

Fixations reveal preference: A VWP study of thematic role processing in Spanish

Previous eye-tracking research [1,2] has found that visual objects related to animate agents received a greater proportion of fixations than those related to patients. The interpretation of this finding is controversial: while some [1] argue that it could reveal greater processing cost, others [2] argue that it indicates a greater preference towards animate agents.

We investigated whether modulating the prototypicality of animacy and thematic role mappings affected proportion of fixations on related visual objects. We contemplated two hypotheses: (i) the Agent Preference, which predicts a preference for agents across the board, and (ii) the Prototypicality Hypothesis, which predicts a preference for prototypical mappings (animate agents, inanimate patients) over non-prototypical ones (inanimate agents, animate patients).

Following a Latin square design, we created 180 Spanish sentences with preverbal subjects, modulating the animacy of the subject (animate, inanimate) and verb type (unaccusative, unergative and transitive) in order to compare agent (unergative and transitive) and patient (unaccusative) subjects. Sentences were paired with visual displays containing 4 gray-scale drawings. Sentential subjects (*the sailor*) were strongly related to the visual target (*ship*) semantically. Sixty-two native speakers participated in two VWP tasks which involved listening to stimuli while looking at the visual displays. First, a visual norming task, in which participants heard an NP in isolation (*the sailor*) while looking at a display containing the visual target (*ship*). This was done in order to assess the strength of relationships between drawings and subjects, as revealed by eye movements. Next, the experimental task, in which participants listened to the full sentences while looking at the displays. We monitored participants' eye movements on the visual objects using a TobiiX120 eye tracker sampling at 120 Hz.

We used the Growth Curve Analysis technique [3] to analyze the proportion of fixations towards the visual target after the verb. Verb presentation was selected as the onset for the analysis because this was the time in which that participants could assign a thematic role to the preverbal subject. Independent variables were verb type, animacy and different types of polynomials with random slopes (by participant per condition). The dependent variable was the proportion of looks to the visual target per time bin across participants.

Results of the visual norming task showed that animacy of the NP did not modulate the proportion of looks to the semantically-related target. Results of the experimental task showed that visual objects related to animate agents and inanimate patients (prototypical mappings) received a greater proportion of fixations than those related to inanimate agents and animate patients (non-prototypical) at the two analyzed post-verb time frames (from 200 to 1700 ms after verb offset, and from 1700 to 3200 ms after verb offset). At the earliest time frame, objects related to animate transitive subjects received less visual attention than those related to animate unergative subjects. However, no difference in intercept was found between any of the prototypical mappings at the latest time frame. Our results are most consistent with the Prototypicality Hypothesis, and replicate previous findings that show a greater preference for animate agents over patients, revealed by a greater proportion of fixations towards a semantically-related object.

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2. Gómez-Vidal B, Arantzeta M, Laka JP, Laka I. Subjects are not all alike: Eye-tracking the agent preference in Spanish. *PLoS ONE*. 2022;17(8): e0272211.
3. Mirman D, Dixon JA, Magnuson JS. Statistical and computational models of the visual world paradigm: Growth curves and individual differences. *J Mem Lang*. 2008 Nov;59(4):475–94.