The Acquisition of Distributivity and its Relationship with Adjectives of Comparison

Chapter 3

A shorter version of this chapter was previously published as:

Abstract

If an explicit distributive marker like each is present, adults will only allow distributive interpretations. For sentences with plural noun phrase subjects, such as the definite plural the, adults will reject distributive readings. Dotlačil (2010) accounts for these differences pragmatically, arguing that plural noun phrases conversationally implicate their collective readings. Young children allow collective and distributive readings with both NP-types, and experiments suggest initially children are unaware that each signals distributivity. How do children become adult-like? The pragmatic account by Dotlačil predicts that children will first learn to restrict explicit distributive markers to distributive readings and only later will begin to reject plural NPs with distributive readings. We investigate this prediction in two truth-value judgment experiments with 114 Dutch children (ages 5-9) and 92 Dutch adults. Study 1 found that correct restriction of each to collective contexts correlated positively with correct rejection of the in the distributive context. Study 2 studied children’s interpretation preference with the distributive adjective of comparison different and sentence internal and sentence external readings. In sentence internal readings, the sentence itself provides the context of the comparison, via a plural licensor (in our case each). In sentence external readings, a comparison is made with a sentence external element mentioned previously in the context. The results of Study 2 indicated that the sentence-internal reading of different is dependent on distributivity and is acquired earlier than the simple distributive judgments of Study 1.
1 Introduction

A fundamental property of human language is its ability to express information about quantities of entities, rather than only about individuals. This can be achieved in various ways, such as using quantificational expressions (each/every boy), numerical expressions (three boys) or plurals (the boys). Take for example the following sentence: The boys are pushing a car. This sentence allows multiple interpretations: Are the subjects acting collectively as a group (the collective interpretation, Figure 1) or separately as individuals (the distributive interpretation, Figure 2)?

The acquisition of distributivity has been studied for decades, but many questions are still unanswered. This project addresses two of them. First existing research has often focused on the acquisition of overtly distributive quantificational determiners like Each and Every, but less work has investigated preferences and dispreferences for distributive interpretations with other determiners. Study 1 examines to what degree improvements in the interpretation of Each correlate with more adult-like preferences for collective interpretations with the definite article the. Second, distributive interpretations are required for the correct interpretation of other linguistic expressions, but little research has examined children’s intuitions with these constructions. Study 2 addresses this issue by investigating children’s preferences in interpreting the adjective of comparison different, which has a distributivity component. Because the same children were tested in both studies, we can compare how interpretations with different relate to distributivity intuitions with each and the.
2 Background

Consider the following two sentences:

(1) **Each** boy is pushing a car.

(2) **The** boys are pushing a car.

Adults interpret sentences like (1) only with a distributive interpretation. On the other hand, adults strongly prefer collective interpretations for sentences like (2) where the subject is a definite plural (Frazier et al., 1999; Kaup et al., 2002). Children instead tend to prefer distributive interpretations regardless of noun phrase type (Syrett & Musolino, 2013). How do children then develop adult preferences?

Dotlačil (2010) hypothesized that definite plurals conversationally implicate their collective meanings. In short, adults have both distributive and collective interpretations available for definite plurals, but reason that if the speaker had meant a distributive interpretation she would have used an explicit distributivity marker like *each*. This explanation treats distributivity as part of the lexical meaning of *each*, but treats the collective preferences with plural subjects as derived via pragmatics. Young children (up to the age of 8) are not able to reason about alternative expressions, because they have an incomplete semantic representation of the quantifier *each* lacking the information that it has distributive meaning. *Each* and *the* mean exactly the same to them, so they can’t use the former to exclude distributive interpretations of the latter.

This hypothesis leads to the following prediction: the rate of rejection of *each* in the collective context will correlate positively with the rate of rejection of *the* in the distributive context. This means that when children learn to understand *each* they will also start rejecting *the* in the distributive context. Pagliarini et al. (2012) found such a correlation in Italian children for the definite *i/le* ‘*the*’ and the quantifier *ciascuno* ‘*each*’.¹ In Study 1 we tested this same hypothesis with Dutch participants.

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¹ Please note that similar results have been found for Spanish by Padilla-Reyes (2018). These results, however, were not published yet when the current paper (de Koster et al., 2017) was published. The results of Padilla-Reyes’ (2018) study are discussed in Chapter 2.
3 Study 1: Comparing distributivity preferences for adults and children

Study 1 used a truth value judgment task with two factors: Picture (Distributive, Collective) and Determiner (Definite Plural, Each), using the Dutch definite plural de ‘the’ and the quantifier iedere ‘each’.

3.1 Participants

114 children, divided in five different age-groups from 5 to 9 years old, participated. Table 1 reports the distribution of the children and their characteristics. The children were tested in a quiet classroom. 40 adults (age range 18-54, mean age 22) who were mainly university students, served as a control group. They performed the experiment online, without the experimenter being present.

Table 1. Characteristics of child participants per age group

<table>
<thead>
<tr>
<th>Age-Group</th>
<th>Total</th>
<th>Age Range</th>
<th>Mean Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>28</td>
<td>5;1 – 5;11</td>
<td>5;6</td>
</tr>
<tr>
<td>6</td>
<td>20</td>
<td>6;6 – 6;11</td>
<td>6;9</td>
</tr>
<tr>
<td>7</td>
<td>23</td>
<td>7;0 – 7;11</td>
<td>7;5</td>
</tr>
<tr>
<td>8</td>
<td>23</td>
<td>8;1 – 8;11</td>
<td>8;6</td>
</tr>
<tr>
<td>9</td>
<td>20</td>
<td>9;1 – 9;11</td>
<td>9;5</td>
</tr>
</tbody>
</table>

3.2 Design and Procedure

We used two types of pictures. They depicted either a distributive context (Figure 3) or a collective context (Figure 4). Sentences were of the form Subject-Verb-Indefinite Object, beginning either with the definite plural de ‘the’ or the quantifier iedere ‘each’:

(3) De meisjes bouwen een zandkasteel.
    The girls are building a sandcastle.

(4) Ieder meisje bouwt een zandkasteel.
    Each girl is building a sandcastle.

Six verbs were used: vasthouden, dragen, duwen, trekken, wassen and bouwen (in English: ‘hold’, ‘carry’, ‘push’, ‘pull’, ‘wash’ and ‘build’). The subjects were girls, boys, monkeys or dogs and every item contained a different object.
The 2x2 design thus has four conditions (Table 2). Participants saw six items per condition, plus twelve control items. Items were distributed over four lists and were presented randomly to the participants. They were presented with one picture at a time, while a recorded sentence was played, and asked to verify whether the sentence matched the picture. All sentences can be found in the Appendix Section of Chapter 3 at the end of this thesis.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Adult Prediction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each - Distributive</td>
<td>Yes</td>
</tr>
<tr>
<td>The - Collective</td>
<td>Yes</td>
</tr>
<tr>
<td>Each - Collective</td>
<td>No</td>
</tr>
<tr>
<td>The - Distributive</td>
<td>No</td>
</tr>
</tbody>
</table>

3.3 Results

Both the adults and the children consistently accepted Each-Distributive and The-Collective around 99% of the time even from the age of 5 years old, so we omit the figure for these conditions. Conditions Each-Collective and The-Distributive showed larger differences between the children and adults, see Figure 5. The results of the Each-Collective condition suggest that 5 and 6-year-old children accept the collective interpretation of the quantifier *iedere* ‘each’. However, starting at age 7, children start rejecting this interpretation, gradually moving toward the adult interpretation, which is reached at the age of 9. The results of the condition The-Distributive show that children from the age of 5 accept the distributive interpretation of the plural definite *de* ‘the’. They start rejecting this condition around the age of 8/9 years old. However they are far from adult-like, in contrast to their results for the Each-Collective condition. This finding suggests that children learn to restrict *each* to distributive meanings before they start rejecting *the* in the distributive context.
The results were analyzed using mixed-effect logistic models. The dependent variable was the response and the predictors were: CONDITION (with the reference level: Each-Distributive), AGE, and the interaction of the two. We also included two random effects for the intercept: PARTICIPANTS and VERB, and one random effect for the slope of the verbs: CONDITION. In the final model, CONDITION Each-Collective turned out to be a significant predictor ($\beta = -6.33$, $z=-5.8$, $p<0.001$). Condition Each-Collective is rejected significantly more than the other conditions. Furthermore, two interactions were significant: AGE with CONDITION Each-Collective ($\beta = -0.2$, $z=-2.2$, $p<0.01$) and AGE with CONDITION The-Distributive ($\beta = -0.36$, $z=-3.9$, $p<0.001$). Other conditions and their interactions with age were not significant. These interactions show that as children grow older both conditions Each-Collective and The-Distributive are accepted less.

Recall that the implicature analysis for distributivity (Dotlačil, 2010) predicts that children should learn to reject condition Each-Collective, as well as condition The-Distributive. This seems to be confirmed by the descriptive statistics and the results of the mixed-effect logistic model. Furthermore, we predict that the correlation between the conditions Each-Collective and The-Distributive should hold at the level of the individual child.
To examine this prediction, we have to examine the correlation between each child’s acceptance of two conditions. We defined ‘acceptance’ as the number of items that a child accepted in a condition. The correlation between the proportion of items accepted in condition Each-Collective and the proportion of items accepted in condition The-Distributive was measured using Spearman’s rank correlation. A significant positive correlation was found between the two conditions (\(\rho=0.3, p<0.001\)). None of the other conditions correlated significantly with condition Each-Collective.

Figure 6 shows the correlation between the two conditions, by showing how many times each child accepted condition Each-Collective (x-axis) and condition The-Distributive (y-axis). Note that there are no data points in the upper left corner of the graph. Data points in that corner would represent children that reject each in the collective context, but accept the in the distributive context. According to our hypothesis, that combination should be impossible, and the empty upper left corner thus serves as evidence for the prediction that learning each precedes learning to reject the in the distributive context.

\[\text{Figure 6. Correlation between the acceptance rates of conditions Each-Collective and The-Distributive: The squares represent the individual children.}\]
3.4 Discussion

We found our predicted positive correlation that children start rejecting *each* in the collective context before they start rejecting *the* in the distributive context, and this holds even at the level of the individual child. However, the acceptance rate of the Each-Collective condition for adults turned out to be higher than expected. We expected adults to overwhelmingly reject this condition but they still accepted it in 36% of the cases. When we compare this with the results of Pagliarini et al. (2012) we see that they found a lower acceptance rate of only 9%. One might think that this difference could be due to the different verbs we used and that some of them might be easier to interpret as collective (e.g., *to build*). This would predict that for the Each-Collective condition, the factor *verb* should be a significant predictor. We tested this in a model but found no effect, suggesting that different verbs played little to no role in this condition.

Another finding that needs some discussion is the unexpectedly high 50% acceptance rate of the adults in condition The-Distributive. However, these results are consistent with the results of Pagliarini et al. (2012) and are in line with our hypothesis since it is known that rates of implicature calculation vary across different lexical items and most implicatures are calculated in around 30% to 70% cases (c.f., van Tiel et al., 2016).

3.5 *Iedere* versus *Elke*

In this study we have referred to the English distributive quantifier *each* as the equivalent of the Dutch quantifier *iedere*. English, however, actually has two distributive quantifiers: *each*, but also *every*. Like English *each* and *every*, Dutch also has two distributive quantifiers: *iedere* and *elke*. The current study used the quantifier *iedere* without a specific reason, as we assumed that there is no difference between the meanings of *iedere* and *elke*. Van der Ziel (2012) concluded that unlike English *each* and *every*, Dutch *elke* and *iedere* seem to be near synonyms. There are several syntactic differences between English *each* and *every* (e.g., *each*, unlike *every*, can occur in partitive constructions and in floating position), but these differences appear to be very limited in Dutch.

In addition to the syntactic differences, there is also a semantic distinction between English *each* and *every*. It is long been claimed that *each* is more distributive than *every*. Tunstall (1998) argues that this is because *each* requires a complete distributive event structure while *every* only requires a partially distributive event structure. She illustrates this claim with the following example.

(5) a. Ricky weighed *each* apple from the basket.
    b. Ricky weighed *every* apple from the basket.
Consider (5) under the following scenario: there are five apples and Ricky weighed three apples by themselves but weighed the last two apples together. Every (5b) can be used to describe this partial distributive situation but each (5a) cannot. Tunstall (1998) claims that this is due to the fact that for each, each affected object (each apple in (15)) must be acted upon individually in its own subevent, differentiated from the other subevents in some way. Each can therefore not be used to describe the situation presented above, because there is no clear way to distinguish the weighing of the last two apples. Every, on the other hand, has no problem with this partial distributive situation. Every can describe situations in which objects are affected individually, but also when they are affected in (sub)groups.

Not much is known about a possible semantical distinction between Dutch iedere and elke. Since the acceptance rate of condition Each-Collective turned out to be higher than expected it might be worth to check if this semantic distinction between English each and every is also present in Dutch for iedere and elke. If Dutch iedere, like English every, is also partially distributive, sometimes allowing the collective interpretation, this could explain the unexpectedly high acceptances of iedere in collective situations. We therefore conducted a follow-up study with adults, replacing the quantifier iedere with the quantifier elke (e.g., replacing sentence (4) with sentence (6)). If there is indeed a semantic distinction between Dutch iedere and elke, similar to the proposed distinction between English each and every, we would expect to see fewer acceptances of Dutch elke in collective situations.

(4) Ieder meisje bouwt een zandkasteel.
Every girl is building a sandcastle.

(6) Elk meisje bouwt een zandkasteel.
Each girl is building a sandcastle.

The follow-up study followed the same procedure as the experiment presented in Section 3.2, with the only difference being the replacement of the quantifier iedere by the quantifier elke. 24 Dutch adults (mean age 26) performed the experiment online, without the experimenter being present. Results are presented in Figure 7.

The left bars in Figure 7 present the results for the quantifier elke and the right bars serve as a reminder of the results for the quantifier iedere presented in Section 3.3. Looking at Figure 7, it immediately becomes clear that the results are virtually identical. Condition Each-Collective is especially interesting, since this condition can show the acceptability of the quantifier elke in collective situations and whether or not this is different from the acceptability of the quantifier iedere in collective situations. If a similar semantic distinction is present between Dutch elke and iedere, as was argued for English each and every, we would expect to see a significantly lower acceptance rate for the quantifier elke in collective situations compared to the
quantifier *iedere* in collective situations. This, however, did not turn out to be the case. Both *iedere* and *elke* turned out to be acceptable in collective situations to a similar degree, with acceptance rates of 36% and 37%, respectively. This finding demonstrates that both Dutch *iedere* and *elke* seem to be acceptable in collective situations to a higher degree than English *each* and Italian *ciascuno*. Recall that Pagliarini et al. (2012) found an acceptance rate of only 9% for *ciascuno* in collective situations.

To conclude, the unexpectedly high acceptance rate of *iedere* cannot be explained by a semantic distinction in the distributive character of the two Dutch distributive quantifiers *iedere* and *elke*, as was argued to be the case for English *each* and *every*. Both Dutch *elke* and *iedere* seem to behave like English *every*, also allowing collective situations in some cases. More research is necessary to examine the distributive character of the Dutch distributive quantifiers and how they differ from their counterparts in other languages.

![Figure 7](image.png)

**Figure 7.** Mean proportion of ‘yes’ responses for all conditions for *elke* (left bars) and *iedere* (right bars). Error bars show standard error.

### 3.6 Other interpretations requiring distributivity

Adjectives of comparison (AOCs), e.g., *different*, *same* and *similar*, are used to compare two or more elements and in one of their interpretations, they are parasitic on distributivity, as discussed below. Study 2 examines the relationship between distributivity and the Dutch adjective of comparison *andere* ‘different’ and the use of *each* or *the*. Consider the following sentence:

(7) The girls pushed a Volvo. Each boy pushed a different car.
(7) is ambiguous or underspecified. First, the boys might have pushed cars distinct from each other. This is the sentence internal reading, where different is interpreted as signaling distinct cars paired to each boy. There is also a sentence external reading, where all boys push a car distinct from the Volvo. In the sentence external reading the car in the current sentence is compared to an element, here the Volvo, mentioned previously in the discourse, while in the sentence internal reading cars are compared between the same subjects. Carlson (1987) proposes that the one-to-one pairing necessary for the internal reading is a distributive interpretation (see also Brasoveanu, 2011; Moltmann, 1992). Thus internal readings require distributive interpretations.

Carlson’s (1987) claim is supported by parallelisms that have been found between the ‘strength’ of distributivity markers and the acceptability of sentence-internal ‘different’ licensors. Brasoveanu and Dotlačil (2012) found in a questionnaire study on English that the degree to which different NPs license distributive readings can be organized on a scale and that this scale of distributivity markers is the same as the scale for sentence-internal different licensors.

Their results showed that when the subject NP appeared with each, the sentence internal reading of different and a distributive reading were fully accepted. When the subject NP was the, the same readings were degraded. These results then support the claim that the sentence-internal reading of different requires distributivity to be licensed. For children, these results suggest that sentences with different with the NP subject each will be treated differently from those with the NP subject the. Given the results from Study 1, we would predict that children will first need to restrict the each sentences to sentence internal readings before they will learn to reject internal readings with the as the subject NP.

Acceptable      EACH > ALL > {THE, NONE}      Unacceptable

Study 2 examines these predictions by testing children’s interpretation preferences for the adjective of comparison different and further compares these results with those of Study 1. We predict that when children show adult interpretations restricting each to distributive meanings, they will also show their mastery of distributivity by preferring the sentence-internal reading of the AOC different in combination with the strong licensor each.
4study 2: the relationship with the adjective of comparison different

Study 2 used a truth-value judgment task with two factors: Picture and Sentence. The experiment is conducted in Dutch, with the definite plural de ‘the’ and the quantifier iedere ‘each’ in both a sentence-internal and a sentence-external context. Additionally we also tested for a correlation between the results of Study 1 and Study 2 to check if the children who showed the adult interpretation of distributivity (rejecting the in the distributive context) will also show the adult reading of the adjective of comparison different (rejecting the internal reading of different in combination with sentences with the).

4.1 Participants

86 children who participated in Study 1 also participated in Study 2 (see Table 1). The children were divided in four different age-groups from 6 to 9 years old. For Study 2 the 5 year olds were excluded because they already had difficulties with Study 1. 52 adults (age range 18-51, mean age 24) served as a control group. None of the adult participants had taken part in Study 1.

4.2 Design and Procedure

We used two different picture types in this experiment. They were presented as little comics and were accompanied by a recorded context story. The pictures were either 'internal' (Figure 8) or 'external' (Figure 9). A 'yes' answer to the internal pictures corresponds to an internal reading and a 'yes' answer to the external picture corresponds to an external reading, hence the names of the pictures.

Figure 8 shows the internal picture. The actual pictures were in color. The black arrows were not present but are used here to indicate the same car in the third and fourth panel. This comic was accompanied by the following context story:

There are three cars, a green one, a blue one and a red one. The girls are pushing the green car one after another. The first boy is also pushing the green car. The second boy is pushing the blue car and the last boy is pushing the red car.

Figure 9 shows the external picture and the context story belonging to this picture is the following:

There are two cars, a green one and a blue one. The girls are pushing the green car, one after another. The boys are pushing the blue car, one after another.
The context stories were recorded in Dutch, but for reasons of space we show only the English translations. A target sentence and question followed directly after each context story and started with either *de* ‘the’ or *iedere* ‘each’.

(8) De meisjes duwden dezelfde groene auto. Klopt het dat *de* jongens een *andere* auto duwdend?

*The girls were pushing the same green car. Is it true that the boys pushed a different car?*

(9) De meisjes duwden dezelfde groene auto. Klopt het dat *iedere* jongen een *andere* auto duwde?

*The girls were pushing the same green car. Is it true that each boy pushed a different car?*

Sentences (8) and (9) were paired with Figures 8 and 9 and exemplify the four different conditions of the 2 x 2 design. Our predictions per condition are shown in Table 3. The same sentences and verbs were used as in study 1, we only left out *build* and *wash*, because they were too difficult to depict in the comic style pictures. The subjects and objects remained also the same. Participants were presented with 5 items per condition plus 12 control items. Items were distributed over four lists and were presented randomly to the participants. They were presented with one picture at a time, while a recorded story was played. The target question followed directly after the context story.

**Table 3.** Expected answers for adults for each condition

<table>
<thead>
<tr>
<th>Sentence / Picture</th>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Each</strong></td>
<td><strong>Condition 1</strong>&lt;br&gt;Yes, because all three boys are pushing a different car.</td>
<td><strong>Condition 3</strong>&lt;br&gt;No, because the boys are all pushing the same blue car.</td>
</tr>
<tr>
<td><strong>The</strong></td>
<td><strong>Condition 2</strong>&lt;br&gt;No, because one of the boys is pushing the same green car as the girls.</td>
<td><strong>Condition 4</strong>&lt;br&gt;Yes, because the boys are pushing a different car than the girls.</td>
</tr>
<tr>
<td>Evokes comparison with external element (girls)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.3 Results

Figure 10 reports the mean proportion of ‘yes’ responses per condition. We start with the internal readings. When comparing the results from the adults in Figure 10 with our predictions shown in Table 3, it becomes clear that adults indeed accept condition Each-Internal, but with an acceptance rate of 72% which is slightly lower than expected. We predicted adults would reject condition The-Internal, because of the expected external reading, but they show an acceptance rate of about 60% which is higher than expected.

In case of the external readings, we see that adults accept Each-External only at the rate of 23%, which closely matches our predictions. The 90% acceptance rate of The-External also accords with the predictions. When looking at the children, we see they are adult-like for Each-External at the age of 8, and at the age of 6 for The-External.

The results were analyzed using mixed-effect logistic models, with the response as the dependent variable. The predictors were: condition (reference level: The-Internal), age and the interaction of the two. We also included two random effects for the intercept: participants and verb, and one random effect for the slope of the verbs: condition. In the resulting model the condition Each-External turned out to be a significant predictor ($\beta = -2.6$, $z=-9.7$, $p<0.001$). The interactions of age with conditions Each-External and The-External were also significant ($\beta = 0.04$, $z=3.0$, $p<0.001$) and ($\beta = 0.09$, $z=4.8$, $p<0.001$). Furthermore, the predictor age also turned out to be significant ($\beta = -0.07$, $z=-4.8$, $p<0.001$). These results show us that older speakers accept condition The-External more than The-internal. Condition Each-External on the other hand is rejected more.

Returning to the question of whether or not there is a relationship between distributivity and the adjective of comparison different, we examined the correlation between each child’s acceptance of condition The-Distributive from Study 1 and their acceptance of condition The-Internal from Study 2. We defined ‘acceptance’ as the number of items that a child accepted in a condition.

We used Spearman’s rank correlation to test for a statistical relationship but found no correlation between the two conditions ($\rho=0.1$, $p>0.1$). The lack of correlation is also visually confirmed in Figure 11, which shows how many times each child accepted condition The-Distributive (x-axis) and condition The-Internal (y-axis).
Figure 10. Mean proportion of ‘yes’ responses for all conditions in Study 2. Error bars show standard error.
4.4 Discussion

The results of Study 2 followed our predictions for external readings. Adults accept external readings with *the* and reject external readings with *each*. Children are adult-like for The-External and show the adult-like interpretation of Each-External at the age of 8. Adult responses are in line with our predictions, see Table 3. The responses of children also follow our predictions relatively closely. First, given that children fully accept *the* in its collective interpretation already at the age of 5, we expect The-External to be acceptable for young children, which is correct. Second, we saw that children are adult-like in their rejection of Each-Collective at the age of 9 and we predict the same pattern for Each-External. In this study, we see that they are adult-like in rejecting Each-External at the age of 8.

The results for the internal picture on the other hand turned out to be different than predicted. The adults accepted both conditions, but we expected them to reject The-Internal items. They showed an acceptance rate of 59%, which indicates an internal reading. However, the 59% might be explained by the fact that this condition is again the condition in which the calculation of the implicature takes place, just like the The-Distributive condition from Study 1, which showed an adult acceptance rate of 50%. Rates close to 50% are not unexpected for implicatures.
Another possible explanation for the unexpectedly high rate of acceptance of internal readings with *the* might be due to the pictures. The external pictures were easier to understand and clearer. In the external picture (Figure 9) there is a distinct separation between the boys and the girls. The girls are pushing one car and the boys are pushing one (other) car. The four subpictures are very similar and the order of the events is transparent. These distinctions make a comparison between the boys and girls very salient. This is contrary to the internal picture (Figure 8), in which comic consists of more difficult subpictures. The separation between the girls and boys is less apparent and the events are harder to understand. It might be the case that the participants just ignored or did not see that the first boy was pushing the same car as the girls.

Also, the target question was asked after the story was played, so the participants might be just using the last picture in their verification process and this last picture shows that the three boys are pushing three different cars.

Thus, a point for future research seems to be to rerun this experiment with different pictures, not in comic style, but just one picture in which the four subpictures of the comics are combined.

5 General Discussion and Conclusion

We will first discuss the positive findings. In Study 1, we confirmed the hypothesis ofDotlačil (2010) and the results of Pagliarini et al. (2012) for Dutch. Rejections of *the* with distributive interpretations arise as the interplay of semantics and pragmatics. We also confirmed previous findings (e.g., Brooks & Braine, 1996) showing that children often interpret *each* collectively. In Study 2, external readings closely confirmed our predictions both for adults and children. In particular, we saw a close match between the acquisition of *each* and *the* in a collective interpretation and Each-External and The-External. The only surprising factor is that the adult-like rejection of Each-External appears one year earlier than the rejection of Each-Colllective (8 years vs. 9 years).

Rates of internal readings in Study 2 did not fit well with our predictions. First, it was surprising to see that Each-Internal was only accepted at 72% by adults. Notice also that Each-External was rejected at the rate of 77% by adults. Assuming that the rejection in the second case was due to the fact that adults expected an internal interpretation, both results would closely converge on the finding that the internal reading with *each* is only accepted in 75% cases. This is surprising given our theoretical assumptions. It is also surprising given previous findings, in particular, that of Brasoveanu and Dotlačil (2012), which showed that Each-Internal was fully accepted in English. This discrepancy might be rooted in the fact that *iedere* ‘each’ is not as strongly distributive in Dutch as it is in English. This is supported by the
findings of Study 1, in which Each-Collective has the unexpectedly high acceptance rate of 36%. The second surprising finding concerned The-Internal. This condition was accepted at the rate of 59% by adults, which is high. It goes against the previous finding of Dotlačil (2010) that acceptance rates of sentence internal readings were lower than acceptance rates of distributive readings. Dotlačil (2010)'s study was in Dutch, so language cannot explain the differences. Also unexplained is the discovery that sensitivity to the sentence internal reading is acquired earlier than adult-like intuitions on straightforward distributivity. While children in Study 2 reached adult-like norms in all conditions by the age of 9, they are still not adult-like in their interpretation of The-Distributive according to Study 1.

What could explain the differences in the acquisition of The-Distributive and The-Internal? We see two possibilities: either the semantic features of different that are not related directly to distributivity have an effect, or there is greater flexibility in anaphoric interpretation compared to felicity or grammaticality judgments. Let's examine the first proposal in more detail. The semantic constraints of distributivity shared in distributive interpretations and in sentence internal readings both require individuals denoted by the subject DP to individually take part in an event, and that objects acted upon must be individual and linked one-to-one to each member of the subject set. Different however adds a further requirement that the objects acted upon must be distinct from one another. This additional semantic constraint might temper preferences because it will generally (though not so much in our actual experiment) make it less likely that the speaker’s intended interpretation is misunderstood. If each in general leads to examining individual boys (or girls) while The encourages treating the boys as a group, different encourages comparing cars, and this additional semantic information might make the intended interpretation in a context less likely to be misunderstood compared to simple transitive sentences. This position would also explain why the rejection of Each-External is acquired slightly earlier than the rejection of Each-Collective. If this is correct, then it is possible that children in fact use sentences with different to learn the right interpretation of each and the. From that perspective, studying the acquisition of adjectives of comparison might give us an important insight into how the interpretations of plural expressions are acquired.