

**Distributional regularity of suffixes facilitates acquisition of gender:
Eye-tracking evidence from Russian and Bulgarian**

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Russian and Bulgarian both have three genders and agreement between an ADJ and a N but differ in how transparent form-to-meaning mapping is in terms of gender suffixes. In Russian, inanimate nouns of all genders can be transparent (-a for FEM, consonant for MASC, stressed -o for NEUT) or opaque (palatalized consonant for FEM and MASC, unstressed -o for NEUT), whereas in Bulgarian, only FEM nouns can be transparent (-a) or opaque (consonant).

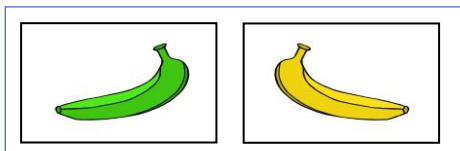
Some scholars suggest that fewer form-to-meaning mappings facilitates acquisition of gender [1]. This account predicts better performance by Bulgarian children because inanimate opaque nouns exist only in FEM. An alternative hypothesis based on distributional learning [2, 3] predicts that opaque nouns will be easier to acquire in Russian than in Bulgarian based on the more regular distribution of these nouns in all genders in Russian. Such hypothesis is in line with analyses based on the density of cues in each gender class resulting in a more complex gender system. However, it provides more evidence in the input and should be easier to acquire because more form-to-meaning mappings is beneficial, not detrimental, to acquisition and processing gender.

In two experiments (Exp.1: Production; Exp.2: Visual World eye-tracking in comprehension), we tested these two hypotheses. Participants were 4-to-6-year-old Russian (N=22) and Bulgarian (N=22) children. In both experiments, the same children viewed two images side-by-side of two identical objects while listening to instructions. In the production experiment (Fig. 1), the objects contrasted in color. When one of the objects disappeared on the screen, the participants had to name the one that remained. Russian children significantly outperformed Bulgarian children in producing correct ADJ-N agreement across the board (RUSS 92.6% vs. BULG 77.8%, $z=4.355$; $p<0.001$, Fig 2). In the Visual World comprehension experiment (Fig. 2), the opaque or transparent target noun (*ladon* 'palm-FEM' or *čaška* 'cup-FEM') was paired with a competitor noun in either the SAME gender or a DIFF gender (*stul*-MASC 'chair'). Children had to point to the correct image while listening to the prompt, and their eye-movements were recorded (Fig. 4). Similar to the production accuracy, the proportion of looks to the FEM targets in the Noun + Silence regions (Table 1) revealed that the Russian children looked significantly more (76%) than the Bulgarian children (68%), $t = -4.49$; $p < 0.001$. The Language effect interacted with Condition: no difference in looks in the FEM-DIFF condition, but fewer looks in Bulgarian in the FEM-SAME condition which indicates that FEM is more salient in Russian regardless of the suffix transparency. Thus, we found support for the Distributional Regularity over the Form-to-Mapping hypothesis: presence of opaque nouns across all gender classes facilitates acquisition of gender by Russian children in contrast to the asymmetrical distribution of opacity in Bulgarian.

Table 1.	Russian Statistics	Bulgarian Statistics
Opaque, DIFF	.75	.64
Opaque, SAME	.79	.61
Transparent, DIFF	.75	.76
Transparent, SAME	.75	.72

No effects
Effect of Condition: $p=.008$

Fig. 1. Sample picture materials in Exp. 1: Elicited production.



	RUSSIAN	BULGARIAN
Prompt 1:	Èto banany. Kakie oni po cvetu?	Tova sa banani. Kakvi sa te na cvjat?
Answer:	Zelenyj i želtyj	Zelen i žält
Prompt 2a:	Čto propalo?	Kakvo izčezna?
Answer:	Želtyj banan	Žältijat banan
Prompt 2b:	Čto ostalos?	Kakvo ostana?
Answer:	Zelenyj banan	Zelenijat banan

Fig. 2. Exp. 1: Accuracy of Adj + N production in Russian and Bulgarian.

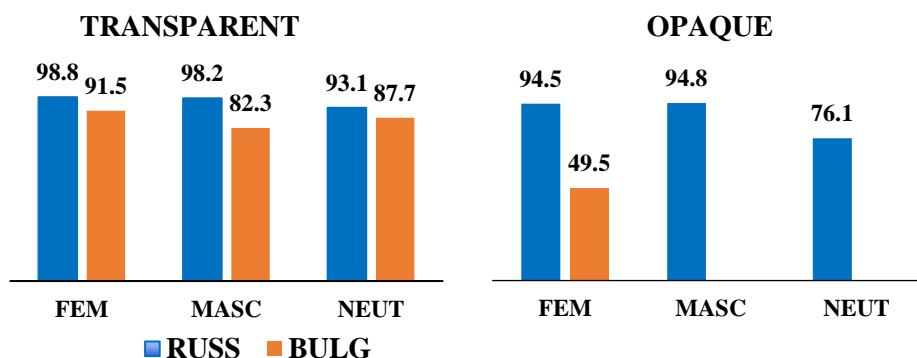
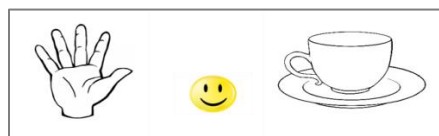
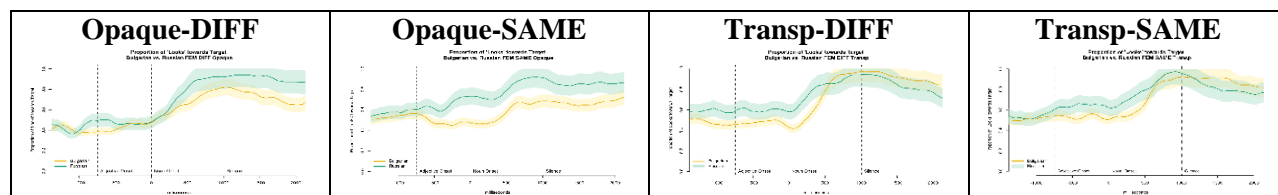


Fig. 3. Sample picture materials in Exp. 2: Visual World eye-tracking.



Pokaži, gde zdes' belaja ladon' / Pokaži kade e bjolata dlan?
 'Show where here [is] the white palm.'

Fig. 4. Exp. 2: Proportions of looks to FEM Target in Russian (green) and Bulgarian (yellow).



REFERENCES:

- [1] Brouwer, Sprenger, & Unsworth (2017). Processing grammatical gender in Dutch: Evidence from eye movements. *Journal of Experimental Child Psychology*, 159
- [2] Hall & Owen Van Horne (2018). Distributional learning aids linguistic category formation in school-age children. *Journal of Child Lang* 45.
- [3] Reeder, Newport, & Aslin (2017). Distributional learning of subcategories in an artificial grammar. *Journal of Memory and Language*, 97.