

## **The interplay of case and agreement features with inhibition and working memory skills in preschool children's processing of object-first structures**

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To solve the important problem of 'who does what to whom' in transitive sentences, German-speaking children are confronted with several challenges: due to the relatively free word order and only partly unambiguous case-marking, children have to be able to interpret different morphosyntactic cues (such as case and number agreement). As the sentence unfolds, children also have to store this morphosyntactic information in working memory and/or inhibit default interpretation strategies (e.g., subject-first), when needed. In this context, the question arises: Which morphosyntactic cues do children deploy to process object-initial sentences and which executive function abilities support them during this task?

Existing studies with pre-schoolers provide controversial evidence (Lindner, 2003; Dittmar et al., 2008) regarding the acquisition and usage of the case marking cue. Moreover, even less is known about comprehension and processing of the number cue in young children. To date, case and number were never tested systematically within the same experiment. Coming to effects of different executive function (EF) abilities on complex sentence interpretation in young children, the proponents of a strong link between working memory abilities and syntactic processing advantages claim storage and retrieval to be the crucial processes for successful sentence interpretation (Kidd, Donnelly & Christiansen, 2018). However, advocates of a strong relation between inhibitory and grammatical skills start to present converging evidence that default interpretations can be inhibited (Woodard, Pozzan & Trueswell, 2016; Gandolfi & Viterbori, 2020). The potential interaction of working memory and inhibitory skills during sentence processing in young children remains to be investigated. We addressed the following research questions: (a) do case and number agreement facilitate sentence processing and comprehension in 4-year-olds and which of these cues is deployed more reliably? (b) are 4-year-olds' comprehension and processing abilities modulated by their working memory and inhibition skills?

To answer these questions, we examined how 4-year-old German-speaking children deploy the case and number agreement morphology for interpretation of S(ubject)-V(erb)-O(bject) and OVS sentences by combining an explicit behavioral (binary picture-sentence matching, Fig. 1) and an implicit eye-tracking (looking-while-listening) paradigm. Participants' working memory and inhibition abilities were also assessed by means of a (forward) digit-span test and a flanker test, whose individual scores did not correlate. Thirty-six monolingual German-speaking children (mean age: 4;6) were asked to select the picture that depicts unambiguously case- (1&2) and number agreement-marked (3&4) sentences.

We found that case-marked OVS sentences (2) are processed more accurately (58%) than number-marked ones ((4), 39%), although both conditions were less accurate than SVO sentences ((1), 95% and (3), 92%). Regarding the EFs, we found a facilitation driven by higher inhibition skills that modulates specifically the interpretation of the more demanding number cue in OVS structures (4) (cf. Panel 2 in Fig.2). Furthermore, higher working memory skills support structure independently the correct parsing of both SVO and OVS in the case cue condition.

The main finding is supported by the behavioral as well as by the eye-tracking data: Higher inhibition skills in 4-year-olds support specifically the processing of the number cue in OVS sentences because the structure can only be resolved at verb position and, at the same time, the initial subject-first strategy has to be inhibited. In contrast, higher working memory skills appear to enhance the sentence processing regardless of word order for the case cue condition behaviorally because the case information has to be kept in storage for the duration of the entire sentence. We explain the general higher accuracy in case- (rather than number-) marked OVS sentences due to its availability at the sentence initial position (on the determiner) in combination with an additionally marked weak noun in the first noun phrase. We conclude that, while case-marking appears to be processed more reliably than number by preschoolers, also number information alone can be processed, especially by children with higher inhibitory skills.

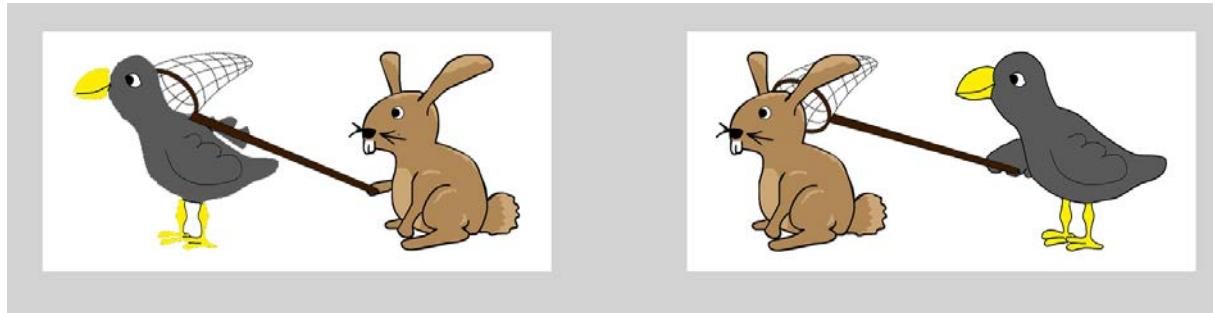
Case cue:

1. Der Rabe fängt den Hasen '[The crow]NOM catches [the bunny]ACC' (SVO)
2. Den Raben fängt der Hase '[The crow]ACC catches [the bunny]NOM' (OVS)

Number cue:

3. Das Schwein fängt die Rehe '[The pig]SG [catches]SG [the deer]PL' (SVO)  
/Die Schweine fangen das Reh. '[The pig]PL [catch]PL [the deer]SG' (SVO)
4. Das Schwein fangen die Rehe '[The pig]SG [catch]PL [the deer]PL' (OVS)  
Die Schweine fängt das Reh. '[The pig]PL [catches]SG [the deer]SG' (OVS)

**Figure 1: Binary picture example (1./2.):**



**Figure 2: Eye-tracking data by inhibition score for case and number cue in OVS/SVO**

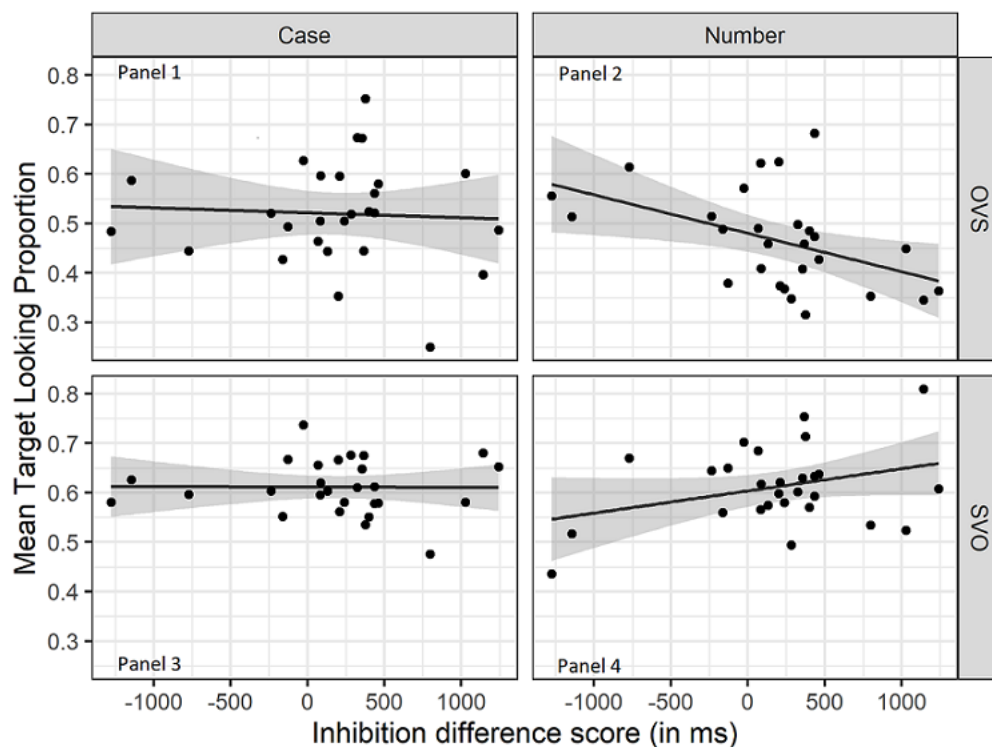


Figure 2: x-axis: Inhibition score as measured by a flanker task, computed by the difference of reaction times for incongruent minus congruent trials; y-axis: Eye tracking data as measured by mean target looking proportions; data divided in all four conditions: disambiguation cue (case/number) and word order (OVS/SVO)

### References:

- Dittmar et al., Child Development, 2018  
 Gandolfi & Viterbori, Language Learning, 2020  
 Kidd, Donnelly & Christiansen, TiCS, 2018  
 Lindner, Linguistics, 2003  
 Woodard, Pozzan & Trueswell, J of Experimental Child Psychology, 2016