

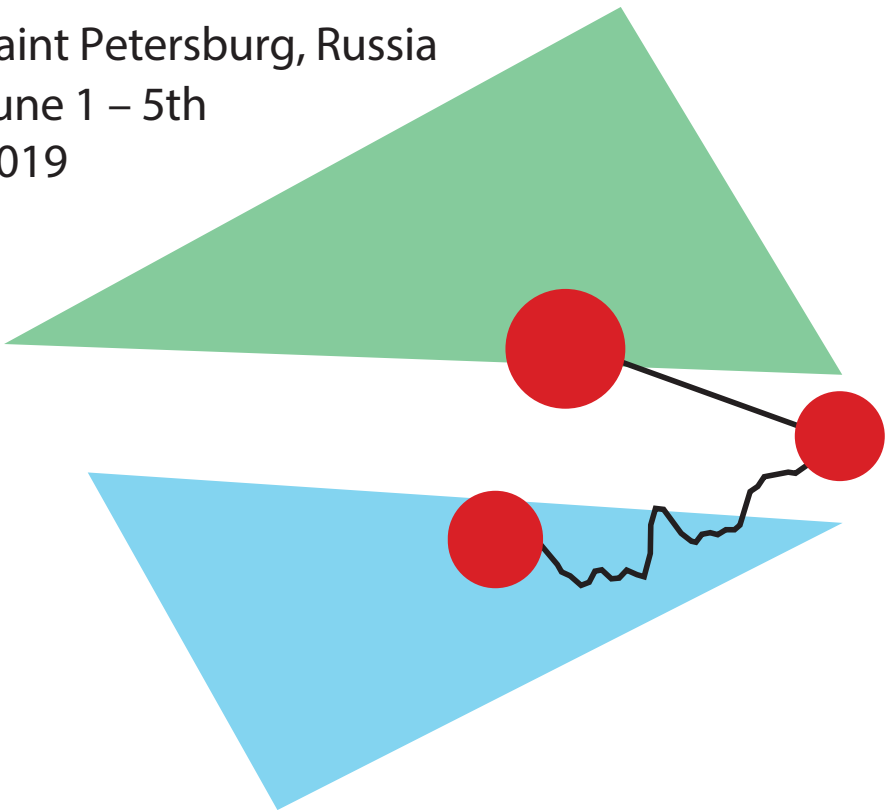
*Proceedings of the 3rd International Conference*

# **NEUROBIOLOGY OF SPEECH AND LANGUAGE**

Saint Petersburg, Russia

June 1 – 5th

2019



Organised by the Laboratory of  
Behavioural Neurodynamics,  
Saint Petersburg State University

Government of the Russian Federation  
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## **Evidence for dual-route morphological processing across the lifespan: Data from Russian number-dominant nouns**

One unresolved psycholinguistic question is how multi-morphemic words are processed in the mental lexicon: namely, whether they are accessed directly as single units (full-listing models; Butterworth, 1983), via decomposition into morphemes (full decomposition models; Taft, Forster, 1975), or via a combination thereof (dual-route models; Schreuder, Baayen, 1995). Recent research suggests that the mechanisms may change across the lifespan: with increasing exposure to language, direct access should be favored over decomposition (Reifegerste et al., 2016). The goal of our study is to test these changes throughout the lifespan in speakers of Russian.

We tested 188 individuals of different ages (9–87 years old) on a lexical decision task. Following the experimental design of Reifegerste et al. (2016), our stimuli were Russian number-dominant nouns: i.e., nouns used more frequently in the singular (mother) or plural (eyes) form. Recognition times for such nouns in their dominant and non-dominant forms allow for identification of the mechanisms of morphological processing. We also checked whether processing mechanisms interacted with the type of plural formation: affix addition (glaz — glaz-a, eye — eyes) or replacement (mam-a — mam-y, mother — mothers).

A linear mixed-effect model with random effects for subjects and items was selected with the stepwise algorithm in the lmerTest package in R. ANOVA tests showed a significant interaction between number dominance and form ( $p < .001$ ) and no three-way interaction with age, favouring the dual-route model for participants across ages. There was also a main effect of age-squared ( $p < 0.001$ ), meaning that the effect of age was U-shaped. Finally, there was a significant interaction of age-squared and type of plural formation ( $p < .001$ ), suggesting that plurals with replacement are more difficult to process for younger people.

The results show that morphological processing mechanisms in Russian seem to be consistent with the dual-route model and persistent across the lifespan, contrary to the hypothesis. The absence of interaction between the type of plural formation and form suggests that citation (singular nominative) forms with and without overt ending are processed similarly: they are stored in the mental lexicon rather than decomposed, regardless of their morphological structure.

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## **Functional brain mapping of speech areas and tracts in pre-surgical preparing of patients with brain tumors**

In modern neurosurgery, the most important role is assigned to save the patient's quality of life after surgery, namely, such an important function as speech. To help neurosurgeons determine access to a tumor during surgery, determine the location of functionally important speech zones and tracts, and to track the dynamics of the patient's condition before and after surgery, special protocol is needed for the best possible preoperative preparation that would be effective for intraoperative mapping and for developing follow-up rehabilitation.

As part of a multidisciplinary team we have developed a preoperative MRI protocol for patients with brain tumors in the dominant speech hemisphere.

This protocol was applied to 4 patients with tumors in the left hemisphere. All patients were right-handed. The scans were performed on a Toshiba Vantage Excelart MRI scanner 1.5 T. A standard MRI scan, DTI, and a functional MRI scan using paradigms for mapping functionally significant areas were performed (headphones, screen, and joysticks Nordic Lab were used). All patients underwent a dichotic audition, an Annette