

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

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Background

Verbs are known to be important to sentence construction and are often targeted in therapy for people with aphasia, where they are selected by their complexity. However, verb argument structure (VAS) parameters other than the number of arguments have received much less attention in previous studies.

Our goal: to investigate the effects of three VAS parameters:

- The number of arguments
- The canonicity of thematic roles (unaccusativity)
- The number of valency options (optionality)

Hypothesis

At sentence level:

- Verbs with more complex argument structure (transitive verbs, verbs with non-canonical thematic roles, verbs with a greater number of valency options) will be more difficult (argument structure complexity hypothesis)

➤ Particularly in non-fluent aphasia (difficulties with grammar)

At single-word level:

- More complex argument structure may have the opposite effect and actually facilitate processing, providing additional routes of lexical access to the verb

➤ Particularly in fluent aphasia (difficulties with lexical retrieval)

Experimental design

The study tests the effects of three argument structure parameters:

- Transitivity: intransitive (*to run*) vs. transitive (*to tear*)
- Canonicity of thematic roles (unaccusativity): unergative (*to run*) vs. unaccusative (*to fall*)
- Number of valency (number of argument) options: verbs with one valency option (obligatory transitive: *to tear*) vs. verbs with two valency options (optional transitive: *to read*)

Participants and tasks

Participants: 40 individuals with chronic post-stroke aphasia (20 participants with non-fluent and 20 with fluent aphasia; 17 females; mean age 59, SD 12.1, range 23-77 years)

Tasks: naming and sentence construction



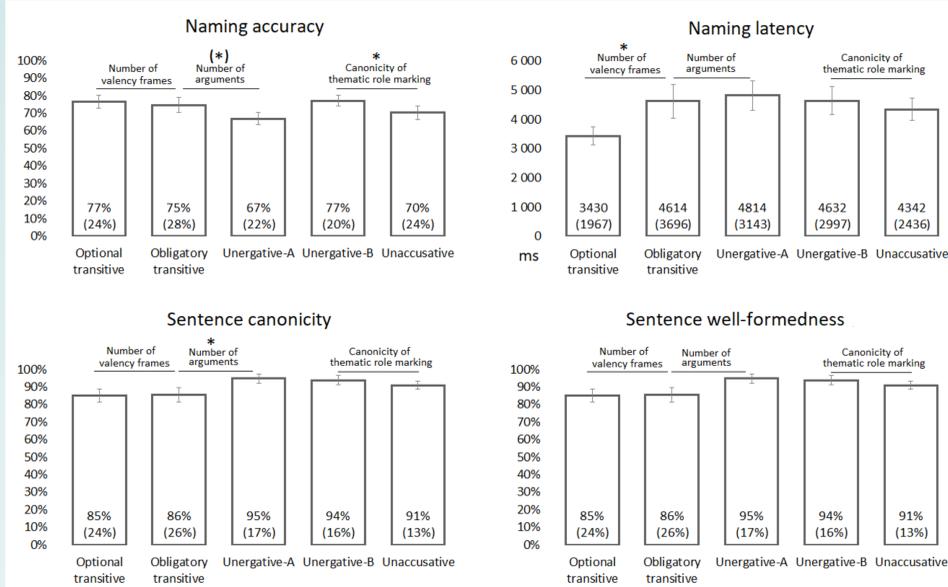
Stimulus for naming for the verb *chitat* ('to read')



Stimulus for sentence construction for the verb *bezhat* ('to run')

- Tasks were always administered in this order;
- The stimuli (n = 66) are taken from (Akinina et al., 2015) database; conditions are balanced for verb length, lexical frequency, name agreement, imageability, action familiarity etc.

Results



Naming task:

- **Accuracy:**
 - **Number of arguments** - more accurate for verbs with more complex VAS (obligatory transitive > unergative verbs, $p = 0.08$);
 - **Canonicity of thematic role marking** - more accurate for verbs with less complex VAS (unergative verbs > unaccusative verbs, $p = 0.004$);
- **Naming latency:**
 - **Number of valency frames** - significantly lower for verbs with more complex VAS (optional transitive < obligatory transitive, ($p = 0.000066$);

Sentence production task

- **Accuracy:**
 - **Number of arguments** - more accurate for verbs with less complex VAS (unergative verbs > obligatory transitive verbs, $p = 0.004$);

Discussion

In naming, more complex VAS *had a facilitatory effect* for accuracy for the number of arguments and latency for the number of valency frames ➔ more complex VAS provides more lexico-semantic associations with possible arguments and thus facilitates lexical access to the verb.

This is in line with the previous research:

- Jonkers & Bastiaanse, 1996, Jonkers, 2000, Dragoy et al., 2009, 2010 and others - a positive effect of a greater number of arguments (= more complex VAS);
- Facilitation-through-complexity effect was also found in healthy individuals (Malyutina & Den Ouden, 2017);
- Evidence of the efficacy of treatments that strengthen verb representations by practice of associated nouns (Webster & Gordon, 2009; Edmonds, 2016);
- This effect is also compatible with models arguing for separate coding of lexical-syntactic and lexical-semantic information in the verb lemma: verbs with greater lexical-syntactic complexity - more difficult for grammatical processing but at the same time have richer semantic connections ➔ facilitated processing in naming & negative effect in sentence production (Biran & Friedmann, 2012; Caley et al., 2017).

In sentence production, we found an expected negative effect of more complex VAS but only for the number of arguments ➔ the task might not be sensitive enough because the arguments presented on a screen along with the verb could facilitate sentence construction.