

# The role of grammar factors and visual context in Norwegian children's pronoun resolution

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## 1 Introduction

Most personal pronouns have one entry in the mental lexicon, but they can have different referents depending on the context they appear in. They are sometimes fairly ambiguous. There is also evidence that pronoun resolution is impaired in many developmental deficits. Children have to learn how to find the intended referent, but we do not know much about how resolution strategies are acquired. How do visual context and syntactic context influence children's pronoun processing? Using eye-tracking, we investigate for the first time the development of Norwegian children's pronoun resolution competencies in their L1.

## 2 The study

The participants were monolingual 3-, 5-, and 7-year-old children, as well as a control group of monolingual adults. There were between 25 and 28 participants in each group. In the first of three experiments, they listened to it-cleft sentences with either subject focus (2a) or object focus (2b), while they watched illustrations of two animals (corresponding to the subject and the object) on a screen. It-clefts provide a good environment for testing syntactically expressed focus, and appear to be more frequent in Norwegian than e.g., English (Gundel, 2002). The animals were sometimes shown performing the actions from the cleft-sentences, and other times not (see Table 1 for overview of conditions). Thereafter, the participants heard an ambiguous pronoun sentence (3), and eye-tracking data were collected to determine whether they looked at the subject or object referent. In addition, offline data were collected, by asking the participants to name or point at the pronoun referent (4).

Example of the stimulus sentences:

1. Introduction sentence:

Der er hesten og kaninen  
*There are the.horse and the.rabbit*

2a. Subject-cleft:

Det er hesten som kiler kaninen  
*It is the.horse that tickles the.rabbit*

2b. Object-cleft:

Det er kaninen hesten kiler  
*It is the.rabbit the.horse tickles*

3. Ambiguous pronoun sentence:

Han kan telle til ti  
*He can count to ten*

4. Question sentence:

Hvem kan telle til ti?  
*Who can count to ten?*

Conditions		
1	Subject-cleft	Depicted action
2	Subject-cleft	No depicted action
3	Object-cleft	Depicted action
3	Object-cleft	No depicted action

Table 1: Conditions.

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### 3 Earlier findings

According to Järvikivi et al. (2013), German 4-year-olds and adults show a subject preference regardless of which word the it-cleft focuses on. Moreover, children seem to show a weaker subject preference than adults. We expect similar results from our data.

Hartshorne et al. (2014) discovered that 2- to 3-year-olds have a first-mention preference that seldom is detected because they take longer to process. We thus expect young children to show a preference for subject and/or first-mentioned character, albeit at a later time window, whereas adults will show an earlier preference than children.

Bittner and Kuehnast (2011) have found that German 3-year-olds rely more on context-cues than older German children, who more often use syntax-cues. We thus expect that young children will be more influenced by the presence of visual context, whereas older children will be more sensitive to syntactically expressed focus.

### 4 Results

A mixed design ANOVA showed that 5-year-olds looked more at the subject referent after subject-clefts than object-clefts from 500-1000 ms after pronoun onset ( $p > .05$ ), whereas adults did the same during the first 500 ms ( $p = .06$ ). Adults also showed a general subject preference both offline ( $p > .001$ ) and online ( $p > .05$ ), specifically after subject-clefts as opposed to object-clefts offline ( $p > .05$ ). Moreover, first-look data (first look at subject or object referent after pronoun onset) revealed a stronger subject preference in 7-year-olds after subject-clefts than object-clefts ( $p > .05$ ). We found no significant effect of visual context in the children. However, an interaction effect in adults showed that their stronger subject preference in subject-clefts than object-clefts offline was only present when the action was not depicted ( $p > .05$ ).

### 5 Conclusions

The results from the time series data suggest that adults process the pronouns faster than children, which supports Hartshorne et al. (2014).

In contrast to the older children, the 3-year-olds performed at chance level in all the different conditions. This may be due to what Hartshorne

et al. (2014) found, namely that young children show a first-mention bias that is too slow to detect, or it may simply show that 3-year-olds are too young to comprehend cleft-sentences. In any case, this shows that older children have a stronger preference for the focused referent than younger children do.

Adults showed an overall subject preference regardless of sentence type, except in the condition with object-cleft and no depicted action. This appears to be the only condition that weakens their subject preference, probably because it leaves the subject without syntactic focus and with no visual support. Thus, the effect of syntactic focus and/or a first-mention preference emerges here.

Moreover, depicted action seems to have distracted the adults, since the effect of subject vs. object-clefts offline was only found when the action was not depicted.

In subject-clefts as opposed to object-clefts, 5- and 7-year-olds displayed an online subject preference, although in different manners. Adults also showed this preference, both offline and online. Hence, all these three age groups appear to use syntax cues, but adults seem to be more aware of them, as 5- and 7-year-olds still only reveal their preferences through their gaze behavior. This supports Järvikivi et al.'s (2013) suggestion that children use the same cues as adults, but that they have not fully developed their ability to do so.

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