

Frequency Effects on Case Inflection in Non-fluent Aphasia in Russian

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Background. Frequency is considered to be one of the most important psycholinguistic variables. However, it remains unclear whether frequency of a grammatical category can contribute to its preservation in non-fluent aphasia. For instance [1] and [2] debate which is more important: frequency of a structure or structural complexity. Apart from this, most works in the field focus on verbal grammatical categories, overlooking morphological forms of nouns. The purpose of this project is to investigate if the frequency of a noun case can affect the correctness of its use by PWA (people with aphasia).

Methods. One of the typical mistakes PWA make in case inflection is using the nominative case instead of an oblique one. Hence, no sentences with nominative were included.

According to [3], the genitive and accusative cases have relative frequencies of more than 10% in Russian; the other cases were considered less frequent. Two lists of 51 stimuli each were created, where the target word was supposed to be used in one of oblique cases (the distribution of stimuli can be found in Table 1). For every target noun, line drawings were generated using the Ideogram AI. As a result, a sentence completion task was created with sentences that need to be filled with the nouns in the pictures (Figure 1). All the stimuli were tested with 24 neurologically healthy adults, which led to the exclusion of 3 stimuli.

30 PWA were tested (15 PWA per stimulus list) in the Center of Speech Pathology and Neurorehabilitation in Moscow, Russia ($M_{\text{age}} = 58$, $SD = 15.9$, 15 females). Each of them was diagnosed with mild or moderate non-fluent aphasia six or more months before the experiment ($M_{\text{months post-onset}} = 42.3$, $SD = 32.5$). The participants signed an informed consent to take part in the study. They were presented with stimuli on a laptop, which audio-recorded responses. The responses containing words unrelated to pictures were excluded. This resulted in a sample of 1409 responses. The data were analysed using R package lme4.

Results. A generalized linear mixed-effects model was created, where the type of the target case (frequent or less frequent) and the presence of a preposition were fixed effects, and the participants, stimuli and lists were chosen to be random factors. Age, sex, severity, education and months post-onset were controlled for. The model demonstrated that without a preposition, more frequent cases were significantly better preserved ($\beta = 0.65$, $p = 0.04$). Moreover, in prepositional government participants made significantly fewer mistakes ($\beta = 1.61$, $p < 0.001$). The results are summarized in Figure 2.

Discussion. The research shows frequency effects only manifest in the presence of other factors (like a preposition). This demonstrates that case inflection is a more complex phenomenon contingent on multiple psycholinguistic and linguistic per se factors.

References

- [1] Bastiaanse, R., Bouma, G., & Post, W. (2009). Linguistic complexity and frequency in agrammatic speech production. *Brain and language*, 109(1), 18–28.
<https://doi.org/10.1016/j.bandl.2008.12.004>
- [2] Gahl, S., & Menn, L. (2016). Usage-based approaches to aphasia. *Aphasiology*, 30(11), 1361–1377. <https://doi.org/10.1080/02687038.2016.1140120>
- [3] Slioussar N. A., & Samoilova M. V. (2015). FREQUENCIES OF DIFFERENT GRAMMATICAL FEATURES AND INFLECTIONAL AFFIXES IN RUSSIAN NOUNS. In Materials of the 21st International Conference on Computer Linguistics „Dialogue“

Figures and Tables

Table 1. The distribution of stimuli across cases, genders and numbers, as well as the distribution of stimuli with prepositions (in brackets).

	<i>Masculine</i>	<i>Feminine</i>	<i>Plural</i>	<i>Total</i>
Genitive	4 (1)	4 (1)	4 (1)	12 (3)
Accusative	4 (0)	4 (1)	4 (1)	12 (2)
Dative	3 (1)	3 (0)	3 (1)	9 (2)
Instrumental	3 (1)	3 (1)	3 (0)	9 (2)
Locative	3 (3)	3 (3)	3 (3)	9 (9)
Total	17 (6)	17 (6)	17 (6)	51 (18)

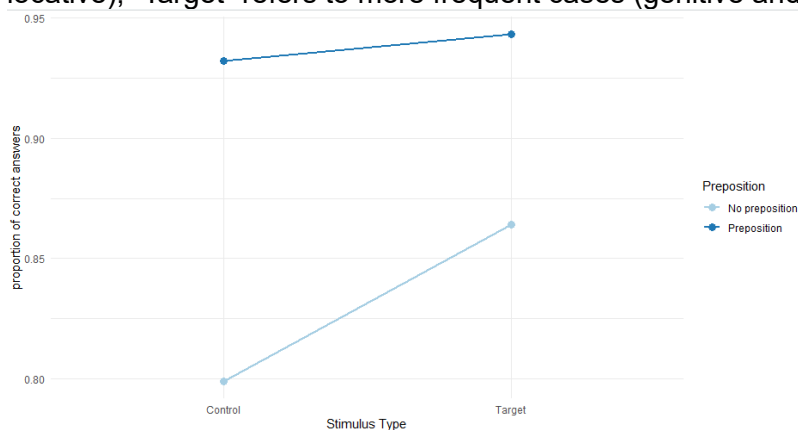
Figure 1. A sample stimulus

Translation: *In the kitchen, one cannot do without a _____* (The expected answer is *chainik-a* (kettle-GEN.SG))

На кухне не обойтись без _____



Figure 2. The proportion of correct answers depending on case frequency and the presence of prepositions. *Note:* “Control” stands for less frequent cases (dative, instrumental and locative); “Target” refers to more frequent cases (genitive and accusative)



Optional Supplemental Information

Most Slavic languages, including Russian, have rich nominal morphology. Nouns are marked for number, gender and case. The six Russian cases are nominative (typically standing for the subject), genitive (used after other nouns, some prepositions and some verbs), dative (the indirect object and used after some prepositions), accusative (the direct object and used after some prepositions, typically indicating direction of movement), instrumental (used for instruments and after some prepositions) and locative (used after prepositions, mostly indicating place). Since locative can be used only after prepositions, we included an equal number of prepositions across the stimuli and decided to include this factor into statistical analysis.

Apart from this, each case can be realized in different forms, depending on the noun gender, number and the final phoneme. To test that the forms per se do not invoke any sort of bias and do not affect the preservation of a case, an equal number of target nouns was used for the more common genders (masculine and feminine) and plural forms for each case. Within each group, all nouns had the same ending.