

Are Children with High-Functioning Autism Better at Syntax than Typically Developing Children? The Case of Dutch Object Relative Clauses

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1. Introduction

Children with High-Functioning Autism (HFA) are a subgroup of individuals with Autism Spectrum Disorder, and have fluent speech and normal intelligence. In terms of language abilities, children with HFA have been characterized as being weak in pragmatics, but strong in syntax (Eigsti, de Marchena, Schuh & Kelley 2011). Nevertheless, recent studies have identified weaknesses in syntactic areas as well (Perovic, Modyanova, & Wexler 2013; Terzi, Marinis, Kotsopoulou & Francis 2014; Durrleman, Marinis, & Franck 2016). The current study contributes to this debate by investigating the syntactic phenomenon of Object Relative Clauses (ORCs) in Dutch-speaking school-age children with HFA.

2. Background

2.1. Dutch Object Relative Clauses

Object Relative Clauses (ORCs) are relative clauses whose head fulfills the role of object in the relative clause, as illustrated for Dutch in (1) (ORC in square brackets):

- (1) Dit is de jongen [die het meisje __ belt] **Object** Relative Clause
this is the boy-object who the girl-subject calls (ORC)
'This is the boy who the girl is calling.'

In (1), the relative clause [*die het meisje belt*] has a head, namely, *de jongen*, which is the original object of the clause [*het meisje __ belt*]. Assuming a movement account for relative clauses (Chomsky 1981), ORCs are derived by movement from object position (indicated by __). The head of the RC and the empty position in the RC share the same thematic role, namely patient. As is

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further illustrated by (1), the word order in a complex sentence containing an ORC is non-canonical: the object precedes the subject.

Dutch ORCs are similar to English ORCs, but a complicating factor is its SOV word-order. Because Dutch is an SOV language, Dutch ORCs are homophonous to Subject Relative Clauses (SRCs), as exemplified in (2), which is homophonous to (1):

- (2) Dit is de jongen [die __ het meisje belt] **Subject Relative Clause**
 this is the boy-subject who the girl-object calls (SRC)
 ‘This is the boy who the girl is calling.’

In order to disambiguate object from subject relative clauses as exemplified in (1) and (2), Dutch native speakers employ different strategies. The first one is passivization. Instead of an ambiguous active ORC, a passive relative clause is produced, turning the head of the relative clause into a grammatical subject. This is illustrated in (3):

- (3) De jongen [die Marie __ belt] active ORC
 the boy-object who Mary-subject calls
 ‘The boy who Mary calls’
 → De jongen [die wordt gebeld door Marie] passive SRC
 the boy who gets called by Mary
 ‘The boy who is being called by Mary.’

Furthermore, there is a semantic feature that can disambiguate object and subject relative clauses, namely animacy. If the subject of an ORC is animate while the object is inanimate, the two arguments often become semantically irreversible. This is illustrated in (4):

- (4) Het boek dat het meisje __ leest irreversible ORC
 the book-object that the girl-subject reads
 ‘The book that the girl is reading.’

2.2. Previous acquisition studies on ORCs

Cross-linguistically, the non-canonical word order of ORCs raises problems for children across languages (Arosio, Guasti & Stucchi 2010; Friedmann, Aram & Novogrodsky 2011). Recent studies on Dutch child language report that Dutch-acquiring children acquire object relative clauses later than subject relative clauses as well. At the age of 6 (the youngest age tested) they can produce and comprehend object relative clauses, although their performance is not adultlike yet (Schouwenaars et al. 2014; Rademaker 2014; Duinmeijer 2017). These studies also show that, similar to Dutch-speaking adults, the TD children often resort to passives when ORCs are elicited. There are no studies yet on how Dutch-acquiring children perform on ORCs with an animacy

contrast. Yet, Arosio et al. (2010) show Italian children’s sensitivity to the animacy contrast: 51 Italian TD children (mean age 9;3) comprehend ORCs with animate objects (and animate subjects) significantly less well than ORCs with inanimate objects (and animate subjects).

Despite the traditional assumption that children with HFA are strong in syntax, complex syntax, including ORCs, has been reported to be impaired in French-speaking children with HFA (Durrleman et al. 2016; Riches et al. 2010; Zebib et al. 2013). As for Dutch, Schaeffer (2016) shows that the Dutch-speaking children with HFA she investigates are unimpaired in morphosyntax (verbal/nominal morphology, Sentence Repetition), but have problems with Direct Object Scrambling. In an elicited production task, a group of 28 Dutch-speaking children with HFA age 5-14² leaves a referential object unscrambled 37% of the time in obligatory scrambling contexts. This is significantly higher than the non-scrambling rate of their TD age mates (9%) (Schaeffer 2016; 2017). As Direct Object Scrambling involves both syntax (word order) and pragmatics (referentiality, hinging on knowledge of speaker/hearer assumptions), this raises the question as to whether the children with HFA have problems with syntax, pragmatics, or both. Besides contributing to the debate as to whether children with HFA can have syntactic impairments, the current investigation of object placement in ORCs, a syntactic structure that can be derived without pragmatic considerations, will also shed light on the possible underlying causes of impaired Direct Object Scrambling (is it syntax?).

2.3. Hypotheses and Predictions

Our research question is whether Dutch-speaking children with HFA are impaired in ORCs as compared to their TD age-mates. We take as our working hypothesis that children with HFA are not syntactically impaired. This hypothesis predicts that, although perhaps not adultlike, Dutch-speaking school-age children with HFA do not differ in ORCs from TD age-mates.

3. Methods

3.1. Participants

As shown in Table 1, twenty-five Dutch-speaking children with HFA age 6-14 were recruited.

Table 1: Participants

	N	Age-range	Mean Age	SD
HFA	25	6-14	10;7	2,2
TD	25	6-14	11;5	2,1
Adults	19		32;6	

²The 25 children with HFA investigated in the current study are a proper subset of these 28 children tested on Direct Object Scrambling.

They were diagnosed by psychiatrists based on the DSM-IV (American Psychiatric Association 2000). Their autism diagnoses were further confirmed by their scores on the CCC-2-NL (Geurts 2007) that we administered: mean Social Interaction Difference Index (SIDI) of 82, SD=20. Children with an IQ < 85 and/or officially diagnosed with any additional disorder were not included. The HFA group was matched on age and gender to 25 TD children (age range 6 – 14, mean age: 11;5, SD: 2.1). Finally, 19 adult mother tongue speakers of Dutch (mean age 32;6) were tested to ensure the psychological reality of the expected target responses.

3.2. Materials and Procedure

3.2.1. Non-verbal intelligence

To further control for intelligence, we administered a non-verbal reasoning ability task to all children (Raven's Progressive Matrices, Raven, 1976). Results show that the HFA group's percentile (64) does not significantly differ from the TD group's percentile (72). Thus, any potential difference in performance on ORCs between the children with HFA and TD cannot be accounted for by a difference in intelligence.

3.2.2. ORC Production

To test production of ORCs we used Duinmeijer's (2017) Elicited Production Task, based on Novogrodsky & Friedmann (2006). The entire task consists of the 3 conditions in Table 2:

Table 2 – Conditions Elicited Production Task

Condition	# items
1 – subject RC irreversible	6
2 – subject RC reversible (sg & pl)	6 sg & 6 pl
3 – object RC reversible (sg & pl)	6 sg & 6 pl
TOTAL	30

The present study only makes use of the data obtained through condition 3. Sample items of condition 3 are provided in (5) (singular) and (6) (plural). Note that the subject and the object are always [+animate].

- (5) Experimenter: Er zijn twee jongens en een vader. De vader slaat een jongen en de vader knuffelt een jongen. Welke jongen ben je liever?
 'There are two boys and a father. The father hits a boy and the father hugs a boy. Which boy would you rather be?'
Target: Ik ben liever de jongen die de vader knuffelt (ambiguous)
 'I'd rather be the boy who the father hugs'
- (6) Experimenter: Er zijn twee jongens en twee tantes. De tantes kietelen een jongen en de tantes knijpen een jongen. Welke jongen ben je liever?

‘There are two boys and two aunts. The aunts tickle a boy and the aunts pinch a boy. Which boy would you rather be?’

Target: Ik ben liever de jongen die de tantes kietelen / knijpen
(not ambiguous)

‘I’d rather be the boy who the aunts tickle / pinch.’

As indicated in (5) and (6), the singular example is ambiguous, or reversible, but the plural example is not: the fact that the subject is plural in (6), triggering plural agreement on the verb, disambiguates the relative clause, allowing only an **Object** RC reading. As Rademaker (2014) shows that Dutch-speaking adults often resort to passives even in such plural contexts, and because it is not the main focus of the current study we do not distinguish between singular and plural ORCs in the analyses of our elicited production data.

3.2.3. ORC Comprehension

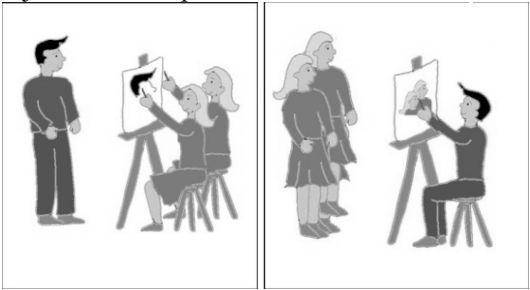
To test ORC comprehension, we used a Picture Selection Task developed by Duinmeijer (2017), based on Friedmann & Novogrodsky (2004). In this task, the participant was asked to point at one of two pictures that matches the orally produced sentence best. Again, we only used the data from condition 4 of the conditions listed in Table 3.

Table 3 – Conditions Picture Selection Task

Condition	# items
1 – subject RC active sg	6
2 – subject RC passive sg	6
3 – subject RC active pl	12
4 – object RC active pl	12
TOTAL	36

A sample item of condition 4 is given in (7):

(7) Object RC active plural



Exp: “Dit is de man die de vrouwen tekenen.”

This is the man whom the women draw.

Target: left picture

Note that these test items are not ambiguous, despite the fact that both the subject and the object are [+animate]: the plural subject and agreement on the verb turn these clauses into true, unambiguous ORCs.

3.2.4. ORC Judgment

Finally, we administered a Sentence-Picture Judgment Task (Duinmeijer 2017, based on Friedmann & Novogrodsky 2004) to explore the role of the semantic feature [+/-animate] in the interpretation of ORCs. In this task, participants are asked to judge whether a sentence matches the picture or not. The full list of conditions and subconditions is given in Table 4. For our purposes only the ORC conditions are relevant. Examples of these conditions are provided in (8) and (9), respectively.

Table 4 – Conditions Sentence-Picture Judgment Task

Condition	# items
Subject RC with 2 subconditions: Animacy – animate head and inanimate object (irreversible) Reversibility – Reversible animate head and object	3 3
Object RC with 2 subconditions: Animacy – Inanimate head and animate subject (irreversible) Reversibility – Reversible animate head and subject	3 3
Fillers	12
TOTAL	24

(8) Animacy condition – Object RC



Exp: “Dit is de boterham die de jongen smeert.”

This is the sandwich that the boy makes

Target: correct

(9) Reversibility condition – Object RC



Exp: “Dit is de man die de jongen duwt.”
This is the man whom the boy pushes
Target: correct

4. Results
4.1. Production

Figure 1 displays the production results from the Elicited Production Task for ORCs (singular and plural combined):

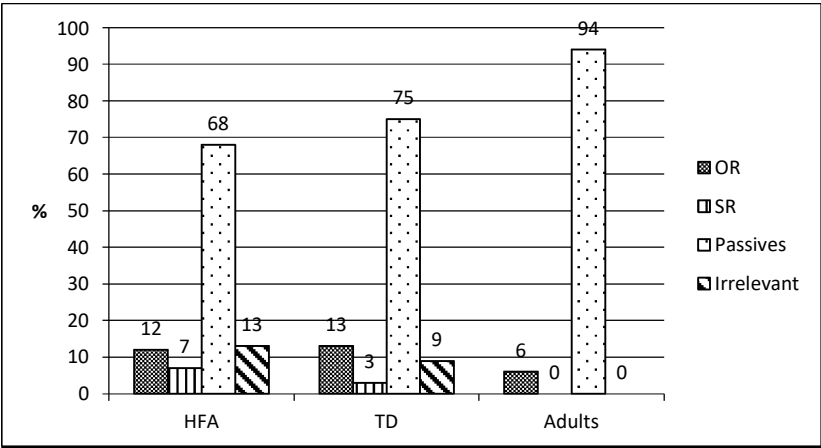


Figure 1 – Proportions SRCs, ORCs, passives and irrelevant responses in **Elicited Production Task**

We distinguish four different response types: (correct) object relative clauses (OR), (incorrect) subject relative clauses (SR), passives, and irrelevant responses. Kruskal-Wallis tests reveal that between-group differences (Kruskal-Wallis) HFA-TD-Adults are non-significant for all response types ($0.052 < p < 0.879$).

4.2. Comprehension

The proportions of correct ORC comprehension in the Picture Selection Task are given in Figure 2:

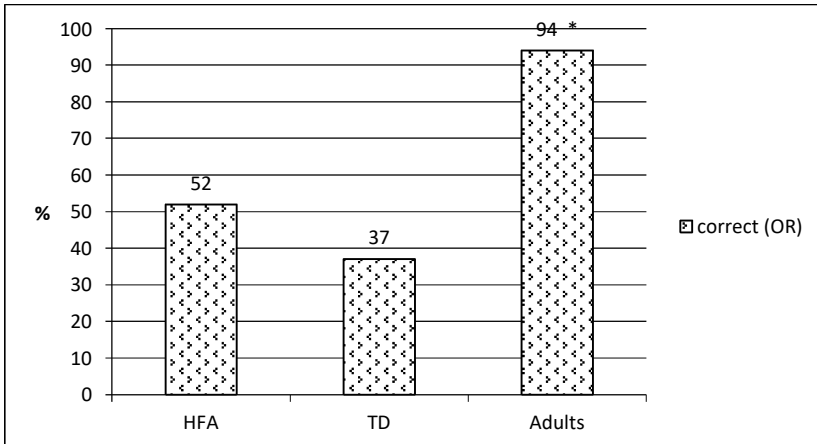


Figure 2 – Proportions correct in **Comprehension Task**

* Significantly higher than HFA and TD

Kruskal-Wallis tests indicate significant between-group differences (HFA-TD-Adult $p < 0.000$). Pairwise comparisons (Mann-Whitney U) reveal that the difference between HFA and TD is not significant ($p = 1.88$), but that both child groups differ significantly from the adults (HFA-Adults: $p < 0.000$; TD-Adults: $p < 0.000$).

4.3. Judgment

Finally, the results on the role of animacy in our Sentence-Picture Judgment Task are presented in Figure 3:

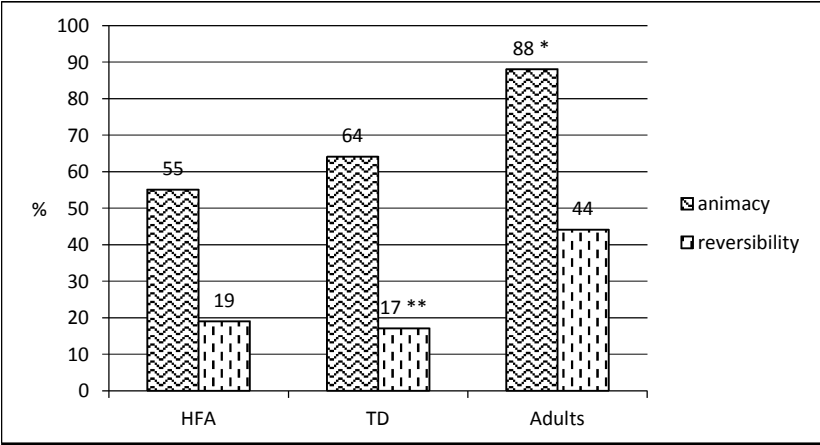


Figure 3 – Proportions correct on animacy and reversibility conditions of **Judgment Task**

*Significantly higher than HFA and TD

**Significantly lower than adults

A Kruskal-Wallis test signals significant between-group differences in the animacy condition (HFA-TD-Adults: $p = 0.007$), but not in the reversibility-condition ($p = 0.09$). Pairwise comparisons (Mann-Whitney U) show no significant differences between the HFA and TD groups, neither in the animacy ($p = 0.425$), nor in the reversibility condition ($p = 0.776$). However, both child groups differ from the adults in the animacy condition: (HFA-Adults: $p = 0.002$; TD-Adults: $p = 0.018$). In the reversibility condition the children with HFA do not differ from the adults and the difference between the TD children and the adults is marginally significant (HFA-Adults: $p = 0.078$; TD-Adults: $p = 0.046$).

Per participant group, all conditions significantly differ from each other (Friedman's 2-way Analysis by ranks; $p < 0.000$ for all groups), i.e., all groups score significantly higher on the animacy condition than on the reversibility condition.

4.4. Development

Finally, in order to obtain some insight in development, we divided the child groups into two age-groups, namely 6-10 and 11-14. The results on production, comprehension and judgment of ORCs are presented in Figure 4.

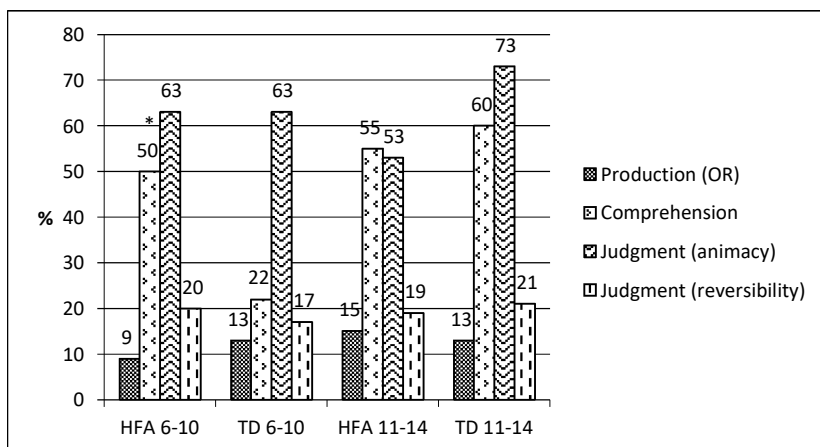


Figure 4 – **Development:** Proportions correct on Production, Comprehension, Judgment-animacy and Judgment-reversibility in different age-groups

*Significantly higher than TD (6-10)

5. Discussion and Conclusion

The results presented in Figures 1, 2 and 3 show that there are no differences between the child groups on any of tasks. This suggests that, as we predicted, the syntax of ORCs in children with HFA is TD-like. Interestingly, none of the children produce many errors of the type ‘Subject Relative Clause’ (12%), an error we do often see in younger (TD) children cross-linguistically (Adani 2011; Arosio et al. 2010; Berman 1997; Friedmann & Novogrodsky 2004; McDaniel, McKee & Bernstein 1998, a.o.). More important for our study is the result that, although all participants do produce real ORCs (around 10%), the proportions of passive production are much higher: 68% for the children with HFA, 77% for the TD-children and 94% for the adults. This indicates that all groups make extensive use of passives as a strategy to disambiguate ORCs in Dutch, and that ORC elicited production is not the most suitable task to show whether Dutch speakers know the syntax of ORCs.³

The comprehension results replicate the production results of the two child groups in the sense of HFA-TD comparison: in the Picture Selection Task there is no difference between the proportions correct of the HFA group (53%) and the TD group (37%), supporting the prediction that children with HFA comprehend ORCs no differently than TD children. However, both child groups perform significantly worse than the adults (94% correct), suggesting that ORC comprehension is still developing.

A similar picture arises from the Judgment results: the HFA and the TD groups do not significantly differ from each other in either the reversibility

condition (HFA: 30% correct; TD: 32% correct) or the animacy condition (HFA: 55% correct; TD: 64% correct). As for the animacy condition, these results demonstrate that, although not adultlike, the children with HFA make use of animacy contrast to the same extent as TD children do to disambiguate Dutch ORCs. In fact, the scores of all groups, including the adults increase significantly when the ORCs are not reversible because of an animacy contrast between the subject ([+animate]) and the object ([-animate]). Arosio et al. (2010) explain this as follows: animacy is used as a semantic feature to assign thematic roles to NPs: an agent prefers to be animate. Thus, in a clause with an animate and an inanimate noun, the animate noun is more likely to be the subject, implying that the inanimate noun should be the object. Nevertheless, the fact that all children differ from the adults in the animacy condition suggests that sensitivity to animacy contrast in the interpretation of Dutch ORCs is still in development in these children.

The group results in Figures 1-3 suggest that ORCs are acquired late by Dutch-speaking children. This is confirmed by the developmental results in Figure 4: Although the younger HFA child group (6-10) performs significantly better than TD age-mates in comprehension (Figure 4), there are no differences on production and judgment, nor do the older age groups (11-14) differ on any of the conditions.

Concluding, Dutch-speaking children with HFA have no more difficulties with the production and comprehension of ORCs than TD age-mates with comparable non-verbal reasoning abilities. Nevertheless, both the HFA and the TD child groups comprehend ORCs significantly worse than adults (Figure 2). Interestingly, the TD child group, but not the HFA child group, judges ORCs significantly more poorly than the adults (Figure 3). This finding, together with the result that the 6-10-year-old children with HFA comprehend ORCs significantly better than their TD age-mates, suggests that, if anything, the syntax of ORCs develops slightly earlier in children with HFA than in TD children, underscoring the syntactic strengths of children with HFA.

Returning to our secondary question as to whether impaired Direct Object Scrambling in (the same group of) children with HFA (Schaeffer 2016; 2017) is due to problems with syntactic object placement or to weak pragmatics, the current results on ORCs suggest that syntactic object placement is not the culprit.

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³ Note that, as ORC-formation, passive-formation also requires knowledge of syntactic object properties: the object (with patient thematic role) of the active clause is fronted, becoming the subject of the passive, but keeping its patient thematic role.

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