Specific Language Impairment and High Functioning Autism

Evidence for Distinct Etiologies and for Modularity of Grammar and Pragmatics

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Specific Language Impairment and High Functioning Autism: Evidence for Distinct Etiologies and for Modularity of Grammar and Pragmatics

Ava Creemers and Jeannette Schaeffer

1. Introduction

An important debate in different domains of science (psychology, neurology, cognitive science, genetics, and linguistics) concerns the relationship between Autism Spectrum Disorder (ASD) and Specific Language Impairment (SLI). The traditional view is that ASD and SLI are two unrelated disorders with distinct etiologies: individuals diagnosed with SLI show severe grammatical impairments, with mostly intact pragmatics (Friedmann & Novogrodsky 2008; 2011; van der Lely 1998), while children with autism, for whom pragmatic problems are argued to be the primary deficit, show mostly intact grammar (see Baron-Cohen 1988; Frith 1989; and Tager-Flusberg 1989 for reviews). More recently, researchers have proposed an etiological overlap between the two conditions. It is argued that individuals with SLI do not only have an impairment specific to language, but that they also have problems with pragmatics that cannot be explained as secondary consequences (Bishop 2000; Friedmann and Novogrodsky 2011; Rapin and Allen 1983); and that the language development of individuals with ASD is deviant when compared to typically developing (TD) children (Kjelgaard and Tager-Flusberg 2001; Perovic, Modyanova and Wexler 2013).

The current study contributes to this discussion by investigating a grammatical and a pragmatic phenomenon in the nominal domain in HFA and SLI: the mass-count distinction in so-called flexible nouns (*some rope* vs. *three ropes*) being a grammatical phenomenon, and the choice between a definite and indefinite article – being driven by pragmatic principles. We argue that the results of this comparison do not provide evidence in favor of overlapping etiologies between HFA and SLI.

Another on-going debate in linguistics concerns the modularity of grammar and pragmatics,[1] and the question whether language consists of autonomous domain-specific modules that operate independently (a.o. Fodor 1983), or whether language is non-modular in the sense that language results from non-linguistic and domain-general principles (a.o. Rumelhart and McClelland 1982). Our results suggest a double dissociation between the investigated pragmatic phenomenon and the grammatical phenomenon and thus provide evidence in favor of a modular view of pragmatics vs. grammar.[2]

In the next section we describe the mass-count phenomenon (section 2.1) and the choice for a definite or indefinite article (section 2.2), followed by our research questions, hypotheses and predictions (section 2.3). Section 3 describes the methods of the two experiments, section 4 presents and discusses the results of the mass-count experiment, and section 5 of the article choice experiment. Section 6 provides a discussion of the research questions and the conclusions.

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[1] When referring to 'grammar' we mean the structural aspect of language, i.e. morphosyntax. When referring to pragmatics, we mean the use of language in social contexts.

[2] Double dissociations are used to show that two related mental processes function independently from each other: patient 1 has function A intact and function B impaired, while patient 2 shows the opposite pattern; function A is impaired and function B is intact. Such a double dissociation shows that the brain is organized into specialized modules, which can be differentially damaged.

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2. Background

2.1. The mass-count phenomenon

The mass-count distinction is the grammatical distinction between nouns that can be counted (e.g. *dog(s), car(s), house(s)*) and nouns that cannot be counted (e.g. *dough, sand, water*). In English and Dutch, count nouns can be pluralized, singular count nouns may be preceded by an indefinite article, and count nouns can be combined with cardinal numerals. In contrast, mass nouns cannot be pluralized, cannot be preceded by an indefinite article, and cannot be combined with cardinal numerals.

Yet, the mass-count distinction is not as clear-cut as presented above, as some nouns that typically get a 'volume-based' interpretation can be used in count syntax (1) and some nouns that typically receive an 'individual-item' interpretation can be used in mass syntax (2).

(1) *twee biertjes*
two beer-DIM-PL
'two beers'

(2) *Er zit hond in de soep*
'There is dog in the soup' (De Belder 2011)

Examples as in (1) and (2) provide one of the main pieces of evidence in favor of a syntactic analysis of the mass-count distinction. Borer (2005) for instance argues that the mass-count distinction is not marked on the nouns themselves, but rather results from the morphosyntactic context within which these nouns embed: e.g. plural inflection or the indefinite article in English, which divide stuff (mass) into countable items.

Previous research has shown that English TD children distinguish mass from count around age 4 (Barner and Snedeker 2005). There are hardly any studies examining the acquisition of the mass-count distinction in children with autism or with SLI (but see Froud and Van der Lely 2008 for mass-count in SLI[3]).

2.2. Article choice

The choice between a definite and indefinite article depends on speaker and hearer assumptions, and is thus assumed to be driven by pragmatic principles. Definite NPs are typically associated with established discourse referents that are familiar to speaker and hearer, while indefinite NPs are used to introduce new referents in the discourse (a.o. Stalnaker 1974; 1978; Heim 1982).

(3) *Ik heb vorige week een film gezien. De film was niet erg interessant.*
'I saw a movie last week. The movie was not very interesting.'

In the Dutch example in (3), the indefinite NP *een film* 'a movie' is used to introduce a new entity into the discourse context, and subsequently, when that entity is introduced, it is further referred to with the definite article *de*. In addition to the referential indefinite exemplified in (3) in which the speaker knows the referent of the noun *film* 'movie', the indefinite article can also be used non-referentially when neither the speaker nor the hearer knows the referent of the noun, as in (4):

(4) *Ik heb zin om een film te zien (wat voor film dan ook)*
'I feel like seeing a movie' (whatever movie it is)

Acquisition studies show that the different properties of definite and indefinite articles follow different developmental paths, illustrated by two main findings. Firstly, many studies find that children

[3] Froud and Van der Lely (2008) show that English-speaking children with SLI (aged 8;0 to 15;6) are not able to use semantic and syntactic cues to discriminate between mass and count novel nouns.

overuse the definite article in referential indefinite contexts (Maratsos 1974; Karmiloff-Smith 1979; Schaeffer and Matthewson 2005). Secondly, Van Hout, Harrigan and de Villiers (2010) show that pre-school TD children (aged 3;7–5;3) have difficulties comprehending the indefinite article. Using a referent-selection paradigm, Van Hout et al. found that TD children (aged 3;7-5;3) are overly liberal in their interpretation of the indefinite article: while the adults correctly choose a new referent 87% of the time, the children choose a new referent only 41% of the time. This is in contrast to the interpretation of the definite article that the TD children correctly interpreted as referring to a determined referent previously mentioned in the discourse.

Van Hout et al. explain the non-adultlike interpretation of indefinites by the idea that children are often insensitive to implicatures when they interpret scalar terms (Noveck 2001; Papafragou 2006; Papafragou and Musolino 2003; Pouscoulous, Noveck, Politzer and Bastide 2007). Scalar terms are terms like *some*, *might* and *or*, and scalar implicatures arise in utterances like *some professors are famous*. Such an utterance induces the scalar implicature that *not all professors are famous*, based on Grice's (1975) Maxim of Quantity requiring the speaker to be as informative as is necessary. Similar to a scalar term such as *some* that implies *not all, the* and *a* provide a contrastive set in which *the* is the logically stronger and most informative member of the pair. Therefore, in adult speech indefinite interpretations are analyzed as implicatures that result from not using the definite article in corresponding expressions (Hawkins 1991; Horn 2006). Van Hout et al. show that children often fail to draw a scalar implicature when they interpret indefinite NPs, which results in an arbitrary choice between a determined referent meaning and a non-determined referent meaning when they hear an indefinite.

Although van Hout et al. consider the scalar implicature for definiteness only in terms of comprehension, we assume that scalar implicatures apply in production as well. In production, this predicts *a*-overuse, as some studies investigating children with SLI indeed found (Chondrogianni and Marinis 2014; Polite, Leonard and Roberts 2011). These studies showed that children with SLI very frequently produce the indefinite article *a* in place of the appropriate definite article *the,* whereas they do not differ from age-matched TD children in the indefinite condition (Polite, Leonard and Roberts 2011), and that children with SLI produce significantly more substitutions of the definite article than the TD age-matched children (SLI: *a*-substitutions of 25%, TD age-matched: 3%), but not of the indefinite article (Chondrogianni and Marinis 2014).

2.3. Hypotheses and predictions

Our research question is twofold: we investigate whether grammar (mass-count, MC) and pragmatics (article choice, AC) are separate linguistic components, and whether there is overlap in the profiles of ASD and SLI. First, hypothesizing that SLI and HFA are not part of same continuum, we predict that the SLI and the HFA group do not perform similarly on the grammatical and the pragmatic tasks. Second, we hypothesize that children with SLI are mainly impaired in their grammar, while having intact pragmatics, and, vice versa, that children with ASD are mainly impaired in their pragmatics, but have intact grammar. This renders the following predictions:

(5) Children with ASD perform worse than their TD matches on AC, while children with SLI do not.
(6) Children with SLI perform worse than their TD matches on MC, while children with ASD do not.

3. Methods

3.1. Participants

We recruited 27 children diagnosed with HFA by psychiatrists according to the DSM_IV (American Psychiatric Association 2000), aged 5-14 (mean 10;4, SD 2.38) and matched them on age and gender to 27 children diagnosed with SLI by speech therapists at special schools for speech and language problems (mean 10;2, SD 2.27), and 27 TD children (mean 10;4, SD 2.22). Children with

SLI or HFA with an IQ < 85 and/or children who were officially diagnosed with any additional disorder (such as autism in the SLI group or language impairment in the HFA group, or AD(H)D) were not included. Nevertheless, we do not exclude the existence of comorbidity with other developmental disorders in both the SLI and the HFA group. Finally, 12 adult mother tongue speakers of Dutch aged 21-53 (mean 35;9, SD 14.37) were tested to ensure the psychological reality of the expected target responses.

As the current study is part of a much larger project, besides the mass-count and the article-choice experiments, the participants were also administered 15 other tests, including the CCC-2-NL (Geurts 2007), the CELF-IV (Semel et al. 2008) and the NWR task (Rispens and Baker 2012). The CCC is a parents' questionnaire, and one of its main goals is to give an impression of pragmatic and grammatical difficulties. Subtracting the sum of scores on the 'language areas' (speech, syntax, semantics and coherence) from the sum of scores on 'pragmatic areas' (initiation, nonverbal communication, social relations and interests) derives the Social Interaction Difference Index (SIDI). This is a difference score that is given as a percentile. Children who score beneath the 10th percentile have more structural language problems than pragmatic difficulties, whereas the opposite is true for children scoring above the 90th percentile. The CCC scores confirmed the autism diagnosis of the children with HFA as opposed to the children with SLI (HFA SIDI: mean = 81.6, SD = 19.8; SLI SIDI: mean = 14.9, SD = 12.9). Vice versa, the CELF percentiles underscored the grammatical impairment in the children with SLI, as opposed to the HFA group (SLI CELF: mean 7.9, SD 7.34; HFA CELF: mean 53.7, SD 29.46). Non-Word Repetition scores (Rispens and Baker 2012) obtained from each group confirm the diagnostic value of this test for children with SLI: the SLI group's NWR score was 33.2%, vs. 62.6 % for the HFA group, and 70.2% for the TD group.

3.2. Materials and procedure mass-count (MC)

Using a Quantity Judgment Task with pictures (Barner and Snedeker 2005; Hacohen and Schaeffer 2013), nouns were presented with an image containing two characters. In every picture, one character is presented with two large objects and the other is presented with four, five or six smaller objects of the same kind which had a smaller combined volume and surface area than the two large objects combined. Participants are asked '*Wie heeft er meer X?*' ('Who has more X?'), where X is a flexible noun appearing in either count or mass syntax. An illustration is given in (7) and (8):

(7) *Count syntax*: Wie heeft er meer pizza's?
'Who has more pizza-PL?'
Correct answer: the horseman

(8) *Mass syntax*: Wie heeft er meer pizza?
'Who has more pizza?'
Correct answer: the cowboy

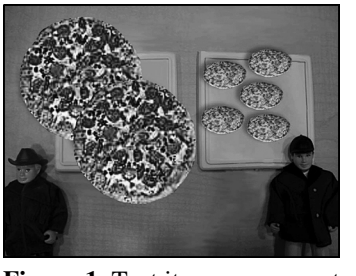

Figure 1. Test item mass-count

The correct answer for a noun presented in count syntax (7) is based on number – i.e. the smaller objects; for a noun in mass syntax (8) the correct answer is based on volume – i.e. the two large objects. The test consisted of 11 items testing the mass condition, 12 items testing the count condition, and 8 fillers, presented in pseudo-randomized order.[4]

3.3. Materials and procedure article choice (AC)

AC was tested by an elicited production task in which participants are asked to describe an event in a picture or short video clip displayed on a computer screen to an experimenter who cannot see the

[4] One of the items in the mass condition was excluded (*Wie heeft er meer papier?* 'Who has more paper?') since all groups performed less well on this item as compared to the other items.

screen, while a second experimenter is sitting next to the participant. The test consisted of 18 fillers (used for another test) and 18 experimental items equally divided over the three conditions: definite, indefinite referential, and indefinite non-referential. Responses were coded for accuracy and substitution, i.e. when a definite article is used in an indefinite condition or when an indefinite article is used in the definite condition.

In the definite condition, a character is first introduced using an image and afterwards the participant is presented a short movie clip in which the character performs some sort of action – illustrated in (9), and in Figure 2 and 3 (still of the movie clip). By making use of this experimental set-up, a natural situation is created in which the existence of a unique entity corresponding to the definite noun phrase *de beer* 'the bear' is part of the shared beliefs between speaker and hearer (the child and the experimenter), because it was established in the previous discourse, by the indefinite noun phrase *een beer* 'a bear'.

(9) **Definite condition**
Experimenter 1: *Hé, wie zie je op het plaatje?*
'Hey, who do you see on the picture?'
Child: **Naam van pop op plaatje*!*
Name of the puppet on the image!
Experimenter 1: *En wat nog meer?*
'And what else?'
Child: *Een beer!*
'A bear!'
[the image changes into a short movie clip in which the puppet hugs the bear]
Experimenter 1: *En wat deed *naam* daarnet?*
'And what did *name* just do?'
Child: *Hij knuffelde de/het beer.*
'He hugged the bear.'
**Hij knuffelde een beer.*
'He hugged a bear.'

Figure 2. Definite condition (I)

Figure 3. Definite condition (II)

The indefinite conditions use a single image and are illustrated in (10) and (11) and Figure 4 and 5:

(10) **Indefinite referential condition**
Experimenter 1: *Hé, wie zie je op het plaatje?*
'Hey, who do you see on the picture?'
Child: *Ernie!*
'Ernie!'
Experimenter 1: *En wat heeft Ernie net gedaan?*
'And what did Ernie just do?'
Child: *Hij heeft een pizza gebakken.*
'He baked a pizza.'
**Hij heeft de/het pizza gebakken.*
*'He baked the pizza.'

(11) **Indefinite non-referential condition**
Experimenter 1: *Hé, wie zie je op het plaatje?*
'Hey, who do you see on the picture?'
Child: *Elmo!*
'Elmo!'
Experimenter 1: *Elmo zegt: 'Oh, ik verveel me zo, ik weet niet wat ik moet doen. Oh, weet je wat, ik ga naar de keuken, en dan ga ik daar iets bakken!*
'Elmo says: 'Oh, I am so bored, I do not know what I should do. Oh, you know what, I am going to the kitchen, and then I am going to bake something!'
Experimenter 1: *Wat denk je dat Elmo gaat doen in de keuken?*
'What do you think Elmo is going to do in the kitchen?'
Child: *Hij gaat een cake/taart/koekje bakken!*
'He is going to bake a cake/pie/cookie!'
**Hij gaat de/het cake/taart/koekje bakken!*
'He is going to bake the cake/pie/cookie!'

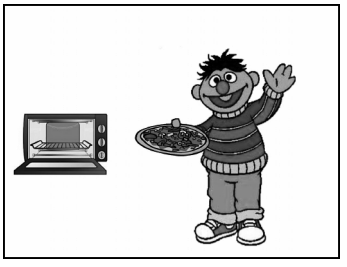

Figure 4. Indefinite referential condition

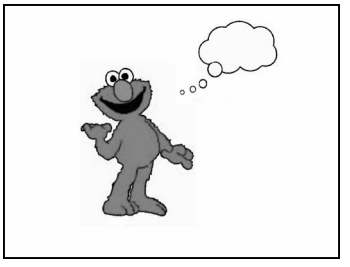

Figure 5. Indefinite non-referential condition

4. Results Mass-Count experiment

4.1. Results

Figure 6 represents the accuracy scores for the four groups of participants. We combine the results on the mass and count conditions, since a Wilcoxon Signed Ranks Test shows no significant differences between the accuracy scores on the two conditions (HFA: p = .366, z = -.904; SLI: p = .620, z = -.495).[5]

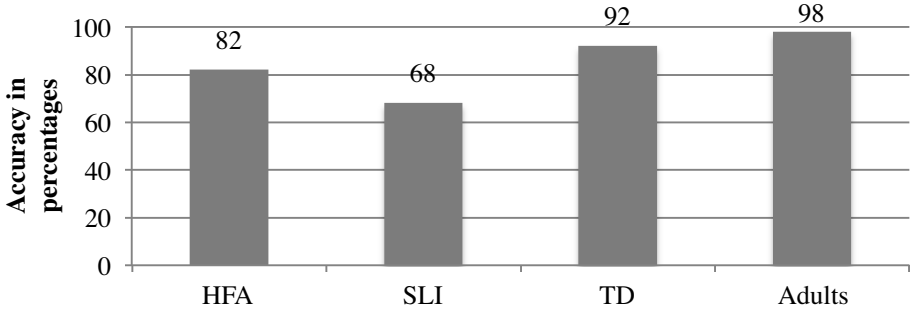

Figure 6. Mass-count: accuracy (rate of correct responses) in percentages per group

A Kruskal-Wallis test reveals that there is a statistically significant difference between accuracy scores of the groups (H(3)= 33,732, p ≤ 0.001). A pairwise post-hoc Kruskal-Wallis test (chance-level adjusted) shows that the SLI group performs worse than the TD children (p ≤ 0.001), while the HFA

[5] No significant difference was found in the adult group (p = .131, z = -1.511). In the TD group, the children do score significantly better on the count items than on the mass items (p = .031, z = -2.161).

group does not (p = 0.352). This confirms our prediction that children with SLI perform badly on grammar (in this case the mass-count distinction) while children with HFA are TD-like in this respect. The children who fail on this experiment show no sensitivity to the plural marker, suggesting a morphosyntactic or grammatical deficit. As SLI and HFA form heterogeneous groups, which is reflected in the data, the next section evaluates the individual results of the child groups.

4.2. Individual variation

The boxplots in Figure 7 illustrate that, when compared to the TD group, the HFA group and especially the SLI group show a large variation in the data. Therefore, we divided the groups into subgroups.

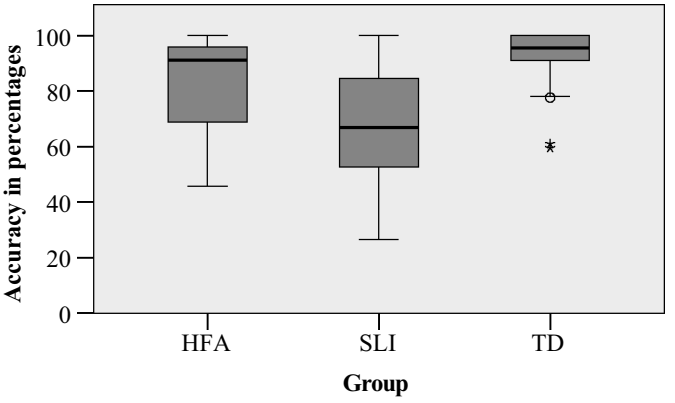

Figure 7. Mass-count: boxplots of the accuracy per group

Based on the performance of the TD-children, participants receive a 'pass' (+) if they have an accuracy score of at least 78%. Participants receive a 'fail' (-) if they have a mean accuracy score of lower than 78%.

Table 1. Mass-count: accuracy in percentages per group

Group	N (N aged 6)	Mean age (SD)	Age range	Mean accuracy score (SD)	Mean percentile CELF (SD)
HFA-	10 (4)	8.8 (2.9)	6-14	.59 (.11)	28.8 (21.7)*
HFA+	18 (0)	11.3 (1.4)	9-13	.94 (.06)	68.4 (22.9)
SLI-	17 (4)	9.3 (2.3)	6-14	.55 (.13)	5.2 (6.5)*
SLI+	11 (0)	11.7 (1.3)	10-14	.87 (.08)	12.6 (6.4)
TD-	2 (2)	6.4 (.07)	6	.60 (.01)	69.7 (20.4)
TD+	26 (2)	10.7 (2)	6-14	.95 (.06)	73.6 (24.9)

Table 1 shows that there are more children with SLI in the 'fail' group (17) than children with HFA (10). It further shows that 2 (out of 4) of the six-year-old TD children received a fail, suggesting that apparently sensitivity to the mass-count distinction is not yet completely acquired at age 6 in TD children (as also reported by Van Witteloostuijn and Schaeffer 2015). In the SLI and HFA groups, all six-year-olds are assigned a fail. Finally, we see that the HFA- subgroup has a very low mean CELF percentile (28.8), which is significantly lower than the CELF percentile of the HFA+ group ($U = 21, p \leq .001$). The SLI- subgroup also has a significantly lower CELF percentile than the SLI+ subgroup ($U = 35, p = .005$), but both groups have (as expected) extremely low CELF percentiles.

5. Results Article Choice experiment

5.1. Indefinite conditions

Figure 8 provides the accuracy rates and the rates of substitutions on the indefinite conditions. All responses that were different from the use of the indefinite or definite article were scored as 'other'.

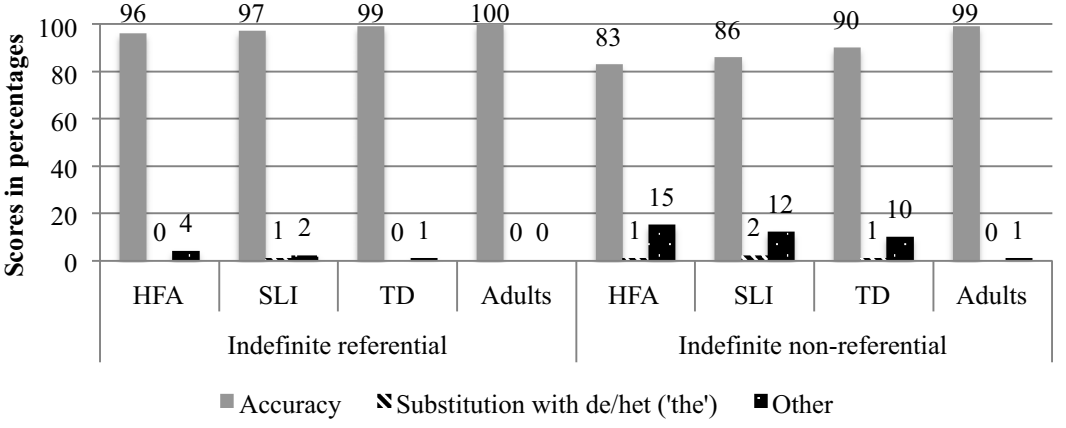

Figure 8. Proportional scores of responses in the indefinite conditions

Figure 8 shows that all participants perform well. A Kruskal-Wallis test reveals no difference between the accuracy scores of the three matched groups in both indefinite conditions (non-referential: $H(3) = 2.381$, $p = .304$, referential: $H(3) = 4.507$, $p = .105$). This result is in line with the findings of Polite et al. (2011) and Chondrogianni and Marinis (2014) for the SLI groups they investigated.[6]

Moreover, we see that there are hardly any substitutions with *de* ('the'-overuse) in the indefinite condition (between 0% and 2%). This finding can be considered surprising, since many other studies (Maratsos 1974; Karmiloff-Smith 1979; Schaeffer and Matthewson 2005) did find *the*-overuse in young TD children. However, Chondrogianni and Marinis (2014) did not find *the*-overuse either in SLI and TD children. Possibly, the children in the present study are old enough to have acquired what is necessary for knowing when to use the indefinite article (i.e., the Concept-of-Non-Shared-Assumptions, Schaeffer and Matthewson 2005).

5.2. Definite condition

Figure 9 provides the accuracy rates, the rates of substitution with *een* ('a'), and the amount of 'other' responses in the definite condition. The results demonstrate that the adults and the TD groups have ceiling accuracies, while the SLI and HFA groups both have a mean accuracy of 81%. A Kruskal-Wallis test shows that the accuracy scores of the three matched groups are significantly different in the definite condition ($H(3)= 8.676$, $p = .013$). A pairwise post-hoc Kruskal-Wallis test (chance-level adjusted) reveals that the TD group outperforms not only the HFA group ($p = .047$), but also the SLI group ($p = .023$).

[6] Figure 8 further shows that in the referential condition, all child groups have ceiling accuracies whereas the scores tend to be slightly lower in the non-referential condition. This difference is due to a higher rate of 'other' responses, and not to more erroneous answers in the non-referential condition. This can probably be attributed to the less-controlling nature of the prompting question in the non-referential condition (e.g. 'What do you think Elmo's going to do?'), allowing for the use of intransitive verbs, plurals, mass nouns, etcetera.

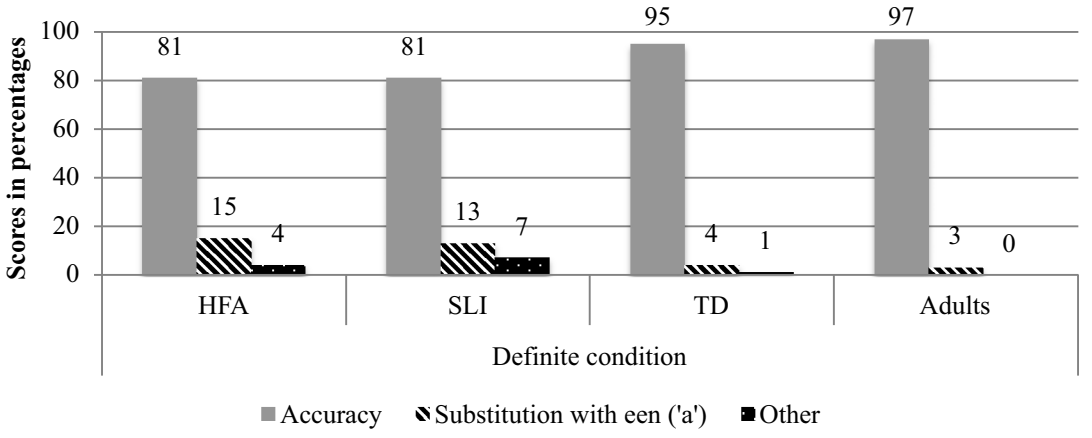

Figure 9. Proportional scores of responses in the definite condition

Figure 9 further shows that in the definite condition, substitution rates (substitution of a definite article by an indefinite article) in the TD group are 4%, while they are 13% for the children with SLI and 15% for the children with HFA. These percentages of *een*-overuse are higher than the percentages of *de*-overuse that we saw in the indefinite condition: a Friedman Test reveals that the difference is significant in the HFA ($\chi^2(2) = 16.294$, $p < .001$) and in the SLI group ($\chi^2(2) = 14.973$, $p = .001$), but not in the TD group ($\chi^2(2) = 5.200$, $p = .074$). For post hoc analysis with Wilcoxon signed-rank tests the significance level was again applied with a Bonferroni correction (resulting in $\alpha = 0.017$). In the SLI as well as the HFA group there are significantly more substitutions in the definite condition than in both indefinite conditions (non-referential condition: HFA: $Z = -2.840$, $p = .005$, SLI: $Z = -2.811$, $p = .005$; referential condition: HFA: $Z = -2.781$, $p = .005$, SLI: $Z = -2.672$, $p = .008$). Corroborating evidence for this result in SLI comes from the studies by Polite et al. (2011) and Chondrogianni and Marinis (2015) who also found overuse of the indefinite article in SLI.

As an explanation for this finding, we propose that the HFA as well as the SLI *een*-overusers fail to draw a scalar implicature, resulting in a free choice between a definite and an indefinite article. Although the semantic meaning of the indefinite article entails the meaning of the definite article, using an indefinite in a definite context is pragmatically inappropriate.

5.3. Individual variation

Similarly to the MC experiment, the SLI and HFA groups show very heterogeneous results. Again we examine individual differences in the amount of substitutions in the definite condition, as illustrated in the boxplot in Figure 10.

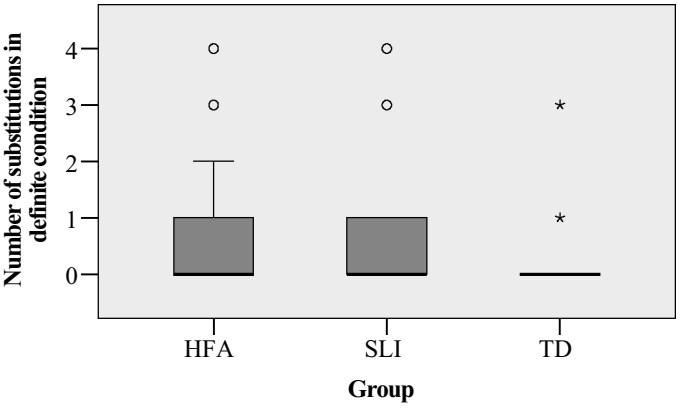

Figure 10. Boxplots of the amount of substitutions in the definite condition

Participants were assigned a pass (+) if they had one substitution or less, and a fail (-) if they had more than one substitution. The results (including average CELF scores) are presented in Table 2.

Table 2. Division into subgroups of the HFA, SLI, and TD groups

Group	N (N aged 6)	Mean age (SD)	Age range	Mean accuracy score (SD)	Mean substitution score (SD)	Mean percentile CELF (SD)
HFA-	6 (2)	9.1 (2.4)	6-11	.39 (.21)	.5 (.11)	79.1 (17.1)
HFA+	21 (1)	10.9 (2.1)	6-14	.94 (.08)	.03 (.07)	48.6 (29.4)
SLI-	4 (0)	9.7 (.7)	8-10	.89 (.18)	.04 (.07)	8.5 (7.5)
SLI+	23 (3)	10.5 (2.4)	6-14	.42 (.17)	.54 (.09)	8.1 (8.2)
TD-	1 (0)	13.7	13	.5	.5	76.8
TD+	26 (3)	10.4 (2.1)	6-14	.96 (.08)	.02 (.06)	72.8 (25.2)

In terms of the amount of *een*-overuse produced, Table 2 shows there are comparable numbers of failers in HFA (6) and SLI (4). Furthermore, we see that there is no relationship between failure on (pragmatic) article choice and CELF scores, which mainly reflect grammatical abilities. Finally, the table reveals a subgroup of children with SLI who show substantial error rates for AC.

6. Discussion and conclusions

The previous sections showed that in the grammatical MC task, as predicted, the SLI group performs worse than the TD group, while the HFA group does not significantly differ from the TD group. For the pragmatic AC task, the results show a disparity between the indefinite and definite conditions, as in the indefinite conditions the accuracy scores of the three matched groups do not differ, while in the definite condition both the SLI and the HFA groups are outperformed by the TD group (and not only the HFA group as we predicted). Furthermore, there are hardly any substitutions in the indefinite condition (*the*-overuse), while we find higher percentages of substitutions (*a*-overuse) in the indefinite condition for the HFA group (15%) and the SLI group (13%).

With regard to the individual variation, on the basis of the MC experiment there were 10 children with HFA who were assigned a 'fail', and 17 children with SLI. For the AC experiment, there were 6 children with HFA who were assigned a 'fail' and 4 children with SLI. In discussing our research questions, it is important to compare the subgroups that were formed on the basis of the two experiments, which results in four logically possible subgroups: +MC/-AC; -MC/+AC; -MC/-AC; +MC/+AC. In order to obtain a more detailed insight in the rest of these subgroups' profiles, we provide the NWR scores, as well as the previously included CELF scores. The results are presented in Table 3.

Table 3. CELF and NWR scores of four subgroups based on MC and AC performance

Subgroup	Group	N	CELF (SD)	NWR (SD)
+MC/-AC	HFA	4	89.9 (9.3)	72.5 (9.1)
	SLI	1	9.1	30
-MC/+AC	HFA	7	18.2 (12.8)	54.6 (5.7)
	SLI	13	5.1 (6.1)	29.1 (12.6)
-MC/-AC	HFA	2	62.8 (10.6)	48.8 (5.3)
	SLI	3	7.7 (10.0)	38.3 (21.3)
+MC/+AC	HFA	14	63.8 (22.5)	67.14 (11.0)
	SLI	10	12.9 (6.7)	40 (6.7)

Table 3 shows that there is a subgroup within the SLI group that shows a pattern opposite to a subgroup in the HFA group and vice versa: in the +MC/-AC subgroup (or the – according to our hypothesis – 'typical HFA' group), there are 4 (out of 27) children with HFA, and in the -MC/+AC subgroup (or the 'typical SLI' group), there are 13 children (out of 27) with SLI. Hence, these results show a double dissociation: we find an SLI subgroup that has impaired grammatical skills, but intact pragmatic skills, and a HFA subgroup that has impaired pragmatic skills, but intact grammatical skills. This suggests that grammar and pragmatics can be impaired independently of each other, and therefore provides evidence for the hypothesis that grammar and pragmatics are two distinct components of language, which can be selectively impaired.

Our second hypothesis was that autism and SLI do not have the same profiles. Prima facie, Table 3 may suggest evidence against this hypothesis: there seems to be one child within the SLI group who performs like the 'typical' HFA group (+MC/-AC), and a small subgroup of 7 children within the HFA group who perform similarly to the 'typical' SLI group (-MC/+AC). However, if we take into account the CELF and NWR scores of the SLI-like children in the HFA group and the HFA-like children in the SLI group, we see a number of important differences between these groups. In the +MC/-AC group the one child with SLI has much lower CELF and NWR scores than the children with HFA in this group.[7] In line with this, in the –MC/+AC group the 7 children with HFA have significantly higher mean CELF and NWR scores than the 13 children with SLI (CELF: $U = 13$, $p = .009$; NWR: $U = 3$, $p < .001$). Although the results do show that there is a subgroup of HFA that is clearly grammatically impaired (they fail on mass-count and the CELF score is below the norm), this impairment seems less severe than the grammatical impairment in SLI.

Combining these observations, we do not find support for the hypothesis that HFA and SLI have overlapping profiles: despite some superficial resemblance between HFA and SLI subgroups in terms of their performance on (grammatical) mass-count and (pragmatic) article choice, scores on the CELF and the NWR reveal different profiles.

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[7] Due to the small sample size (N=1 in the SLI subgroup), statistical analysis is not meaningful here.

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