

## “Quantum leaps” in grammar acquisition: Evidence from child Russian

**Introduction.** How do children acquire grammatical categories of the target grammar? Constructivist theories of language acquisition emphasize the importance of item-by-item learning (Tomasello 1992, 2003), whereas generativist theories posit abstract rules and categories from early on (Pinker 1984, Valian 1986). We focused on the acquisition of grammatical aspect in Russian — a category which is expected to be particularly challenging for children given the complexity of form-meaning mappings in this domain (Forsyth 1970, Zaliznjak & Šmelev 2000, Janda & Lyashevskaya 2011). We report on a cross-sectional study testing the comprehension of Perfective and Imperfective verbs when used to describe episodic accomplishment events localized at a specific time point in the past. In this context, Russian aspect typically marks the contrast between ongoing (Imperfective) and completed (Perfective) events. The study combined online and offline measures (eye tracking and picture selection).

**Participants.** 174 Russian-speaking children were sampled from five age groups: 3 y.o. ( $n=33$ ), 4 y.o. ( $n=34$ ), 5 y.o. ( $n=36$ ), 6 y.o. ( $n=33$ ), and 7-8 y.o. ( $n=38$ ).

**Materials and procedure.** Each trial included an audio preamble which located the narrative in the past (e.g. *It was a sunny day*), followed by a sentence-picture matching task where the participants were presented with a pair of pictures on a screen: one representing an Ongoing Event (OE), i.e. an action in progress (Fig. 1), and one representing a Completed Event (CE), i.e. the result that obtained after the action was completed (Fig. 2). While looking at the pictures, the participants heard an audio recording of a sentence in the past tense with either a *perfective* or an *imperfective* verb (ex. 1). They were asked to choose the picture that best corresponded to the sentence. The experiment consisted of 24 test trials, 2 practice trials and 11 fillers. The participants’ eye-movements and offline responses were recorded.

**Online results.** To investigate the effect of aspect on the gaze patterns, we conducted a cluster-based permutation analysis (Maris & Oostenveld 2007) comparing looks to the OE picture in the two aspectual conditions (Fig. 3). The analysis revealed significantly more looks to the OE picture in the Imperfective condition compared to the Perfective in all age groups.

**Offline results.** In the analysis of offline responses, OE pictures were coded as targets in the Imperfective condition, and CE pictures — as targets in the Perfective condition. Mean accuracy scores for the different age groups are given in Table 1. A mixed-effects logistic model revealed a significant difference in mean accuracy between the 5- and 4-year-olds ( $p = 0.024$ ) and between the 6- and 5-year-olds ( $p = 0.048$ ). The mean accuracy in all age groups was significantly above chance. We further analyzed the distribution of participants’ accuracy scores in the different age groups (Fig. 4). In order to identify the presence of distinct sub-populations (clusters) within each age group, we fit a series of intercept-only binomial finite mixture models. The analysis did not reveal any distinct sub-clusters in the 3 y.o. age group. Within each of the other age groups, however, the analysis identified two separate clusters of participants: one performing at approx. 60-70% accuracy, and one performing at ceiling (>90%) accuracy on average (Table 2).

**Discussion.** Both eye tracking data and offline results indicate sensitivity to the grammatical aspect distinction already in the youngest age group (3 y.o.), with average effect size increasing with age (Vinnitskaya & Wexler 2001, Stoll 1998, Kazanina & Phillips 2007). However, already from the age of 4 y., children fall into two distinct sub-groups: one sub-group performing slightly above chance, and the other performing at ceiling. This pattern is sustained in all the older age groups (4, 5, 6, and 7-8 y.o.), with the proportion of participants in the higher-performing sub-group steadily increasing with age (Table 2). This suggests a two-phase process of aspect acquisition: children start off with verb-by-verb acquisition which allows them to achieve up to 70% accuracy on the comprehension task, which is then followed by a “quantum leap” to above 90% accuracy. We hypothesize that this leap is triggered by the emergence of aspect as a discrete and obligatory verbal category in the children’s grammar. Our results indicate broad variability in the age at which this occurs (cf., Maratsos 2000; Yang 2002).

Ex. 1. Babuška saža-la / po-sadi-la belyj cvetok  
 grandma plant.IMP-PAST / PVF-plant-PAST white flower  
 ‘Grandma was planting a white flower.’

Age group	Mean Accuracy
3 y.o.	64.3%
4 y.o.	68.1%
5 y.o.	77.5%
6 y.o.	85.9%
7-8.y.o.	86.9%

Table 1. Accuracy on the picture selection task

	Cluster 1		Cluster 2	
	N of participants	Estimated mean accuracy	N of participants	Estimated mean accuracy
3 y.o.	38 (100%)	64.1	0 (0%)	—
4 y.o.	22 (65%)	56.6	12 (35%)	90.9
5 y.o.	18 (50%)	61.2	18 (50%)	94.2
6 y.o.	12 (36%)	70.6	21 (64%)	94.2
7-8 y.o.	14 (37%)	70.1	24 (63%)	96.8

Table 2. Sub-populations of participants based on offline accuracy scores within the age groups.

## Figures



Fig 1. The ongoing event of ‘grandma planting a flower’.



Fig 2. The completed event of ‘grandma planting a flower’.

## Looks to Ongoing Event

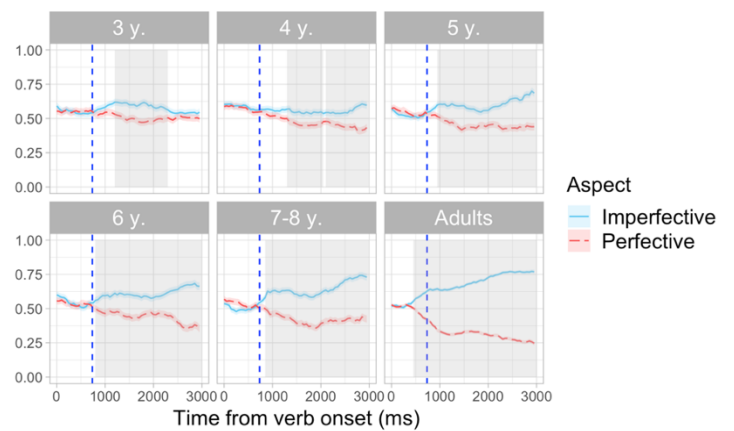


Fig. 3. Looks to the OE picture by Aspect for the five child age groups. Adult data ( $n=124$ , mean age = 22) from a previous study using the same design included for comparison. Plots start at verb onset. Dashed vertical lines represent average verb offset. Shading marks the localization of significant effects.

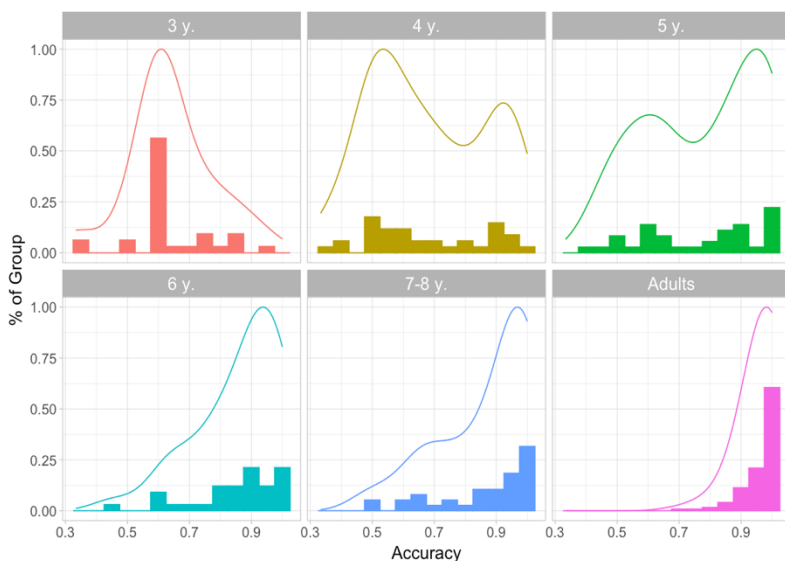


Fig. 4. Distributions of accuracy scores (histograms and densities) for the different age groups. Once again, adult results included for comparison.

**Selected references:** Forsyth (1970). *A grammar of aspect: Usage and meaning in the Russian verb*. CUP. Janda & Lyashevskaya (2011). Aspectual Pairs in the Russian National Corpus. *Scando-Slavica*. Kazanina & Philips (2007). A developmental perspective on the Imperfective Paradox. *Cognition*. Maratsos (2000). More overregularizations after all: new data and discussion on Marcus, Pinker, Ullman, Hollander, Rosen & Xu. *J of Child Lang*. Maris & Oostenveld (2007). Nonparametric statistical testing of EEG-and MEG-data. *J of Neurosc Methods*. Stoll (1998). The Role of Aktionsart in the Acquisition of Russian Aspect. *First Language*. Vinnitskaya & Wexler (2001). The role of pragmatics in the development of Russian aspect. *First Language*. Yang (2002). *Knowledge and Learning in Natural Language*. MIT working papers in linguistics. OUP. Zalaznjak & Šmelev (2000). *Vvedenie v russskuju aspektologiju*. [Introduction to Russian aspectology]. Moscow: Jazyki russkoj kul'tury.