Verb argument structure complexity in discourse in aphasia

Svetlana Malyutina (s.malyutina@gmail.com), Jessica D. Richardson, Dirk den Ouden

(Department of Communication Sciences and Disorders, University of South Carolina)

Introduction

- Verbs are central to language production and comprehension, determining sentence structure (Anna *gave* a book to her son)
- Persons with aphasia (PWA) have difficulty producing verbs (Bastiaanse & van Zonneveld, 2004)
- More complex verb argument structure (VAS) parameters render verb processing more complex for both healthy controls and PWA (Kegl, 1995; Kim & Thompson, 2000; Thompson, 2003)
- Many aphasia treatments focus on VAS processing:
  - E.g., Complexity Account of Treatment Efficacy (Thompson et al., 2003) sequences treated verbs according to VAS complexity
- However, VAS effects have mainly been investigated in restrictive tasks (mainly word and sentence production)

Research Question:

- Will there be VAS complexity effects in **verb choice by PWA in discourse**, particularly in the number of **verb's subcategorization options** (SO)? Will effects be modulated by **aphasia type**?

Linguistic background

Some characteristics contributing to VAS complexity:
  - Number of arguments:

John runs (1 arg = intransitive) vs. *John reads a book* (2 args = transitive) vs. *John gives a gift to his son* (3 args = ditransitive)
  - Thematic options:

John ran (agent) vs. *John fell* (patient)
  - Number of subcategorization options:

*John completed the task* (1 SO) vs. *John ordered a pizza / John ordered that they leave* (2 SO's)

Methods

- Data obtained from Aphasia Bank (MacWhinney et al., 2011) (http://talkbank.org/APhasiaBank)
- Verbs used by each participant in Cinderella discourse
- Participants:
  - 159 healthy control participants;
  - 173 PWA:
    - 69 with anomic aphasia;
    - 48 with Broca's aphasia;
    - 38 with conduction aphasia;
    - 18 with Wernicke's aphasia

Results

Analysis 1:
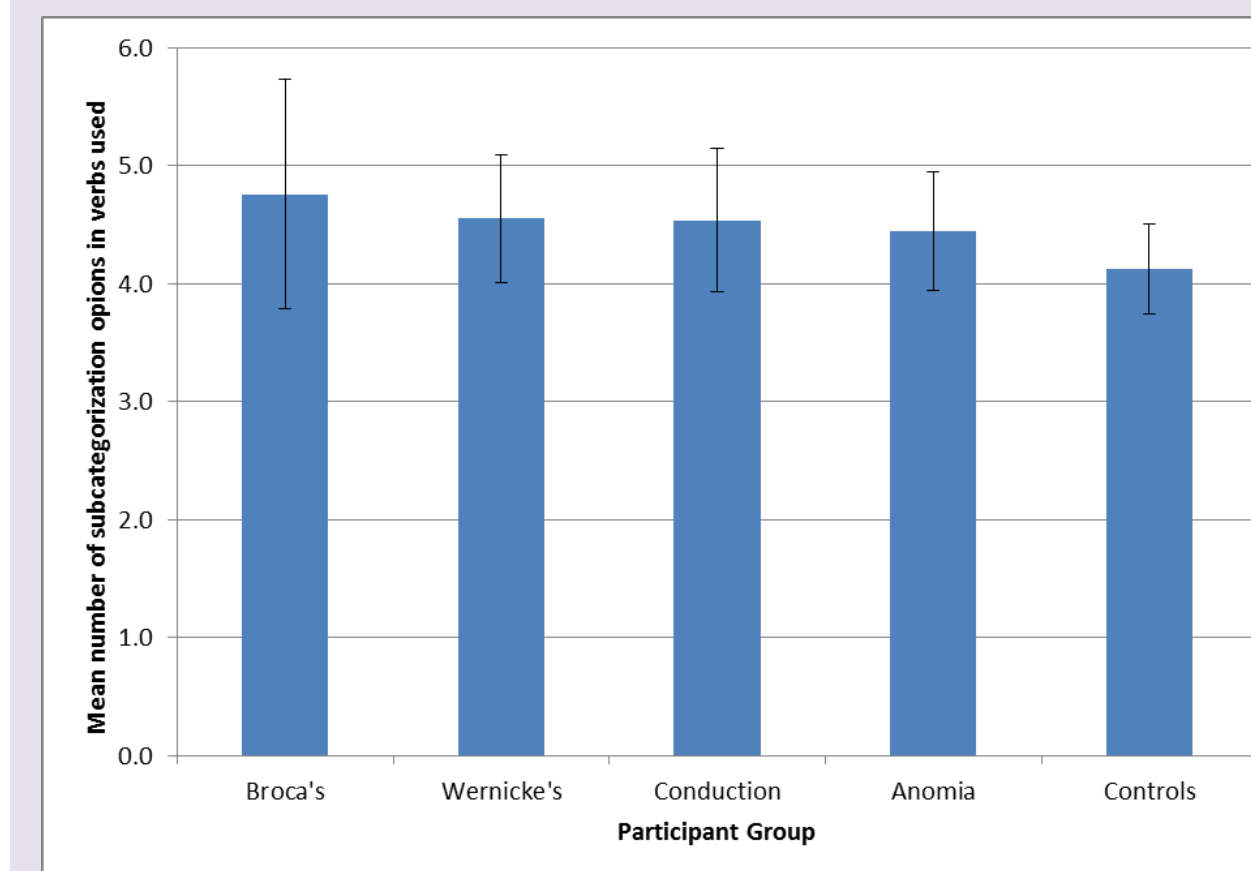

- Effect of participant group: $F_{(4,330)} = 5.54$, $p < .001$
- Significant pairwise comparisons:

Broca's aphasia > Anomic aphasia;

Every aphasia type > Controls

- i.e., participants with aphasia (in particular, Broca's aphasia) use verbs with a greater number of subcategorization options
- However, can this be due to contribution of other linguistic variables?
  - Correlation of the number of SO's with the logarithm of spoken frequency (obtained from CELEX database):

  $r = .571$, $p < 001$.
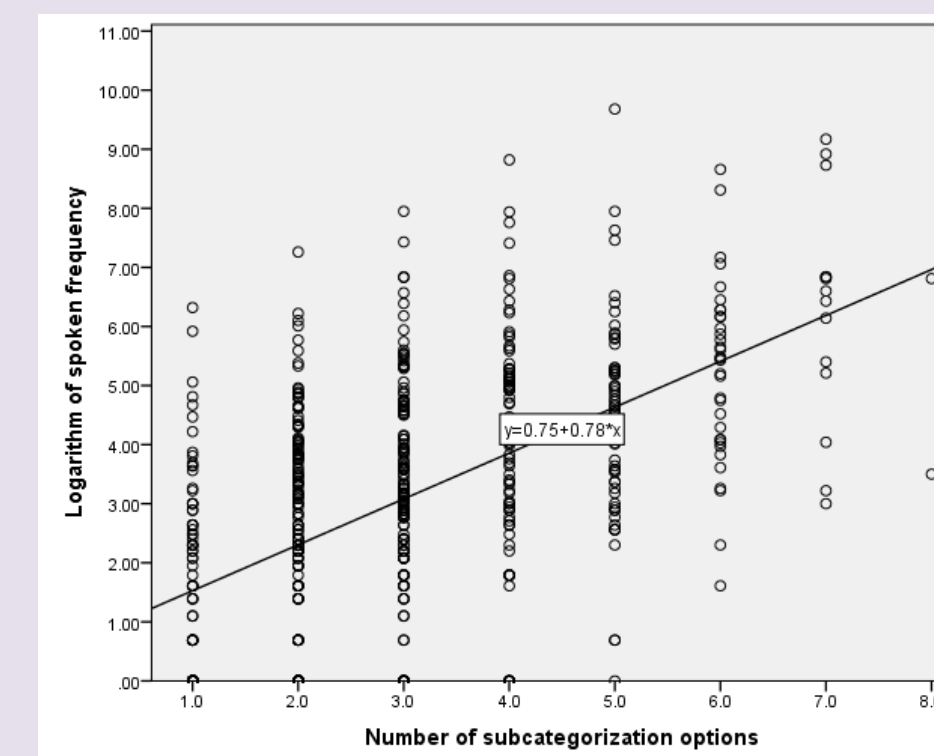
Methods (cont.)

- Two types of statistical analysis, performed in SPSS 22.0:
- Analysis 1: Do participant groups differ in the mean number of SO's of verbs that they use?
  - ANOVA
  - Dependent variable: mean number of SO's in verbs used by each participant
  - Independent variable: participant group
- Analysis 2: Do participant groups differ in the mean number of SO's of verbs that they use, <u>when accounting for verbs' other linguistic properties</u>?
  - Linear regression model
  - Dependent variable: number of participants who used the verb
  - Independent variables: participant group; linguistic characteristics of verbs (number of SO's; possibility of transitive use; length, frequency, imageability)

Results (cont.)

Analysis 2:

- When accounting for other linguistic variables, no differences in VAS properties are found between verbs used by participant groups:
  - No effects in the number of subcategorization options ($F_{(4,562)} = .186$, $p = .946$)
  - No effects in the number of transitive verbs ($F_{(4,562)} = 1.319$, $p = .261$)
  - Results hold when only investigating subsets of data within a restricted frequency range
- However, there are differences in factors not related to VAS:
  - PWA use more frequent verbs ($F_{(4,562)} = 17.634$, $p < .001$)
  - PWA use shorter verbs ($F_{(4,562)} = 2.369$, $p = .052$)

Discussion & Future Directions

<u>VAS complexity effects:</u>

- No evidence of PWA showing different patterns from controls in VAS complexity of their verb use in unrestricted narrative speech.
  - Although PWA still do not use the same verbs as controls: differences in non-VAS-related characteristics (frequency, length)
- I.e., in producing discourse, PWA have to draw upon verbs of varying VAS complexity
- However, PWA's use of 'complex' verbs in discourse is not necessarily correct – there may be errors in production of sentences containing these verbs.
  - Future research direction: are there VAS complexity effects in *correct* verb usage by PWA in discourse?

<u>Methodological considerations:</u>

- Effects of linguistic variables in restrictive tasks need to be complemented by studies of their effects in spontaneous speech.
- However, it is important to account for linguistic variables that may be confounding the variable when not explicitly controlled for. Examples of correlated variables:
  - Verb's number of subcategorization options and frequency;
  - Grammatical class (verb/noun) and imageability (Bird et al., 2003);
  - Age of acquisition, imageability, familiarity, frequency (Akinina et al., 2014).

References
Akinina Y, Malyutina A, Ivanova M, Iskra E, Mannova E, Dragoy O. Russian normative data for 375 action pictures and verbs. Behav Res; in press.
Bastiaanse R., van Zonneveld R. Broca's aphasia, verbs and the mental lexicon. Brain Lang 2004;90:198-202.
Bird H, Howard D, Franklin S. Why is a verb like an inanimate object? Grammatical category and semantic category deficits. Brain Lang 2000;72:246-309.
Kegl J. Levels of representation and units of access relevant to agrammatism. Brain Lang 1995;50:151–200.
Kim M, Thompson CK. Patterns of comprehension and production of nouns and verbs in agrammatism: Implications for lexical organization. Brain Lang 2000;74:1–25.
MacWhinney B, Fromm D, Forbes M, Holland A. AphasiaBank: Methods for studying discourse. Aphasiology, 2011;25:1286-1307.
Thompson, CK. Unaccusative verb production in agrammatic aphasia: the argument structure complexity hypothesis. J Neurolinguistics 2003;16:151-67.
Thompson C, Shapiro L, Kiran S, Sobeck J. The role of syntactic complexity in treatment of sentence deficits in agrammatic aphasia: The complexity account of treatment efficacy (CATE). J Speech Lang Hear Res 2003;46:591-607.