Aspect Processing Across Languages
Visual World Eye Tracking Evidence for Semantic Distinctions
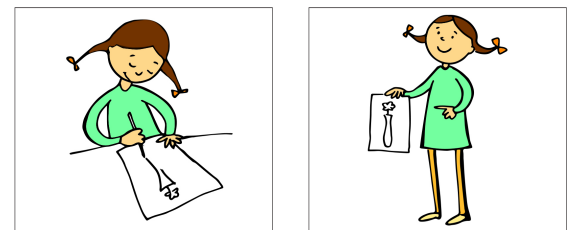
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1. Introduction. The Visual World paradigm (VWP) has been a richly productive methodology in the area of linguistic processing, ever since the seminal study of Tanenhaus et al. (1995). The usefulness of the paradigm stems from the general fact that human eye movements or saccades track the focus of linguistic attention, if that attention is given a visual manifestation (Huettig 2015). In this study, we apply the VWP to experimentally probe into the semantic representation of aspectual categories (perfective vs imperfective) across three languages: Russian, Spanish and English. We show that this methodology can reveal subtle differences in processing, reflecting the different meaning and morphosyntactic encoding of aspectual categories in these languages.

2. Processing of Aspect. Previous offline studies have provided evidence that imperfective aspect focuses on the in-progress, activity stage of an event, while perfective aspect triggers a representation of the event as a completed whole, highlighting the final stage and/or the result (goal) state of the event (Madden & Zwann 2003; Ferretti et al. 2007 *a.o.*). The VWP is well-suited to investigate this contrast by employing a visual set-up that counterposes two pictorial event representations which focus on different temporal portions of the depicted event— a snapshot of the ongoing event (OE), and a snapshot of the completed event (CE), i.e. the immediate aftermath of the event. Linguistic cues have be shown to drive anticipatory visual attention (Altmann and Kamide 2007), and aspectual information coded by grammatical morphemes have been shown recently in a number of eye tracking VWP studies to facilitate event recognition (Zhou et al. 2014 for Mandarin and Foppolo et al 2021 for Italian). In each of these two latter cases, the perfective morpheme or functional element triggers preferential looks towards the completed picture, thus corroborating the general semantic judgements that in the context of telic verbs, perfectivity generates a culmination entailment by default. *The present study is the first attempt to explicitly compare typologically different aspectual systems using the same task while eye-tracking.*

3. The Experiment. Each experimental trial included an audio preamble which located the narrative in the past (e.g. *It was a rainy day*), followed by a sentence-picture matching task where the participants were presented with a pair of pictures: one representing an action in progress (OE, Fig. 1a), and one representing the result that obtained after the action was completed (CE, Fig. 1b). While looking at the pictures, the participants heard a sentence in the past tense (e.g. *A girl was drawing/drew a slender vase*). In all the investigated languages we manipulated the aspect of verb in the target sen-

(a) Ongoing event   (b) Completed event

Figure 1: 'A girl drawing a vase'

tence (Imperfective vs Perfective verbs in Russian; Imperfect vs Preterite verb forms in Spanish; Past Progressive vs Simple Past verb forms in English). The participants were asked to choose the picture that best corresponded to the sentence. Each experiment included 24 test trials. In all cases, we used accomplishment predicates and reused the picture stimuli between the languages as far as possible. The participants' eye-movements and offline responses were recorded. Overall, we tested 124 Russian speakers, 66 English speakers, and 32 speakers of Argentinian Spanish.

4. Cross-linguistic Differences and Predictions. In a narrative context, all three languages use the imperfective forms for event overlap, conveying the notion of an event that is in progress at a given time interval or reference point (Klein 1994). We thus expected imperfective forms in all three languages to draw attention to the activity stage of telic events (OE pictures). Conversely, all

the perfective verb forms we tested are used to convey sequencing of events in a narrative. There are however subtle differences in the meaning of the perfective forms among the three languages, which we predicted could lead to contrasting results. In the Russian experiment, the aspectual manipulation involved perfective/imperfective aspectual pairs (*risovat'* 'draw[IMP]' - *na-risovat'* 'draw[PFV]'; cf. Forsyth 1970, Zaliznjak & Šmelev 2000). The Perfective verb in such pairs entails that the event reached an *inherent boundary*, i.e. a lexically specified result state or the maximal possible extension of the event (Klein 1995, Filip 2008, Tatevosov 2013). In Spanish, verbs in the preterite also entail the existence of an event boundary (Fábregas 2015). However, in contrast to the Russian perfective verbs, they do not require an *inherent* boundary (e.g. the attainment of a result state), as evidenced from the fact that adjuncts introducing temporal boundaries license the use of the preterite in Spanish but not perfective in Russian (Janda & Fábregas 2019). Finally, the case of English is especially interesting. Given its role in event sequencing, the Simple Past form of non-stative predicates has been analyzed as a kind of perfective which presents the event as a completed whole (Smith 1991, Wurmbrand 2014, Martin 2019, cf. de Swart 1998 for a dissenting view).Given the existence of non-culminating contexts in English, however, it is unclear how strongly the English past generates completive entailments in practice (cf. Martin 2020).

5. Results. In all three languages, the results revealed at-ceiling preference for the OE picture in the imperfective condition both in the offline task (picture selection; 98% of the trials in Russian, 97% in Spanish, 95% in English) and the online gaze patterns. In the perfective condition, we found robust differences: In Russian, the choice of the result state (CE) picture in the offline task was once again at ceiling (95%); for Spanish it was high, but not quite at ceiling (83%); in English there was no statistical preference for the OE picture in the Simple Past condition (54%, not significantly different from chance, $p = 0.39$). The analysis of the participants' online gaze patterns yielded parallel results (Fig 2). These results confirm our prediction that the imperfective forms in all the three languages draw attention to the in-progress representation of the event. With respect to the perfective forms, our results suggest that perfective accomplishment verbs in Russian strongly highlight the result state of the event. In Spanish, the preterite also highlights event completion, but to a lesser extent than in Russian, in line with its less restrictive semantics in not requiring an inherent boundary.
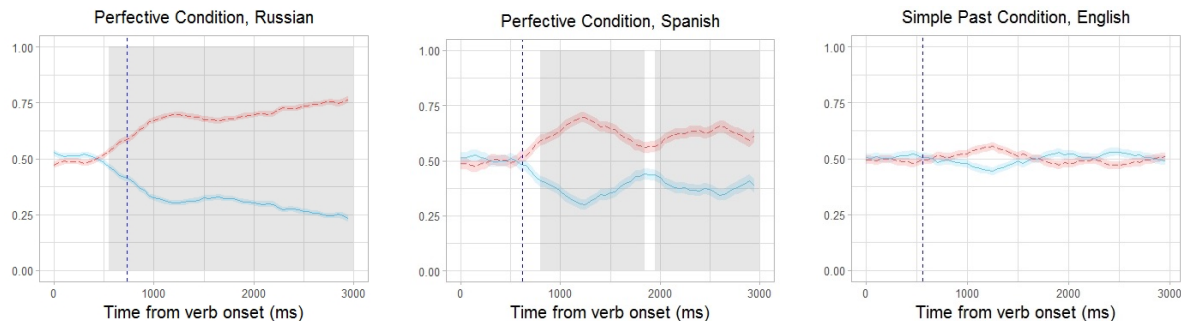

Figure 2: Proportion of looks to the OE (solid blue line) and CE (dashed red line) pictures in the perfective condition. Shading represents the time windows where the probability of looks to the CE picture was significantly above chance. The dashed vertical blue lines mark the average verb offsets.

Our results for the English Simple Past condition are striking. They suggest that even on telic predicates, the Simple Past form does not encode a preferential cognitive salience for either the activity portion of an event *or* its result state. Our result points to a dissociation between the role of verbal categories in encoding narrative sequencing, vs. highlighting particular portions of a complex event structure. These facts do not emerge cleanly if one relies solely on offline judgements of entailment in context, thus highlighting the role and value of online experiments of this type.

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