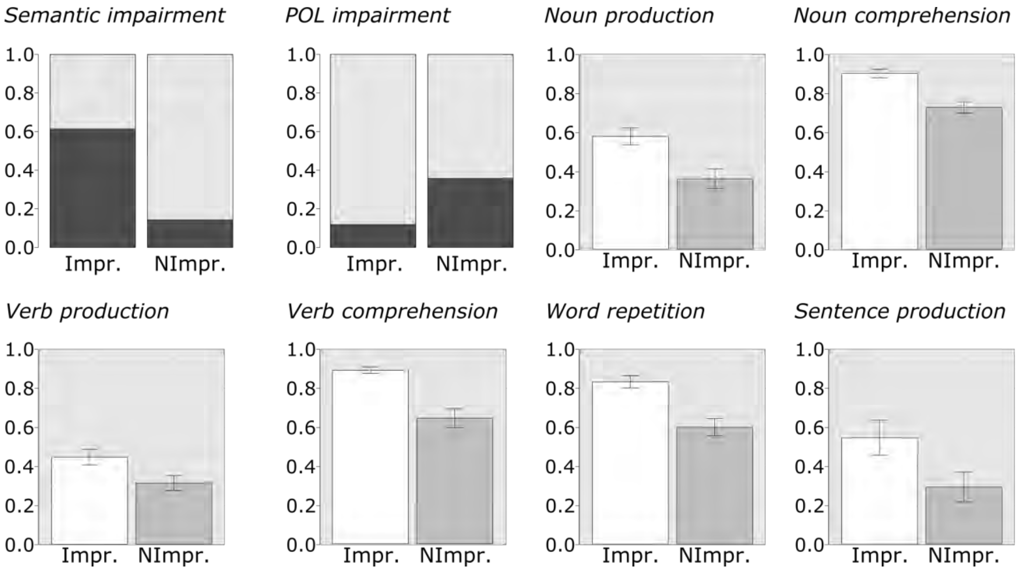

Figure 1. Differences between cases with treatment success and failure. “Impr”=patients who improved. “NImpr.”=patients who did not improve. For the “Semantic impairment” and “POL impairment” panels, light grey represents cases with impairment, and dark grey represents cases without impairment at the respective level. In these two panels, the proportion of cases with/without impairment is represented in the y-axis. For the remaining panels, the y-axis represents the proportion of correct responses in each test.

Patients with semantic impairment were less likely to improve, while patients with POL impairment were more likely to improve. A comprehension deficit may interfere with the therapeutic process (Gianella et al., 2011). In addition, whereas only 69 cases (out of 163) were treated with tasks designed to address semantic processing, POL was engaged by the treatment task in all subjects. Considering the specificity of treatment effects to the levels of language processing engaged by the task (Jacquemot et al., 2012), this sample might be biased.

In conclusion, our data suggest that severity in relevant tasks (that is, tasks that engage cognitive computations necessary for the to-be-rehabilitated processes) may be a predictor of treatment success. In addition, results support the idea that, when effective, treatment modifies performance in tasks that require the processing levels engaged by the task used during treatment.

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Buffer/resource limitation in phonological encoding: Consequences for word production

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Introduction

Shallice and Warrington (1977) originally argued that the phonological difficulties of a portion of conduction aphasics could result from short-term memory limitations. In a seminal paper, Caramazza, Miceli & Villa (1986) outlined the characteristics of a buffer impairment to be phonological errors across spoken tasks and across words and nonwords (because a buffer would hold both types of stimuli while they are being converted into articulatory plans).

More recent studies, however, have raised the issue of differences in the processing needs of words and non-words (e.g., Romani, Galluzzi & Olson, 2011; Shallice, Rumiati & Zadini, 2000; see also Glasspool, Shallice & Cipollotti, 2006, for similar arguments in the orthographic domain). If the phonology of a non-word decays too soon before an articulatory plan is realized, it is lost forever. Instead, if the phonology of a real word decays, it can be re-instantiated using lexical-semantic activation. This suggests that while a buffer impairment should clearly result in phonological errors, non-words should be much more severely affected than words and words should be affected by lexical-semantic variables such as imageability and frequency because stronger representations will be better able to support degrading information in the buffer.

Moreover, effects of length and position should be much more evident with nonwords than words. In a previous study, we showed no evidence that capacity limitations were causing phonological errors with words in a group of six aphasic patients, although capacity limitations were affecting nonwords in one patient (Romani et al., 2011). We argued, however, that difficulties with words could also become evident in other patients with more severe resource limitations. Here we present one such case which shows special characteristics indicative of resource limitations at the interface of lexical activation and articulation (i.e., at the level of phonological encoding).

Method

CS was a 75 year old, right-handed man who suffered an ischemic stroke two years before we started testing. His CT scan indicated a wedge-shaped area of low attenuation in the left parietal region (middle cerebral artery territory) with some normal density within it. CS's speech was grammatical with good range of words, but was halting with pauses, false starts and phonological errors.

In formal tasks, CS showed only a mild impairment in phonological input processing and word comprehension, and more severe, although still mild, impairment in spoken word production (word repetition, word reading, picture naming). In spoken tasks, including naming, he did not make omissions or circumlocutions, but, instead, produced a majority of phonological errors (lexical, but especially nonlexical).

A salient characteristic was a large number of false starts where he began to produce the word, stopped mid-word and, then, started again to produce a more complete response. Similar types of errors across repetition and naming indicated that his main problem was not in lexical access (anomia), but, instead, involved more peripheral processes.

Limited numbers of phonetic errors and phonological simplifications and no complexity effects in controlled lists, however, suggested that that CS's main difficulty was in phonological encoding rather than articulatory processing.

Experimental Results

Further characteristics of CS's speech shed light on his specific impairment. They include:
a) Worse performance with nonwords than words;
b) A clear *length effect with nonwords* but not with words;
c) False starts with words, but not nonwords, consistent with the fact that phonological information can be re-instantiated with words but not nonwords;
d) With words, more false starts with increasing length;
e) Positional effects especially with nonwords, with errors increasing linearly from the beginning of the word to the end, consistent with the fact that information at the end of words is more likely to be lost;
f) Clear frequency and imageability effects.

Taken together, these characteristics suggest a limitation of resources, like a buffer impairment, but also a strong interactions between buffered information and lexical activation. We explored these influences in two ways. First of all, we asked CS to practice some narrative speech, on topics of his choice, in a variety of ways (using a written script, an audio file or a combination) and we found that practice reduced phonological errors and, particularly, false starts.

Secondly, we administered some computerized tasks with controlled lists assessing: 1) *imageability X frequency* and 2) *complexity X frequency* in repetition and reading and 3) *length* in repetition, reading and naming. These tasks allowed us to measure effects not only in terms of error rates, but also in terms of onset RT and word durations. CS showed strong effects of imageability and frequency not only for onset RT, but also for word durations, differently from a matched control. He took longer to say words of lower frequency and lower imageability (see Figure 1).

Discussion

These results showed the influence of lexical variables and practice effects on fluency of spoken word production. In a patient with halting speech, phonological errors and false starts, spoken production was more accurate and more fluent (fewer false starts and shorter word durations) when the words had higher imageability, higher frequency and/or were practiced. Lexical influences on capacity/buffer limitations have been noted before in dysgraphic patients (e.g., Glasspool, et al. 2006; Ward & Romani, 1998). However, these patients produced fragments, rather than false starts, which could result from missing part of a lexical representation.

False starts suggest processing difficulties in a more compelling way, since the word is produced correctly after an aborted attempt. One could ask whether the term 'phonological buffer impairment' is the best way to capture the difficulties of a patient like CS.

Talking of resource limitations may be more appropriate because, given this terminology, it is easier to stress that resource limitations affect a specific processing stage (phonological encoding; CS has a very respectable digit span, around 5 digits) and vary with the strength of the representations that need encoding. This, however, is largely a terminological preference.

What is important, here, is the demonstration that there is a processing stage, after lexical access and before articulatory planning, that is affected both by capacity limitations and by lexical-semantic influences.

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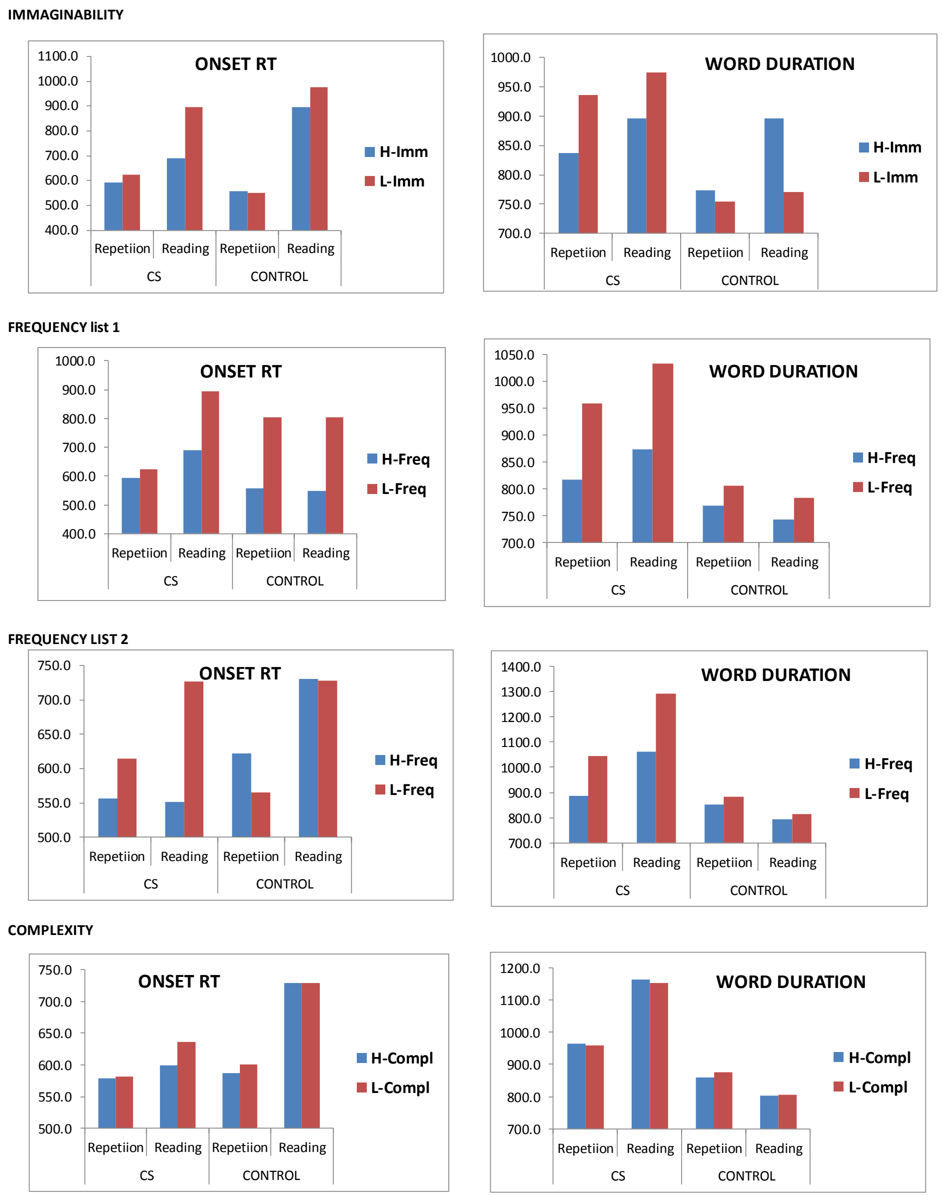

Figure 1. CS's performance and that an impaired control matched for age and education in computerized repetition and reading tasks.

Morphosyntactic and syntactic production in Italian-speaking agrammatic aphasia.

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Introduction

Impaired verb-related (morpho)syntactic production is the hallmark of agrammatic aphasia. Several hypotheses have been proposed to account for agrammatic production, which often make different predictions. For instance, the Distributed Morphology Hypothesis (DMH) (e.g., Wang, Yoshida, & Thompson, 2014) posits that categories involving inflectional alternations (e.g, tense, subject-verb agreement, henceforth "agreement") are impaired in agrammatic aphasia. The Tense Underspecification Hypothesis (TUH) (Wenzlaff & Clahsen, 2004, 2005) states that what is impaired ("underspecified") in agrammatic aphasia is tense; agreement and mood are well-preserved. The Interpretable Features' Impairment Hypothesis (IFIH) (e.g, Fyndanis, Varlokosta, & Tsapkini, 2012) predicts categories involving integration processes (e.g., tense, mood, negation) to be more impaired than categories that do not involve integration processes (e.g., agreement). The Tree Pruning Hypothesis (TPH) (Friedmann & Grodzinsky, 1997) states that, in agrammatic aphasia, the syntactic tree is pruned at a specific node, usually Tense; all nodes/categories above the pruning site are deleted and all nodes below are intact. To reliably test these accounts, one should test agrammatic individuals on a wide range of verb-related (morpho)syntactic phenomena/categories.

Against the above background, we investigated the ability of Italian-speaking agrammatic individuals to produce four categories: sentential negation, mood, tense, and agreement.

Methods

Participants

Eight native speakers of Italian with agrammatic aphasia and eight controls participated in the study. All agrammatic participants had suffered a left CVA at least 6 months earlier. The diagnosis of agrammatism was based on analysis of semispontaneous speech—following the coding procedures described in Thompson et al. (1995)—and clinical presentation.

Experiments

Three constrained tasks were developed: a picture-based constituent ordering task (COT) tapping sentential negation (based on Rispens, Bastiaanse, and Van Zonneveld, 2001), a sentence completion task tapping mood (SCT1), and a sentence completion task tapping tense and agreement (SCT2).

The COT consisted of 25 negative sentences and 25 control affirmatives. The participant was presented with a picture and cards. The cards—presented in a semi-random (but never grammatical) order—always contained the negative element *non* ''not''. Participants were asked to put the cards in the correct order to construct a sentence, and on the basis of the picture they had to decide whether or not to use the negative element.

The SCT1 consisted of 30 sentences eliciting indicative mood and 30 sentences eliciting subjunctive mood. Each sentence consisted of two clauses: a matrix and a conditional one. Participants were cross-modally presented with a sentence, in which the target verb form was missing from the conditional clause. The infinitive form of the missing verb appeared within parentheses below the sentence. Participants were asked to read out the sentence providing the correct verb form.

The SCT2 included 80 experimental items, half of which tested tense and half agreement. Participants were auditorily presented with a source sentence and the beginning of the target sentence (TS), and were asked to orally complete the TS providing the missing verb.

Results

Results are presented in Table 1. The control group performed significantly better than the aphasic group on all four (morpho)syntactic conditions (in all comparisons, by Fisher's exact test, $p < .001$). Both groups showed similar patterns of performance, with significantly better performance on agreement and tense than on mood. Negation was found to be significantly better preserved than agreement, tense, and mood in the aphasic group, but in the control group negation was not significantly different from any other category. At the individual level, despite some variation in accuracy, five agrammatic participants (MD, SM, CA, RL, AC) exhibited the same pattern of performance (agreement/tense/negation > mood).

Discussion

At the group level, the results of the agrammatic participants are not consistent with any of the hypotheses discussed here. They are against the TUH (Wenzlaff & Clahsen, 2004, 2005), as participants performed significantly better on tense than on mood. The results cannot be accounted for by the DMH (Wang et al., 2014), as this theory cannot explain the observed selectivity of the impairment of categories involving inflectional alternations (tense/agreement > mood). The results do not support the TPH (Friedmann & Grodzinksy, 1997), as the higher the category in the syntactic hierarchy (Neg > T(future/past) > M) (Cinque, 1999; Zanuttini, 2001), the better the performance of agrammatic participants. Lastly, the results are at odds with the IFIH (Fyndanis et al., 2012), because sentential negation, which involves integration processes, is better preserved than agreement, which does not involve integration processes.

A similar situation is observed at the individual level. None of the agrammatic participants lends support to the TUH, as mood was found to be either more impaired than tense (see MD, SM, CA, RL, AC) or not significantly different from tense (see AZ, GP, SP). Only SP's results are consistent with the DMH, as he exhibited no dissociations between the three categories involving inflectional alternations, namely agreement, tense, and mood. The remaining agrammatic participants showed selective deficits. Only SP's results are in line with the TPH, because he was comparably impaired in mood (possibly the pruning site of SP's syntactic tree, given his severe aphasia) and tense. The remaining participants performed worse on mood than on tense and/or negation. None of the agrammatic participants lends support to the IFIH, as none of them performed better on agreement than on all the other categories.

None of the hypotheses above can account for the patterns of performance of all the agrammatic participants. Their results, together with the production results of other agrammatic speakers reported in the literature, show that all possible patterns of (morpho)syntactic production can be observed in agrammatic aphasia, and that a unitary account of the disorder is unlikely to succeed (Miceli et al., 1989). We suggest that a number of factors such as subject-specific characteristics (e.g., site, type and volume of brain damage, type and severity of aphasia, education, age) and language-specific properties of functional categories (e.g., syntactic hierarchy, interpretability/involvement of integration processes, morphological complexity, frequency) interact in determining the way in which (morpho)syntactic impairments manifest themselves across agrammatic speakers and languages.

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Table 1. Raw and percent accuracy scores, standard deviations, and comparisons (by Fisher's exact test for count data) for agrammatic (P1-P8)
and control (C1-C8) participants.

	Agr	T	M	Neg	Agr vs. T	Agr vs. M	Agr vs. Neg	T vs. M	T vs. Neg	M vs. Neg
P1 (MD)	30/40	34/40	27/60	22/25	*p* = .402	***p* = .004**	*p* = .340	***p* = .000**	*p* = 1	***p* = .000**
	(75%)	(85%)	(45%)	(88%)						
P2 (SM)	37/40	39/40	28/60	21/25	*p* = .615	***p* = .000**	*p* = .415	***p* = .000**	*p* = .068	***p* = .002**
	(93%)	(98%)	(47%)	(84%)						
P3 (AZ)	23/40	11/40	23/60	23/25	***p* = .012**	*p* = .068	***p* = .004**	*p* = .289	***p* = .000**	***p* = .000**
	(58%)	(28%)	(38%)	(92%)						
P4 (GP)	11/40	25/40	27/60	19/25	***p* = .003**	*p* = .094	***p* = .000**	*p* = .104	*p* = .290	***p* = .016**
	(28%)	(62%)	(45%)	(76%)						
P5 (CA)	40/40	35/40	35/60	23/25	*p* = .055	***p* = .000**	*p* = .144	***p* = .000**	*p* = .698	***p* = .002**
	(100%)	(88%)	(58%)	(92%)						
P6 (SP)	18/40	24/40	30/60	N/A	*p* = .263	*p* = .685	N/A	*p* = .413	N/A	N/A
	(45%)	(60%)	(50%)							
P7 (RL)	39/40	40/40	35/60	25/25	*p* = 1	***p* = .000**	*p* = 1	***p* = .000**	*p* = 1	***p* = .000**
	(98%)	(100%)	(58%)	(100%)						
P8 (AC)	39/40	40/40	39/60	25/25	*p* = 1	***p* = .000**	*p* = 1	***p* = .000**	*p* = 1	***p* = .000**
	(98%)	(100%)	(65%)	(100%)						
TOTAL	**237/320**	**248/320**	**244/480**	**158/175**	*p* =.356	***p* = .000**	***p* = .000**	***p* = .000**	***p* = .000**	***p* = .000**
	(74%, ±27.8)	**(78%, ±25.6)**	**(51%, ±8.9)**	**(90%, ±8.6)**						
C1 (GT)	40/40	40/40	60/60	25/25	*p* = 1	*p* = 1	*p* = 1	*p* = 1	*p* = 1	*p* = 1
	(100%)	(100%)	(100%)	(100%)						
C2 (EZ)	40/40	40/40	49/60	25/25	*p* = 1	***p* = .003**	*p* = 1	***p* = .003**	*p* = 1	*p* = .029
	(100%)	(100%)	(82%)	(100%)						
C3 (AB)	40/40	40/40	60/60	23/25	*p* = 1	*p* = 1	*p* = .144	*p* = 1	*p* = .144	*p* = .084
	(100%)	(100%)	(100%)	(92%)						
C4 (FD)	40/40	40/40	48/60	24/25	*p* = 1	***p* = .001**	*p* = .385	***p* = .001**	*p* = .385	*p* = .096
	(100%)	(100%)	(80%)	(96%)						
C5 (MV)	40/40	40/40	58/60	25/25	*p* = 1	*p* = .515	*p* = 1	*p* = .515	*p* = 1	*p* = 1
	(100%)	(100%)	(97%)	(100%)						
C6 (PG)	40/40	40/40	60/60	25/25	*p* = 1	*p* = 1	*p* = 1	*p* = 1	*p* = 1	*p* = 1
	(100%)	(100%)	(100%)	(100%)						
C7 (AG)	40/40	40/40	60/60	25/25	*p* = 1	*p* = 1	*p* = 1	*p* = 1	*p* = 1	*p* = 1
	(100%)	(100%)	(100%)	(100%)						
C8 (WG)	40/40	40/40	60/60	25/25	*p* = 1	*p* = 1	*p* = 1	*p* = 1	*p* = 1	*p* = 1
	(100%)	(100%)	(100%)	(100%)						
TOTAL	**320/320**	**320/320**	**455/480**	**197/200**	*p* = 1	***p* = .000**	*p* = .056	***p* = .000**	*p* = .056	*p* = .032
	(100%, ±0)	**(100%, ±0)**	**(95%, ±8.6)**	**(99%, ±3.0)**						

iReadMore: Computer-based rehabilitation for reading impairments in aphasia

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Introduction

Central alexia is a common reading impairment seen in the majority of patients with aphasia (Leff & Starrfelt, 2013). It has a significant impact on the quality of life (Leff & Behrmann, 2008). Despite its prevalence, few patients receive sufficient reading therapy. A scientifically proven online reading therapy app could counter this large unmet need.

We have developed iReadMore, an adaptive multi-modal, single-word training therapy that consists of pairing the written word with both the spoken word (which will activate phonological representations) and pictures (which will activate semantic representations). In theory, by bootstrapping the written word to these other, familiar, long-term representations over many hundreds of trials, the written word forms become themselves better represented in patients' brains. When the patients re-encounter the words outside of the therapy package and thus without these cues, recognition of trained words is both faster and more accurate.

We investigated if using iReadMore training improved single word reading accuracy and reaction times. Using MEG, we also assessed if any neurological changes were present in the reading network between trained and untrained words after therapy.

Methods

Word reading was tested twice at baseline (T1 and T2, one month apart); before (T3) and after the first training block (T4) and after the second training block (T5). Participants completed 35 hours of iReadMore therapy over 4 weeks in each training block. The trial is still ongoing so we restrict our reporting to 10 patients who have completed both training blocks.

Participants

10 participants (mean age (SD); 52.34 (10.45), mean time post stroke; 5.65, 6 males) with aphasia and word reading impairments following left hemisphere stroke were recruited to the study. One participant withdrew from the study at the end of the first block for personal reasons (moving out of London).

Procedure

Participants received training in two word lists, one list was trained in each block. At every time point, word reading accuracy and speed was assessed using a 270 word reading test containing trained and untrained words. All lists were matched for linguistic features and the participant's baseline performance.

MEG data acquisition

Participants silently read: 1) trained words; 2) untrained words; and, 3) proper names over four runs in MEG scanner. They were asked to press a button whenever they read a name (catch trial, not analysed).

Analysis

Word reading accuracy was coded as follows; 1=correct, 0.5=self-corrected error, 0=incorrect. Repeated measures ANOVAs with levels time (pre vs post therapy) and list (trained vs untrained words) were conducted for each of the two therapy blocks separately. Reaction time (RT) data from two participants were excluded from the analysis as their word reading accuracy was too low to calculate reliable RTs.

MEG analysis

The data were pre-processed. The following contrast was applied to the data; trained=1, untrained = -1. The data was converted to images and smoothed for analysis.

Results

Does iReadMore training improve word reading accuracy?

A repeated measures ANOVA showed a significant time by list interaction for word reading accuracy (see Figure 1A) over the first training block, $F(1,9)=23.32$, $p<0.01$ and second training block, $F(8,1)=857$, $p<0.02$. Paired t-tests post therapy revealed significantly greater accuracy for trained words over untrained words after block one, $t(9)=4.98$, $p<0.01$, and block two, $t(8)=7.23$, $p<0.01$. Word reading accuracy for trained items was significantly higher after training compared to before training over block one $t(9)=3.49$, $p<0.01$, and block two, $t(8)= 4.73$, $p<0.01$. No significant difference was observed in untrained word reading accuracy over block one $t(9)=0.67$, $p=0.525$ or block two $t(8)=-0.72$, $p=0.49$.

Does iReadMore training improve word reading speed?

A significant time by list interaction was observed for reaction times over the first training block, $F(7,1)=10.27$, $p<0.05$. After training, reading reaction times were significantly lower for trained compared to untrained words $t(7)=-2.96$, $p<0.05$, 95% CI; -239.67 to -26.59. A significant interaction was not observed over the second training block $F(6,1)=0.02$, $p=0.887$.

MEG analysis

A significant difference in activation between trained and untrained words after therapy was observed in the sensor space in an area corresponding to the left inferior frontal gyrus (see figure 1b) at 117ms post stimulus onset.

Discussion

iReadMore therapy shows promising preliminary results in improving single word reading accuracy and speed in a group of central alexia patients. In line with previous research, training did not generalise to untrained items.

In a group of patients with pure alexia, Woodhead et al. (2013) showed reading therapy strengthened feedback connectivity from the left inferior frontal gyrus (IFG) to the left occipital cortex, in the first 200ms after a word is seen. This indicates that feedback from the IFG could be driving reading recovery. Our results, in a group of patients with central alexia, suggest that the left IFG may have an important role restructuring the representation of visual word forms. In the next stage of analysis, we will conduct dynamic causal modelling on these data. This will allow us to identify how the left IFG is interacting with the rest of the reading network in patients with central alexia.

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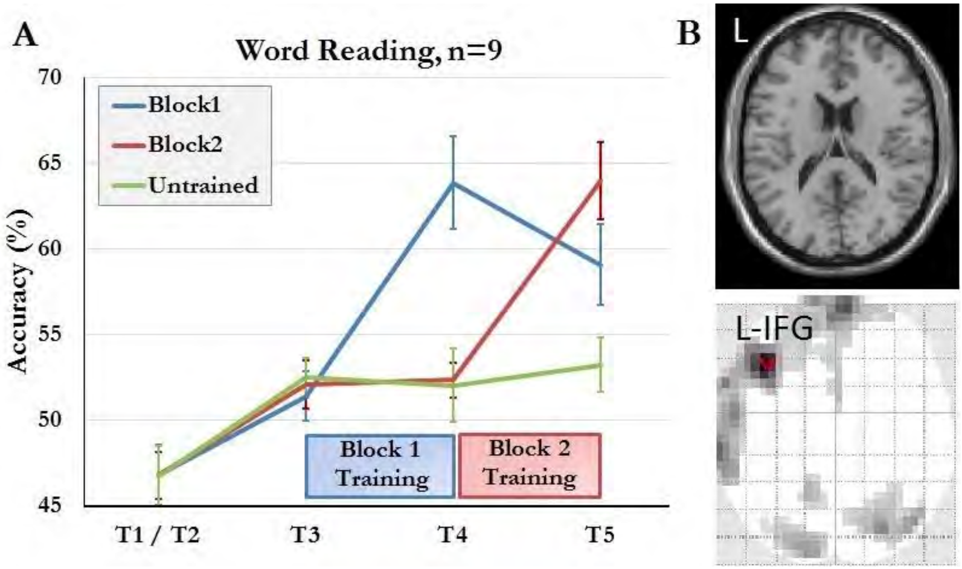

Figure 1

A. Average word reading accuracy across 9 central alexia patients for words trained in block 1 (blue), block 2 (red) and untrained words (green). iReadMore training (35 hours over 4 weeks) occurred between T3 and T4 during block 1 and between T4 and T5 during block 2.

B. Differences in activation for trained and untrained words after block 1 training. The red arrow highlights a significant difference in a regions corresponding to the left inferior frontal gyrus at 117ms post stimulus onset. Areas with higher activation differences between trained and untrained words appear darker. To aid in orientating the reader, a template brain is displayed above the sensory space analysis. Abbreviations; L = left, L-IFG= Left inferior frontal gyrus.

The role of semantically rich gestures in aphasic conversation

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Introduction

Gestures play an important role in everyday communication (Kendon, 1997). They provide additional information to conversation partners about the meaning of verbal utterances and help to clarify even abstract concepts. There is evidence that gestures are not simply produced for the benefit of the listener but also support the speaker (Krauss, Chen, & Chawla, 1996; McNeill, Cassell, & McCullough, 1994). The relationship between speech and gesture is of great theoretical interest. Indeed the strong ties between speech and gesture have stimulated discussions about the neurological links between the modalities and the possible gestural origins of language.

Because of the importance of gesture in communication, several studies have investigated the use of gestures in aphasia (see Rose, 2006 for review). It is important to know how people with aphasia (PWA) use gesture as an accompaniment to speech, as a compensatory modality and during word-finding difficulties. Such knowledge can contribute to potential treatment regimes and may point to strategies that can assist everyday communication. Studying gesture use in people with compromised language can also contribute to the theoretical debate about the relationship between the modalities.

Most studies to date have focused on the effects of gesture in structured naming tasks, rather than in more natural conversation.

Methods

Aims

This study examines the natural conversational use of gestures in aphasic speech and addresses several research questions. This presentation focuses only on the following research questions:

(1) To what extend to PWA and neurologically healthy participants (NHP) employ semantically rich gestures (i.e., gestures that convey stand alone meanings or reflect an aspect of the spoken discourse)? What impact does their semantic competence have on gesture production?
(2) Do semantically rich gestures take different roles during conversation (facilitative, communicative, augmentative, compensatory)?
(3) Do different topics, for example, narrative (i.e., telling about a life event) and procedural (i.e., describing a process) elicit different gesture patterns?

Procedures

Language and conversation data of 20 PWA and 21 NHP have been collected. Extensive background testing of PWA has been done including tests of lexical semantics and non-verbal semantics. Conversation samples of eight minutes in total have been collected. Video samples have been transcribed and analysed for gesture production, speech production and word-finding difficulties. Semantically rich gestures (e.g., they reflect concrete or abstract reference in the discourse (iconic, metaphoric and air writing & number gestures) or convey meaning in their own right (pantomime and emblem gestures)) were contrasted with semantically empty gestures (e.g., they refer to places or objects (deictic gestures) or mark speech rhythm (beat gestures). The roles of semantically rich gestures were coded to determine if participants are using gesture mainly to supplement speech, to replace speech or to facilitate lexical retrieval.

The following methods are being used in the analysis:

(1) All semantically rich gestures are identified within the conversation.

(2) Semantically rich gestures which occur during a word finding difficulty (i.e. which occur within three seconds of word finding behaviour and before the next utterance) will be either categorised as being facilitative or communicative.
   a. If the word finding difficulty is resolved, the gesture will be categorised as being *facilitative*.
   b. If the word finding difficulty is not resolved (by the speaker), the gesture will be categorised as being *communicative*.

(3) All other semantically rich gestures will be either categorised as being augmentative or compensatory.
   a. If a gesture occurs alongside speech and supplements it, it is considered as being *augmentative*.
   b. If a gesture is produced to replace speech, it will be categorised as being *compensatory*.

Results

The data analysis is on-going and results for both PWA and NHP will be available for presentation at the conference.

Preliminary results indicate that PWA used significantly more semantically rich gestures than semantically empty ones ($t(15) = 5.229$, $p < .05$). Surprisingly, the semantic impairment did not correlate with the use of semantically rich gestures ($r_s = .053$, n.s.; $r_s = .171$, n.s.). Overall, semantically rich gestures took different roles ($X^2(3) = 34.956$, $p < .05$). Most semantically rich gestures were produced during a procedural than a narrative conversation ($t(15) = -2.538$, $p < .05$).

Discussion

Semantically rich gestures play an important role in conversation for PWA. They can take different roles with many gestures being produced alongside speech (augmentative gestures) and those facilitating lexical access (facilitative gestures). Only a small number of gestures replace speech (compensatory gestures). Finding out more about the different roles of gestures in speech production, helps us to better understand the relationship between language and gestures. This is vital for gestures to be implemented into aphasia therapy.

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Reference to the Past in Broca's Aphasia: Inflectional and Semantic Complexity

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Introduction

One defining feature of sentence production in agrammatic Broca's aphasia is the omission and substitution of free and bound grammatical morphemes in simple and complex sentence structures (e.g., Caramazza & Berndt, 1985). Profound difficulties with production of sentences that refer to the past (compared to non-past) have been shown for many languages including Turkish (e.g., Yarbay Duman & Bastiaanse, 2009; Bastiaanse et.al., 2011).
This study tested impact of inflectional complexity on time-reference in Turkish agrammatic aphasia. Reference to the past and present were tested for morphologically simple past (-*DI*) and simple present (-*IYOR*) and production of sentences with these inflections was compared to the sentences referring to the past with morphologically complex verbs (–*MISDI* for past perfect & –*IYORDU* for past progressive). From a general inflectional complexity perspective, morphologically complex verb forms (–*MISDI* & –
IYORDU) are expected to be more difficult to produce than morphologically simple verb forms (–*DI* & –
IYOR) for individuals with agrammatic Broca's aphasia. However, according to Yarbay Duman & Bastiaanse (2009), morphologically simple past tense (perceptual –*DI*) is the semantically most difficult form to produce for individuals with Turkish agrammatic aphasia, since this verb form indicates highest degree of epistemic-speaker certainty as to the happening of a past event and, agrammatic speakers are uncertain in this respect. If semantic complexity plays a role in sentence production in agrammatic aphasia, morphologically simple but semantically complex past tense verbs can be expected to be as difficult as inflectionally complex verb forms referring to the past. That is, an effect of inflectional complexity would not necessarily be seen for semantically complex past verbs but for semantically simple present verbs. In terms of semantic complexity, this study also questioned whether the ease with simple progressive would make sentences with past progressive easier than sentences with past perfect. Overall, nature of errors to the target verb inflection in the test was examined for all past tense forms.

Methods

Participants

Seventeen Turkish individuals (3 females, 14 males, MA: 54.17, SD: 13.50) clinically diagnosed with Broca's aphasia by *Turkish Aphasia Assessment Test* (ADD: Maviş & Toğram, 2009) participated in the study. All patients had a left hemisphere lesion and had suffered a single cerebrovascular accident (except for two who had single Traumatic Brain Injury) at least 3 months prior to testing. Seventeen agematched Turkish speakers with no speech and language impairment history served as the control group.

Materials

A pictorial sentence completion test was developed by using a similar methodology of *The Test for Assessing Reference of Time (TART:* Bastiaanse, Jonkers, & Thompson, 2008). In 4 test conditions, present progressive *(–IYOR)*; simple past *(–DI),* past perfect *(–MISDI),* past progressive *(–IYORDU*) were tested. There were 15 sentences per condition. Time-adverbs (shortly after, shortly before, now) were used to manipulate a specific reference time. An example is given below (in the test, two pictures describing the two sentences were used for each test item). The patients' task was to complete the sentence with a verb.

Example test sentence:
Biraz önce kadın muzu soydu. Şimdi kadın portakalı… (Participant: soyuyor)
Shortly before the woman-nom the banana-acc peeled. Now the woman-nom the orange-acc… (Participant: is peeling)
'The woman peeled the banana shortly before. The woman is peeling the orange now'

Results

The control group performed at ceiling on producing target verb inflections in the test. Thus, their data were not considered for statistical analyses. For the agrammatic group, a repeated measures ANOVA with Condition (simple past, simple progressive, past perfect, past progressive) as the within participants variable indicated a significant main effect for Condition ($F(1.62, 25.98)=38.54$, $p < .001$, $\eta^2 = .70$, with a Greenhouse-Geisser correction because sphericity assumption was violated). Figure 1a shows accuracy data. Pairwise comparisons with Bonferroni correction indicated that the mean difference between *–DI* & *–IYOR* (–7.64); *–MISDI* & *–IYOR* (–11.82) and, *–IYORDU* & *–IYOR* (-11.82) was significant ($p = .001$ for all comparisons). However, the mean difference between *–DI* & *–MISTI* (4.17) and *–DI* & *–IYORDU* (4.17) was not significant (p=.205; p=.104 respectively). The mean difference between *–MISTI* & *–IYORDU* (.000) was not significant either (p=1.000). Error data analyses revealed that the patients produced nontarget past tense inflections (see Figure 1b) to refer to the past: for *–DI*: *–MIS*: M= 6.7; *–MISDI*:
M=1.4; for *–MISDI*: *–MIS*: M=6.9; *–DI*: M=5.8; for *–IYORDU*: *–MIS:* M=1.0; *–DI*: M=1.9).

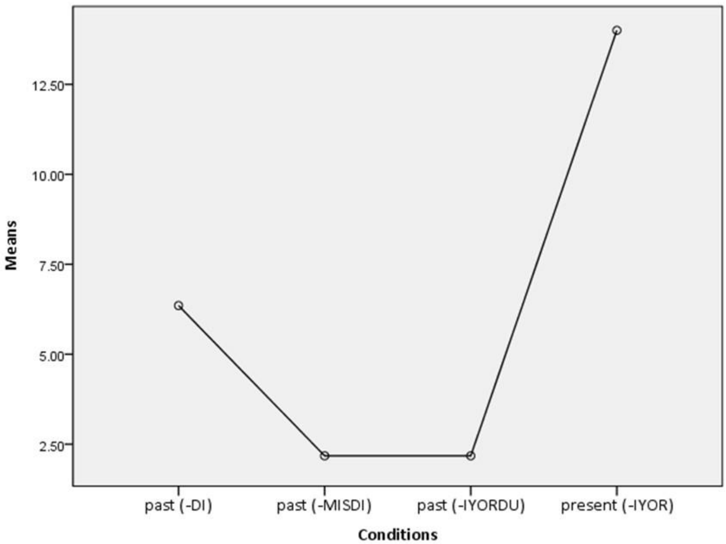

Figure 1a. Accuracy Means for Target Verb Inflections per Condition

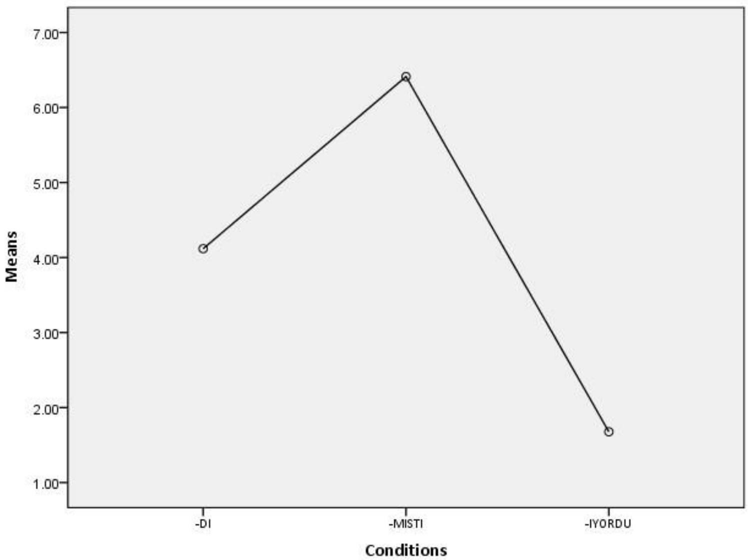

Figure 1b. Reference to the past with nontarget verb inflections per past tense conditions

Discussion

The study has several findings. First, morphologically simple past (–*DI*), as shown in earlier studies on Turkish, was more difficult to produce than morphologically simple progressive (–*IYOR*). Second, morphologically complex verb forms inflected for –*DI* (past perfect: –*MISDI* & past progressive: – *IYORDU*) was equally difficult, indicating that presence of progressive aspect does not ease production of morphologically complex verb forms, at least when –*DI* is present. Finally, morphologically simple past (–*DI*) was as difficult as difficult as morphologically complex verb forms (–*MISTI* & –*IYORDU*). These findings suggest that reference to the past is difficult for the patients and semantic complexity involved in –*DI* (problems attributing epistemic certainty when there is reference to the past, see Yarbay Duman & Bastiaanse, 2009) makes this verb form as difficult as morphologically complex verb forms.

Error data indicated that when the target inflection required production of –*DI* in the test, the patients often produced a nontarget past inflection (e.g. –*MIS* for –DI*; –MIS* or –*DI* for –MISDI*)*. The difference between –*DI* and –*MIS* in Turkish is that –*MIS* indicates indirect or hearsay evidence and, as such, involve a lower degree of speaker and event certainty compared to the perceptual –*DI*. Thus, the problems with past time-reference can be due speaker's uncertainty as to the happening of the event (Yarbay Duman & Bastiaanse, 2009). A similar idea has recently been proposed by Tosun et.al. (2013) for healthy Turkish adults that their epistemic certainty degrees of a past event impact their interpretations of these past tense forms, which leads overgeneralizations of epistemically more reliable –*DI* in source judgement tests. We are currently investigating varying degrees of speaker and event certainty in past time comprehension in aphasia since such an overgeneralization would indicate sentence production-comprehension asymmetry in domain of epistemic certainty in aphasia.

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Speech segmentation in chronic left hemisphere stroke

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Introduction

Human language is a richly structured system with multiple statistical regularities (Yurovsky, Yu, & Smith, 2012). Infants and adult learners can extract the statistical properties of language such as the transitional probabilities (TP) between co-occurring syllables to parse fluent speech into word units (Saffran et al., 1996a, b). The regions proposed to underlie speech segmentation via statistical learning (SL) in the adult brain (Rodríguez-Fornells et al., 2009) largely overlap those recruited for language processing and therefore, the functionality of speech segmentation may be vulnerable to left hemisphere stroke. Only recently, we evidenced that speech segmentation abilities can remain preserved in some people with stroke-induced chronic aphasia, and this preservation seemed to be linked to the integrity of the left inferior frontal regions and to the functionality of verbal STM (Peñaloza et al., 2015).

The present work will report the preliminary behavioral results of our ongoing study of speech segmentation via SL in people with chronic left hemisphere stroke using a voxel-lesion symptom mapping approach. As a logical continuation of our previous study (Peñaloza et al., 2015) we will examine this ability in a larger sample with chronic left hemisphere stroke who will undergo detailed structural brain imaging by MRI. This should help us to better understand the lesion-behavior relationships concerning speech segmentation. This ongoing study will also examine whether language performance and other cognitive abilities are associated with speech segmentation ability in this group.

Methods

Participants

The present study will include 20 Spanish-speaking participants with a chronic left hemisphere stroke who fulfill the following criteria: age range of 25-80 years, ischemic or hemorrhagic lesion involving cortical or cortico-subcortical regions, aphasia diagnosed acutely after stroke, enrollment at least 6 months post-stroke, premorbidly right-handed, normal or corrected-to-normal vision and audition. A group of 10 healthy older adults within the same age range will also be included for comparison.

Experimental task

The participants' ability to segment words from running speech will be evaluated with the speech segmentation task reported in Peñaloza et al (2015). In this task, each participant is briefly exposed to a continuous artificial speech stream composed of 4 trisyllabic nonsense words created with the phonotactic rules of the Spanish language. The TPs between adjacent syllables are the only reliable cue to detect word boundaries in the novel language (TP between syllables forming a word =1.0; TP between syllables spanning word boundaries = 0.33). After exposure, participants are presented with a 2-alternative forced-choice test (2AFC test) that requires the discrimination of words of the novel artificial language from nonwords (foil items created with syllables of the language that were never concatenated in the speech stream) across 16 testing trials.

Results

The performance of each participant in the 2AFC test will be scored for accuracy and the percent of correct responses on the 2AFC test will be used as a measure of their individual speech segmentation ability. The performance of the participants with left hemisphere stroke will be compared both to chance level and to the performance of the group of healthy controls. We will further examine the differences in speech segmentation performance according to lesion location and examine if specific language and cognitive measures associate with speech segmentation in left hemisphere stroke.

Discussion

Based on our previous research (Peñaloza et al., 2015), we expect to find a large individual variability of speech segmentation performance. The study of speech segmentation via SL in a larger sample of people with chronic left hemisphere stroke using a more detailed lesion characterization will allow us to further confirm if impaired speech segmentation is significantly associated with the integrity of the left inferior frontal region, and to determine whether not just verbal short-term memory but also other aspects of language and cognitive functioning are related to speech segmentation ability in people with chronic left hemisphere stroke.

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Electrophysiological correlates of grammatical and semantic gender processing

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Introduction

A gender system of a gender marked language (e.g., Italian, German, Serbian) usually comprises two kinds of gender, grammatical (purely formal feature) and semantic gender (semantically based feature). The former is language specific (e.g., *chair* is masculine in German but feminine in Italian), whereas the latter is almost always universal (e.g., *mother* is feminine in any Germanic, Slavic, or Romance language marked for gender). The difference between the two seems intuitive, as only semantic gender can coincide with the sex of the referent in the extralinguistic world.

Individuals with aphasia seem to have relatively well spared gender knowledge (e.g., Akhutina et al., 2001; Bastiaanse, Jonkers, Ruigendijk, & Van Zonneveld 2004). However, more fine-grained testing revealed that there is a dissociation between semantic and syntactic gender, with semantic gender being better preserved after brain damage. Biran and Friedmann (2012) reported a case of an individual with aphasia who had impaired grammatical gender knowledge but performed at ceiling (both at gender retrieval and gender agreement operations) when the noun had semantic gender. Vigliocco and Zilli (1999) tested two individuals with aphasia and 64 non-brain-damaged speakers on a production task manipulating grammatical and semantic gender. The error analysis revealed that the participants (with and without aphasia) were more likely to produce agreement errors in the grammatical gender condition.

The authors of both studies explain their findings in terms of an additional information source in case of semantic gender. In case of syntactic gender, the gender feature is only available as a formal lexical-syntactic feature. Semantic gender, however, can be accessed both as a lexical-syntactic gender feature, and as a semantic feature stemming from conceptual knowledge. These two pieces of information exist parallelly, with the effect of enhancing gender knowledge. In case of a disruption or loss of the formal gender feature, semantically based gender can still be retrieved through conceptual knowledge.

Studies with Event Related Potentials (ERPs) aimed to capture the semantic aspect of semantic gender in real time language processing (e.g., Barber, Salillas, & Carreiras, 2004; Deutsch & Bentin, 2001). Previous ERP gender agreement studies demonstrate that grammatical gender is a syntactic feature, and agreement involving grammatical gender is a syntactic process (e.g., Barber & Carreiras, 2005; Hagoort & Brown, 1999). However, the results of studies involving semantic gender vary considerably from each other, and the presence of the semantic component has not yet been proven.

Previous studies only measured the effect of semantic gender on elements unspecified for gender, ranging from gender marked predicates to gender marked pronouns. This can be the reason for the inconsistent findings in the literature, as each of these structures uses different gender agreement mechanisms. The aim of the current study is to fill in a neglected niche in gender agreement studies, which is measuring the effect of gender type at the gender source - the noun. This enables us to look directly at the source of the conceptual knowledge needed for semantic gender, and not at the copy of the gender feature on gender unspecified elements (verbs, adjectives, pronouns). By doing so, we investigate how individuals process semantic gender, and if such data complement or contradict processing theories based on patient data.

Methods

Materials

We created 160 experimental sentences and 80 filler sentences in Italian, and divided them into two lists. Each participant heard 80 experimental stimuli and 80 fillers. The experimental sentences were built in the same way; they all started with an adverbial followed by a DP followed by a verb, and ending with an object or a PP:

(1) Now the boy is helping his mother.

Half of the sentences have a subject with semantic gender (semantic gender condition), and half a subject with grammatical gender (grammatical gender condition). Each sentence is presented both as grammatically correct and with a grammatical violation. The (gender) violation is on the article, thus creating a gender mismatch between the article and the noun (2). The violation is detected and measured on the noun as our region of interest.

(2) *Now the$_{\textbf{Fem}}$ **boy**$_{\textbf{Masc}}$ is helping his mother.

Procedure

Sentences were presented auditorily. After each trial, the participant judged whether the sentence was grammatically correct by pressing the appropriate button on the keyboard. The continuous EEG signal was recorded with a 64-channel system.

Results

The experiment is in its data collection stage. At the moment, 15 participants have been tested out of the planned 25-30 participants.

Discussion

None of the previous ERP studies looked into semantic gender when the mismatch is created between the article and the noun. Since semantic gender is based on the conceptual information of the noun, the logical step is to measure how it is processed at the source. This way, we eliminate possibly interfering factors, such as co-reference establishing in pronoun agreement or distance effects in subject-predicate agreement.

As soon as the results are available, we will draw parallels between the data from individuals with aphasia and our data from a healthy population. We will be able to either support or reject the idea that semantic gender can be accessed via two routes, that is, as a purely formal feature (exactly like grammatical gender) or as a semantic feature whose source is in our conceptual knowledge. If the evidence goes in favour of this theory, we expect to find an effect at the integration stage (after 500 ms). The issue at hand can shed more light on the mechanisms of the interaction between semantic and syntactic knowledge in both healthy and impaired language processing.

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Testing the lexical/functional divide in aphasia

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Introduction

Classical studies in neuropsychology have assumed double dissociation between noun and verb categories (Caramazza, A. & Hillis, A.E. 1991). In contrast, recent studies have suggested this dissociation should be defined in terms of lexical versus functional dichotomy (Franco, 2014). These two perspectives lead to different predictions about aphasic individuals' performance. The former, which can be referred as 'the categorical view' predicts, in Broca´s aphasia, dissociation between spared noun processing but impaired verb processing (assumed to involve temporal and frontal regions, respectively). The latter, referred as 'the lexical/functional divide' (Franco, 2014), predicts intracategorical dichotomy within the verbal category, some verbs being more problematic than others due to their internal semantic or syntactic features. The present study aims at testing these predictions on the language performance of two French-speaking individuals with agrammatic aphasia.

Methods

Participants

2 French-speaking adults with agrammatism (a man and a woman; age: 58 and 37, 24 and 7 years post onset, respectively) and ten French-speaking control adults (5 men; 5 women; Max age: 63; Min age: 21; Mean age: 32) participated in the study.

Methodology

A multilingual language assessment tool was developed in French, Basque and Spanish in order to assess inflectional and lexical processing of nouns and verbs across these languages. The battery includes five oral tasks: 1) object naming; 2) action naming ; 3) sentence production ; 4) sentence comprehension ; 5) prepositional phrase production. A total of 160 stimuli were chosen and controlled on properties such as argument structure, frequency, imageability and age of acquisition. The same nouns were used in tasks 1 and 5 and the same verbs were used in tasks 2, 3 and 4. These tasks aim at collecting data in these three languages with adult aphasic to address questions in the context of clinical linguistics and neuropsychology of language, such as: Do we observe noun/verb dissociation at the lexical level? Does verb argument structure complexity increase verb lexical and morphosyntactic deficits? In both production and comprehension? Do inflectional errors cut across noun and verb categories?

Procedures

In task 1, participants were asked to name an object (i.e. to produce an uninflected noun: e.g. "boat"), while in task 5 they were asked to answer a question forcing them to inflect the noun (e.g. Where is the child jumping from? –*from the* boat.). In task 2, participants were asked to name an action (i.e. to produce an uninflected verb: e.g. "read"), while in task 3, they were asked to make a sentence forcing them to inflect the verb (e.g. “The man reads the newspaper.”). In task 4, participants were presented with fours pictures and asked to point to the one corresponding to the sentence they heard: e.g. “They read the newspaper.” Each target picture was presented along with a lexical distractor (i.e. different verb, e.g. picture depicting two men *cutting* the newspaper); a functional distractor (i.e. different agreement, e.g. picture depicting *one man* reading the newspaper) and a mixed distractor (i.e. different verb and different agreement, e.g. picture depicting *one man cutting* the newspaper). This allowed us to assess lexical and functional verb comprehension and to identify the nature of errors: lexical, functional or mixed. All tasks and pictures were presented on a computer with concurrent auditory presentation by the tester. Sessions were recorded with an audio-video camera to capture spoken data and picture selection in the comprehension task. The study was approved by the ethics Committee of *Université de Montréal* and each participant signed a consent form.

Results

Results collected from the two agrammatic cases showed spared noun lexical processing (28/30 and 26/30 accurate object naming, compared to 300/300 accurate in the control group) but impaired noun functional processing, as observed in the prepositional phrase task by the lack of prepositions and determiners (0/30 and 2/30 accurate, compared to 297/300 accurate in the control group). Although performed worse than object naming, action naming was not totally impaired (19/30 and 10/30 accurate verbs compared to 300/300 in the control group). However, verb morphosyntactic processing was strongly impaired in both sentence production (0/35 and 0/35 inflected verbs, compared to 350/350 inflected verbs, in the control group) and sentence comprehension (20/35 and 20/35 good answers among which 15/15 and 14/15 were functional errors, respectively, compared to 348/350 good answers in the control group). Comprehension errors involved verb inflection (ex : *il rempl**it**/ils rempl**issent** le verre* ‘He fills/They fill the glass’) as well as object clitics ; *Il **la/les** remplit*. ‘He fills it/them.’). Interestingly, a complementary comprehension task showed that number agreement decoding was facilitated by the use of determiners (**le monsieur** remplit/**les monsieurs** remplissent le verre, ‘The man fills/The men fill the glass. ; 31/35 and 33/35 correct answers) and even more when a quantifier was used (**Un homme** remplit/**Deux hommes** remplissent le verre. ‘One man fills/Two men fill the glass. ; 33/35 and 34/35 correct answers).

Discussion

Since noun and verb processing are spared or impaired depending on the extent to which they involve lexical or morphosyntactic processing, the data collected here support, inductively, the lexical/functional divide organization of language processing against the classical categorical view. Moreover, a continuum of intelligibility is observed in comprehending functional elements, which suggests gradient complexity among functional elements in agrammatic aphasia. The present results are in line with aphasiological studies on agrammatic verb processing that consider differential grammatical properties of verbs and not the category of verbs as a whole (Bastiaanse, R., Rispens, J., Ruigendijk, E., Juncos Rabadán & C.K. Thompson, 2002). The results are also consistent with neurolinguistic studies on healthy individuals that suggest brain activation involved in noun and verb processing does not depend on word class but on the grammatical level of processing: semantico-lexical or inflectional. (Tyler, L.K., Bright, P., Fletcher, P., Stamatakis, E.A., 2004.). Finally, the present study agrees with the view of abandoning classical ideas in neuropsychology of language for the improvement of neurocognitive models of language (Poeppel & Hickock, 2004). Cross-linguistic data are needed to further explore the lexical vs. functional divide in aphasia.

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How do categorical & associative primes affect picture naming in aphasia?

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Introduction

A plethora of studies used the picture-word interference paradigm (PWIP) to investigate lexical-semantic context effects on picture naming in healthy subjects (see Mahon, Costa, Peterson, Vargas, & Caramazza, 2007, for a review). Typical results on reaction times (RT) show semantic interference emerging with categorical primes, but semantic facilitation with associative primes (Costa, Alario, & Caramazza, 2005). Only a few studies used a PWIP with aphasic speakers. Wilshire, Keall, Stuart, & O'Donnell (2007) showed in an anomic patient an increased error rate (ie. interference) with auditory categorical primes presented before picture onset compared to unrelated ones, thus mirroring the pattern of increased RT in healthy speakers. However, with simultaneous picture-prime presentation, naming latencies were shorter (ie. facilitation) in this patient. Hashimoto & Thompson (2010) also reported in a group of 11 non-fluent patients increased error rates and RT (ie. interference) with written categorical primes compared to unrelated (or phonologically related) ones; the results of their aphasic group were rather homogeneous, although 2 out of 11 patients tended to show semantic facilitation instead of interference. To our knowledge, no other study used the PWIP in aphasic speakers and none used associative primes. As associative priming seems to decrease RTs in healthy speakers, it is of interest for anomia therapy to know whether associative primes can also improve naming in aphasic patients. Therefore, the aim of the present study is to investigate the effects of categorical and associative primes in a PWIP in aphasic and healthy participants.

Methods

Population

9 French-speaking aphasic persons participated in this study (aged 21-80, mean 49.2). All patients suffered a left hemispheric stroke in the last 12 months (mean 8.8 months post-onset, except for one participant who was tested 27 months post-onset). The Boston Naming Test indicated moderate anomia in 4 cases (45-74% correct responses) and only residual anomia in the other 5 cases (> 88% correct responses). Their comprehension at the word-level was relatively spared, except for one patient (P4), who showed multimodal semantic impairment.

We also tested an extended version of this paradigm in a group of 24 French-speaking young adults (aged 19-39, mean 24.9), with no significant history of neurological disorder.

Material & Procedure

21 black and white line drawings (59 items in the case of the healthy speakers' group) from different semantic categories were preceded by auditory word primes in 3 conditions : associative, categorical

or unrelated (e.g. the target picture « airplane » was preceded either by « flight », « helicopter » or « string » respectively). Each picture was preceded either by 1 or 2 word primes in a pseudo-random order. The picture was presented at screen 150ms after the end of the prime(s). Participants were asked to name the pictures while ignoring the auditory presented words.

Results

RT analysis using linear mixed models showed a main effect of condition in our group of healthy speakers: naming latencies were shorter with categorical primes as compared to unrelated primes ($t=53.043$, $p<.001$) and even shorter with associative primes as compared to categorical primes ($t=7.031$, $p<.001$).

Error rates in aphasic patients varied between 0.8% and 46.8% (mean 15%). Most errors (60.5%) were omissions (no responses), 19.7% phonological errors and 10.5% semantic errors. Relative to unrelated primes, categorical primes increased error rate (Wilcoxon Signed Ranks Test, $p<.05$), whereas associative primes had no effect. This tendency was observed in all patients producing more than 2% errors, except for the patient with semantic impairment (P4) who showed no effect of categorical primes and a tendency towards an increased error rate with associative primes.

Surprisingly, when analyzing the different **error types** separately with a generalized linear mixed model, phonological errors were more frequent following categorical primes as compared to unrelated primes ($z=-2.092$, $p<.05$), whereas the other error types (semantic and omissions) were not modulated by the primes.

Discussion

Using a PWIP in healthy speakers, we observed that picture naming was speeded up with both associative and categorical primes, as compared to unrelated primes. By contrast, in aphasic speakers' error rates, we observed interference with categorical primes, thus replicating the findings in the literature, and a null effect with associative primes (as compared to unrelated primes). Surprisingly, this pattern of results was carried by an increase of phonological errors following categorical primes, suggesting that the semantic manipulation has an effect on phonological encoding. These results are rather in line with the response exclusion hypothesis which locates semantic interference and facilitation effects at a post-lexical processing stage (Finkbeiner & Caramazza, 2006; Janssen, Schirm, Mahon, & Caramazza, 2008; Mahon et al., 2007).

The only patient with a multimodal semantic impairment did not seem to follow the same pattern, as he showed a tendency towards interference with associative primes and no effect of categorical primes. This pattern of results needs however to be confirmed with other patients presenting with multimodal semantic impairments.

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The shortened DuLIP protocol: pre- and postoperative language assessment in brain tumor patients

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Introduction

Awake surgery with direct electro(sub)cortical stimulation is the gold standard treatment for brain tumors (gliomas) in eloquent areas (motor and language) to avoid permanent postoperative functional impairments[1]. Generally, low-grade glioma patients (LGG) present subtle and mild language deficits due to slow tumor growth and plasticity mechanisms[2]. A standardized language battery such as the Akense Afasie Test[3] often did not detect the reported aphasic problems in glioma patients[4]. Hence, there was a need for a more refined and sensitive language protocol. For the first time, a test-battery for brain tumor patients, the Dutch Linguistic Intraoperative Protocol (DuLIP), was developed to measure language functions in the pre-, intra- and postoperative phase of awake surgery[5]. This protocol consists of tasks at the basic linguistic levels (semantics, phonology, syntax) for language production and perception with different grades of difficulty. DuLIP appeared to be mostly suitable for the intraoperative setting. However, in view of the slight sedation of the patient during tumor resection, tasks had to be relatively easy to perform. In this study, we aim to develop a shortened and more sensitive version of DuLIP for the pre- and postoperative setting based on results of our recent outcome study and clinical experience[6].

Methods

Study design

This study is divided in 3 phases. Phase 1: task and item selection of the existing DuLIP protocol. Phase 2: standardization in healthy controls (will be finalized by the end of the academic year). In phase 3: clinical use of shortened DuLIP illustrated with pre- and postoperative case descriptions (data collection is ongoing).

Phase 1: task and item selection

DuLIP was revised for pre- and postoperative assessments. To increase linguistic difficulty, some DuLIP tasks were adapted by including more complex items based on linguistic parameters such as frequency, imagebility and syllable structure using CELEX and SUBTLEX-NL[7,8]. Goal: to design 20 items for each task suitable for the Dutch and Flemish population. A threshold of 80% correctness will be applied in order to eliminate unreliable items for standardization (phase 2)[9]. No self-corrections or repetitions by the tester were allowed.

Subjects

In phase 1 we tested 110 healthy controls in total. Different groups were formed for age: 18-35, 35-55, 55-75 years and for education: ≤12 and ≥ 12 years. We aim to collect norm data (phase 2) in about 200 participants (currently 110 participants). We will pilot shortened DuLIP in a group of glioma patients pre- and postoperatively (phase 3).

Results

Selection of tasks and items

We included 7 DuLIP tasks: repetition of words, sentences, semantic-odd-picture-out, sentence completion and 3 sentence judgment tasks (phonology, semantics and syntax). The 3 sentence judgment tasks were combined into 1 E-prime task: reaction time can be recorded. Visual and auditory stimuli were presented simultaneously. Tasks such as the phonological-odd-word-out and syntactic fluency were excluded based on clinical experience and results from our previous study[5].

Phonology: repetition
Repetition tasks: words and sentences: 20 words (3 syllables). 20 compound words (3 to 6 syllables), 20 non-words (3-4 syllables) and 20 sentences (4-8 words) were added to the protocol. In all repetition tasks, we included items with variable syllable stress patterns, consonant clusters and/or phonemic similarities.

Semantics: odd-picture-out
Semantic-odd-picture-out (nouns): 10 pictures organized into series with narrow semantically related items: e.g. snake, dog, cat (subcategories within the category animals). Ten pictures of verbs were newly added to the semantic-odd-picture out.

Syntax: sentence completion
Sentence completion: 20 items of which 10 with a missing constituent (semantically less induced) and 10 with a missing noun (semantically induced).

E-prime: sentence judgement
Sixty sentences: 20 items per linguistic level: phonology, semantics, syntax in of which 50% correct and 50% incorrect in each linguistic level.

Elimination of items

In all tasks, apart from semantic sentence judgment, the 80% threshold of correctness could be applied. Percentages of correctness: repetition of words and compounds 100% (15/20, 12/20 items resp.), sentences and non-words 95% (13/20, 12/20 resp.), semantic odd-picture-out nouns and verbs 90% (6/10, 5/10 items resp.), sentence completion 100% (12/10 items), phonological sentence judgment 100% (15/20 items), semantic sentence judgement 80% (9/20 items) and syntactic sentence judgment 90% (12/20 items). Elimination of the remnant items (>10) was based on clinical experience. The results of phase 2 and 3 will be added at a later stage (when data collection is finished) and presented via poster.

Discussion

A shortened and linguistically more complex version of DuLIP was designed for pre- and postoperative language assessment of LGG patients, based on our earlier study and clinical experience with DuLIP as an intraoperative measurement[5]. The threshold of at least 80% correctness in healthy people implies that all tasks are feasible and can be used for the standardization phase. However, the E-prime task could have received some false incorrect responses, as participants may have replied too fast due to simultaneous presentation of visual and auditory stimuli (registered as incorrect). In phase 2, a visual presentation alone will be administered to control for such an effect.

We expect that the shortened DuLIP will be an efficient and sensitive tool to measure linguistic disorders in LGG patients pre- and post-tumor resection. Currently, Dutch data are gathered in 110 healthy controls and Flemish data collection is ongoing. We will calculate norms and the effect of demographic variables, such as gender, age, education and handedness on the test-scores. Based on our earlier study, we expect an effect of age and education on most tasks. If the shortened DuLIP protocol appears to be more sensitive than the frequently used standardized language tasks, such as the AAT, the Boston Naming Test and the Token Test, it should be adopted in standard clinical practice for the assessment of mild language disturbances in glioma patients (and possibly also in other mildly impaired clinical populations).

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Help Mr. X along, so say it with a beautiful song*

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Introduction

Music is a very powerful multimodal stimulus, which activates specific networks and subcortical structures of our brains. fMRI data indicate that the basal ganglia are performing a crucial function in beat processing, and are strongly linked to the internal generation of the beat (Grahn, 2009). Increased connectivity between cortical motor and auditory areas is found in those with musical training (Zipse et al., 2014). Turning to the relation between language and music, the first reference to the dissociation between impaired language systems and spared musical capacities can be traced back to 1736. However, it was not until recently that the common studies of both disciplines have started to provide positive results in the realm of the clinic. Music therapy in aphasia can provide new insights for the neurocognition of language. What makes music more resilient, and hence such a valuable instrument for language recovery? That is, to what degree and in what fashion do language and music share the processing mechanism?

The connection between music, the basal ganglia, and language lies at the heart of this paper. The relationship between the basal ganglia and premotor and supplementary motor areas can be very beneficial in the treatment of aphasia, either by rehabilitating or by stimulating pronunciation (Jungblut et al., 2014). It has been reported for more than 100 years that patients with severe non-fluent aphasia are better at singing lyrics than they are speaking the same words (Schlaug et al., 2010). This led to the development of specific therapeutic models such as the Melodic Intonation Therapy (MIT) (Zumbansen, Peretz, & Hebert, 2014). This review paper attempts to clarify the efficacy of this therapy by means of a review of cases of aphasia after damage to the basal ganglia.

Methods

The first search conducted on PubMed and Medline included the key words 'music therapy' AND 'aphasia'. We started including 17 research articles, reporting on 191 individuals with aphasia, and 6 additional reviews. In the same fashion, we conducted a second search with the key words 'aphasia' AND 'lesion' AND 'basal ganglia'. We selected 31 articles on basal ganglia out of 79 papers. We applied the following inclusion criteria: articles referring to adult acquired aphasia (rather than congenital deficits) written in English. A total number of 708 subjects including both case studies and group experiments were revisited in the present study.

Results

Taken together, the results of the first search revealed that music generally has an effect on therapy. This seems to be more relevant for subjects with lesions in Broca's area (Schlaug, Marchina, &

Norton, 2008). Rhythmic specific methodology seems to be better at least in the case of non-fluent aphasias as show by the improvement reates after Melodic Intonation Therapy (MIT).

Two studies on the correlations between basal ganglia and aphasia turned out to be especially revealing (Stahl et al., 2011; Akanuma et al., 2014). In Stahl et al.'s (2011) study, seventeen non-fluent aphasics with lesions including basal ganglia showed to benefit from rhythmic therapy. Among participants, lesions circumscribed to the basal ganglia accounted for 55% of the variance related to rhythmicity. The study by Akanuma et al. (2014), which only includes patients (n=10) with left basal ganglia lesions, confirm the improvement of language skills after acoustic stimulation.

The benefits are particularly significant if we consider the results of the second search. Among the participants in the 79 studies on damage to the basal ganglia, the presence of aphasic symptoms was the inclusion criteria in 26 studies, but the results of 4 studies analyzing 107 participants with lesions involving these nuclei indicate that the percentage of aphasia after damage to the BG can reach around 39.25%.

Discussion

The present work focuses on the relation between aphasia, the basal ganglia, and music therapy, especially on the outcomes of Melodic Intonation Therapy (MIT). Data suggest a general positive effect that is most visible in two studies (Stahl et al., 2011; Akanuma et al., 2014). These suggest that rhythm has an overt impact on the rehabilitation of aphasic patients with lesions affecting the basal ganglia. Intactness of the right basal ganglia is assumed to assist the efficacy of rhythm during the singing training (Akanuma et al., 2014). If this is the case, preservation of this area can be taken to be highly informative to predict the outcome.

However, positive effects of rhythm have been also found in participants with bilateral and right lesions in these nuclei. As a crucial part for processing rhythm, the basal ganglia complex and music stands out as a direct window into language. With the information currently available, the implementation of therapies using rhythm in individuals with non-fluent aphasias after damage to the basal ganglia seems to reinforce the cortico-subcortical connections and benefit language performance.

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* Lyric from Irving Berlin: “Say it with music”

The involvement of prefrontal cortex in language switching: intraoperative electrical stimulation evidence

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Introduction

Language switching (LS) enables the selection of the appropriate language in bilingual communication (Bialystok,Craik,Green,&Gollan, 2009; Penfield &Roberts,1959) and may be triggered by external language-related cues, such as linguistic knowledge of the interlocutor, face-related cues or other contextual cues (Rodriguez-Fornells, Krämer, Lorenzo-Seva, Festman, & Münte, 2011; Soveri, Rodriguez-Fornells, & Laine, 2011). When this ability of suitable language use is impaired, effective communication within bilingual community could be disturbed. Despite the inherent importance of LS in bilingual behaviors, the neural bases underlying this process are not fully clear. In the present study we aimed to explore the possible involvement of the left prefrontal and lateral temporal areas in LS using intraoperative electrical stimulation mapping (ESM). ESM is regularly used to map eloquent language-related cortical brain areas in neurosurgical operations involving tumors and vascular malformations. In a previous two-case study (Sierpowska et al., 2013) we reported that electrical stimulation applied at the level of the middle frontal gyrus provoked spontaneous (non-cued) language switching in one patient and disturbed the cued LS task performance in another patient. Here we present a series of 9 cases recruited during the last two years and assessed with the same set of tasks as in the case study.

Methods

In our ongoing study, we currently collected the data from 9 Spanish-Catalan bilingual patients (3 with Spanish as their L1, 4 female, age range 30-54) harboring intrinsic brain lesions (6 tumors and 3 vascular malformations) located in the left perisylvian language areas. All these patients were candidates for the awake brain surgery and had above 65% accuracy rates in the bilingual language naming tasks performed during the pre-surgical evaluation, thus fulfilling the performance criterion for the inclusion in this study.

Neuropsychological assessment

A novel language switching task was designed to be carried out in three time points: pre-, intra- and post-surgically. The task encompassed both single language naming (1) and cued LS naming where the Catalan and Spanish stimuli were mixed within the same trial (2). This allowed controlling for LS under two conditions: constant inhibition of non-target language in simple naming and alternation of activation of cued language versus inhibition of the non-target one in the LS naming. Small Catalan and Spanish flags were used as cues to indicate to the patient which language should be used. All the stimuli were non-cognates.

ESM

Electrical stimulation mapping was carried out at the level of cortex and following the methodology proposed by the team of Ojemann (Ojemann, Ojemann, Lettich, & Berger, 2008). Brain exposure boundaries were individually tailored according to the lesion site and size. The current discharge was applied during 3 s synchronized with the picture presentation on the laptop computer screen, point by point and in the distance of 5 mm between the neighboring points until the whole exposed brain surface was covered. A stimulated point was considered to be crucial for both single language naming and cued LS naming if the current discharge within the same location impaired naming in at least 2 out of 3 trials.

Results

Single language naming sites for Spanish and Catalan, as well as cued LS naming sites were detected by ESM in 8 patients (in the remaining single case, only Spanish related sites were detected). Importantly, the single language naming points outnumbered the LS sites (overall in our sample 41 vs. 22) and did not overlap with each other. Moreover, the LS related points were mainly distributed across the inferior and middle frontal gyri of the frontal lobe (19 out of 22 points).

Discussion

Our ESM results highlight the importance of the inferior and middle frontal gyri regions in LS. Furthermore, it allowed the neurosurgeons to plan tumor resection avoiding the damage to both areas crucial for language production for each single language and for the LS. In bilingual patients, standard single language ESM protocols may not be sufficient to map and protect crucial language-related sites. The pre-and intra-surgical assessment used in the present study may provide important neuropsychological support to neurosurgical operations in bilinguals.

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The Additional Effect of Transcranial Direct Current Stimulation (tDCS) in Post-stroke Sub-acute Aphasia: A Pilot Study

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Introduction

Although behavioural treatment of aphasia is considered evidence based, Transcranial Direct Current Stimulation (tDCS) is a promising new treatment to optimize regular aphasia rehabilitation (Brady, Kelly, Godwin & Enderby, 2012; Monti et al., 2013). This non-invasive technique would stimulate the brain by modifying cortical excitability (Torres, Drebing & Hamilton, 2013; Nitsche & Paulus, 2000, 2001) and combined with aphasia therapy its application leads to greater improvements in language functioning. Specifically, tDCS would modulate neuronal excitability by delivering weak electric currents to the cortex via two electrodes, applied transcranially on the scalp (Nitsche & Paulus, 2000). The anode would enhance neuronal excitability while the cathode would inhibit neuronal excitability. tDCS seems to have an additional effect on aphasia therapy in the chronic stage. However, data regarding the application of tDCS in sub-acute aphasia are much more limited. As the larger proportion of language treatment for stroke patients is provided in the sub-acute phase, during the first weeks and months post stroke, and the progression rate of patients with aphasia is highest during the first three months following the onset of the stroke (Mally, 2013), it is also important to evaluate the potential benefits of tDCS in the sub-acute phase, in a clinical setting. The aim of the present pilot study is therefore to evaluate the application of tDCS in the sub-acute stage of post-stroke aphasia, in regular aphasia rehabilitation programs. Potential effects of tDCS on language functioning and its feasibility in a clinical setting, including drop-out rates and side effects, will be evaluated. Results will be used to outline the design of a randomized controlled clinical trial.

Methods

Participants

Five participants, enrolled at the Rijndam in- and outpatient rehabilitation, matched with in- and exclusion criteria and were willing to participate in the study. All patients had an ischemic stroke in the left hemisphere.

Procedure

Regular aphasia therapy was adapted for either one week or two seperate weeks. During a study week, the regular aphasia treatment was replaced by a daily 45-minute session of aphasia therapy either combined with anodal tDCS over left Broca's area or sham-tDCS (i.e. inactive stimulation). Before and after each study week (T1 and T2), the Boston Naming Test (BNT) was assessed. Immediately after the tDCS session, participants rated discomfort on the Wong-Baker FACES pain rating scale, a visual description scale designed for patients with limited verbal skills.

Prior to each language therapy session, two elektrodes (5x7 cm) were placed on the head, using plastic tape. The anode was placed on the inferior frontal gyrus. The cathode was placed on the contralateral suborbital region. The main investigator allocated randomly whether a participant will be in the experimental condition, or in the control condition (sham stimulation). Participants in the experimental condition received active anodal stimulation of 1 mA during 20 minutes. Participants in the control condition received inactive stimulation. Both the patient and the therapist were blinded for stimulation condition. The language therapy session consisted of a word finding training (Linebaugh, Shisler & Lehner, 2005). Participants had to name a picture and were provided with cues so as to help the participant to retrieve the correct word. The cues can differ per patient and the pictures used during the therapy were selected based on the individual performance on an oral picture naming task (Kremin et al., 2003). Hundred items which the patient could not name or gave no response in 20s were selected. Two sets were made: 50 items were used as a therapy set, items trained during the therapy, and 50 items were used as a control set, to study the generalization effects of the therapy. During each session 10 new items were trained.

Results

All participants completed the intervention week; two participants underwent, and completed, a second tDCS- intervention week, after a 2-week pause of regular aphasia therapy. No side effects were reported on the Wong-Baker FACES pain rating scale. Three participants received anodal tDCS stimulation and two participants received sham stimulation.

Regarding the therapy set and the control set, both groups showed an enhanced improvement after the intervention week. As expected, this improvement was stronger for the therapy set, thus the items that were trained during the therapy sessions. Participants in the experimental condition had a larger percentage correct on both sets than the participants in the control condition.

When comparing the experimental group with the control group, the recovery patterns on the BNT show a potential benefit for the active stimulation group (Figure 1). Figure 1 shows the BNT scores at 3 test moments, for the 2 groups. The intake BNT score is part of a standard test battery that is assessed at intake for patients enrolled at the Rijndam in- and outpatient rehabilitation. The blue line represents the active stimulation group and the green line represents the sham group.

Two participants receiving active tDCS participated in a second intervention week. The second week and the extra testmoments gave us more insight in the recovery pattern and these results also show a potential benefit of active stimulation.

Discussion

Results show that tDCS is a user-friendly and feasible instrument to apply in a regular aphasia rehabilitation program in sub-acute stroke patients. The observed effect on language functioning should be interpreted cautiously because of the small sample size and the individual variability. Regarding the design for the clinical randomised controlled trial, two separate intervention weeks are preferred; this will provide more detailed information about the individual tDCS-induced recovery pattern.

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Appendix

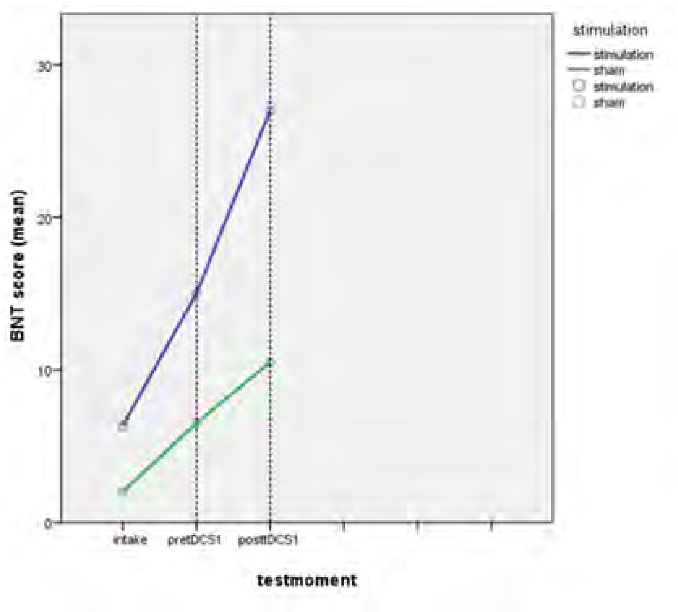

Figure 1:
Improvement on the BNT for the two groups at intake, T1 (pre-tDCS) and T2 (post-tDCS).

Subcortical structures and language disruption

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Introduction

The advancement of neuroimaging techniques over the past 20 years has challenged our traditional view of the lesion-deficit correlation and the boundaries of the language network (Price, 2010). Traditionally, studies on aphasia had focused on individuals with cortical lesions to capture the underlying pattern of impairment. The evaluation of the extent of the lesions described, mostly consequence of a single stroke, was difficult to carry out and consequently, variation across cases was a constant in these studies. Different sources of evidence have shown the close relationship between damage to the thalamus, the cerebellum, and the basal ganglia, and language disruption. The observation of acquired lesions such as cerebro-vascular accidents and traumatic brain injuries, degenerative processes such as dementia, and treatment studies for aphasia are starting to bring some insight into the contribution of these subcortical structures to the language network (Damasio et al., 1982; Weiller et al., 1993; Luzzatti et al., 2006). However, so far, scattered information and different methodological approaches make it difficult to build up a clear picture.

In this work, we explore the relationship between aphasia and lesion site when this affects the thalamus, the cerebellum, and the basal ganglia. To do so, we present the results of a pilot review targeting these nuclei, which reveals that the incidence of aphasia as a consequence of lesions affecting subcortical portions is similar to that of cortical insult. We feel that this has important consequences for both assessment and recovery. The review also exposes the need to add association tracts to the discussion.

Methods

The literature review conducted on PubMed and Medline included the key words ‘aphasia’ AND ‘lesion’ AND (‘thalamus’ OR ‘basal ganglia’ OR ‘cerebellum’). After a first search, which retrieved 180 results (80 on thalamus, 79 on basal ganglia, 21 on cerebellum), we applied the following inclusion criteria: articles referring to adult acquired aphasia (rather than congenital deficits) written in English. A total of 56 studies were finally included (21 referring to the thalamus, 31 to the basal ganglia, 4 to the cerebellum). Three were literature reviews and 53 reported the results of either case or group studies in typologically different languages, including among others Chinese, Dutch, English, German, Japanese, Portuguese, Serbian, and Turkish. A final set of data of 1196 individuals was classified according to the presence/absence of assessable language deficits. When possible, subcortical damage was further specified.

Results

Taken together, the results indicate that aphasia is a common outcome after a lesion to subcortical structures. See figure 1. However, the impact was difficult to verify given that in most studies, the presence of aphasic symptoms was part of the inclusion criteria. This is the case for the 4 studies reporting on cerebellar lesions, in which aphasia was attested with independence of the location of the insult (right, left, or bilateral). Studies on the thalamus suffer from the same shortcomings; in 16 studies, language deficits were again part of the selection process. However, the results of 5 additional studies indicate that, out of the 382 individuals that participated in the study, 87 developed aphasia after a lesion affecting thalamic nuclei (22.19%). These symptoms are found both after left and right thalamic lesions, mostly due to mesencephalo-thalamic infarcts. As for the basal ganglia, the results of 4 studies including 107 individuals indicate that lesions to these nuclei can originate aphasic symptoms in 39.25% of the cases.

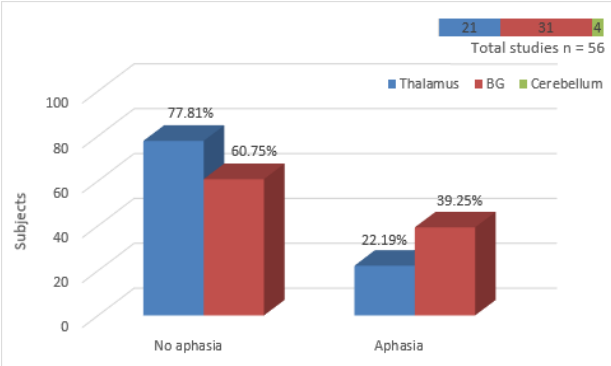

Figure 1: Incidence of aphasia after lesions in the thalamus and the basal ganglia.

Methodologically, there is wide variation in the tools used to characterize the presence and extent of language deficits, ranging from complete language batteries to tasks designed for specific purposes. This results into significant differences in the details of the linguistic profiles.

Discussion

Despite contradictory results and even cases of double dissociation (for an example of absence of language deficits in the event of thalamic lesions see Cappa et al., 1986), our literature review shows an active contribution of subcortical structures to the language network, comparable to the statistics for cortical lesions (25-40% of people after a stroke in cortical portions; Cao et al., 1999). However, not only the cerebellum, the thalamus, and the basal ganglia have been shown to be recruited, but crucially, association tracts emerge as key to account for the presence of a complex array of aphasic deficits across a broad range of pathologies of neuropsychological origin. This is, for example, the case of the cerebellar-encephalic pathways, connecting the cerebellum to the frontal supratentorial areas, and the frontal-caudate functional system (Kuljic-Obradovic, 2003; Baillieux et al., 2008).

There is considerable variability in the aphasic profile of individuals with damage to the three structures under examination. Although some authors adhere to the Boston classification system or apply the general label ‘subcortical aphasia’, striato-capsular and thalamic aphasias are commonly reported after damage to the thalamus or the basal ganglia. These are claimed to resemble dynamic syndromes after frontal lesions (Kuljic-Obradovic, 2003). Integrity of the basal ganglia is taken to contribute to more efficient reorganization of language functions and to support good recovery (Parkinson et al., 2009).

The co-occurrence of right cerebellar lesions and aphasia has been taken to suggest deactivation of prefrontal left hemisphere language functions due to the loss of excitatory impulses through cerebello-ponto-thalamo-cortical pathways (Mariën et al., 1996). The literature suggests that the left basal ganglia play a role in the output of a highly automatized language (Aglioti &

Fabbro, 1993). As for the thalamus, some of the data reviewed indeed points to its role in “bringing online” the cortical networks involved in language (Lazzarino & Nicolai, 1991). Taking all data together, this pilot investigation suggests that subcortical structures crucially contribute to language organization. However, not only lesioned, but also deactivated areas and the tracts connecting them have to be further studied. Treatment and recovery data could contribute to this enterprise.

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Production and comprehension of time reference in Akan speakers with agrammatic aphasia.

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Introduction

Previous studies have found that tense and aspect are susceptible to impairment in individuals with agrammatic aphasia (Dragoy & Bastiaanse, 2013; Wenzlaff & Clahsen, 2004; Stavrakaki & Kouvava, 2003). Bastiaanse (2008) found that both finite and nonfinite verbs referring to the past were more difficult for Dutch agrammatic speakers to produce than verb forms referring to the present. According to Zagona (2013), reference to the past through verb inflection requires discourse linking. Avrutin (2000; 2006) showed that discourse linking is difficult for agrammatic individuals. Based on these two theories, Bastiaanse et al. (2011) formulated the PAst DIscourse LInking Hypothesis (PADILIH) that predicts that verb forms referring to the past are more difficult to produce than those that refer to the non-past (like present and future forms). However, most of the observations come from languages with verb morphology, where it is not possible to tease out verb inflection from time reference. Therefore, it is interesting to investigate other ways of marking time reference, such as the use of tone in Akan.

Akan is a tonal language spoken in Ghana, and it has a grammatical tone. Thus, the difference between the habitual aspect (non-past) and the past tense is grammatical tone rather than grammatical morphology (Dolphyne, 1988).

All studies done on tone processing in aphasia have focused solely on lexical tone processing, leaving grammatical tone an untapped research area. Processing of lexical tone has been found to be impaired in aphasia as well as in individuals with right hemisphere damage (Kadyamusuma, De Bleser, & Mayer, 2011; Yiu & Fok, 1995). The current study addresses the following questions: 1) Is production and comprehension of past time reference impaired in agrammatic aphasia when expressed through grammatical tone? 2) Does past time reference deficit manifest also in patients with right hemisphere damage? 3) Is grammatical tone impaired in Akan speakers with agrammatic aphasias and/or right hemisphere damage, as it has been found for lexical tone in other languages?

Methods

Materials and Design

The African version of the Test for Assessing Reference of Time (TART: Abuom & Bastiaanse, 2010) was adapted to Akan and 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. The actions in each time frame are depicted by two colored photographs placed side-by-side, and one above the other in the production and the comprehension tasks, respectively. Five Akan native speakers with Agrammatic aphasia, 3 Right Hemisphere Damage (RHDs: control group) patients from

Korle Bu Teaching Hospital in Accra, Ghana, and 5 Non-brain Damage speakers (NBDs: control group) participated in this study.

Procedure

For the production task, the experimenter first read aloud a sentence that described the action in the picture on the left. The experimenter then continued to read the second sentence until he reached the point where the participants were prompted to produce the target verb and the object to complete the sentence. For the comprehension task, the experimenter read aloud only one sentence and the participants were prompted to point to one of the two pictures that corresponded with the target time frame.

Results

The NBDs performed at ceiling on both tasks. The RHDs also performed at ceiling on the production task, whereas in comprehension their performance was significantly lower than the NBDs ($\beta = -2.05$, $SE = 0.38$, $z = -5.44$). The RHDs performed significantly better than the agrammatic speakers, both in production and in comprehension ($\beta = 0.88$, $SE = 0.30$, $z = 2.90$).When the RDHs and the agrammatic speakers made errors, these affected past time reference more than present and the future time references ($\beta = 2.45$, $SE = 0.57$, $z = 4.31$, $p = 0.001$ and $\beta = 1.42$, $SE = 0.47$, $z = 3.02$, $p = 0.007$, respectively), as predicted by the PADILIH.

Discussion

The conclusion is that when time reference is expressed by grammatical tone, reference to the past is difficult for agrammatic aphasic individuals, both in comprehension and in production. Thus, the results of a grammatical tone language do not differ from those of grammatical morphology languages. Interestingly, unlike in grammatical morphology languages, comprehension of grammatical tone is impaired in individuals with right hemisphere damage. The latter result is in line with findings on lexical tone. Kadyamusuma et al.'s (2011) explanation that for the processing of lexical tone the right hemisphere is recruited may be extended to processing of grammatical tone.

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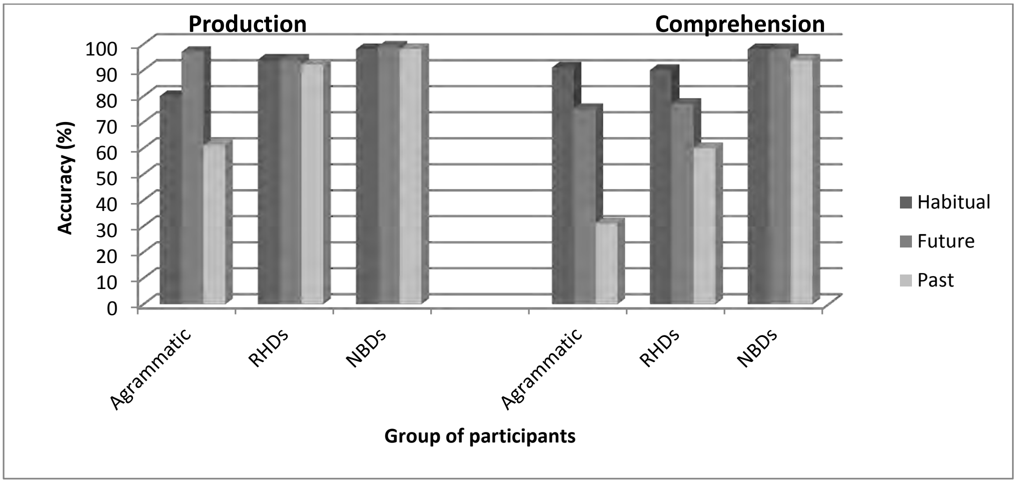

Fig 1: Accuracy scores per condition per group of participants in production-TART and comprehension-TART.

Phonetic and/or phonological errors and phonetic flexibility abilities: A case study of two non-fluent aphasic patients

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Introduction

In aphasia, an important question is the level of language processing at which speech errors occur. This study focused on errors than can arise at phonological or phonetic encoding. Phonetic paraphasias are generally considered as occurring in patients with non-fluent aphasia and consist in incorrect articulatory realization of phonemes due to motor planification impairment in the phonetic system. On the other hand, phonological paraphasias generally occur in patients with fluent aphasia and are defined as substitution, transposition, deletion or inversion of phonemes due to incorrect phoneme selection within the phonological system (Laine & Martin, 2006; but see Blumstein et al., 1980; Nespoulous et al., 2013). However, the distinction between phonological and phonetic paraphasias is generally based on perceptual analyses that could be influenced by the experimenter's perceptual system.

In this study, we assessed language difficulties of two French-speaking aphasic patients, TM (age = 62 years) and CL (age = 65 years). On a description task, both patients presented non-fluent aphasia, as indicated by great word finding difficulties and frequent pauses in inappropriate places in the sentences. On a picture naming task, both patients produced semantic paraphasias and substitutions of phonemes. TM presented impaired frequency and length effects and CL impaired length effect. These results led us to assume that both patients presented lexical selection and phonetic deficits.

In order to clearly attribute these errors affecting phonemes to phonetic difficulties, we used acoustic analyses. We focused on the analysis of voice onset time (VOT), a reliable cue of motor speech control that may be affected in patients with phonetic impairment. We assumed that patients with phonetic impairment would show a tendency to devoice voiced stop consonants and to produce VOT that fell between the voiced and voiceless categories. By contrast, in case of phonological impairment, patients' voicing errors would show no clearly-established preferential tendencies in phoneme substitutions (Blumstein et al., 1980; Nespoulous et al., 2013).
In a second time, we addressed the question whether patients were still capable of phonetic and articulatory flexibility (Delvaux et al., 2013, 2014) because this would be an interesting cue for speech therapy, frequently based on repetition paradigms.

Methods

Part 1

Patients' VOT durations were analyzed in a repetition task of 84 CVCV nonwords (the six stop consonants /p/, /t/, /k/ and /b/, /d/, /g/ combined with the three vowels /a/, /i/, /u/ presented in initial or intermediate position in the nonword). VOT was analyzed for each CV syllable by measuring the distance from the onset of the burst (associated with the release of the consonant) to the first periodic cycle of the following vowel (Lisker & Abramson, 1964).

Part 2

Patients' phonetic flexibility was assessed through an investigation of their capacity to acquire a phonetic variant that is not usual in their mother tongue, a $C_{[t]}V_{[a]}$ syllable with a long VOT (Cho & Ladefoged, 1999; paradigm from Delvaux et al., 2013, 2014). Experimental stimuli consisted in 5 $C_{[t]}V_{[a]}$ syllables of respectively 20-, 40-, 60-, 80-, and 100-ms VOT. The paradigm consisted first in an AX discrimination task and then in a repetition task, both including the 5 stimuli.

Results

Part 1

The results of our analyses indicated that CL showed a great tendency to devoice voiced stops (48% of the voiced stops) but the mean VOT values of the correctly produced voiced stops were within the norms (mean patient VOT = -98.72 ms, average VOT for French = -100 ms, Laeufer, 1996). The patient only voiced one voiceless stop and the VOT values for the correctly produced voiceless stops were also within the norms (mean patient VOT = 35.26 ms, average VOT for French = 35 ms, Laeufer, 1996). He also presented a lack of articulatory accuracy that led him to transform stops in fricatives. These analyses suggested that CL had phonetic impairment. TM's mean VOT for voiced stops were of -64 ms, which is shorter than the average values for these stops in French (-100 ms), indicating that TM may present difficulties to maintain the voicing before the onset of the burst of the consonant. By contrast, his mean VOT values for voiceless consonants (32.22 ms) were within the norms. These results suggest that the patient presented motor difficulties with the planification of speech. However, TM also presented a tendency to voice voiceless stops (17% of the voiceless stops) and to substitute the consonants with a different consonant including a change of place of articulation (e.g., /t/ becomes [k]; 18.48% of voiced and voiceless stops). These observations also suggest the presence of phoneme selection difficulties for this patient.

Part 2

As indicated on Table 1, both CL and TM still show a capacity to acquire a non-usual phonetic variant and therefore still have a certain phonetic flexibility. Indeed, response VOT fairly matched stimulus VOT in the repetition task. Their performance did not differ from the control participants', matched in age with the patients, as indicated by the patients' Z-scores in Table 1.

Only the patients' discrimination performances were low. These scores may be due to difficulties with instructions understanding.

Discussion

The results of the present study highlight the importance of conducting acoustic analyses in order to help distinguish between phonological and phonetic errors that both affect phonemes. Our data also show that non-fluent aphasic patients can present phonological difficulties as well, as already indicated by a few studies in the literature (Blumstein et al., 1980; Nespoulous et al., 2013; Ryalls et al., 1995).

The outcomes of the second part of this study indicate that, even with motor planification of speech difficulties, our patients are still able to adapt to non-familiar linguistic variants and therefore to keep a certain articulatory flexibility. Differences between patients will be discussed with regards to their different profile, as well as about possibilities of language rehabilitation for patients with their kind of pattern.

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Table 1

Mean VOT values (in ms) and percentages of correct responses for patients TM and LC in the articulatory flexibility paradigm in comparison with mean performances of healthy participants matched for age

	Patient TM	*Controls of 55-65 years*	*SD 55-65*	*Z-score for TM*	*Patient LC*	*Controls of 65-75 years*	*SD 65-75*	*Z-score for LC*
Discrimination (%)	0	66	48	-1.40	0	59	49	-1.26
Repetition								
20-ms VOT (ms)	61.00	45.00	26.00	0.59	12.38	53.40	29.55	2.38
40-ms VOT (ms)	47.00	53.00	23.00	-0.29	55.73	61.90	33.93	-0.18
60-ms VOT (ms)	53.00	55.00	24.00	-0.07	70.23	69.70	37.16	0.01
80-ms VOT (ms)	81.00	68.00	30.00	0.43	78.68	70.40	36.79	0.22
100-ms VOT (ms)	58.00	66.00	32.00	-0.24	71.98	73.70	39.70	-0.04

The role of paradigmatic and syntagmatic relations in noun-verb dissociation

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Introduction

Noun-verb dissociation following brain damage has been reported in numerous neuropsychological studies. There are several explanations were suggested for this phenomenon: distinct cortical representation of nouns and verbs (Damasio and Tranel, 1993), morphological differences between nouns and verbs (Tyler et al., 2008), the differences in imaginability between nouns and verbs (Crepaldi et al., 2006), imbalanced visual complexity of pictures for action and object naming (Liljeström et al., 2008). Indeed, in order to assess word-class deficit neuropsychologists use picture naming test with different sets of images: single object pictures for nouns and complex action pictures for verbs. We suggest that in the first case the patient has to rely on paradigmatic relations (differentiation between words with similar meanings) and in the second case – on syntagmatic relations (syntactic context) for word retrieval. The verbs have greater breadth of meaning than nouns and verb argument structure plays the main syntactic role in the sentences (Genter et al., 1981). At the same time, we always have to choose an appropriate noun among the nouns with similar meanings (Genter et al., 1981). If we take into account these two arguments we can conclude that we usually retrieve verbs using syntagmatic processes and nouns using paradigmatic processes in our speech. We also know that syntagmatic processes suffer after frontal lobe damage and paradigmatic - after temporal lobe damage (Jacobson R. & Morris H., 1956). Thus the noun-verb dissociation can be also explained in terms of the paradigmatic/syntagmatic relations.

Methods

Nine patients with brain tumors in the left temporal lobe (6 female; aged 17 to 64 years) performed pre- and postoperatively several subtests from “The Speech Assessment in Aphasia” (Tsvetkova, Pylaeva, Akhutina, 1981) including object naming and action naming tasks. Only one of nine patients (male, 33 years old) demonstrated noun-verb dissociation after brain surgery and none of them before surgery.

Results

The patient performed much more better in action naming task than in object naming task: 4 correct nominations out of 30 in object naming task and 20 correct responses out of 30 in action naming task. The most common incorrect answer during object naming task had a syntagmatic nature, like “it shows us the time” instead of “a clock” or “it's for sleeping, we sleep on the...on the bed” instead of “a bed”. The incorrect responses during action naming task has a nature of semantic paraphasias like “to read” instead of “to write” or “to eat” instead of “to drink”.

Discussion

Our results are consistent with the previous studies: patient after tumor resection in the left temporal lobe performed action naming task better than object naming task (Damasio and Tranel, 1993). And as we can see our patient compensatory used syntagmatic associations to retrieve an appropriate noun and sometimes he succeeded. At the same time it was difficult for him to differentiate the verbs with the similar meanings (for example “to eat” and “to drink”) because of disfunction of paradigmatic processes. These results support our suggestion that we usually use paradigmatic relations for noun retrieval and syntagmatic ones for verb retrieval and noun-verb dissociation could be associated with damage of paradigmatic and syntagmatic processes in the speech. These preliminary results and conclusions should be verified with behavioral and neuroimaging studies on a larger samples of patients and normal subjects.

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Neural substrate of apraxia in stroke patients: Voxel-based lesion symptom mapping (VLSM)

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Introduction

Apraxia may be defined as disorders of the execution of learned movement which cannot be accounted for either by weakness, incoordination, or sensory loss, or by incomprehension, or inattention to commands.[1] Apraxic deficits are more frequent in left hemisphere lesion, however, in some cases, severe apraxia was observed following right hemisphere lesions.[2-5] Apraxic deficits are most frequently reported following left parietal and frontal lesions, but were also reported following left temporal, occipital and subcortical lesions.[6-9] Previous neuroimaging studies have failed to find a consistent association between the lesion locus and the severity of apraxia.[10-13] Voxel-based lesion symptom mapping (VLSM) is a recent technique which is able to statistically assess the lesion's effect on behavioral scores on a voxel-by-voxel basis.[14] This method produces a high resolution statistical map (1mm^3) and avoids many limitations seen with previous studies, such as difficulty in finding patients with similar lesions, the disadvantage of analyzing large lesions without distinguishing sub-region.

The purpose of this study is to assess neuroanatomical correlates of apraxia using VLSM. In addition, the secondary purpose is to find relationship between the apraxia test score and clinical characteristics.

Methods

Subjects

Stroke patients were included according to the following criteria: 1) performed an apraxia test using KAT, 2) underwent brain magnetic resonance imaging (MRI) after stroke, 3) no prior cognitive or psychiatric illness, 4) sufficient understanding of the instructions (more than 2 points of auditory comprehension score of KAT). Patients with hemorrhagic stroke and infratentorial lesion were excluded and total of 65 stroke patients (37 men, 28 women) were finally included for the study. The study protocol was approved by the institutional review board of the Korea University Hospital.

Behavioral testing

Korean Limb and Oral Apraxia Test (KAT) was used to measure apraxia. KAT is composed of total 80 items in five domains (meaningless gesture, intransitive gesture, transitive gesture, oral gesture, actual tool use), and the score of each item ranges from 0 to 3 (0, incorrect; 1, partially adequate; 2, adequate; 3, normal) points. The maximum total score of KAT is 216 points, which is a summation of limb subscore (168 points) and oral subscore (48 points). Demographic data including biographical (age, sex, education, handedness), neurological (time post onset, lesion side) data, and the presence of aphasia were collected for analysis.

Voxel-based lesion-symptom mapping (VLSM)

All lesions were mapped using the MRIcron software (http://www.mccauslandcenter.sc.edu/mricro/mricron/) and were drawn manually on patient's individual FLAIR scans by a single researcher. After coregistration and normalization using SPM 8, these normalized lesions were then submitted to statistical mapping analysis using VLSM algorithms implemented in the MRIcron and non-parametric mapping (NPM) softwares .[15] The continuous KAT scores were compared on a voxel-by-voxel basis in patients with or without a lesion in each voxel, only testing voxels damaged in at least 10% of the subjects. Only voxels surviving a conservative false discovery rate (FDR) corrected significance threshold of $P<0.05$ were considered in the results. Color-coded lesions on MNI template brain were labeled into anatomical region and brodmann area, using xjview 8 toolbox (http://www.alivelearn.net/xjview8/) in SPM 8 software.

Results

The lesion distribution between apraxia and non-apraxia groups showed a significant left hemisphere dominance ($p=0.007$). Apraxia group was significantly associated with aphasia than non-apraxia group ($p=0.001$).(Table 1) VLSM revealed that apraxia was associated with damage to the left inferior and middle frontal gyrus, insula, middle and superior temporal gyrus, inferior and superior parietal lobule with underlying white matter. Lesion patterns were different according to gesture production mode. While gesture-to-imitation was associated with left temporoparietal lesions, gesture-to-command was associated with left temporoparietal and left frontal lesions. (Figure 1)

Discussion

Results of this study showed that apraxia was associated with a broad, left lateralized lesions which include inferior and middle frontal gyrus, temporoparietal areas with underlying white matter. Also It is known that apraxia is commonly associated with aphasia.[9, 16, 17] However, several studies failed to find correlations between apraxia and aphasia,[18, 19] but concomitant deficits could be explained by their shared neuroanatomical substrates.[20] In this study, majority of patients (89%) in apraxia group had concomitant aphasia, thus supporting the previous knowledge.

Recently, in the studies which used VLSM analysis, the involvement of left inferior frontal and temporoparietal lesions in apraxic stroke patients was revealed.[9, 21] In line with the previous lesion data, the result of this study has revealed the involvement of the left temporal lobe, extending to inferior and superior parietal lobule, underlying white matter, and insula, inferior and middle frontal gyrus. There is a controversy about the importance of subcortical structures in the genesis of apraxia. Some studies noted that lesions to subcortical pathways were not commonly associated with limb apraxia,[22] but other investigators reported that apraxia was more common in patients with subcortical lesions involving periventricular white matter tract.[23, 24] Author found that apraxia was associated with underlying white matters as well.

In this study, gesture-to-command score was associated with lesions on the left temporoparietal areas and left frontal areas including middle (Brodmann 46) and inferior frontal gyrus (Brodmann 44), while gesture-to-imitation score was associated with lesions on the left temporoparietal areas only. This is in line with previous studies. In a recent study which used apraxia task based on verbal command, left inferior frontal and temporoparietal region were reported to be associated with apraxia.[21] Other previous studies suggested that the inferior parietal lobule is critical in visuo-imitative apraxia.[25, 26] Therefore, left frontal regions (dorsolateral prefrontal cortex and Broca's area) may be more important in mediating gesture-to-command than to imitation.

In conclusion, apraxia was associated with left lateralized lesions including inferior and middle frontal gyrus, temporoparietal areas and underlying white matter. And left frontal region was more important for mediating gesture-to-command than imitation. Further research combining another neuroimaging technique, such as diffusion tensor tractography, is needed to elucidate more specific anatomical area for apraxia.

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Table 1. Comparison of Variables According to Presence or Absence of Apraxia

	Total	Apraxia	Non-apraxia	*p-value*
Number	65	19	46	
Age, years	65.5 (±12.0)	64.3 (±11.5)	66.0 (±12.3)	0.610
Gender (m/f)	37/28	9/10	28/18	0.325
Location of stroke				
Right	20	2	18	0.007*
Left	40	13	27	
Bilateral	5	4	1	
Time between onset and KAT, weeks	3.0	6.4	2.5	0.132
Handedness (right/left)	62/3	18/1	44/2	0.873
Education, years	9.1 (±4.9)	8.2 (±4.5)	9.4 (±5.1)	0.348
K-MMSE (30)	21.5 (±8.0)	11.5 (±7.1)	25.6 (±3.6)	0.001*
Aphasia (present/absent)	29/36	17/2	12/34	0.001*

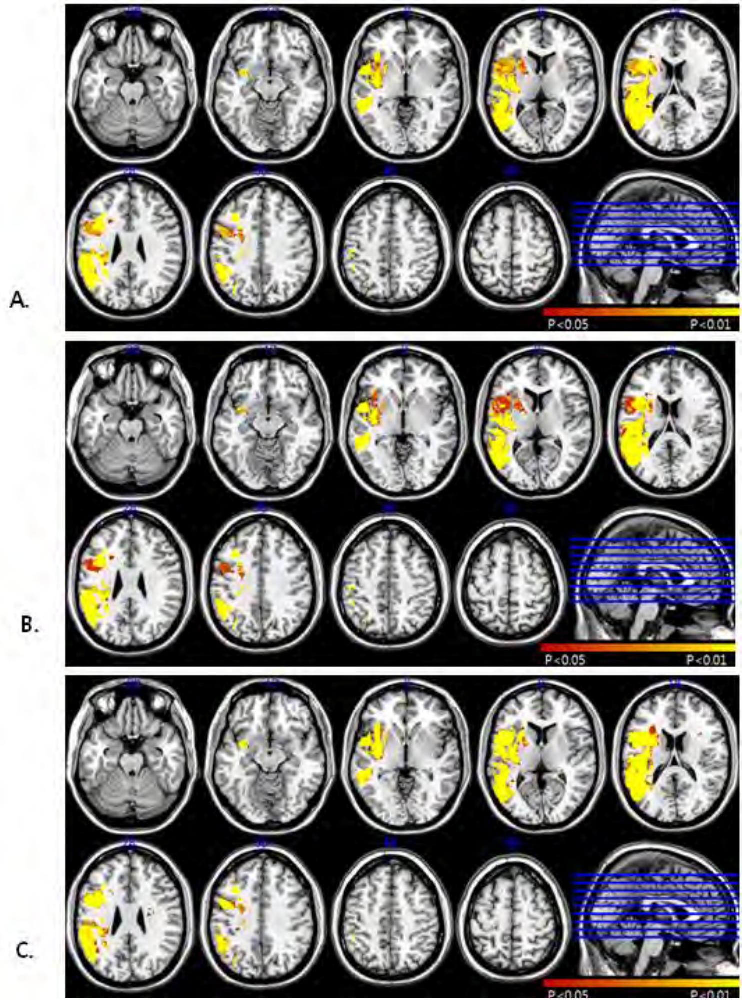

Figure 1. Lesion patterns associated with continuous scores of KAT**.** Voxel-based lesion symptom mapping analysis shows the relationship between continuous scores of KAT and brain lesion. A) continuous KAT total score, B) continuous KAT limb subscore, C) continuous KAT oral subscore. Only voxels significant at p<0.05 FDR corrected are color-coded ranging from red to yellow. Numbers refer to z-coordinates of the MNI space, with left hemisphere on the right side.

Cortico-cortico diaschisis in chronic Wernicke's aphasia

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Introduction

Focal diaschisis is the reduction in functional integrity of neural structures remote from but functionally connected to structural lesion. Diaschisis has been a theoretically important concept and postulated as one mechanism accounting for the wide variation in symptoms experienced post-cortical lesion. Investigations of diaschisis have predominantly been undertaken with patients with motor impairments at an early stage post stroke. Such studies routinely provide evidence for subcortical diaschisis following cortical lesions (e.g. Bowler et al., 1995); however evidence for cortical diaschisis remains elusive. This study used a measure of cerebral blood perfusion, arterial spin labelling, to investigate the extent to which cortical diaschisis contributes to the clinical profile in chronic Wernicke's-type aphasia.

Methods

Participants

Thirteen individuals with Wernicke's-type aphasia (WA, two female) and thirteen age-matched controls (two female) were recruited. Aphasia diagnosis was confirmed through clinical observation and the Boston Diagnostic Aphasia Examination-Short Form (Goodglass, Kaplan, & Barresi, 2001).

Data Collection

3T MRI scanning was performed with all participants. T1w structural images and resting-state pulsed arterial spin labeling cerebral blood perfusion images were collected. WA participants undertook a battery of neuropsychological assessments. Cognitive-semantic capacity was assessed using the Pyramids and Palm Trees test (Howard & Patterson, 1992, three picture version) and Raven's coloured Progressive Matrices (Raven, 1962). Phonological skills were assessed with the imagability x frequency reading and repetition subtests from the PALPA battery (Kay, Coltheart, & Lesser, 1992). A naming assessment from the Cambridge Semantic Battery (Bozeat, Lambon Ralph, Patterson, Garrard, & Hodges, 2000) was included to weigh on both semantic and phonological systems.

Statistical Analysis

A joint Independent Component Analysis (ICA) was performed to explore the relationship between structural lesion (segmented CSF images) and cerebral blood perfusion. Joint ICA is a multivariate statistical method which enables underlying sources or components of complex datasets to be extracted and compared (Calhoun, Liu, & Adalı, 2009). By considering the two imaging modalities in the same ICA analysis, components from each modality which carry similar co-variance between participants can be identified (Specht et al., 2009); i.e. patterns of cerebral blood perfusion which are statistically related to patterns of lesion can be observed. Joint ICA analysis was performed using the Matlab Fusion ICA toolbox (FIT: http://icatb.sourceforge.net). The analysis estimated six z-scaled components, one of which indicated consistent differences in mixing coefficients between the WA and control groups. Partial correlations, accounting for time post onset and age at scanning, were performed in the WA group to investigate the relationship between ICA component mixing coefficients and neuropsychological tests.

Results

The ICA component identified a large area of structural lesion centering on the white matter underlying the posterior superior temporal gyrus/sulcus and inferior parietal lobe in the left hemisphere. This was associated with an extended area of hypoperfusion in structurally intact grey matter lateral to the core lesion. A further three small areas of hypoperfusion remote from the area of lesion were observe affecting the ipsilateral cuneus, ipsilateral posterior parahippocampal gyrus and contralateral mid superior temporal gyrus, Figure 1.

Significant positive correlations were observed between the reading, repetition and naming tests and ICA mixing coefficients were observed (reading r^2=0.90, p=0.016; repetition r^2=0.86, p=0.028; naming r^2=0.91, p=0.013). These results indicated that the more the WA participants conformed to the identified pattern of lesion and hypoperfusion the greater the neuropsychological impairment.

Discussion

This study found evidence for hypoperfusion of structurally intact brain regions lateral to lesion. This indicates a reduction of functional efficiency of perilesional areas and mirrors cerebral perfusion data gathered in acute stroke (Hillis, Barker, Beauchamp, Gordon, & Wityk, 2000). Three small areas of remote cortical hypoperfusion were observed. This may be considered evidence of cortico-cortico diaschisis as recent evidence from animal models indicates that small reductions in perfusion can correspond to significant reductions in synaptic activity (Gold & Lauritzen, 2002). However, with the exception of the right superior temporal lobe, the functional relevance of this remote hypoperfusion is unclear. In particular the cuneus and parahippocampal regions have a role in low and high level visual processing, a skill relatively well preserved in WA.

Correlations between reading, repetition and naming data and lesion/perfusion maps appear predominantly driven by abnormality in the superior temporal and inferior parietal lobe, regions consistently associated with phonological decoding and encoding (Vigneau et al., 2006). Therefore, while this study found evidence for extensive hypometabolism surrounding cortical lesion, evidence for *clinically relevant* cortico-cortico diaschisis remains limited.

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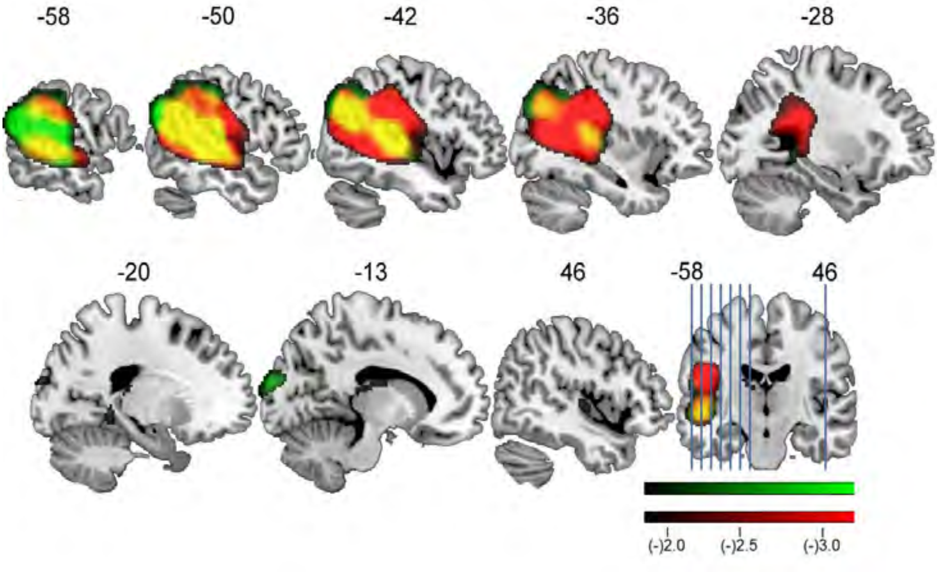
Figure 1:
Multislice image displaying ICA results. Regions of lesion/CSF are displayed in red. Regions of associated hypoperfusion/ASL perfusion maps are displayed in green. Overlapping areas of lesion and hypoperfusion are displayed in yellow. Numbers indicate MNI X coordinate.



Nouns and verbs: perioperative comparisons in brain tumors

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Introduction

People with brain tumors suffer from language deficits that affect their quality of life (e.g., Moritz-Gasser et al., 2012) and that are indicators of disease progression (e.g., Heimans & Taphoorn, 2002). Researchers and clinicians have traditionally administered object-naming tasks to assess such deficits, particularly at the lexico-semantic language level (see De Witte & Mariën 2013, for a review). In many of such reports, patients typically perform within the norm before surgery, below the norm within a month after surgery, and return to the preoperative level three to seven months after surgery (e.g., Duffau et al., 1999; Sanai et al. 2008). Although pioneering, these data may not show the full picture as patients may show impaired language that cannot be fully detected with object-naming tasks (e.g., Rofes et al., 2013, Satoer et al., 2013).

In-depth assessments of oral/written language production and comprehension have been proposed to identify specific deficits in this population (De Witte et al., 2015; Połczyńska 2006; Santini et al., 2012). The question remains as to which language deficits prevail in these patients and, therefore, which tasks (if any) may be more sensitive and specific to tackle language disorders affecting the everyday language use and quality of life of people with brain tumors. There exists an extensive literature on noun and verb deficits in people with aphasia, particularly after stroke (see Mätzig et al., 2009). In this study, we asked whether deficits with verb tasks were prevalent before and/or after surgery in patients with brain tumors who underwent awake surgery, particularly considering that verb tasks have already been used to assess people with brain tumors (Rofes & Miceli, 2014, for a review) and that those that use finite verbs seem to be better predictors of language abilities in daily life (Rofes et al., in press). The aim was to determine whether verb tasks are relevant for the type of perioperative language assessments that are being proposed at the moment.

Methods

Participants

Four Italian-speaking subjects with a brain tumor participated in this study. There were two females and two males aged between 45 and 65 years and with 8-17 years of education. Two subjects had a high-grade glioma (subject EC in the middle-temporal gyrus and inferior temporal gyrus; and AR in the superior temporal gyrus and inferior parietal lobe) and two a low-grade glioma (subject AA in the middle temporal gyrus; and OS in the inferior and middle frontal gyrus).

Materials and procedure

All subjects were assessed before (T_0), within a week (T_1), and 7 months after surgery (T_2) with a language battery that included sublexical, lexical, and grammatical tasks both for production and comprehension (*Batteria per l'analisi dei deficit afasici*, Miceli et al., 2006). Two overt naming tasks designed for awake surgery were also administered (Rofes et al., in press.): an object-naming task requiring participants to produce the noun together with its corresponding determiner (i.e., "the book"), and an action-naming task requiring participants to produce the verb in its correct inflected form followed by a pronoun (i.e., "she paints"). The two naming tasks allowed the assessment of some psycholinguistic variables that affect naming production in people with aphasia (e.g., length in phonemes, frequency, animacy, transitivity, instrumentality, etc.). The two tasks were also administered to detect language function related to language during surgery (i.e., language mapping).

Results

We summarized the results in Table 1. OS showed no particular language deficits. EC was particularly impaired at T0, AR at T0 and T1, and AA at T1 and T2. Relative to sublexical processes, EC was particularly impaired in reading non-words at T0, AR at repeating non-words at T0, and AA at writing non-words to dictation at T1. Deficits in lexical processes also accrued, EC was impaired at visual lexical decision, object-naming, and naming finite verbs at T0. AR showed deficits at naming finite verbs at T1. AA was impaired at object-naming and naming finite verbs at T1 and T2. Deficits at the grammatical level were detected in AR, who was particularly impaired in oral grammatical comprehension at T1, and AA who was particularly impaired at visual grammatical comprehension also at T1. Comparisons between matched sets of objects and actions indicated that nouns and verbs were equally impaired at every time point and that at no time point there were significant effects of any psycholinguistic variable.

Discussion

Deficits in sublexical, lexical, and grammatical processes co-occurred in three out of four subjects. EC, AR, and AA presented deficits in naming finite verbs in at least one of the three assessments, regardless of tumor type. Subjects AR and AA showed deficits in tasks that require oral or visual grammatical comprehension at T1. The administration of in-depth language batteries seems relevant for the perioperative assessment of people with brain tumors, as we were able to detect language deficits that extend those that can be assessed with object-naming tasks alone in three out of four participants. The use of verb tasks seemed particularly relevant in subject AR: she showed deficits in naming finite verbs and oral grammatical comprehension at T1, but not at object-naming. Finding no differences between matched sets of items for both tasks or significant effects for any specific psycholinguistic variable indicates that further work should be aimed at disentangling whether the use of verbs/actions vs nouns/objects, or the extra linguistic morphosyntactic processes that are processed when naming finite verbs (e.g., argument structure, thematic role-assignment, subject-verb agreement, time reference) make verb tasks particularly sensitive to assess perioperative language deficits in this population.

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Table 1. Times at which deficits were detected.

	EC	**AR**	**AA**
Sublexical processes			
Writing non-words to dictation (BADA)			T1 (6/12)
Reading non-words (BADA)	T0 (14/23)		
Repeating non-words (BADA)		T0 (15/18)	
Lexical processes			
Visual lexical decision (BADA)	T0 (34/40)		
Oral lexical decision (BADA)			
Object naming (Rofes et al., in press)	T0 (29/57)		T1 (1/70) T2 (37/70)
Naming finite verbs (Rofes et al., in press)	T0 (52/70)	T1 (45/70)	T1 (5/70) T2 (52/70)
Grammatical processes			
Oral grammatical comprehension (BADA)		T1 (22/30)	
Visual grammatical comprehension (BADA)			T1 (15/23)

Notes. We indicated the number of correct responses and the total number of items of the task.

Plasticity of cognitive functions before and after awake brain tumor surgery

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Introduction

Deficits in cognitive functions, i.e. language memory, attentional and executive functions are common in patients with primary brain tumors in eloquent areas[1-3]. Tumor resection may aggravate the cognitive problems, which can recover in the first year postoperatively[4] . However, this finding was based on a group study, there is in clinical practice individual variety in cognitive performance and/or recovery. Pre- and postoperative neural plasticity mechanisms play an important role; substantial support is provided for a hodotopic (i.e. dynamic) approach of functional organization in the brain as opposed to a topological viewpoint (i.e. static organization)[5]**Error! Not a valid filename.**. We aim to describe the influence of plasticity on cognition by means of pre- and postoperative profiles of patients with a similar brain tumor localization.

Methods

Subjects

We present 4 right-handed patients (P1, P2, P3, P4) originating from 2 outcome studies[4,6] with an age range of 34-64 years. P1 and P2 were diagnosed with a primary brain tumor in the temporoparietal area and P3 and P4 with a primary brain tumor in the insula. Language dominance was found in the left hemisphere for all patients.

Treatment

All patients were treated with awake brain surgery. Electrical stimulation was carried out at cortical and subcortical level with a bipolar electrode. Pathological examination of tumor tissue obtained during resection revealed a slow growing brain tumor (low-grade) in P1 and P3 and a fast growing brain tumor (high-grade) in P2 and P4. Postoperatively, the extent of resection was calculated at 52,73% in P3 and at 81,48% in P4. P4 received postoperative adjuvant therapy (radiotherapy).

Neuropsychological test-protocol

We administered an extensive neuropsychological test-protocol: Language: Object naming, action naming, category and letter fluency, AAT-subtests: repetition, writing to dictation, reading aloud, Token Test. Memory: 15 word test (imprinting, recall), digit span. Attentional and executive functions: Design fluency, Trail Making Test A, B, Stroop Color Word Test I-III. The pre- and/or postoperative z-scores of the patients were compared with the normal population. Cognitive functioning was described preoperatively in all 4 patients and postoperatively in 2 patients (P3 and P4) at 3 and 12 months.

Results

Preoperative neuropsychological protocol: all cases

P1 and P2 and P3 and P4 for their part showed opposite cognitive profiles. P1 obtained normal cognitive results and P2 had clinically significant impairments in all cognitive domains: language (letter fluency, AAT Token Test), memory (15 WT inprinting, digit span), attention and executive deficits (TMT B, BA, Stroop I-III) (z-scores= ≥-1.50). P3 was impaired in memory (15 WT recall) and executive functions (TMTB, BA) (z-score= ≥-1.50), but P4 obtained overall intact cognitive results.

Intraoperative monitoring and postoperative neuropsychological protocol: P3 and P4

Intraoperatively, in both cases (P3 and P4) positive language sites were found at the left inferior frontal gyrus, below motor cortex, and left parietal lobe (see figure 1) as revealed with repetition tasks and/or object naming during stimulation. At the end of resection, perseverations occurred in both cases and the resection was stopped.

Figure 1. Intraoperative mapping P3 and P4 (see page 5)

At 3 months postoperatively, P4 presented language deficits (AAT repetition) followed by recovery at 12 months, whereas P3 appeared to have recovered at 3 months postoperatively from the observed preoperative impairments in executive functioning (TMT B, BA) (z-score= <-1.50).

Discussion

In patients with similar brain tumor localizations, we found distinct cognitive profiles, possibly affected by different processes of neural plasticity. At the preoperative level, a favorable effect of neural plasticity on cognition was found in P1 (temporoparietal area), potentially affected by tumor grade. Preserved cognitive functions in P1 was possibly facilitated by the slow growth rate of a low-grade tumor allowing functional reorganization (4 mm p/y)[7], i.e. preoperative cognitive plasticity. However, P2 with a brain tumor in the same area showed preoperative deficits in several domains (language, memory and attention/executive functions). A faster growth rate of a high-grade tumor could have more aggressively affected these preoperative cognitive functions. In the other 2 patients P3 and P4 with the same tumor localization (insula), a different effect was found on the cognitive recovery process; at short term (3 months), improvement of the preoperatively observed cognitive impairments in a low-grade tumor P3, whereas a more gradual functional reorganization was found in language (between 3 and 12 months) in P4, a high-grade tumor, which is not in line with other studies[8,9].

Also, an effect of extent of resection could also be responsible for a cognitive decline, as P4 was treated with a larger tumor resection than P3. However, our recent follow-up study did not reveal a relation between extent of resection and cognitive decline[4]. Currently, there is only evidence that a more extensive resection is associated with longer survival in both LGG and HGG patients[10].

From these case reports, it is unclear when improvement exactly takes place, as the range between 3 and 12 months is relatively long. However, a recent outcome study found that the postoperative interval of 3 and 6 months is crucial for language improvement (De Witte et al., submitted). Evidently, larger subgroups with patients with a comparable brain tumor localization need to be analyzed to investigate the different courses of neural plasticity.

In conclusion, the findings of these case studies provide support for a hodotopical functional organization as different cognitive profiles were found in patients with the same tumor localization (P1 vs P2 and P3 vs P4). Hence, an extensive neuropsychological investigation at different cognitive domains, language, memory, attention and executive functions, at both pre- and postoperatively level is of fundamental importance in glioma patients due to neural plasticity.

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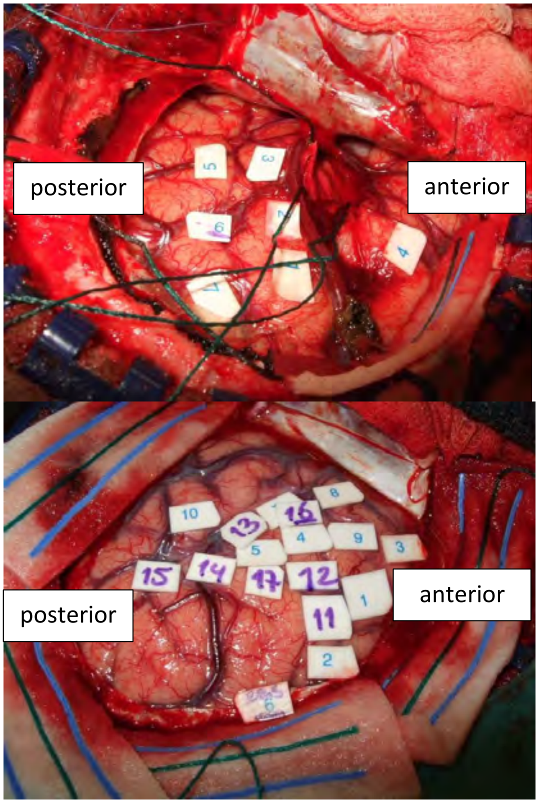
Figure 1. Intraoperative mapping P3 (A) and P4 (B)



A. P3 (left): speech arrest 1,2, 4, 6, 7; phonematic paraphasia 3, 5.

B. P4 (right): speech arrest 1, 5, 8, 9, 14; phonematic paraphasia 6, 7, 13, 15; neologism 10; dysarthria 2-4; contraction tongue 11, 12, 16, 17.

Interaction of Executive Functions and Word Retrieval in aphasic patients and healthy controls -a Psycholinguistic Investigation

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Introduction

Prior research has established that frontal parts of the brain, which are closely linked to executive functions, interact with word retrieval processes (see Shao, 2013). However, it is not clear yet as to what extent word retrieval tasks interact with which tests of executive function and which role word retrieval tasks play in tests of executive functions, such as verbal fluency. To assess influences of executive functions of word retrieval, we employed the blocked cyclic naming paradigm, where semantically related sets of objects (homogeneous blocks) and semantically unrelated sets of objects (heterogeneous blocks) are named multiple times, and the continuous naming paradigm, where consecutively presented semantically related items are named once only (see Belke & Stielow, 2013), and assessed, to what extent they involved various aspects of executive functions, such as shifting between tasks, monitoring and updating the working memory, and inhibition (see Miyake, Friedman, Emerson, Witzki, Howeter, & Wager, 2000). We hypothesized that executive functions correlate with the blocked naming paradigm but not with the continuous naming paradigm, as prior research suggests that top-down executive modulation, mediated by the left inferior frontal gyrus, plays a role in the blocked but not in the continuous naming paradigm (see Belke & Stielow, 2013). Regarding influences of word retrieval on executive functions, we assessed to what extent different word retrieval tasks (naming, rhyming) are involved in verbal fluency tasks which have "been commonly viewed as a component of executive function" (Mitrushina, Boone, Razani & D'Elia, 2005, p. 202). We assume that using verbal fluency tasks solely to test executive functions severely underestimate the word retrieval processes which are involved and essential to perform these tasks.

Methods

Participants and Pre-Tests

We tested nine mild to moderate anomic aphasic patients and nine healthy controls, matched to the patients in gender, age and education. We assessed the linguistic performance of the patient group using an extensive language testing battery. In addition, we had both groups of participants complete the Trail Making Test, the Digit Span test and the Corsi block-tapping as well as the Stroop test to assess the shifting, working memory and inhibition capacities, respectively.

Experiments

The blocked cyclic naming paradigm (see Damian, Vigliocco & Levelt, 2001) was conducted in three different conditions; a semantically homogeneous, a phonologically homogeneous and a mixed condition, containing neither semantic nor phonological relations among set members. Across conditions, the same items were used. The continuous naming paradigm was conducted as described by Howard, Nickels, Coltheart & Cole-Virtue (2006). The naming paradigms were analyzed considering both errors and naming latencies.

Additionally, we conducted a letter (d, n, h, s) and a semantic (sports, clothes, sweets, animals) fluency task and analyzed them with respect to the number of correct words as well as the switching and clustering component scores (for an overview see Troyer & Moscovitch, 2006).

Finally, the results in the blocked and the continuous naming paradigm as well as the results in the verbal fluency tasks were correlated with the performance in the tasks tapping executive functions. Additionally, the language tests which were conducted with the aphasic patients were correlated with the verbal fluency tasks.

Results

In the blocked cyclic naming paradigm, a semantic inhibition effect as well as a phonological facilitation effect was seen in the healthy controls. Aphasic patients showed a semantic inhibition effect but performed inconsistently in the phonological condition. In the continuous naming paradigm results from previous studies were replicated, yielding significant interference effects in analyses of all speakers. Considering all participants, shifting and working memory skills correlated with the semantic context effect obtained the blocked naming paradigm. However, there were no such correlations when the two groups were considered separately. For the control group, there was a significant correlation between inhibition ability and the build-up of the semantic interference effect across cycles. However, there was no such correlation between inhibition ability and the semantic interference effect in the continuous naming paradigm. Both letter and semantic fluency were correlated more strongly with executive functions in the group of aphasic patients compared with the group of healthy controls. Interestingly, considering the language tasks, accuracy in naming was correlated with semantic fluency whereas the performance in rhyming was correlated with letter fluency.

Discussion

The present study confirmed the hypothesis that the performance in the blocked cyclic naming paradigm is linked to executive functions while the continuous naming paradigm is not, providing further support for the idea that, depending on the task, lexical selection can and being modulated top down. Furthermore, the study delivers important insights to the performance of aphasic patients in the different conditions in the blocked naming paradigm as well as in the continuous naming paradigm. The blocked naming paradigm was examined with aphasic patients considering both the error rate and naming latencies. Additionally, the phonological condition was conducted as little is known about that condition. Finally, the continuous naming paradigm was conducted with aphasic patients and replicated the cumulative semantic effect that is seen in healthy speakers. The current state of research lacks in information especially regarding naming latencies of aphasic patients in these naming experiments.

In addition, we showed that letter and semantic fluency tasks draw on word retrieval processes in different ways. While semantic fluency is linked with lexical-semantic processes and also correlates with other lexical-semantic tasks like picture naming, letter fluency is linked with phonological retrieval processes and correlates with other phonological tasks like rhyming. That shows that not only executive functions, but also different linguistic components are important and needed to successfully perform semantic and letter fluency tasks. As verbal fluency tasks are widely used in cognitive psychology and neuropsychological assessments in many different diseases (e.g. Alzheimer, schizophrenia, depression, Huntington's) it is important to clarify what exact executive and language components are involved in these tasks. The present study furthers this issue in verbal fluency research.

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"To talk or not to talk"- an rTMS study about naming during stimulation

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Introduction

Repetitive transcranial magnetic stimulation (rTMS) has been associated with language improvement in chronic aphasia. Several protocols had been described in the literature that target different brain areas with different frequencies. Nevertheless, to the best of our knowledge, no previous study has compared the possible influence of a naming task during the stimulation.
Empirically, we assume that patients are engaged in a language task during the protocol. This could affect the rTMS results and may offer better results.
In this pilot study, we explored the possible benefit of incorporating a naming task during stimulation on the final fluency scores.

Methods

Participants

In this pilot study, we studied 10 patients (8 male) with chronic non-fluent aphasia. Patients were subsequently divided to either engage in the naming task or to receive the standard protocol (5 patients in each group).
No statistical differences were found between the two groups regarding the variables of age, gender, time since onset, stroke location, handedness and aphasia classification.
Participants inclusion criteria were as follows: aphasia resulting from a single ischemic stroke (i.e. left-sided middle cerebral infarction), absence of psychiatric or other neurological diseases previous to stroke and living at home before stroke. The time after onset occurred at least 12 months to assure clinical stability. The exclusion criteria were: cognitive decline, major depression, prior substance abuse or severe concomitant disease and be illiterate. Patients medicated with drugs that could change the level of cortical excitability (e.g., neuroleptics and benzodiazepines) were also excluded. All subjects spoke European Portuguese as their native language and had normal or corrected-to-normal vision. All subjects exhibited strong premorbid right-handedness (>80), as measured by the Edinburgh Handedness Inventory (Oldfield, 1971).
An extensive language assessment was performed before and after rTMS with the Portuguese adaptation of the Multilingual Aphasia Examination (Benton, 1989) named BAAL. We also measured the aphasia quotient (AQ) by calculating the sum of the scores from the four major language tasks: verbal fluency, naming, word repetition and oral comprehension. Other evaluations included apraxia examination and a shortened version (22 items) of the Token test (de Renzi & Vignolo, 1962).

All study participants provided informed, written consent using aphasia-friendly materials. All stimulation parameters were chosen according to current safety guidelines for rTMS (Wassermann, 1998; Rossi et al., 2009). In addition, an Ethics Committee approved all TMS procedures.

rTMS Protocol

The MagPro X100 equipment from MagVenture (Farum, Denmark) was used with a Figure 8-shaped rTMS coil placed tangentially to the scalp. Impulses were applied at 90% of the resting motor threshold (rMT) at a 1 Hz frequency. The rMT was determined daily for each subject before stimulation; it was defined as the minimum stimulus intensity capable of producing a motor evoked potential (MEP) of at least 50 mV in 5 or more successive discharges. The MEP was verified using the left dorsal inter-osseus muscle of the left hand (Rossini et al., 1994).
We used a two-phase protocol similar to that described in previous reports (Turkeltaub, Messing, Norise & Hamilton, 2011). All participants received four 10 min sessions of phase-one rTMS to select the best ROI and an additional 10 sessions of 1 Hz rTMS in the right PTr at 90% rMT. The target areas were chosen based on information from prior MRIs and a neuro-navigation system.
Patients lay on a reclining medical table that allowed them to keep their arms and hands relaxed along the body with the head supported by a customized pillow. Earplugs and padding were provided to maximize comfort and minimize involuntary head movements.
During each session, the experimental group was engaged in a naming task in a prerecorded presentation, which was displayed on a 17-inch monitor with previously selected items. The patients were prompted to ignore errors while attempting to name the image stimuli. The different sets of pictures that were played in each session contained items from different semantic categories, e.g., animals, furniture, food, tools, clothing, vehicles and household objects, with variations in frequency and word length. These pictures were presented in the same order for each participant (N=205). None of the previously mentioned stimuli were similar to those used in the experimental protocol. Each picture was displayed on the screen for 12 sec followed by the corresponding word for another 12 sec. If needed, MRI-compatible trial frames were provided to ensure optimal corrected visual acuity.

Results

After the rTMS sessions, the majority of patients (N=8) had significant improvements in verbal comprehension and naming scores relative to baseline language evaluation (all $p<0.001$). However, the experimental group had higher scores and a significant statistical difference in the naming tasks versus the group that not use the naming task during stimulation. Patients that were engaged in the naming task they scored considerably higher than the controls in aphasia quotient ($U=108.00$; $p=0.000$), in BAAL naming ($U=174.0$; $p=0.002$), in BAAL fluency task ($U=101.00$; $p=0.001$) and in word repetition ($U=196.0$; $p=0.000$). No significant differences between the two groups were detected for BAAL comprehension task ($t=-0.22$ (1,06), $p=0.203$) and Token test scores ($U=201.1$; $p=0.117$).

Discussion

Although our study used a small clinical sample, this study supports the empirical notion that the utilization of a naming task during stimulation results in better outcomes.
Our data suggest that this resource should be utilized in future rTMS studies of aphasia patients to improve the outcome.
Our study also highlights some clinical and technical parameters that could be useful to clinicians who intend to use rTMS in patients with severe non-fluent aphasia.

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Atypical cerebral and cerebellar language organisation: A case study

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Introduction

Language is subserved by an extensive network of cortico-subcortical connections including the cerebellum via an intricate network of crossed subcortical pathways. Within this language network the dominant fronto-insular region and the contralateral posterior cerebellum are crucially implicated in language and speech production. In the vast majority of right-handers (> 97%) the left hemisphere and the right cerebellum are dominant for language (Knecht et al., 2000; Mariën, Paghera, De Deyn, & Vignolo, 2004). We report unexpected anatomoclinical findings in a right-handed patient with an extensive recent right cerebellar infarction and an older left fronto-insular stroke.

Methods

Neuropsychological examination

In-depth neuropsychological investigations were performed one week after stroke. Neuropsychological assessments consisted of the revised version of the Wechsler Memory Scale (WMS-R; Wechsler, 1987), the Wechsler Adult Intelligence Scale, third edition (WAIS-III; Wechsler, 1997), the Hierarchic Dementia Scale (HDS; Cole & Dastoor, 1987), the Mini Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1987), Raven's Progressive Matrices (Raven, 1938), the Stroop Colour Word Test (Golden, 1978), the Wisconsin Card Sorting Test (WCST; Heaton, Chelune, Talley, Kay, & Curtis, 1993), the d2 test of attention (Ross, 2005), and the Trail Making Test (TMT; Reitan, 1958). Language was assessed with the Aachener Aphasia Test (AAT; Graetz, de Bleser, & Willmes, 1992), the Boston Naming Test-NL (BNT; Mariën, Mampaey, Vervaet, Saerens, & De Deyn, 1998), and verbal fluency tasks.

Functional neuroimaging

A quantified Tc-99m-ECD SPECT study was carried out one week poststroke. To identify language dominance, fMRI of the brain was conducted six weeks poststroke. The fMRI experiment was performed using a block-designed paradigm consisting of two conditions, each lasting for 30s: a resting period (R) and a noun-verb association task (T) (as in Baillieux et al. (2009)). The lateralisation index (LI) was calculated based on the number of voxels activated in the standard language areas and their homologue counterparts in the right cerebral hemisphere, according to the formula LI = (L-R)/(L+R) (Rutten, Ramsey, van Rijen, &

van Veelen, 2002; Stippich et al., 2007). Left-sided laterality is associated with a positive LI, right-sided laterality with a negative LI. Bilateral language distribution is reflected by a LI between -0,25 and +0,25 (Lehericy et al., 2000; Adcock, Wise, Oxbury, Oxbury, & Matthews, 2003). In addition, Diffusion Tensor Imaging (DTI) was performed.

Results

Neuropsychological examination

A strong and consistent right hand preference was objectified by means of the Edinburgh Handedness Inventory (Oldfield, 1971) demonstrating a laterality quotient of +100.
Cognitive screening revealed severely disturbed attention skills and a pathologically slow working speed. Frontal planning and problem solving were distorted, as well as cognitive flexibility, and the ability to inhibit a competing more automatic response.
At the behavioural level, frontal-like behavioural disturbances were noted. The patient behaved in a childish manner, expressed blunt opinions in a theatrical way. Responses to external stimuli were generally characterised by disinhibited behaviour, manifesting as inappropriate behavioural and emotional reactions, overfamiliarity, or flamboyant and impulsive actions.
No speech or language deficits were found apart from a slightly abnormal visual confrontation naming (BNT: SD -1.87).

Functional neuroimaging

A quantified Tc-99m-ECD SPECT study revealed a significant bilateral hypoperfusion in the frontal cortex, more pronounced on the left than on the right side. A significant hypoperfusion was also found in the motor cortex and the right parietal cortex.
A clear bilateral distribution of language functions at the cortical level was detected as indicated by the LI (LI = +0,11).
At the cerebellar level, fMRI revealed a clear left lateralised activation (LI = +0,66) with almost five times as many voxels activated in the left posterior cerebellar hemisphere than in the right posterior hemisphere.
Bilateral hemispheric language distribution was also suggested by DTI. DTI showed a slightly more pronounced arcuate fascicle on the right than on the left, without any significant difference in Fractional Anisotropy (FA) or Mean Diffusivity (MD). The minimal difference between the number of tracts, the FA, and the MD also suggests a bilateral language distribution at the cerebral level.

Discussion

This exceptional patient showed no language deficits after a left insular and a right cerebellar stroke. By contrast, Schmahmann's syndrome (Manto & Mariën, 2015) was identified after the cerebellar infarct and reflected on SPECT by crossed cerebello-cerebral diaschisis in the anatomoclinically suspected frontal regions. Evidence from fMRI and DTI in

this patient suggests atypical bilateral language organisation at the cortical level as a maturational variant of cerebral language representation (Rowan et al., 2004; Vernooij et al., 2007; Stieglitz, Seidel, Wiest, Beck, & Raabe, 2012; Mendez Orellana et al., 2014). At the cerebellar level a much stronger activation of the left cerebellar hemisphere during the semantic noun-verb association task (LI = +0,66) was observed.
Since linguistic functions in subjects with atypical bilateral language representation are less dependent on one language dominant hemisphere, it might not be surprising that no language disturbances were detected after left insular and right cerebellar damage. It could be argued that in patients with a bilateral language organisation, the contralateral homologue regions can flawlessly and apparently instantly compensate for possible functional loss due to cerebral or cerebellar damage.

This could explain the stronger activation of the left cerebellar hemisphere despite a bilateral language distribution at the cerebral level. Although it could be argued that the asymmetry was caused by the right cerebellar lesion, this would imply that there should be a loss of linguistic function due to loss of activation. Since no linguistic deficits were observed, it is reasonable to assume that the potential loss of function due to cerebellar damage is compensated for by a stronger activation of the left cerebellum. This unusual left cerebellar lateralisation might indicate that the left cerebellum compensated the functional loss in the right cerebellum after acute damage in a context of a previously existing bilateral organisation of language function.
However, to confirm this hypothesis a more systematical analysis of subjects with congenital bilateral distribution of language should be performed.

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Investigating phonological and cholinergic therapies for speech comprehension deficits in chronic aphasia: What works and why?

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Introduction

This study investigated the efficacy of two concurrent interventions for speech comprehension deficits in patients with chronic, post-stroke aphasia. The first was phonological awareness and auditory processing training using 'Earobics' software (www.earobics.com). The second was a pharmacological intervention using donepezil, an acetylcholinesterase inhibitor previously shown to improve aphasia severity (Berthier *et al.* 2003; Berthier *et al.* 2006). In order to investigate the neural mechanisms underlying the therapy effects, a vowel mismatch negativity (MMN) magnetoencephalography (MEG) paradigm was used to identify changes in effective connectivity within the patients' surviving auditory processing network.

Methods

Participants

Twenty aphasic stroke patients with significant auditory speech comprehension impairments participated (3 female; mean age=62y, 4m). All patients had no more than age-related hearing loss and were a minimum of 6 months post-stroke (mean time since stroke=3y, 3m).

Design

A randomized, placebo-controlled crossover design was used to allow a within-subjects evaluation of the two treatments. Participants were block-randomised into two crossover groups, according to whether drug or placebo was administered first, and both participants and researchers were blinded to the block allocation.

As shown in Figure 1a, each participant received 4 x 5-week blocks of treatment: (1) Drug only, a 5mg daily dose of donepezil; (2) Drug and Earobics, a 10mg daily dose of donepezil, combined with 2 x 40 minute daily sessions of Earobics; (3) Placebo only; and (4) Placebo and Earobics.

The participants were assessed before (1) and after (2) Earobics training, in both Drug (D) and Placebo (P) conditions, leading to five distinct assessment time points: Baseline, D1, D2, P1, P2. This design allowed for a repeated-measures analysis of behavioural and effective connectivity outcome measures, in a 2x2 factorial design, with factors Before/After Earobics and Drug/Placebo.

Behavioural Outcome Measure

Language ability was assessed at each time-point using the Comprehensive Aphasia Test (CAT, Swinburn *et al.,* 2004), with scores from the Speech Comprehension subtest used as the main behavioural outcome measure.

MEG Effective Connectivity

Participants were scanned at D1, D2, P1 and P2 time-points, using an established index of auditory perception, the Mismatch Negativity paradigm (MMN), to investigate therapy effects on phonological perception. Following Teki *et al.* (2013), a passive oddball design was used, consisting of a standard auditory stimulus '*bart*', and three deviant stimuli varying in acoustic and phonological distance from the standard. Dynamic Causal Modelling (David *et al.,* 2006) was used to test how effective connectivity within the auditory network differed between phonological versus acoustic deviants, which can be interpreted as a neuronal marker of phonological sensitivity. The auditory network included left and right Heschl's gyri (L HG, R HG) and superior temporal gyri (L STG, R STG).

Results

The baseline CAT assessment demonstrated that the participants could be classified as Moderate (n=13) or Severe (n=7), based on their Speech Comprehension scores (independent samples t-test: t(18)=7.77, *p*<.001). The two sub-groups also differed significantly in Written Comprehension, Repetition, Naming, Reading and Writing (*p*<.05 in all cases); but not on age (*p*=.35), time since stroke (*p*=.43) or lesion volume (*p*=.94).

The effects of therapy on Speech Comprehension scores were assessed with a mixed effects ANOVA, with within-subjects variables Earobics (before/after Earobics) and Drug (on drug/on placebo). Two between-subjects variables were also included: Severity group (Moderate/Severe) and Crossover group (drug first/placebo first).

The results, shown in Figure 1b, demonstrated a significant main effect of Earobics, with better scores after versus before Earobics training (F(1,16)=6.56, p<.05). Conversely, there was a significant negative main effect of Drug, due to lower scores on drug than placebo (F(1,16)=11.60, p<.005). Drug by Severity and Earobics by Severity interactions were also significant, as both therapy effects were larger in the Severe patient group (F(1,16)=6.6, p<.05 and F(1,16)=4.9, p<.05 respectively).

The MEG effective connectivity data were analysed using the same mixed effects ANOVA, in order to assess the effects of Earobics and Drug on phonological sensitivity in the auditory network. As shown in Figure 1c, two connections showed a main effect of Earobics, as they became more sensitive to phonological differences after Earobics training: a forward connection from L HG to L STG and a self-connection (reflecting neuronal gain or sensitivity to inputs) on the L STG (F(1,16)=11.3, *p*<.005 and F(1,16)=6.65, *p*<.05 respectively). In addition, three connections showed significant Earobics by Severity interactions, as the training effect was stronger in the Severe versus Moderate patients: the L HG to L STG connection, the L STG to R STG connection and the R STG to L STG connection (F(1,16)=8.30, *p*<.05, F(1,16)=6.65, *p*<.05 and F(1,16)=5.13, *p*<.05 respectively). Only one connection, from L HG to L STG, was significantly stronger on drug than placebo (F(1,16)=21.08, *p*<.001).

Discussion

These results indicate that phonological awareness training can improve speech comprehension abilities in patients with chronic post-stroke aphasia, and may be particularly effective for patients with severe deficits. However, there was no evidence to suggest that donepezil, a cholinergic agonist, could facilitate training effects: rather, the drug intervention had a negative effect on speech comprehension training.

The effective connectivity results suggest that the L STG has an important role in mediating these therapy effects. The predictive coding model of hierarchical processing (Friston 2005) posits that beneficial training effects will increase the strength of self-connections at the same level that the intervention is having its effect. This means that higher-order auditory representations (presumably at the phonemic level) in the L STG have become more sensitive or tuned to phonological as opposed to acoustic vowel deviants. We would also expect to see stronger connections between regions that have been affected by the therapy (reflecting more efficient recurrent, message-passing).
Finally, the Severe patients (who showed the greatest behavioural improvements) also showed strengthening of bidirectional connections between L STG and R STG, perhaps suggesting that, for these patients, auditory therapy additionally induces improved message-passing between higher levels of auditory cortex in both hemispheres.

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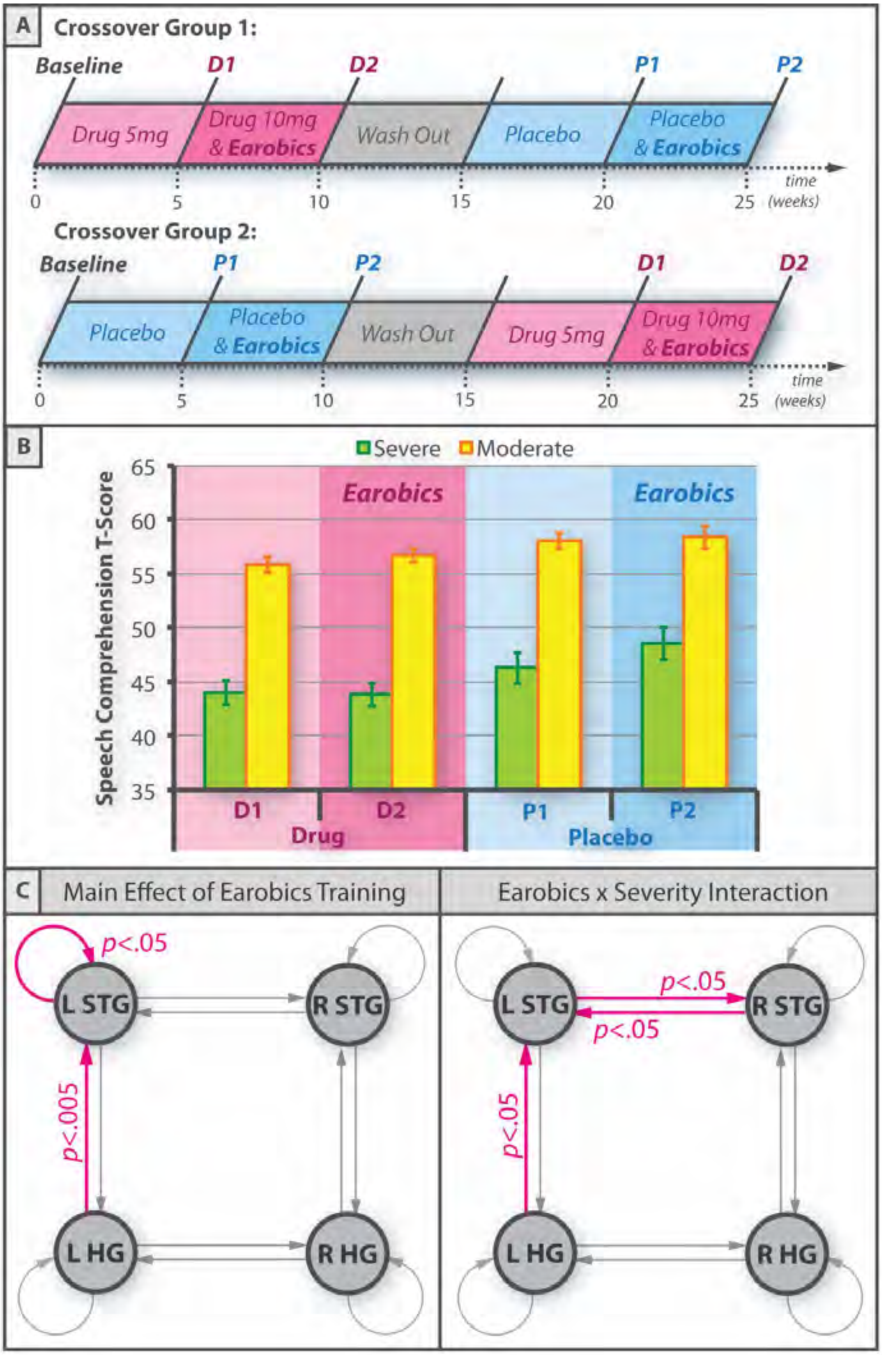
A
Crossover Group 1:
Baseline
D1
D2
P1
P2
Drug 5mg
Drug 10mg & Earobics
Wash Out
Placebo
Placebo & Earobics
0
5
10
15
20
25
time (weeks)
Crossover Group 2:
Baseline
P1
P2
D1
D2
Placebo
Placebo & Earobics
Wash Out
Drug 5mg
Drug 10mg & Earobics
0
5
10
15
20
25
time (weeks)
B
Severe
Moderate
Speech Comprehension T-Score
65
60
55
50
45
40
35
Earobics
Earobics
D1
D2
P1
P2
Drug
Placebo
C
Main Effect of Earobics Training
Earobics x Severity Interaction
p<.05
p<.005
L STG
R STG
L HG
R HG
p<.05
p<.05
p<.05
L STG
R STG
L HG
R HG

Don't count on this Number. Exploring mismatches between referential numerosity and morphological encoding.

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Introduction

Noun morphology is one of the means that encode some salient properties of a reference. In the case of Number morphology, for example in Italian, a Singular or Plural value is mandatorily expressed and it usually encodes the referential numerosity (e.g., a Plural number value on the noun corresponds to a plurality concerning the reference). It is known from the literature that the processing of morphological Number value on nouns should involve a cognitive elaboration of numerosity as well (i.a.: Carreiras et al., 2010).

Italian allows to test the mismatch between morphological Number value expressed on a noun and the referential numerosity by comparing two quantification expressions (QEs), *qualche* and *alcuni*. Both QEs refer to a plural numerosity, meaning 'some' (Zamparelli, 2007). While in presence of the QE *alcuni* the noun congruently surfaces at the Plural (N-pl), in presence of the QE *qualche* the noun displays a value of Singular (N-sg). Since both conditions are grammatical, they represent a privileged testing ground to observe the relationship between morphological Number value and numerosity.

Methods

Materials and participants

30 nouns referring to countable, concrete objects were chosen. All nouns were controlled for i) frequency by means of the it-WaC corpus (Baroni et al., 2009), ii) subjective frequency by means of a dedicated rating study (Zanini et al., 2014), and iii) length. The length and the frequency of the whole phrase *qualche*/*alcuni* + N were also controlled.

34 subjects participated to the study (age 21-35, 16 females).

Task

A picture–phrase matching paradigm was developed. Two pictures were created for each noun: one representing one object, and one representing the same object repeated four times. Each picture was presented twice: once with *qualche* and once with *alcuni* (table 1). Thus, the experimental conditions were 4, for a total of 120 experimental stimuli. 180 filler stimuli were added in order to counterbalance each experimental condition (table 1). The presentation of the stimuli was randomized for each participant.

The participant was asked to press one key if the phrase matched with the picture (true), and another key in the opposite case (false). The keys were counterbalanced across the participants. The structure of each trial was the following: fixation point (800ms), picture presentation (1000ms), blank (200ms), phrase presentation (1000ms) and another blank (3000ms). Participants could answer after the presentation of the phrase. RTs measurement was triggered at the onset of the phrase presentation.

PICTURE	Q-EXPRESSION	NUMEROSITY ENCODED BY THE QE	MORPHOLOGICAL NUMBER VALUE	TRUTH VALUE	CONDITION
SINGULAR	*qualche* + N	plural	Singular	F	A
	alcuni/e + N	plural	Plural	F	B
PLURAL	*qualche* + N	plural	Singular	T	C
	alcuni/e + N	plural	Plural	T	D
SINGULAR	*un/uno/una* + N	singular	Singular	T	Filler
	plural bare noun	plural	Plural	F	Filler
	singular bare noun	singular	Singular	T	Filler
PLURAL	*un/uno/una* + N	singular	Singular	F	Filler
	plural bare noun	plural	Plural	T	Filler
	singular bare noun	singular	Singular	F	Filler

Table 1: Experimental conditions.

Results

An ANOVA was carried out both by subject and by item. A significant main effect $F(1,33) = 57.81$, $p < .001$ was found for QE: the RTs for conditions with *qualche* + N-sg (mean = 868.75 ms; sd = 224.69) were longer than for conditions with *alcuni* + N-pl (mean = 816.88 ms; sd = 227.15). This means that when the numerosity encoded by the QE matched the morphological Number value as in conditions B and D (*alcuni* + N-pl) faster RTs are recorded, irrespectively of the truth value. Conversely, when the numerosity encoded by the QE did not match the morphological Number value as in conditions A and C (*qualche* + N-sg) RTs are slower.

Discussion

Conditions with *qualche* + N-sg may elicit longer reaction times because of the mismatch between the numerosity of the reference and the value expressed on the noun by Number morphology. In Italian each occurrence of a noun must bear a morphological value of Singular or Plural. Usually, the value Singular is linked to a semantic feature that implies a numerosity of one, while the value Plural implies that the numerosity is different from one. When this link between a morphological value and a semantic feature is not present, the morphological value is “empty” and non-interpretable. In this case the numerosity is encoded by the quantifier and the value on the noun is non-interpretable. Non-interpretability with respect to an inflectional morphological value may be the reason why a larger amount of cognitive resources are required, similarly to what has been observed for Gender morphology (Franzon et al., 2014).

Morphological values must be always present -even when they do not surface at the phonological level- in order to become available for syntactic operations (such as Agreement). Morphological inflection may be conceived to provide the quick expression of salient semantic features such as numerosity. At the same time morphology entails the possibility to underdetermine such salient semantic features, depending on the communicative context. Such operation of underdetermining consists in an inhibition of the semantic interpretation of the morpheme: this may result in greater processing costs.

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Stem-, Spraak- en Taalpathologie

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