

## **Beyond Truth Value Judgments: the Semantic Choice Task with Eye Movement Recording, a powerful instrument for the developmental investigation of language interpretation and processing at the sentence level**

**Introduction:** The investigation of language development provides important insights concerning the interplay of competence, i.e. the principles of UG that are assumed to be present in the grammars of both adults and children, and performance, which is known to be affected by processing limitations in children. One method that is widely used for this purpose is the Truth Value Judgment Task (TVJT), introduced in the pioneering work of Crain and Thornton (1998). The TVJT allowed researchers to overcome certain limitations at the level of children's performance (e.g. pragmatic limitations) in order to assess their competence or knowledge about grammatical principles (cf. for instance the acquisition of negation and quantifiers, Crain and Thornton, 1998). The task consists in setting up an experimental situation where the subject assists in a played-out scenario that is described by a puppet. The subject is instructed to either reject or accept the puppet's description of the scenario (the experimental sentence), and often subjects are also asked to justify their answers in order to have more fine-grained information about the interpretation underlying the answer. Since 1998, TVJT has been intensively used by psycholinguists to investigate children's understanding of grammatical structures and linguistic operators. One obvious limitation of this method, however, is that it does not provide any information about how children understand and process language in real time. This kind of information becomes crucial in cases where the available or privileged parsing strategies affect the final interpretation children assign to a given sentence. Trueswell et al. (1999), for instance, recorded eye-movements during an act-out task to investigate the processing of temporary PP-attachment ambiguity in young learners. They asked 5-year-old children to perform actions following the experimenter's instructions, such as 'put the frog on the napkin in the box'. They found that about 60% of 5-year-old children interpreted 'on the napkin' as a destination, and failed to subsequently revise their initial interpretation towards the correct one (i.e. modifier of the noun 'the frog'): the children first put a frog on a napkin, and then moved it in the box, while the correct action would have been to move the frog that was already placed on the napkin in the box. Eye-movement analysis showed that children shifted their looks to the incorrect destination 300 ms after they heard 'on the napkin' and failed to revise their initial parse once they heard the whole sentence, showing that eye-movements are sometimes necessary to obtain insights into the on-line parsing of children. Another limitation of the TVJT comes from the fact that participants are confronted with only one scenario at a time, depicting only one possible interpretation of the sentence. This gives rise to two potential problems. First, one must then assume that children obey the Principle of Charity (Grice 1975) and always try to adopt an interpretation that makes the puppet's statement true, if possible. Second, such a setting does not allow one to disentangle the causes underlying children's eventual objections to the puppet's statement: if children say that the puppet is wrong, we cannot know if they did so because they cannot access the correct interpretation of the sentence, or because they can in fact access it, but prefer the another interpretation. For example, Musolino (1998) presented adults and 4- to 5-year-old children with scopally ambiguous sentences involving negation and a universal quantifier in subject position (e.g. 'every horse did not jump over the fence') in a context that satisfied the inverse scope reading (i.e. only two out of four horses jumped over the fence), using the TVJT. Musolino found that while adults uniformly accepted the statement, thereby adopting inverse scope, children consistently rejected it. Assuming that the Principle of Charity applies, he concluded that children of that age can only access surface scope interpretations, and formulated the "Observation of isomorphism", which he attributed to the absence of the grammatical mechanisms that generate inverse scope readings in adults. Now, let us assume that children have a strong surface scope preference but can nonetheless access inverse scope interpretations. In this case, the linguistic behavior they would manifest would presumably be indistinguishable from that observed in Musolino's experiment. An even more general objection was raised by Gualmini et al. (2008), who claimed that experiments such as Musolino (1998) may in fact owe their results to the improper control of the pragmatic felicity of the critical sentence. Gualmini et al. argue that any statement is understood as an answer to a question

made salient by the discourse (the Question-Answer Requirement, QAR), and failing to address the salient question might result in interpretational troubles in children, possibly due to their lack of adult-like capacity of accommodating another question in order to satisfy the QAR. Any experiment on the interpretation of ambiguous sentences, for example, should therefore carefully control for this possible confound. Some experimental studies use slightly modified versions of the TVJT in which the relevant alternative interpretations of the investigated construction are included in the experimental scenario. For instance, Panizza et al. (2013) investigated children's interpretation of numerals with a set-up consisting of three fictional characters, each dealing with a different number of objects (e.g. one, two and three butterflies). The critical sentence uttered by the puppet, 'I think this boy brought me two butterflies', was repeated for every character. The participants were asked to reward the character with a coin if he did the right thing. Given that numbers can be assigned two different interpretations (i.e. 'at least N' and 'exactly N'), the participants were confronted with several possible truth value judgments: plainly false (the boy with one butterfly), plainly true (the boy with two butterflies), and either true (under the 'at least N' reading) or false (under the 'exactly N' reading). This kind of set-up provided a critical control for the Question-Answer Requirement.

**Semantic Choice Task with Eye Movement Recording:** The experimental method (Semantic Choice Task, SCT) we illustrate in this paragraph improves the TVJT in two respects: the questions of accessing a given meaning and preferring one interpretation over another are teased apart, and eye-movement recordings indicate whether there is an initial preference for one reading and whether one interpretation is cognitive more effortful. In SCT, the participant is presented simultaneously with two parallel scenarios, and rewards the characters of the scenario that better acted out the instructions provided by the experimenter or by a fictional character (i.e. a recorded voice). The method was tested in an investigation of scopally ambiguous German sentences involving a universal quantifier (*alle*) and negation (*nicht*). In the experiment, one experimenter (a native speaker of German) told the subject a story about two groups of pirates, while another experimenter acted out the story by playing with real toys. Two different scenarios were presented in each trial, and the test sentences (e.g. 'every pirate did not climb in the tree') were uttered at the end of the trial by a third recorded character, the theater director, who called the experimenters on a toy phone. The subjects were asked to reward the pirates who followed the instructions. Trials in which one scenario was false with respect to the experimental sentence (i.e. 'all the pirates climbed in the tree') whereas the other was true on one of the interpretations (e.g. for surface scope: 'no pirate climbed in the tree') were used to determine accessed interpretations: to test for preference, we used ambiguous trials, where both scenarios were true on one interpretation of the sentence. Eye-movements of the participants were recorded at every trial. The methodology therefore allows to test a) whether participants access a given interpretation, b) whether they prefer a given interpretation, c) whether prosody affects the interpretational pattern and the processing of the experimental sentence, d) whether there is an initial parsing preference, and e) whether one interpretation is more difficult to process than the other. In sum, the methodology combines the advantages of TVJT and eye-tracking experiments with children, allows controlling for prosody and intonation, and investigates how linguistic interpretation unfolds over time. In our talk/poster, we illustrate how the methodology sheds light on the interpretation of scopally ambiguous sentences in children and adults.

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