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Schaeffer, J.; Siekman, B.

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Object relative clauses in Dutch-speaking children with High-Functioning Autism (HFA)

Jeannette Schaeffer and Bart Siekman

Universiteit van Amsterdam / University of Amsterdam

Previous studies show that Direct Object Scrambling (DOS) is impaired in Dutch-speaking children with High-Functioning Autism (HFA). However, as DOS can be considered a syntax-pragmatics interface phenomenon, it is unclear whether DOS errors are due to impaired syntax or impaired pragmatics. In order to shed light on this question, the current study investigates Object Relative Clauses (ORC), assumed to involve syntactic object placement (as in DOS), but not pragmatics, in children with HFA.

We examine the elicited production, comprehension and judgment of ORCs in 25 Dutch-speaking children with HFA (age 6–14) and 25 TD matches with comparable non-verbal reasoning scores. Results reveal no differences between groups, but show that, similar to TD children (and adults), children with HFA use passives and animacy to disambiguate ORCs. The TD-HFA similarity indicates that the syntactic part of DOS is unimpaired in children with HFA and suggests problems with the pragmatic part.

Keywords: high-functioning autism, object relative clauses, direct object scrambling, syntax-pragmatics interface

1. Introduction

In terms of language, Autism Spectrum Disorder (ASD) is characterized as having “persistent deficits in social communication and social interaction” (DSM-5, APA 2013). Although syntax has been reported to be mostly spared in this population, recent research also shows that a subgroup of children with autism does have syntactic impairments, often referred to as ALI (Autism Language Impaired) as opposed to ALN (Autism Language Normal) (e.g., Perovic et al. 2013). In particular, recent studies report that several constructions containing object placement

are problematic for children with ASD (object relative clauses: Riches et al. 2010; object questions: Zebib et al. 2013; direct object scrambling: Schaeffer & Geutjes 2014). In contrast, there is relative consensus in the literature that children with ASD are pragmatically impaired (see Baron-Cohen 1988; Eigsti et al. 2011 for reviews), although not all parts of pragmatics seem to raise problems (Chevallier et al. 2010; Kuijper et al. 2015; Kissine et al. 2015).

A recent study by Schaeffer (2016) reports that Dutch-speaking children with High-Functioning Autism (HFA) perform significantly worse than typically developing (TD) age-mates on the choice between a definite and an indefinite article, as illustrated in (1) (see also Creemers & Schaeffer 2015):

- (1) This is a story about a girl. The girl lived in a big castle.

The article preceding *girl* in the first sentence is indefinite, indicating that the speaker, but not the hearer, assumes the existence of the reference of *girl*. In the second sentence, *girl* must be accompanied by a definite article, as at that point, both the speaker and the hearer assume the referent of *girl* to exist. As knowledge of speaker and hearer assumptions is involved in the choice between a definite and an indefinite article, article choice is considered a pragmatic phenomenon (cf. Schaeffer & Matthewson 2005 and references therein). Similar pragmatic knowledge of speaker/hearer assumptions is involved in Dutch direct object scrambling (DOS), which also appears to be impaired in the same Dutch-speaking children with HFA (Schaeffer 2016 to appear).¹ Yet, as DOS concerns the position of the object in the sentence, it has syntactic properties as well. An example of DOS is given in (2), showing that the direct object can appear to the left or to the right of the adverb *zorgvuldig* ('carefully'):

- (2) a. Jan heeft een/het boek zorgvuldig gelezen
 Jan has a/the book carefully read
 'John carefully read a (certain) book'
 'John carefully read the book'
- b. Jan heeft zorgvuldig een/*het boek gelezen
 Jan has carefully a/*the book read
 'Jan carefully read a book' (any book)

1. The same study reports that these children with HFA show no differences with their TD controls on any of the grammar tasks that were administered, including a Quantity Judgment Task making crucial use of plural morphemes, an Elicited Production Task on subject-verb agreement, and the Sentence Recalling part of the CELF-IV-NL (Kort, Schittekatte, & Compaan 2008). Moreover, the children with HFA do not differ from their TD controls on the cognitive tests carried out (Theory of Mind, Verbal and Non-Verbal Working Memory, Non-verbal Inhibition, Non-verbal Reasoning).

If the direct object is referential, meaning that (at least) the speaker assumes the referent to exist, it occurs to the left of the adverb *zorgvuldig* (a). In this case, the direct object can be either indefinite or definite. In contrast, if the direct object is non-referential, meaning that neither the speaker nor the hearer assumes the existence of a referent for *boek*, it occupies a position to the right of the adverb *zorgvuldig* (b). In this case, the direct object can only be indefinite (Schaeffer, 2012; to appear, and references therein). Schaeffer (to appear) reports that 28 Dutch-speaking children with HFA aged 5–14 scramble referential direct objects significantly less often (63%) than TD controls (84%) and adults (91%).

The current study attempts to shed light on the underlying nature of DOS impairment in Dutch-speaking children with HFA. Is it the children's syntax or their pragmatics that causes object scrambling to fail? To answer (part of) this question, we investigate object relative clauses (ORCs) in the same children with HFA who fail to scramble. An example of an ORC is given in (3), in which the underscored part is the ORC, an embedded clause that modifies the object head *boy*:

(3) This is the boy that the girl pushed

Similar to DOS, ORCs concern syntactic object placement. However, they involve no pragmatic properties such as knowledge of speaker and hearer assumptions, or a relationship to former discourse. If the children with HFA behave TD-like on ORCs, it is unlikely that the syntax of DOS causes its failure. If children with HFA perform worse than their TD age-mates on ORCs, this suggests that the cause of DOS impairment should be sought in object placement, i.e., syntax. Furthermore, assuming that ORCs are purely syntactic, the results on ORCs contribute to the debate as to whether syntax can be impaired in children with HFA.

In the next section we provide some theoretical and acquisition background on ORCs, followed by hypotheses and predictions regarding ORCs in Dutch-speaking children with HFA. Section 3 presents details about the participants, and three different experiments on ORCs: an elicited production task, a comprehension task, and a judgment task. Section 4 contains the results, showing that children with HFA are no different from their TD age-mates regarding ORCs. This is further discussed in section 5, in relation to the research questions, hypotheses and predictions. The study is concluded in section 6.

2. Background

2.1 Object Relative Clauses

Object Relative Clauses (ORCs) are relative clauses whose head fulfills the role of object in the relative clause, as illustrated in (4):

- (4) This is the boy [that the girl pushed]

In (4), the relative clause [that the girl pushed] has a head, namely, *the boy*, which is the original object of the clause [the girl pushed ____]. Assuming a movement account for relative clauses (Chomsky 1981), ORCs are derived by movement from object position (marked by t_i), as schematized in (5):

- (5) This is the boy_i that_i the girl pushed t_i

The subscripts indicate a chain sharing the same thematic role, namely patient.

Dutch ORCs are similar to English ORCs, but a complicating factor is their SOV word-order. The fact that the Dutch embedded finite verb appears clause-finally often obscures the difference between subject and object relative clauses, and makes them ‘reversible’, as illustrated in (6):

- | | | |
|--------|--|------------|
| (6) a. | ... Jan _i die _i t _i Marie belt
John who Mary calls
‘... John who is calling Mary’ | Subject RC |
| b. | ... Jan _i die _i Marie t _i belt
John who Mary calls
‘... John who Mary is calling’ | Object RC |

In (6a) the head *Jan* is the original subject of the relative clause, whereas in (6b) the head *Jan* is the original object of the relative clause. Nevertheless, the two sentences are homophonous, resulting in ambiguity. This ambiguity can be resolved by different strategies, including passivization and animacy.

As Rademaker (2014) shows, Dutch-speaking adults often resort to producing a passive to convey the meaning of an ORC. This is illustrated in (7):

- (7) ... Jan_i die_i Marie t_i belt → ... Jan die wordt gebeld door Marie
John whom Mary calls John whom is called by Mary
‘John whom Mary is calling’ ‘John whom is being called by Mary’

Furthermore, the semantic feature [+/-animacy] can help comprehend a relative clause as an object relative clause, as exemplified in (8):

- (8) ... het boek_i dat_i het meisje t_i leest
 the book that the girl reads
 ‘... the book that the girl is reading’

As *books* ([-animate]) cannot read, but *girls* ([+animate]) can, this relative clause is not reversible, and the embedded clause in (8) is interpreted as an object relative clause, rather than a subject relative clause.

Previous studies report that (as in many other languages) Dutch-speaking typically developing (TD) children acquire object relative clauses later than subject relative clauses, but that at the age of 6 (the youngest age tested) they can produce and comprehend object relative clauses, although their performance is not adult-like yet (Schouwenaars et al. 2014; Rademaker 2014; Duinmeijer in progress). 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 the age at which Dutch-acquiring children become adultlike on the production and comprehension of ORCs, nor 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 significantly less well than ORCs with inanimate objects (and animate subject).

For the present study, we take the traditional hypothesis that children with HFA are not grammatically impaired. Assuming that both syntax (object placement) and semantics (animacy) are part of grammar, we formulate the following predictions:

Dutch-speaking children with HFA behave like TD Dutch-speaking children in the production and comprehension of ORCs:

- i. Production: they use the ‘Passive strategy’
- ii. Comprehension: they do better at ORCs with an animate subject and an inanimate object

3. Methods

3.1 Participants

We recruited 25 children diagnosed with High-Functioning Autism (henceforth: HFA) by psychiatrists according to the DSM-IV (American Psychiatric Association 2000), aged (age range 6–14, mean age: 10;7, SD: 2.2). 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 procedures

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 Duijnmeijer's (in progress) Elicited Production Task, based on Novogrodsky & Friedmann (2006). The entire task consists of the 3 conditions in Table 1:

Table 1. 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 (10) (singular) and (11) (plural). Note that the subject and the object are always [+animate].

- (10) Exp: 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’

- (11) Exp: 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 (10) and (11), the singular example is ambiguous, or reversible, but the plural example is not: the fact that the subject is plural in (11), triggering plural agreement on the verb disambiguates the relative clause, allowing only an **Object RC** reading.

3.2.3 *ORC Comprehension*

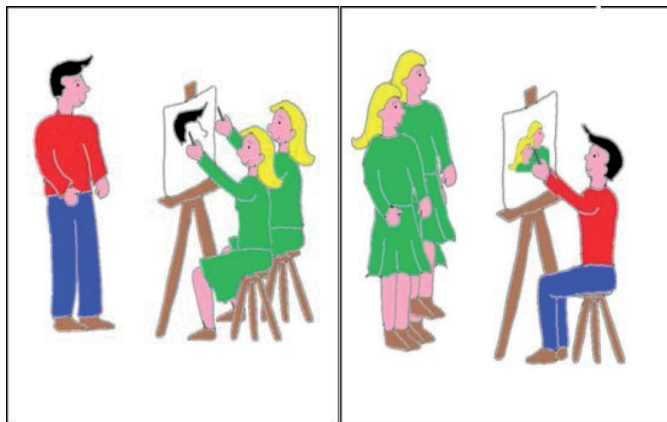
To test ORC comprehension, we used a Picture Selection Task developed by Duinmeijer (in progress), based on Friedmann & Novogrodsky 2004. In this task, the participant was asked to point at one of two pictures that matches the orally produced sentence best. Again, we only used the data from condition 4 of the conditions listed in Table 2.

Table 2. 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 (12):

(12)



Experimenter: 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 in progress, 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 3. For our purposes only the ORC subconditions 'Animacy' and 'Reversibility' are relevant. Examples of these subconditions are provided in (13) and (14), respectively.

Table 3. Conditions Sentence-Picture Judgment Task

Condition	# items
Subject RC with three subconditions	
- <u>Animacy</u> : Animate head and inanimate object (irreversible)	3
- <u>Plausibility</u> : Animate head and object with plausibility distinction (irr)	3
- <u>Reversibility</u> : Reversible animate head and object	3
Object RC with three subconditions	
- <u>Animacy</u> : Inanimate head and animate subject (irreversible)	3
- <u>Plausibility</u> : Animate head and subject with plausibility distinction (irr)	3
- <u>Reversibility</u> : Reversible animate head and subject	3

Table 3. (continued)

Condition	# items
Fillers	12
TOTAL	30

(13) Animacy condition – Object RC

2

Experimenter: Dit is het ijsje dat het meisje eet.

'this is the ice-cream that the girl eats'

Target: correct

(14) Reversibility condition – Object RC

Experimenter: Dit is de man die de jongen duwt.

'this is the man whom the boy pushes'

Target: correct

3.2.5 Analysis

Results were analyzed using Kruskal-Wallis tests. This is the non-parametric equivalent of an (one-way) analysis of variance (ANOVA) test. The rationale behind this choice is the non-normality of the data. Follow-up analyses were performed using Mann-Whitney U-tests, which are non-parametric T-tests. As multiple group comparisons were made, Bonferroni corrections were applied where necessary. For example, when performing 3 Mann-Whitney U-tests, the alpha-level was set to 0.017 (0.05/3).

4. Results

4.1 Group results

4.1.1 Production

Figure 1 displays the production results from the Elicited Production Task for ORCs.

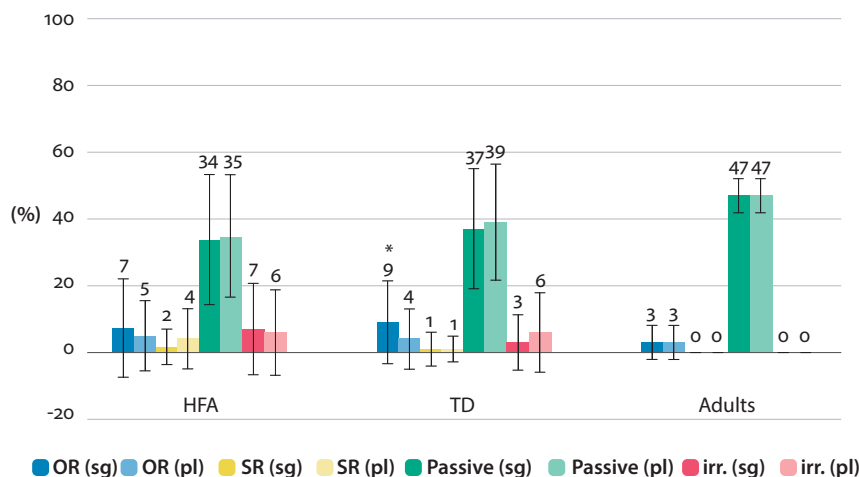


Figure 1. Proportions object relative clauses (OR), subject relative clauses (SR), passives and irrelevant responses in ORC condition of Elicited Production Task, for singular (sg) and plural (pl)

* Significantly higher than OR (pl) (4%)

We distinguish four different response types in singular (sg) and plural (pl), adding up to a total of eight different response types: (correct) sg and pl object relative clauses (OR), (incorrect) sg and pl subject relative clauses (SR), sg and pl passives, and sg and pl irrelevant. Kruskal-Wallis tests reveal that between-group differences (HFA-TD-Adults) are non-significant for all response types ($0.052 < p < 0.879$). Furthermore, Wilcoxon Signed Rank tests show that also within groups, differences between singular and plural are non-significant ($0.068 < p < 0.783$), except for one, namely, the singular-plural difference in the OR responses of the TD group: the TD children produce significantly more correct singular ORCs than correct plural ORCs ($p = 0.007$).

4.1.2 Comprehension

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

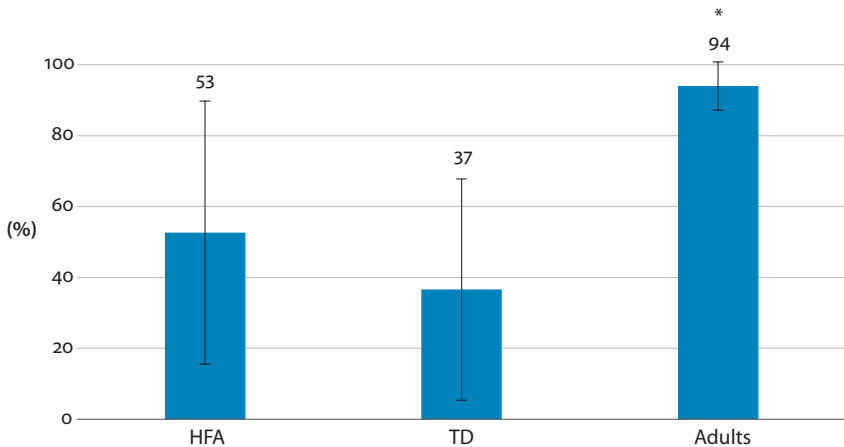


Figure 2. Proportions correct on ORC condition (4) of Picture Selection Task

* 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: $p < 0.000$).

4.1.3 Judgment

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

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, the HFA group differs from the adults in the animacy condition (HFA-Adults: $p = 0.002$), and the TD group displays a strong trend towards significance (TD-Adults: $p = 0.018$). In the reversibility condition neither the children with HFA nor the TD children differ from the adults (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.

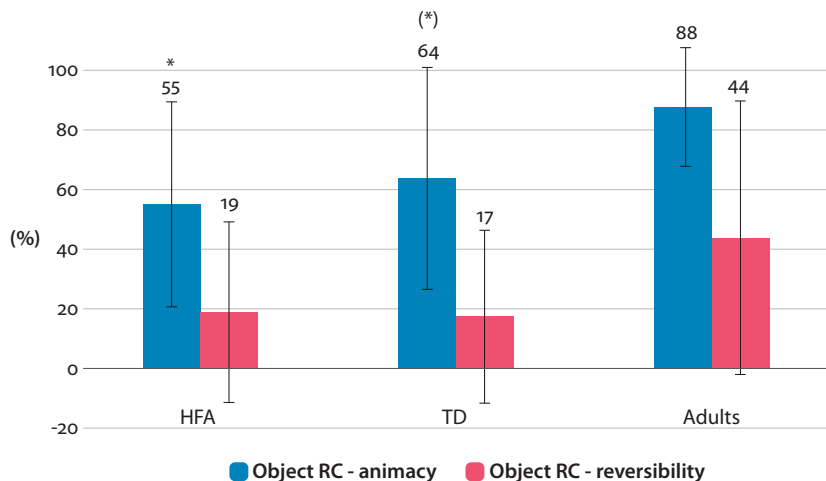


Figure 3. Proportions correct on animacy and reversibility conditions of Sentence-Picture Judgment Task

* Significantly lower than adults (88%)

4.2 Division into age-groups

Because the age-range in our child groups is quite wide (6–14), we divided both the HFA and the TD children into two age-groups: 6–10 and 11–14. The results are depicted in Figure 4.

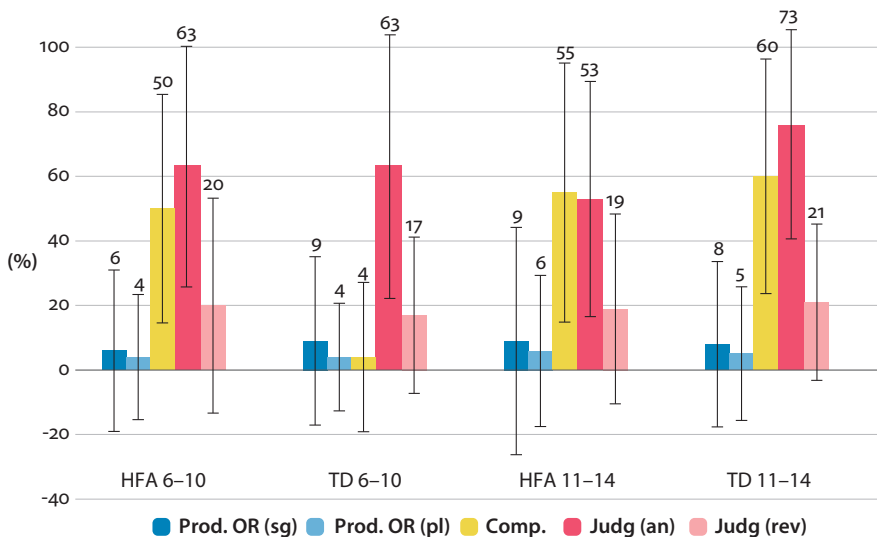


Figure 4. Proportions correct on Production (sg), Production (pl), Comprehension, Judgment-animacy and Judgment-reversibility in different age-groups.

Kruskal-Wallis tests reveal no between-group differences (HFA 6–10; TD 6–10; HFA 11–14; TD 11–14) on any condition: Production OR (sg): $p = 0.714$; Production OR (pl): $p = 0.525$; Comprehension: $p = 0.075$; Judgment-animacy: $p = 0.200$; Judgment-reversibility: $p = 0.924$.

5. Discussion

Returning now to our hypotheses and predictions, our Elicited Production Task results show that there is no significant difference between the HFA and TD groups in any of the response types. This supports the prediction that children with HFA are TD-like in the production of ORCs. In fact, neither child group even differs from the adults. Interestingly, none of the children produce many errors of the type ‘Subject Relative Clause’ (6%), an error we do often see in younger (TD) children cross-linguistically (Adani 2011; Arosio et al. 2010; Berman 1997; Friedmann & Novogrodsky 2004; McDaniel et al. 1998, a.o.). More important for our study is the result that, although all participants do produce real ORCs (children: 12%; adults: 6%), 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, confirming prediction (i) regarding ORC production.²

The comprehension results replicate the production results of the two child groups: in the Picture Selection Task there is no difference between the proportions correct of the HFA group (53%) and the TD group (37%), supporting prediction (ii) 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: 19% correct; TD: 17% correct) or the animacy condition (HFA: 55% correct; TD: 64% correct). As for the animacy condition, these results demonstrate that 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 grammatical

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

(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. Furthermore, the fact that the 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.

Examining the results in Figure 4, the division into two age-groups (6–10 and 11–14) reveals no differences between age-groups in either HFA or TD on any of the tasks. This means that neither the younger (6–10), nor the older (11–14) children with HFA differ from their TD age-mates, providing further evidence for our hypothesis that Dutch-speaking children with HFA behave like TD Dutch-speaking children in the production and comprehension of ORCs. Perhaps surprisingly, we do not see any development in either the TD group or the HFA group on any of the tasks or conditions. This implies that even at age 14, many children (TD and HFA) do not comprehend ORCs adultlike yet.

Finally, the Standard Deviation lines in all graphs suggest much individual variation within all child groups, but not in the adult group. However, since this individual variation is not restricted to the HFA groups, and is visible to the same extent within the TD groups, we interpret this as further evidence for the hypothesis that children with HFA behave like children in the production and comprehension of ORCs.

In summary, our predictions are borne out, and we can conclude that 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. This brings us to our original questions, namely, what the underlying cause is for impaired Direct Object Scrambling (DOS) in children with HFA, and whether children with HFA have syntactic impairments. Our study on ORCs provides no evidence for impairment in this part of syntax, i.e., in object placement. This suggests that it is not the syntactic properties (object placement) of DOS that pose problems for children with HFA. This finding restricts the nature of DOS failure in HFA to potential problems with the pragmatic properties of DOS (calculation of speaker/hearer assumptions, defining referentiality) or to inadequate integration of information from the syntactic and the pragmatic components involved in DOS. The fact that the same children with HFA underperform on a pragmatic article choice task (as mentioned in section 1) supports the hypothesis that the weakness of children with HFA lies in pragmatics. Yet, this still does not exclude the possibility that inadequate information-integration between syntax and pragmatics could also be an underlying cause of DOS problems in HFA. Future research should point out which of the two lines of thought is on the right track. Independent tests on the calculation of speaker/hearer assumptions and

information-integration need to be developed and administered to distinguish between the two possible explanations.

6. Conclusion

In this study we examined the production, comprehension and judgment of Object Relative Clauses (ORCs) in Dutch-speaking children with High-Functioning Autism (HFA). Assuming that ORCs are syntactic constructions involving direct object placement but no pragmatics, one of the aims was to clarify the underlying causes of the weak performance of the same children with HFA on Dutch Direct Object Scrambling (DOS), an object placement construction on the interface between syntax and pragmatics. The results show that children with HFA do not differ from their TD age mates in any of the ORC tasks. This suggests that the underlying cause for failure to scramble by children with HFA should not be sought in syntactic object placement, but probably in pragmatics (as also suggested by their underperformance on pragmatic article choice) or in the ability to successfully integrate information from syntax and pragmatics. Future research on the relevant pragmatics and on information integration in children with HFA should be conducted to reveal which direction is the most promising one to pinpoint the underlying cause of DOS failure.

Our results further indicate that children (HFA and TD) and adults alike produce passives as a strategy to disambiguate Dutch ORCs, and use animacy contrast between the subject and the object in their comprehension of ORCs.

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Authors' addresses

Jeannette Schaeffer
 University of Amsterdam
 Department of Linguistics
 Spuistraat 134
 1012 VB Amsterdam
 The Netherlands
 J.C.Schaeffer@uva.nl

Bart Siekman
 University of Amsterdam
 Department of Dutch Language and Culture
 Spuistraat 134
 1012 VB Amsterdam
 The Netherlands
 bart.siekman@student.uva.nl