Subject interpretation of object questions by Dutch 5-year-olds

The role of number agreement in comprehension

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We investigated the interpretation of Dutch *wie* 'who'- and *welke* 'which'-questions in Dutch 5-year-olds. In contrast to wh-questions in many languages, Dutch wh-questions are structurally ambiguous between a subject and an object reading. We used test items in which the ambiguity was resolved by number agreement. The participants (N = 20) heard a wh-question and had to choose the corresponding picture out of a set of four; this method revealed their interpretation as either subject or object question. The results show that 5-year-olds interpret all question types as subject questions, independent of the agreement cues. Thus, they effectively do not attend to the agreement mismatch that this interpretation causes for the object questions. These errors suggest an overly strong subject-first bias in 5-year-olds. We argue that number agreement is too weak a cue for children to overcome this tendency.

Keywords: first language acquisition, wh-questions, object questions, subject questions, subject verb agreement, agreement mismatch, subject-first bias, Dutch

1. Introduction

We investigate Dutch children's sensitivity to number agreement in their understanding of wh-questions. Section 2 reviews the L1 acquisition background of wh-questions, specifically, the finding that there is a subject-object asymmetry in question comprehension. Section 3 analyzes the structural ambiguity of Dutch wh-questions and shows the disambiguating role of number agreement. In Section 4, we formulate our research questions and hypotheses. Section 5 describes the study and Section 6 the results. Section 7 presents the discussion and in Section 8 we draw our conclusions.

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2. A subject-object asymmetry in the acquisition of wh-questions

In *who-* and *which*-questions, the wh-phrase functions as subject or object. Valian & Casey (2003) note that for a correct interpretation of wh-questions it is often not necessary to use all the syntactic information available. For a question like 'What does Sally eat?' a child can make a very reasonable guess about the meaning with just the words *what*, *Sally* and *eat,* and answer the question correctly without processing its structure. In the case of reversible verbs with two animate arguments, however, there is no such shortcut, (1).

(1) a. Which bear knocked over the monkey?
b. Which bear did the monkey knock over?

Stewart & Sinclair (1975) investigated these two question types by acting out a situation with toy animals and trucks showing several instances of knocking over (e.g., a monkey knocking over a bear, a truck knocking over another monkey). Participants were asked subject and object questions like those in (1). The children had no problems with subject *which*-questions like (1a), but had difficulties interpreting object *which*-questions like (1b), often giving a reversal interpretation. Avrutin (2000) found a similar pattern. Tyack & Ingram (1976) found the same asymmetry for subject-*who* and object-*who* questions in an experiment showing pictures of people and objects involved in actions of helping, touching, riding, etc. The same was found by Philip et al. (2001), who furthermore noted that the most frequent mistake that children made was interpreting object questions as subject questions.

Seidl, Hollich & Jusczyk (2003) investigated subject and object *what*-questions in younger English learners with a preferential-looking paradigm (*what hit X?* and *what did X hit?*). The 15-month-olds in this study showed an asymmetry: for subject questions they looked longer at the correct answer, whereas for object questions there was no preference. The 20-month-olds, on the other hand, looked at the correct picture for both subject and object questions. The target behavior of the latter group reveals very early sensitivity to the subject-object question distinction. Seidl et al. argue that the difference in performance across studies may be due to task demands: their preferential-looking task posed a much lower demand than tasks requiring a verbal response.

Subject-object comprehension asymmetries have also been found in children acquiring other languages: Hebrew (Friedman, Belletti & Rizzi 2009), Italian (de Vincenzi et al. 1999) and Dutch (van der Meer et al. 2001). The Dutch study used ambiguous Dutch *who*-questions and pictures that allowed for both a subject and an object interpretation. For example, one monkey was squirting a bear, and the bear was squirting another monkey. Children gave mostly subject interpretations

for the ambiguous question *Wie zei je dat het/een beertje natspoot?* 'Who did you say that the/a bear squirted wet?' and 'Who did you say squirted the bear wet?'.

The asymmetry has also been attested in the production of wh-questions. Children are more accurate on subject than object questions at an early age. It takes a long while until the production of both types of questions reaches similar accuracy rates. This has been established with English learners (Ervin-Tripp 1970; O'Grady 2005; van der Lely & Battell 2003; van der Lely, Jones & Marshall 2011; Wilhelm & Hanna 1992) and Italian learners (Guasti, Branchini & Arosio 2012).

There is a general consensus in the literature that the difficulties of object questions have to do with the longer syntactic distance between filler and gap. Explanations relate the asymmetry to two possible causes: i) incomplete acquisition of the syntactic structures and/or rules (de Vincenzi et al. 1999; Friedman et al. 2009; Guasti et al. 2012; van der Lely & Battell 2003); ii) insufficient resources for processing the longer filler-gap distance (Avrutin 2000; Deevy & Leonard 2004; O'Grady 1997; Seidl et al. 2003).

Dutch *who* and *which*-questions are structurally ambiguous between a subject and an object reading. Dutch differs from many other languages in which word order and/or case-marking signal a structural difference between subject and object questions. The Dutch listener is dependent on context for disambiguation. Sometimes, however, Dutch wh-questions are disambiguated by subject-verb agreement. The goal of our study is to investigate the role of number agreement as a cue for distinguishing subject versus object questions.

3. Wh-questions in Dutch and the role of number agreement

The question in (2) has two interpretations: *wie* 'who' can be interpreted as subject or object. (3) illustrates how the two readings of (2) involve a long and a short filler-gap dependency, following generative-syntactic accounts.

(2) Wie wast de jongen?
who wash-SG the boy
'Who is washing the boy?' and 'Who is the boy washing?'

(3) a. Subject question: Wie __ wast de jongen?
b. Object question: Wie wast de jongen __ ?

Dutch *wie* 'who' is underspecified for number; it is compatible with singular, (2), and plural-marked verbs, (4). When verb and postverbal NP match, as in (2) and (4), *who*-questions are ambiguous, because the verb agrees with the postverbal NP as well as the wh-phrase.

(4) Wie wassen de jongens?
who wash-PL the boys
'Who is washing the boys?' and 'Who are the boys washing?'

The ambiguity disappears, however, when there is a number mismatch between verb and postverbal NP, (5). Here the wh-phrase is subject, since *de jongens* 'the boys' does not agree with the verb.

(5) Wie wast de jongens?
who wash-SG the boys
'Who is washing the boys?'

Which-phrases are specified for number, and so there are two overt cues for disambiguation: in (6a) verb and *which*-phrase match; moreover, the verb does not agree with the postverbal NP, so the wh-phrase is subject. In (6b), on the other hand, the verb does not agree with the *which*-phrase; here the postverbal NP is the agreeing subject, hence, this is an object question.

(6) a. Welke vrouw wast de jongens?
which woman wash-SG the boys
'Which woman is washing the boy?'
b. Welke vrouw wassen de jongens?
which woman wash-PL the boys
'Which woman are the boys washing?'

Summarizing the role of number, number mismatch between verb and postverbal NP leads to a subject interpretation for *who-* and *which*-questions, (5)–(6a). In *which*-questions with a number mismatch between verb and *which*-phrase and a match between verb and postverbal NP, the wh-phrase is the object, (6b).

Two recent production studies established that Dutch children acquire number agreement early. From the age of 3;0 or 3;6 onwards, they use correct number agreement on the verb for singular and plural subjects (van Kampen 2010, for spontaneous production; Polisenska 2010, for elicited production). This suggests that the agreement system is in place by age three.

4. Research questions and hypotheses

Dutch wh-questions are structurally ambiguous. Number is the only cue for disambiguation, making it an ideal testing ground for examining the pure contribution of number agreement in understanding wh-questions. Is number on the verb used to correctly interpret wh-questions as subject or object question? Specifically, can

number agreement cues prompt children to overcome their subject preference? What is the influence of the type of wh-phrase (*wie* 'who' versus *welke* 'which')?

We investigate the following two hypotheses: i) Dutch 5-year-olds are sensitive to number agreement (van Kampen 2010; Polisenska 2010); ii) the interpretation of *which*-questions renders more problems than *who*-questions (Avrutin 2000; Friedman et al. 2009; Stewart & Sinclair 1975). This yields the following set of predictions, (7).

(7) Predictions
   a. Dutch children correctly interpret unambiguous subject questions as subject questions.
   b. Dutch children correctly interpret unambiguous object questions as object questions.
   c. Dutch children are better at the interpretation of *who*-questions than *which*-questions.

5. Method

5.1 Participants

Twenty 5-year-old Dutch children (mean age 5;6, age range 5;0–5;8) and ten adults participated; both groups consisted of 50% females.[1] We tested 5-year-olds in order to compare our results to those of van der Meer et al. (2001); the participants in that study (mean age 5;7, age range 4;3–6;9) preferred a subject interpretation of ambiguous Dutch questions.

5.2 Design

We used the design and stimuli constructed by van der Lely and colleagues (van der Lely et al. in preparation).[2] The experiment varied two factors: question type (subject versus object question) and wh-word (*wie* 'who' versus *welke* 'which'), yielding a 2x2 design, Table 1. Two lists, varying the order of the items, with six items per condition and a total of 24 items were constructed. The lists were counterbalanced for presentation across participants. Upon inspection of the adult results, we removed two items from further analyses because they elicited non-target-like behavior.[3]

Table 1. Design with sample questions and number of items

	Who	*Which*
Subject	6 items	5 items
	Wie voert de elfjes?	*Welke vrouw kietelt de oma's?*
	'Who is feeding the fairies?'	'Which woman is tickling the grannies?'
Object	5 items	6 items
	Wie wassen de koninginnen?	*Welke prinses duwen de danseressen?*
	'Who are the queens washing?'	'Which princess are the dancers pushing?'

5.3 Materials

For each condition, the same six reversible verbs were used: *duwen* 'push', *trekken* 'pull', *wassen* 'wash', *pakken* 'catch', *kietelen* 'tickle' and *voeren* 'feed'. The nouns in the sentences were: *oma's* 'grannies', *vrouwen* 'ladies', *danseressen* 'dancers', *prinsessen* 'princesses', *koninginnen* 'queens' and *elfjes* 'fairies'. Table 1 lists sample test items for every condition.

We tested interpretation of wh-questions with a picture-selection task with a choice of four pictures (following Adani et al. 2010). Figures 1 and 2 show a subject and an object item. One picture represented the target; the others involved different kinds of distracters, designed to reveal a variety of error types. The role-reversal distracter shows when an object question was interpreted as subject question, or vice versa. The number distracter shows when children did not pay attention to the number of the postverbal NP. The incorrect-action distracter points out a lexical problem.[4] In this question-interpretation task, participants did not produce an answer. Instead, the picture choice reflected how they interpreted the question, i.e., as subject or object question.

All questions were recorded in a sound-proof studio. The questions were articulated well, so that word endings with the agreement information were clearly audible. These recordings were inserted with the picture sets into a PowerPoint presentation.

In order to make unambiguous questions, we manipulated number, creating (mis)matches between verb, wh-phrase and postverbal NP. In both *which*-conditions, the postverbal NP was always plural and the *which*-phrase singular; a singular verb agreed with the *which*-phrase, yielding a subject question; a plural verb agreed with the postverbal NP, producing an object question. Of the *who*-conditions only one was unambiguous, however. Since *wie* 'who' is underspecified for number, *wie* 'who' was unambiguously subject when the verb was singular and the postverbal NP plural. (Figure 1). When verb and postverbal NP were both plural, the who-question was ambiguous (cf. (4)). In this case the pictures offered the relevant information for disambiguation, as only the object-question interpretation was presented (Figure 2). Given the limitations of the syntax of Dutch questions, the design thus included three unambiguous question forms (subject-*who*, subject-*which*, object-*which*) and one ambiguous form (object-*who*).

Figure 1. Sample subject *who*-question: *Wie voert de elfjes?* 'Who is feeding the fairies?' 1: Different verb, 2: Target, 3: Role reversal, 4: Different number.

Figure 2. Sample object *who*-question: *Wie wassen de koninginnen?* 'Who are the queens washing?' 1: Target, 2: Different verb, 3: Role reversal, 4: Different number.

5.4 Procedure

The participants were tested individually in a quiet room. The first slide showed all the figures that appeared in the experimental items. The experimenter labeled them, and the participant repeated the labels. The experimenter then told the participant that all upcoming pictures looked very similar, but were slightly different, so s/he had to choose carefully.

First a slide with all four pictures was shown; then the recorded wh-question was played (and replayed if needed, which children occasionally asked for). The participant was asked to point to the right picture. There was no time pressure. The answers were scored following the four categories: target, role reversal, different number and different action.

The experiment started with two unambiguous subject *wie* 'who' questions as practice items. With these practice items, the experimenter corrected the child if necessary. No corrections were given for the test items.

6. Results

6.1 Subject versus object questions

Table 2 lists the means and standard deviations for the four conditions for children and adults. First, a repeated-measures ANOVA with three factors was computed: Wh-phrase (*wie* 'who', *welke* 'which'), Sentence type (subject, object) and Group (children, adults). There was a main effect of Group ($F(1,28) = 169.78$ $p < .001$) and Sentence type ($F(1,28) = 35.64$ $p < .001$), and an interaction between Group and Sentence type ($F(1,28) = 25.49$ $p < .001$).

To further inspect the effect of group, two subsequent repeated-measures ANOVAs with Sentence type and Wh-phrase were run separately for each group. There was a main effect of Sentence type for children ($F(1,19) = 62.63$ $p < .001$) as well as for adults ($F(1,9) = 7.55$, $p = .023$), with both groups achieving higher scores on subject questions rather than object questions. For the children, there was a marginal effect of Wh-phrase ($F(1,19) = 3.37$, $p = .082$), with the children performing slightly better on *who*- than *which*-questions. No interaction effects were found.[5]

The means correct and the analyses show clearly that children had more difficulties with object questions than subject questions. Furthermore, *who*-questions elicited slightly more target answers overall than *which*-questions.

Table 2. Mean percentages of correct answers on the four conditions for children and adults.

	Children		*Adults*	
	Mean	**SD**	**Mean**	**SD**
Subject-*who*	69.2	0.24	98.3	0.05
Subject-*which*	63.0	0.29	98. 0	0.06
Object-*who*	18.0	0.20	96.0	0.08
Object-*which*	11.0	0.11	91.7	0.12

6.2 Error analysis

Figures 3 and 4 summarize the mistakes the children made for subject and object questions, respectively. There were three possible error types: role reversal, incorrect number and different action (see Section 5 for definitions and Figures 1–2 for illustrations of these error categories). Subject questions were answered correctly by most of the children (69% *wie* 'who'; 63% *welke* 'which'); most errors were of the incorrect-number type (15% *wie* 'who'; 23% *welke* 'which'). With object questions, however,

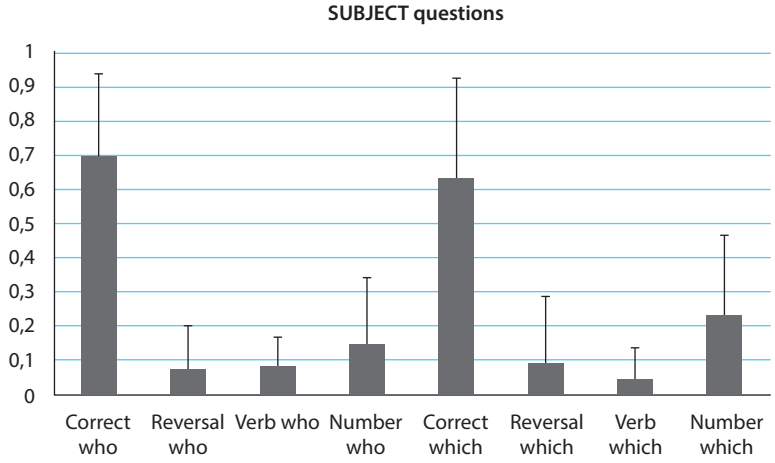

Figure 3. Percentages of answer types for subject questions by children: correct answer, role reversal, incorrect verb and incorrect number. The four bars on the left reflect the *who*-questions; the four bars on the right the *which*-questions.

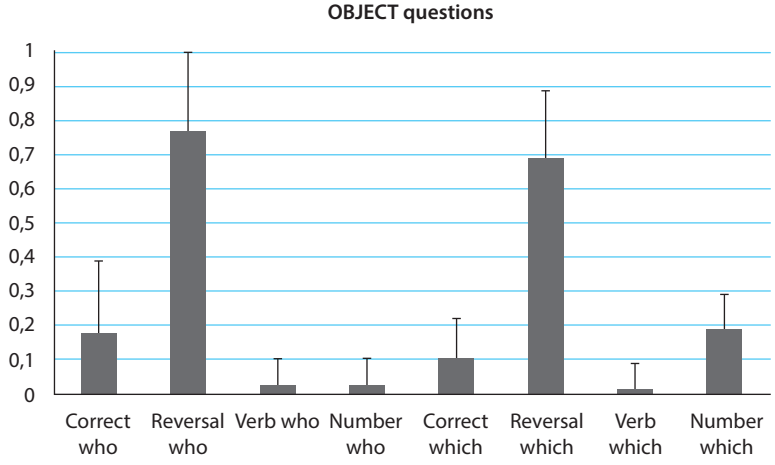

Figure 4. Percentages of answer types for object questions by children.

the percentage correct was strikingly lower (18% *wie* 'who'; 11% *welke* 'which'); by far most of the errors were reversal errors (68% *wie* 'who'; 76% *welke* 'which'). In other words, object questions were very often misinterpreted as subject questions.[6, 7]

7. Discussion

We investigated whether number agreement can help children to correctly differentiate subject and object questions, asking whether number is a strong enough cue to prompt children to overcome the subject-interpretation preference that was found by van der Meer et al. (2001) for Dutch. If Dutch 5-year-olds are sensitive to number agreement (van Kampen 2010; Polisenska 2010), we expect them to interpret unambiguous subject questions as subject questions, and moreover, unambiguous object questions as object questions. The results do not support this prediction: the children made many reversal errors on object questions, and did not differentiate subject and object questions, effectively interpreting both as subject questions. We conclude that number agreement does not disambiguate wh-questions for Dutch 5-year-olds.

We furthermore asked whether the type of wh-phrase (*wie* 'who' versus *welke* 'which') plays a role in interpretation. Hypothesizing that *which*-questions are more problematic than *who*-questions (Avrutin 2000; Friedman et al. 2009; Stewart & Sinclair 1975), we predicted that Dutch children are better at interpreting *who*-questions. The results support this prediction only marginally.

Our design included three unambiguous conditions (subject-*who*, subject-*which*, object-*which*) and one ambiguous form (object-*who*); the latter was disambiguated by the visual context (see Section 5.3 and Figure 2). Despite this difference in ambiguity of the verbal cues, the children had the same difficulties with both types of object questions, which, again, strengthens our conclusion that number does not play a role.

Our results thus show that there is a strong subject-first tendency in children, which is not overcome by number agreement cues. We conclude that children do not attend to number agreement between wh-phrase and verb, and verb and post-verbal NP. This leads to reversal errors for object questions. These findings are in line with previous comprehension studies with English and Hebrew learners (Friedman et al. 2009; Philip et al. 2001; Stewart & Sinclair 1975; Tyack & Ingram 1976).

One possible explanation for children's bad performance on object questions in our study is the demanding nature of the task. Listening to a sentence and selecting one out of four minimally different pictures may tax children´s linguistic and visual processing systems to such an extent that they have trouble comprehending sentences they would have no trouble with otherwise (cf. the preferential-looking

paradigm in Seidl et al. 2003). However, an overall high task demand does not explain the subject-object asymmetry.

Another explanation of our results could be that the design of our study with two unambiguous subject question conditions and only one unambiguous object condition led to a subject-question bias (especially since the two practice questions were subject questions too). However, the preliminary results of the big crosslinguistic study show the same subject-object asymmetry even for languages where subject and object questions are unambiguous (van der Lely et al. in preparation). So we need an independent explanation why children interpreted object questions as subject questions.

We propose a processing account to explain our results. In processing wh-questions, the wh-phrase is kept in working memory until the gap is reached further on in the sentence. In object questions, the filler has to be kept in working memory for a longer period of time than in subject questions, since wh-word and gap are further apart. The adult processing literature shows a subject-object asymmetry with Dutch wh-questions (Frazier & Flores d'Arcais 1989; Kaan 1997), and there was a main effect of the subject-object distinction even in the adults in our study. We argue that the children's parser 'suffers' from an overly strong subject-first bias in the processing of wh-questions: children take the first NP they encounter as the subject of the sentence, i.e., the wh-phrase. This strategy is OK for subject questions, but leads to mis-parsing of object questions. Apparently, children are not able to recover from their erroneous parse when they encounter the agreement cues later on in the sentence (cf. Deevy & Leonard 2004). This can be seen as another instance of the so-called Kindergarten-Path effect (Trueswell et al. 1999).

Given that Dutch children's production of subject-verb agreement is acquired early (van Kampen 2010; Polisenska 2010), it is striking that the much older children in our study do not attend to number cues in this context in interpretation. A similar disregard for subject-verb agreement was established by Blom & Vasić (2012) in a self-paced listening task with 5-year-olds. This may suggest a production-comprehension asymmetry. Schouwenaars (2012) recently investigated wh-question comprehension and production within the same subjects, and indeed found such an asymmetry in Dutch 6-7-year-olds. This raises the intriguing question of why interpretation would lag behind production. One possible reason is that disambiguation of Dutch wh-questions in comprehension typically relies on contextual cues. Therefore Dutch children are used to attend to contextual cues whereas morpho-syntactic cues may be salient in other languages. Further investigations are needed to pit contextual versus syntactic cues in a cross-linguistic comparison to see whether such language-specific attention to different cues can be revealed (van der Lely et al. in preparation).

8. Conclusions

Our study contributes new data about the interpretation of Dutch wh-questions. The 5-year-olds showed a subject-object asymmetry, interpreting object questions as subject questions, despite an agreement mismatch. Apparently, number does not offer a sufficiently strong cue for properly parsing wh-questions for Dutch 5-year-olds. We conclude that the subject-first preference in parsing wh-questions is so strong that children abide by it at the expense of allowing (number) ungrammaticality.

What exactly is the role of number in the parsing of Dutch subject and object questions? When are Dutch children able to use number agreement to correctly interpret object questions? Future research should take a developmental approach to show how the interpretation of wh-questions develops, and when children reach adult levels of comprehension.

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Notes

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2. This research was part of the EU-funded COST-A33 project "Crosslinguistically robust stages of children's linguistic performance, with applications to the diagnosis of Specific Language Impairment" (chair Uli Sauerland, vice-chair Heather van der Lely, 2006–2010). Researchers from twenty-five different countries participated. The goal was to provide a cross-linguistically uniform picture of 5-year-olds' knowledge of grammar. <http://www.zas.gwz-berlin.de/index.php?id=47&L=1>

3. One item used a wrong recording. For the other item, half of the adult answers were not on target (showing reversal and incorrect-action errors), for reasons not clear to us. Since this did not happen for any other items of that condition, we decided not to include this particular item.

4. For two items the target verb was pulling and the different-verb distracter catching, or vice versa. Adults' answers reflected that they had difficulty distinguishing catching and pulling in the pictures. This led to a number of lexical errors (adults chose the pulling picture, whereas the

question was about catching, or vice versa). For these two unfortunate items we counted the different-verb option correct as well as the target.

5. We did not do an item analysis because we do not have any reason to suspect different answer patterns for different items within conditions.

6. Even the adults occasionally made a mistake with the object questions (7 errors/110 object-questions, of which 4 reversal errors).

7. An anonymous reviewer observed that the 'incorrect number' answer is chosen in three of the four conditions, but not for object-who. We don't know why this is so.

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