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Variable verb placement in embedded clauses: comparing English and Norwegian children and adults[*]

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This paper reports on two priming studies focusing on embedded word order in English and Norwegian, more specifically on subject-auxiliary inversion (SAI) in embedded questions in English and verb-adverb order (V2) in *that*-clauses in Norwegian. While the adult languages typically disprefer SAI or V2 in embedded contexts, spontaneous data show that these word orders are produced to a certain extent in specific contexts. Research on child language has shown that children go through a stage where these word orders are relatively frequent. A priming experiment was carried out in both languages, eliciting data from both adults and children. As priming is assumed not to affect ungrammatical structures, we expected there to be priming in the child data, indicating that these word orders are part of the child grammar, but potentially not in the adult data. The results show a clear and reliable priming effect in the English child data, but no priming in the Norwegian experiments.

Dear Adriana – We wish you all the best on the occasion of this milestone in your life!

1. Introduction
This paper reports on a priming study investigating embedded word order in English and Norwegian, in both children and adults. More specifically, the project focuses on verb placement in relation to the subject in embedded *wh*-questions in English and the position of the verb in relation to an adverb or negation in *that*-clauses in Norwegian. Previous research has shown that young children make mistakes in this domain: English-speaking children sometimes produce the word order V-S; i.e. subject-auxiliary inversion (also affecting the copula *be*), while Norwegian-speaking

children use the non-target-consistent V-Adv/Neg word order for an extended period. Examples (from Westergaard 2009a, b) are provided in (1)-(2). In both cases these orders are fully grammatical in root clauses in the adult language, but either ungrammatical or dispreferred in these embedded contexts.

(1)   I don't know [what **are they**]. (Adam, 2 ; 11.28)

(2)   det er ho   mamma som **har**   **også** tegna. (Ina.26, age 3;2.05)
        it   is DET mommie who have.PRES also draw.PART
        'It's mommie who has also drawn.'

These phenomena in English and Norwegian have received some attention in the literature (e.g. Radford 1992, Guasti 2002, Bentzen 2003, Westergaard & Bentzen 2007, Westergaard 2009b), and main clause word order has also been attested in embedded contexts in other child languages, e.g. Swiss German (Schönenberger 2002) and Swedish (Waldmann 2008, 2014). Nevertheless, the reasons for these errors are not well understood. To our knowledge, the current pilot study is the first priming study investigating embedded word order. The ultimate goal is to establish (a) whether the distribution of these "embedded root phenomena" is lexically or pragmatically conditioned in either or both the adult and the child grammars, (b) whether the differences between child and adult production are due to performance limitations or non-target grammatical representations in the child grammar, and (c) whether the developmental patterns and causes are the same or different in the two languages. Although the results are not completely straightforward, this study has allowed us to make some progress in this direction.

     This short paper is organized as follows: In the next section we provide some background on these phenomena and state the aims of the study. We then describe the methodology and participants of the English study and provide the results. Section 4 provides the same for the Norwegian study. Section 5 is a brief discussion and conclusion.

2. Background

As mentioned above, English-speaking children occasionally produce (non-target-consistent) Subject-Auxiliary inversion (SAI) in embedded questions at an early stage. Although we describe this as non-target consistent, it has to be recognized that these structures may also occur in the adult language; relatively freely in some dialects and only very rarely in others. According to McCloskey (2006), SAI is most likely when the embedding context is not "resolutive", i.e. when it does not entail that the answer to the question is known to the referent of the matrix subject. This means that (3a) is better than (3b) and (4a) is better than (4b).

(3)   a.   I wonder where are my socks.
        b.   I know where are my socks.

(4)   a.   I don't remember where are my socks.
        b.   I remember where are my socks.

McCloskey (2006) also claims that embedded SAI is most favoured when the matrix subject is first or second person. Finally, it is also more likely with a non-auxiliary use of the copula than with any other verb, including *be* used as an auxiliary. This has also been found to be the case in English child language (Westergaard 2009b).

Norwegian is an asymmetric V2 language, which means that it is similar to English in that it typically displays verb movement in main but not in embedded clauses; unlike English however, V2 in Norwegian is not restricted to interrogatives. As has been discussed in much literature on Scandinavian languages, V2 is also optionally available in certain embedded contexts, both as subject-verb inversion and verb movement across negation, the latter shown in (5a, b) (cf. among others Holmberg & Platzack 1995, Vikner 1995, Heycock 2006, Heycock et al 2012, Julien 2007, Wiklund, Bentzen, Hrafnbjargarson & Hróarsdóttir 2009).

(5)   a.   Han sa   at   hun **ikke fikk /   fikk ikke** komme på festen.
                 he   said that she not   could / could not come   on party.the
                 'He said that she was not allowed to come to the party.'
    b.   Hun fant ut   at hun **ikke hadde /   hadde ikke** nok   penger.
                 she found out that she not had /   had   not   enough money
                 'She discovered that she didn't have enough money.'

In a recent corpus survey using the Nordic Dialect Corpus (see Johannessen, Priestley, Hagen, Åfarli & Vangsnes 2009), Bentzen (2013) shows that the word orders Adv/Neg-V and V-Adv/Neg are equally frequent in negated *that*-complement clauses in spoken Norwegian. Thus, in certain embedded contexts, the word order V-Adv/Neg is perfectly acceptable also in adult Norwegian. Bentzen (2013) shows that these are contexts where embedded inversion is also generally accepted, such as *that*-complements of assertive predicates (e.g. *say, believe*) and semi-factive predicates (e.g. *discover, find out*) and certain adverbial clauses (*because*-clauses, consequence clauses, etc.). However, in other embedded contexts V-Adv/Neg (and also inversion) is not possible in the adult language, such as *that*-complements embedded under non-assertive/non-factive predicates (e.g. *doubt, be impossible*) as well as factive predicates (e.g. *regret, it's strange*), embedded *wh*-questions, relative clauses, and certain other adverbial clauses. Norwegian-speaking children have been found to produce V-Adv/Neg in embedded contexts where this is either disallowed or dispreferred in the adult language for quite an extended period, often until age 4-5. That is, children seem to allow V-Adv/Neg in all types of embedded contexts at a certain age (for discussion see Bentzen 2003, Westergaard & Bentzen 2007, Westergaard 2009b).

Given the variation often found in the child data, it is not clear whether the non-target-consistent production is due to the child's linguistic system being syntactically different from the adults', or whether these word orders are caused by problems with pragmatics, processing or other issues. In the study reported here, we aimed to test

a) whether SAI in embedded questions can be primed in children and in adults in English, and
b) whether V-Adv/Neg in embedded *that*-complements can be primed in children and in adults in Norwegian.

On the assumption that ungrammatical structures cannot be primed (Loebell & Bock 2003; Savage, Lieven, Theakston & Tomasello 2006; , the results of this experiment would provide evidence as to whether word orders that are ungrammatical in the adult language are in fact part of the child grammar. If this is the case, we would expect priming of the word orders in question to be observable in children but not in adults. Furthermore, if priming is found to have an effect also in the experiments on adults, this would indicate that the unusual word orders are not completely ungrammatical even for adults, but simply strongly dispreferred. Thus, we might expect to find more priming in the Norwegian adult data than in English, as V-

Adv/Neg word order in embedded *that*-clauses seems to be more frequently attested in spontaneous adult data than SAI in embedded questions in English.

3. The English Study
3.1 Participants and Methodology
There were sixteen child participants (eight females, eight males) aged 3;09 to 4;06 (mean age 4;03). The children were recruited from nursery schools in Edinburgh and Falkland. In addition, a control group of 16 adult participants (13 females, three males) from the University of Edinburgh's student population took part. Standard ethics procedures were followed concerning parental and institutional consent.

Data were collected through a syntactic priming elicited production procedure (Pickering & Branigan 1998), which has been extensively tested in previous research: the Snap card game. We prepared two sets of 32 cards with colored illustrations depicting an object or person. Each set included 24 experimental items and eight filler items. One set of cards was termed the Experimenter's Description Set and the other the Child's Description Set. In the course of the game, the experimenter and the child will take turns in describing a card in their set. An experimental item was defined as an experimental card from the Experimenter's Description Set (the prime card) plus an experimental card from the Child's Description Set (the target card). There were two different pairings. For the target card depicting a teddy who had forgotten where his umbrella was, the two prime conditions were the experimenter's descriptions:

(6)   a. He can't remember where **his sweets are**. (non-SAI)
          b. He can't remember where **are his sweets**. (SAI)

In all the test conditions the object depicted on the experimenter's card was different from the one on the target card, so that the pairings were not a `Snap. In addition, half the prime cards depicted a single object which was described with a singular auxiliary verb, while the target card showed more than one object which required a plural auxiliary verb. In the other half of the trials, this manipulation was the other way round. This was done in order to avoid the child simply repeating the same verb that was said by the experimenter; i.e. to make sure that if there was priming, it was the syntactic structure that would be primed, not the actual lexical items.

For the eight filler cards the object did match, so the child was expected to say that these cards were a 'Snap'. In addition, these cards were described using a different sentence structure, e.g. as in (7):

(7)   He can't remember what goes in the sink.

Two scripts were prepared, each containing a description for each of the prime cards. In each script, 12 of the cards had non-SAI word order and the remaining 12 had SAI. From the scripts we constructed four randomized lists, each containing 24 experimental items and 8 fillers.

In addition to the priming experiment, we also administered to the child participants the British Picture Vocabulary Scale (BPVS), a standardized measure of receptive vocabulary (Dunn, Dunn, Whetton, & Pintilie, 1982) to ensure that children were comparable in terms of verbal ability.

3.2 Procedure and scoring

Each participant was tested individually. Both the children and the adults were told a short story about the "Forgetful teddy". In the story, they heard about a teddy who had lost lots of objects in his house. Twenty-four objects were named in the story, corresponding to the target card objects.

After the story, all participants were told that they were going to play a game of 'Snap' and had to decide when two cards matched. The experimenter showed them three pairs of practice cards to explain what a 'Snap' would look like. The first two pairs were similar to the experimental cards and the experimenter described one card using a non-SAI structure, and the other using an SAI structure. On the final pair, the cards were a match. On each practice trial, the child was prompted in how to describe the card and also encouraged to look carefully at the picture to see if they matched. If the child understood the task, the experimenter continued with the rest of the experiment. The order of the test items (pairs of experimenter-child cards) was randomized for each subject. The experimenter and the Child had a set of stacked cards in front of them. The experimenter explained that for each card they had to look at the picture and describe it before placing the card on the table so that both could see the picture. Each pair was treated as an individual trial and the Experimenter always went first. Thus the experimenter picked up the first card, turned it over and described it before placing it on the table, and then the Child did the same. The Child decided whether they matched or not.

The experimenter also presented each child with the BPVS. The child listened to a spoken stimulus and had to point to the corresponding picture from a choice of four. The order of the Snap game and the BPVS was counter-balanced across the children. Each experimental session was digitally recorded and subsequently transcribed.

Each utterance in the Snap game was coded for sentence structure. We coded an utterance as a non-SAI structure if the object was described before the auxiliary or copula verb, e.g. *He can't remember where **his umbrella** is*. We coded an utterance as an SAI structure if the auxiliary verb was before the object, e.g. *He can't remember where **is** his umbrella*. Partial utterances such as *where his umbrella is* were coded as if the participant had produced a full sentence. If the auxiliary verb was missing or if the participant described the wrong object, the responses were classified as Others. In this category we also placed other utterances that could not be defined using the regular coding.

3.3 Results

We computed the relevant proportions as follows. We divided the number of non-SAI target selections following non-SAI primes by the total number of non-SAI primes (i.e. all non-SAI primes, whether followed by non-SAI or SAI target selections). Similarly, we divided the number of non-SAI target selections following SAI primes by the total number of SAI primes. These proportions were calculated for each participant and for each item. ANOVAs were performed on these data, with separate analyses treating participants (F1) and items (F2) as random effects.

The participants produced descriptions which could be coded using the above scoring method on 690 trials (90%). Of these, 350 (50.7%) were non-SAI trials and 340 (49.3%) were SAI trials. In these 690 trials, the participants produced 666 (96.5%) non-SAI target descriptions and 24 (3.5%) SAI target descriptions. Table 1 shows the proportion of non-SAI and SAI structures that were produced in each of the prime conditions.

Table 1: Number of non-SAI and SAI target descriptions produced after each prime condition.

Group	Prime condition	non-SAI	SAI

Children	non-SAI	168	0
	SAI	138	21
Adults	non-SAI	182	0
	SAI	178	3

There was a strong and reliable priming effect. A 2 (Group) x 2 (Prime) mixed ANOVA revealed a main effect of Group ($F1(1,30) = 5.51$, $p<.05$, partial $\eta2 = .15$; $F2(1,46) = 25.5$, $p< .001$, partial $\eta2 = .36$), with adults producing more non-SAI structures than children. There was also a main effect of Prime ($F1(1,15) = 9.10$, $p<.01$, partial $\eta2 = .23$; $F2(1,46) = 42.5$, $p< .001$, partial $\eta2 = .48$); i.e. more non-SAI targets were produced after non-SAI primes than after SAI primes.

However, the priming effect differed between the Groups, in that there was a reliable interaction between Group and Prime ($F1(1,30) = 5.51$, $p<.05$, partial $\eta2 = .15$; $F2(1,46) = 25.5$, $p< .001$, partial $\eta2 = .36$). Inspection of Table 1 shows that there was a larger priming effect in the group of children than in the group of adults. Simple main effects revealed reliable priming for only the children ($F1(1,30) = 14.4$, $p<.001$, partial $\eta2 = .32$; $F2(1,46) = 66.9$, $p<.001$, partial $\eta2 = .59$); for the adults there was no priming effect ($F1(1,30) = .22$, n.s.; $F2(1,46) = 1.08$, n.s.)

Participants' responses were fit using a mixed logit model (see Jaeger, 2008) that predicts the logit-transformed likelihood of a non-SAI. Due to empty cells (there were no SAI target responses after non-SAI primes), the data was transformed using a weighted empirical logit (see Barr, 2008). The full factorial model (including Prime and Group as factors) was fit and is summarized in Table 2. The non-SAI responses were influenced by Prime; there were more non-SAI targets following non-SAI primes. No other factors were significant.

Table 2: Model coefficients and probabilities for non-SAI target responses models.

Target response	Predictor	Coefficient	Std. Error	t-value	p-value*
non-SAI	Intercept	3.22	0.18	17.5	<.001
	Prime: SAI	-0.39	0.19	-2.08	<.05
	Group: Children	-0.01	0.24	-0.42	=.68
	PrimeXGroup: SAIxChildren	-0.08	0.50	-1.64	=.11

* p-values were estimated using pvals function in R.

4. The Norwegian study
4.1 Participants and Methodology
The participants in the study were 12 children and eight adults. The children (four boys, eight girls), aged 4;2.20-5;11.11, all live in Tromsø in North Norway, and are acquiring the local dialect of Norwegian spoken there. They were recruited from various kindergartens in Tromsø. The adults were all students at the University of Tromsø. Both genders were represented (two males, six females) and all adult subjects were in their early twenties.

The experiment was an elicited production task in two parts, conducted on separate occasions. Both parts involved a set of cards displaying pictures of a teddy bear in various contexts. The cards display two conditions. In the first condition, the cards showed that Teddy could or could not find things he was looking for (the 'find' condition). In the second condition, the cards showed that Teddy was or was not allowed to play with various toys (the 'be allowed to' condition). There were

altogether 32 items and four trials in the tasks. The items were divided into two conditions, with 16 items in each condition. In each of the two conditions, 12 of the 16 item were negative contexts (where Teddy didn't find something, or where he wasn't allowed to play with something), and these (altogether) 24 items were the test items, showing verb placement with respect to negation. The remaining four items in each of the two conditions were positive contexts, and these (altogether) eight items constituted fillers. In addition there were four trials, one positive and one negative for each condition.

The first part of the experiment was aimed at testing which word order the participants would use spontaneously, without priming, in embedded complements of semi-factive predicates. The participants were asked to describe what the cards displayed, and during the trial session, they were specifically instructed to start their descriptions by saying 'This card shows that…'. This was done to ensure that they would produce a semi-factive *that*-clause. Demonstrations of descriptions of the negative cards were provided by the experimenter using the word orders Neg-V and V-Neg one time each during the trial session. During the actual test session, the children were prompted about what the card was showing, if needed. This prompt was provided without the experimenter producing embedded clauses. Examples of the conditions are illustrated in (8)-(9):

(8)   **Condition 1: the 'find' condition:**
a.   Dette kortet   viser at   han finner bananen.   (positive)
        this   card.DEF shows that he   finds banana.DEF
        'This card shows that he finds the banana.'
b.   Dette kortet   viser at   han **ikke finner / finner ikke** koppen.   (negative)
        this   card.DEF shows that he   not   finds   / finds   not   cup.DEF
        'This card shows that he doesn't find the cup.'

(9)   **Condition 2: the 'be allowed to' condition:**
a.   Dette kortet   viser at   han får leke med ballongen.   (positive)
        this   card.DEF shows that he   gets play with balloon.DEF
        'This card shows that he is allowed to play with the balloon.'
b.   Dette kortet   viser at   han **ikke får / får ikke** leke med hatten. (negative)
        this   card.DEF shows that he   not   gets / gets not play with hat.DEF
        'This card shows that he isn't allowed to play with the hat.'

The second part of the experiment investigated the effect of word order priming. As in the English experiment, the participants and the investigator engaged in the specially designed card game 'Snap'. In this game, the players each have a deck of 32 cards with pictures, the same cards as those used in part one. The procedure of the game was as follows: The investigator would pick up one of her cards, and without showing it to the other player, describe what it showed. Then the other player would do the same, and after that, both players would put their card on the table with the picture up. If the cards were different, the game would continue. If they were identical, this was a 'Snap' condition, and the first player to place their hands on both cards and say 'Snap!' would get the pair of cards. The aim of the game was to gain as many cards as possible. The design was such that all the eight positive (filler) items would constitute 'Snap' situations. The 24 negative contexts were sorted in such a way that whenever the investigator had described a card in the 'find' condition, the participant's card would be one from the 'be allowed to' condition, and vice versa. This was done to avoid the participant simply repeating the crucial part of the investigator's description. The investigator used word order Neg-V in 6 items in each condition, and word order V-Neg in 6 items in each condition (altogether 12 items of each word order).

4.2 Results

In part 1 of the experiment, the 12 children generally used the word order Neg-V spontaneously when describing the pictures without any priming. There were occasional examples of V-Neg word order attested, altogether 17 out of a total of 282 relevant examples (6%). In the group of adults, the proportion of V-Neg is in fact higher, with 27 examples of this word order out of a total of 234 relevant examples (11.5%). However, 24 of these are produced by only one participant, who used V-Neg in absolutely all cases. This means that the percentage of V-Neg is quite low for the remaining seven adults, only 1.4% (3/210)

The results from part 2 of the experiment are provided in Table 3. As we see, both children and adults still prefer Neg-V word order, despite the fact that the investigator used V-Neg half of the time. Again there are occasional examples of V-Neg in the child data, but this does not seem to be caused by the word order chosen by the investigator. In fact there are more examples of V-Neg after a Neg-V prime than after a V-Neg prime, 7/143 (4.9%) vs. 4/143 (2.8%). In the adult data, one participant again produced exclusively V-Neg, being responsible for all the 24 examples with this word order in the data. The seven other adults produced only Neg-V, regardless of the priming condition. Unlike in the English data (cf. Table 1), we must conclude that there was no effect of priming in the Norwegian experiments.

Table 3: Number of Neg-V and V-Neg target descriptions produced after each prime condition.

Group	Prime condition	Neg-V	V-Neg
Children	Neg-V	136	7
	V-Neg	139	4
Adults	Neg-V	83	12
	V-Neg	84	12

5. Discussion and general conclusion

The results of this pilot study show that SAI in embedded questions can be primed in monolingual English children, despite its extremely low frequency in the language. Priming is known to boost structures that are part of speakers' knowledge even if they are dispreferred; the results therefore lend support to the view that SAI in child English may be due to non-target grammatical representations and not (only) to performance limitations. The fact that a few examples of priming were also found among the adult controls also suggests that SAI in embedded questions might have, even in the adult language, a different status from completely ungrammatical structures. This would also be consistent with the fact that this structure is found in several varieties of English, in some colloquial styles, and is also amply attested in non-native speakers of English from different native language backgrounds (Pozzan 2011, Pozzan & Quirk, in press).

However, the results from the Norwegian study show absolutely no priming effect, neither in the child group nor in the adults. This is quite surprising, especially given the findings from spontaneous speech in the Nordic Dialect Corpus that the "dispreferred" V-Neg word order is in fact attested to the same extent as the word order Neg-V (Bentzen 2013). For this reason we had expected that there would be more priming in Norwegian than in English.

The results from English, where priming was observed in the child data, support the hypothesis that SAI in embedded contexts is part of the child grammar, rather than the result of problems with pragmatics or processing. Correspondingly,

the lack of any priming effect in the English-speaking adults is consistent with the possibility that for the majority of adult speakers in this study, embedded SAI is in fact ungrammatical. The lack of priming in either Norwegian group, on the other hand, is unexpected for the reason discussed above. Given the evidence that the V-Neg word order is relatively common in embedded contexts in spoken Norwegian, we are reluctant to conclude from the absence of priming effects here that this order is actually ungrammatical for both adults and children. In order to explore other possible explanations for the results obtained in this study, we must consider an adjustment of the methodology and also try out experimental material involving predicates other than *vise* 'show'. We may then be able to better address the extent to which the status of embedded SAI in English and embedded V-Neg order in Norwegian differs in adult and child language. This must be left to further research.

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