Characterizing verb argument structure production in discourse in chronic aphasia

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Background

- People with aphasia (PWA) and especially agrammatism produce fewer verbs in discourse
- Verb argument structure (VAS) is often tested with action naming or sentence production tasks
- Measuring VAS in discourse is more ecologically valid and can help clinical assessment, but requires intensive manual coding
- A previous study found that PWA and especially speakers with Broca's aphasia do not have problems with accessing more complex verbs, but use their argument structure less accurately (Malyutina et al., 2016, Seminars in Speech and Language)

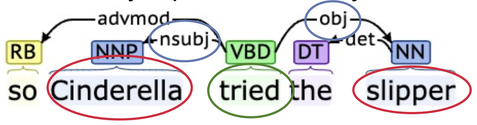
➢ We aimed to extract verb argument structure automatically from discourse using dependency parsers
➢ And we rated verb argument structure use in aphasia relative to controls from AphasiaBank

Participants and Stimuli

- Participants: 263 controls from AphasiaBank, 106 PWA collected at USC
- Anomia: 29, Broca: 33, Conduction: 15, Global: 4, Wernicke: 7, Transcortical motor: 1, not aphasic by WAB (None): 17
- Stimuli: Cinderella, transcribed according to CHAT

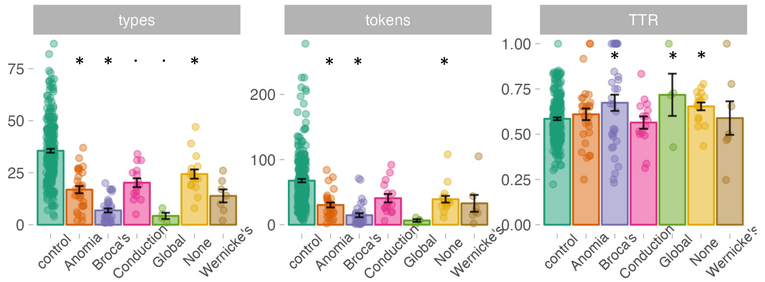
Dependency parser

- Dependency parser (coreNLP) finds grammatical relations between words in a sentence:
- heads (verbs), dependents (arguments), types of relations
- Approach validated by replication of Malyutina et al.'s results

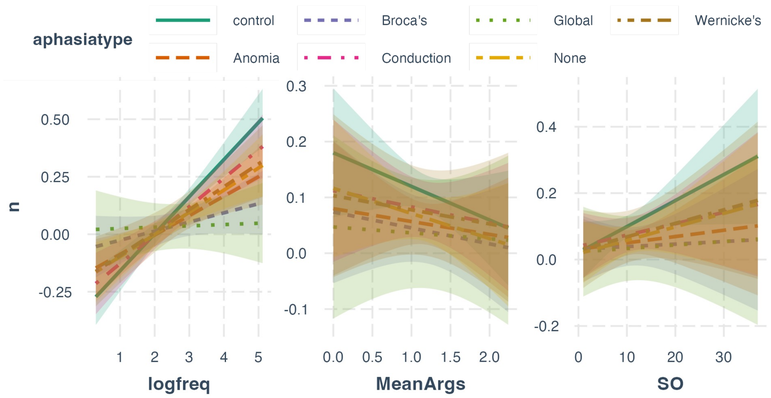


Dependency relation	Argument	Coded as	Example sentence
nsubj	noun subject	subject	*the boy* hugs the girl
csubj	clausal subject	subject	*that he was quiet* annoyed Mary
obj	object	object	the boy hugs *the girl*
ccomp	clausal complement	object clause	he thought *that she was right*
xcomp	open clausal complement	object clause	he wanted her *to leave*
iobj	indirect object	indirect object	the boy gave *her* the book
obl	indirect argument/adjunct	oblique	he put the book *on the table* // he read *on the couch*

Verb choice



- Linear model controlling for severity: fewer verb types and tokens and higher TTR in aphasia overall, but high variability
- Linear mixed model for frequency of verb use: less sensitivity to verb characteristics in aphasia vs. controls

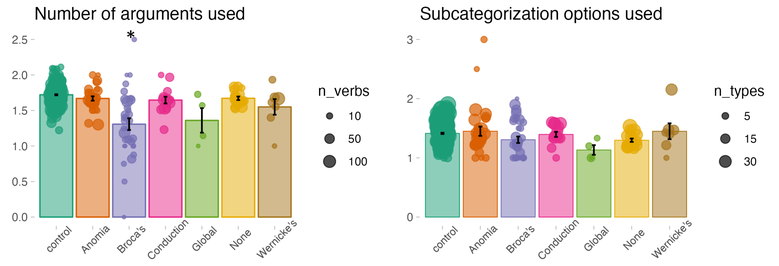


VerbBank

- Corpus of Contemporary American English (> a million words)
- 273,200 instances of verb use (excluding auxiliaries)
- 4500 verbs coded automatically for their:
  - Average number of arguments: **MeanArgs**
  - Subcategorization options: **SO**

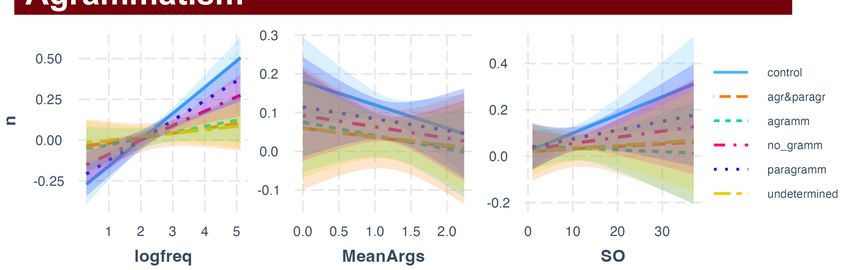
verb	times used	log freq	concreteness	MeanArgs	SO	subj (%)	obj (%)	iobj (%)	ccomp (%)	xcomp (%)	obl (%)
say	8054	4.68	2.58	1.58	25	88.11	16.86	0.00	39.72	3.96	8.98
have	7316	5.12	2.18	2.03	16	88.11	76.61	0.00	23.61	0.00	14.84
go	4837	4.78	3.15	1.54	22	83.50	5.81	0.00	1.59	27.02	36.34

Argument structure use

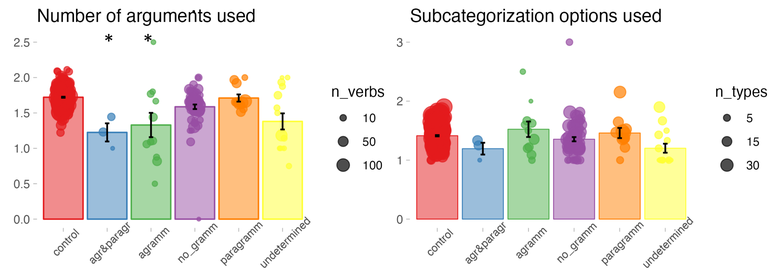


- Speakers with Broca's aphasia produce fewer arguments
- No significant differences in subcategorization options used

Agrammatism



- Participants with agrammatism are less sensitive to verb characteristics and use fewer arguments



Conclusions

- Automatic annotation of VAS is feasible and powerful
- PWA dissociate in VAS choice and use relative to controls
- Large individual variability within aphasia types: impairments with verb use may span across types
- Agrammatic speakers deviate from other groups in VAS, while paragrammatism behaves similarly to controls

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