Subject-object Asymmetries in the Acquisition of Clefts

Athulya Aravind, Eva Freedman, Martin Hackl and Ken Wexler

1. Introduction

A well-documented asymmetry in children’s acquisition of A-bar movement constructions is that movement of objects is more difficult than movement of subjects. This asymmetry has been most frequently observed with relative clauses (de Villiers et al. 1979, Correa 1995, Friedmann and Novogrodski 2004, Adani 2011, Guasti et al. 2012, a.o), but has also been reported, to a lesser extent, with wh-questions (Tyack and Ingram 1977, Stromswoeld 1995, Philip et al. 2000) and clefts (Bever 1979, Lempert and Kinsbourne 1980, Hirsch and Wexler 2006). This asymmetry is not straightforwardly predicted by syntactic theories of movement, according to which A-bar dependencies can be established while skipping over elements that do not have properties directly relevant to that particular A-bar operation. For instance, the NP the dog in (1) is taken to be irrelevant for the computation of the wh-dependency, since it is not a wh-phrase and cannot participate in wh-question formation to begin with (see e.g. Rizzi 1990).

(1) Which cat did the dog chase ___?

The asymmetry in child language, then, is puzzling. The literature offers two main proposals regarding the source of these patterns, both of which take the asymmetry to be largely superficial. One the one hand, it has been suggested that children’s poor performance with object extraction should be taken to be an indicator of non-adult grammar for the relevant construction across-the-board. Apparent high accuracy on subject extraction is merely the result of child-specific heuristics, like “Agent First” (e.g. Tavakolian 1981, Friedmann and

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1 There are exceptions to this rule. In what Prince (1978) calls “Informative Presupposition” clefts, illustrated in (i) (Prince, 1978), the cleft-clause presents new information.
An alternative family of proposals attributes full competence to children, taking their failures to result from performance or methodological factors. It has been argued, for instance, that infelicitous experimental conditions contribute to children’s low accuracy on object-relatives (Hamburger and Crain 1982, Correa 1995). Processing factors have also been argued to play a role (Goodluck and Tavakolian 1982, Friedmann et al. 2009): specifically, children’s low accuracy with object extraction has been argued to be an exacerbated version of the well-known difficulties adults have in processing object extraction constructions.

This paper discusses subject-object asymmetries in children’s comprehension of cleft sentences, an A-bar movement construction that has received relatively little attention in the acquisition literature. The few previous acquisition studies on clefts have found that children, well into their early school years, show chance-level performance with object clefts, even when they are performing at ceiling with subject clefts, leading to the conclusion that children have an immature grammar of clefts (Bever 1979, Lempert and Kinsbourne 1980, Hirsch and Wexler 2006). Based on a series of experiments, we argue instead that subject-object asymmetries, where they appear, reflect an interaction between two independent factors: pragmatic infelicity and processing difficulty. It has been established in the adult processing literature that object clefts lead to longer reading times than subject clefts (e.g. Tily et al. 2013 and references therein), so it should come as no surprise that these difficulties carry over to child behavior. Pragmatic infelicity, on the other hand, has been overlooked in previous work. One of the key insights from our studies is that once we pay closer attention to pragmatic factors, a novel picture about the subject-object asymmetry emerges: children show non-adult behavior with clefts only when faced with cleft sentences that are both (i) pragmatically infelicitous and (ii) costly to process for independent reasons. In the absence of either factor, children as young as 4 can be shown to be essentially adult-like in their understanding of cleft structures. When pragmatic conditions on cleft-use are satisfied, children are highly accurate on both subject and object clefts. Taken together, our data point to a more nuanced view of the subject-object asymmetry. Given that children can be shown to be adult-like some of the time, even with object clefts, we conclude that their grammatical understanding of clefts need not be qualitatively different from adults. Children’s more limited facility with object clefts, as indicated by their asymmetric failure on infelicitous object clefts, may reflect a general difficulty in processing structures involving object extraction.

2. Background on clefts

Clefts are syntactic focus constructions in which a prominent, i.e. focal, part of the sentence is structurally separated from a backgrounded part. In its classical form, clefts consist of a copular verb, an informationally prominent
phrase, often called the *pivot*, and an embedded relative clause, the *cleft clause*. This paper focuses on English *it*-clefts, exemplified in (2).

(2) a. It’s a dog that ___ chased the cat.  
    b. It’s a cat that the dog chased ___.

A well-known semantic property of clefts is that they are associated with an existence presupposition: they trigger a presupposition to the effect that there exists an entity that satisfies the predicate denoted by the cleft-clause (Akmajian 1970, Higgins 1973, Rooth 1985, Percus 1997, den Dikken 2009). Thus, (2a) above presupposes the existence of a cat-chaser and (2b) presupposes that something was chased by the dog. Furthermore, the presupposition is anaphoric, in the sense that it implies the existence of prior linguistic references to the same information (e.g. Delin 1992). Thus, to felicitously use e.g. (2a), the prior discourse has to have established that something chased the cat. A clearer illustration is provided by the contrast between (3) and (4). The cleft sentence in (3b) and (4b) presuppose the existence of some individual who went to Harvard. Surely, in both contexts, the existence of Harvard-attendees is common knowledge. Nevertheless, only in (4) is the use of a cleft felicitous. This is because only in (4) does the preceding *discourse* mention the information that someone went to Harvard.¹

(3) a. Speaker A: Harvard is a great school.  
    b. Speaker B: Yes. #It’s John that went to Harvard.

    b. Speaker B: Yes. It’s John that went to Harvard.

¹ There are exceptions to this rule. In what Prince (1978) calls “Informative Presupposition” clefts, illustrated in (i) (Prince, 1978), the cleft-clause presents new information.

(i) It was just about 50 years ago that Henry Ford gave us the weekend… He decided to establish a 40-hour work-week, giving his employees two days off instead of one.

There is debate in the field as to whether or not these uses of the cleft form are in fact a variant of the canonical type. Though the information presented in the cleft clause in these cases is indeed new, it nevertheless has the status of not-at-issue content and is generally non-negotiable (Prince 1978, Delin 1992). Lambrecht (1994) argues that these clefts involve a process of presupposition accommodation that has become conventionalized. Given that these types of clefts involve an additional interpretive component that we are not directly interested in, we leave them out of the present discussion.
An immediate consequence of these interpretive constraints is that cleft sentences will necessarily be infelicitous if not couched within an appropriate discourse context, a feature we take to be of importance to the acquisition question at hand. Previous acquisition studies looking at clefts primarily employed act-out and sentence-picture-matching tasks, in which the target cleft-sentences were presented without any supportive context. Thus, to complete the experimental tasks, children consistently had to evaluate sentences that involved presupposition failures. This raises the possibility that previous studies had underestimated children’s competence with clefts. To arrive at a fuller understanding of children’s abilities with clefts, it is essential that we control for the potential effects of pragmatic infelicity. The studies reported here do precisely this, by manipulating directly whether or not the felicity conditions of clefts are met in the experimental context.

3. Design and Predictions

Unlike previous experiments, all of our test items were preceded by a visual and linguistic context. Cleft-sentences for which the existence presupposition is satisfied in the preceding context were considered a “Match” given the context. An example is given in (4). The cleft sentence in (4) introduces a presupposition that an individual exists that is chasing the cat. So much has already been established in the prior discourse. (The tags “Old” and “New” below signals which aspects of the cleft meaning has already been mentioned in the context.)

(4) *Something is chasing the cat. I wonder what it is.*
   It’s *[a dog] [that is chasing the cat.]*
   
   OLD

In “Mismatch” conditions, the existence presupposition of the cleft was not supported by the context. Consider the cleft sentence in (5), which triggers a presupposition that there is something that the dog is chasing. However, this information is new at the point of utterance, since the prior discourse only mentions the existence of something that is chasing the cat.

(5) *Something is chasing the cat. I wonder what it is.*
   It’s *[a cat] [that the dog is chasing.]*
   
   NEW

Felicity (Match versus Mismatch) was crossed with cleft-type (Subject versus Object), giving rise to the 4 conditions in Table 1. We use a Timed Truth Value Judgment Task in all of our experiments, and collected accuracy as well as response times as dependent measures.
Table 1: General Experimental Design

<table>
<thead>
<tr>
<th>Felicity:</th>
<th>Subject Cleft</th>
<th>Object Cleft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Match</td>
<td><em>Something is chasing the cat. I wonder what it is.</em></td>
<td><em>The dog is chasing something. I wonder what it is.</em></td>
</tr>
<tr>
<td></td>
<td>It’s a dog that is chasing the cat.</td>
<td>It’s a cat that the dog is chasing.</td>
</tr>
<tr>
<td>Mismatch</td>
<td><em>The dog is chasing something. I wonder what it is.</em></td>
<td><em>Something is chasing the cat. I wonder what it is.</em></td>
</tr>
<tr>
<td></td>
<td>It’s a dog that is chasing the cat.</td>
<td>It’s a cat that the dog is chasing.</td>
</tr>
</tbody>
</table>

This design allows us to tease apart pragmatic issues from underlying competence in the acquisition of clefts. Below we outline the specific predictions we can make. If children have an adult-like grammar of both subject and object clefts, but have difficulties when faced with presupposition failures, we predict an effect of Felicity. We should find improved performance on the Match Object Cleft condition, but low performance on the Mismatch Object Cleft condition. Moreover, an adult-like grammar might very well imply adult-like processing patterns. Therefore, we expect child RT-patterns to be comparable to those of adults. More concretely, we might expect both adults and children to show longer RTs for object clefts compared to subject clefts (in keeping with the adult processing findings) and also for infelicitous clefts compared to felicitous ones.

If, on the other hand, clefts are genuinely delayed, we expect no effect of felicity; we should simply replicate previous findings. In other words, we should find that children—presumably employing a shallow, word-order-based strategy like “Agent First”—are accurate on subject clefts, but only at chance on object clefts. Furthermore, if children are employing an “Agent First” type of strategy in executing the task, we do not expect there to be any effect of felicity on reaction times. The strategy should successfully apply for all subject-clefts and fail across-the-board in the case of object clefts.

4. Results
4.1. Experiment 1

48 English-speaking children (Mean Age = 5.96), recruited from Boston area daycares and museums, and 45 adults² participated in Experiment 1. Visual and auditory stimuli were presented over a computer using the OpenSesame presentation software with children and Ibex Farm with adults. All of the test scenarios involved two animate entities engaged in a reversible action. There

² 3 adults were excluded from the analysis because they displayed overall (critical + filler items) accuracy rates below 70%.
were 4 items per condition, resulting in 16 critical items altogether. Each item was associated with two scenes. The first scene depicted a partially-occluded event and was accompanied by a prompt calling attention to the occlusion. In the second scene, the full image was revealed, accompanied by a cleft sentence. An example is given in Figure 1. Participants were asked to press one of two keys on the keyboard to indicate whether the cleft sentence was right or wrong with respect to the scenario. Accuracy and Response Times (RTs) were collected as dependent measures.

**Figure 1: Sample test item, Experiment 1**

![Sample test item](image)

Look! Something is chasing the cat        It’s a dog that is chasing the cat.

Though Truth, in the sense of the cleft sentence corresponding to what is depicted in the scene, was initially counterbalanced, the false items are not included in the analysis in Experiment 1 due to a confound. Specifically, these items did not include a genuine “Match” condition, making them difficult to interpret with respect to the relevant factor, namely Felicity.

Figure 2 summarizes the Accuracy results from Experiment 1, for both adults and children. Unsurprisingly, adults showed high accuracy across-the-board on all conditions. Children gave adult-like responses on both Match subject and object clefts at rates of 84% and 83% respectively. Children were also highly accurate on Mismatch subject clefts, at a rate of 82%. However, accuracy dropped to just 34% for Mismatch object clefts. Statistical analyses of the child data (using logistic mixed-effects regressions) revealed a significant Felicity by Cleft-type interaction ($p = .005$), indicating that infelicity led to lower accuracy only with object clefts.

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3 Children were also given 4 filler items involving simple transitive sentences. Adults saw 40 filler items, counterbalanced for Felicity.
Figure 3 represents the RT data from both adults and children. Since errors could have been produced for a number of reasons that we cannot adequately tease apart (e.g., genuine failure, failure to pay attention, etc.), only accurate trials were considered in the reaction time analysis. For both adults and children, object-extraction led to longer RTs than subject-extraction. Infelicitous clefts also led to longer RTs than felicitous ones. Confirming these trends, statistical analyses (using linear mixed-effects regressions) revealed main effects of Felicity ($p = .006$ for adults; $p < .001$ for children) and Cleft-type ($p < .001$ for adults and children).

Age was included as a co-predictor in both models and was found to be highly significant. Increase in Age corresponded to higher accuracy rates ($p < .001$), as well as lower RTs ($p < .001$).

Results from Experiment 1 reveal that children display adult-like accuracy rates with object clefts when their presuppositions are satisfied. This seems to suggest that previous studies, by using infelicitous target sentences, may have misrepresented children’s ability to interpret cleft structures. However, our methodology varied considerably from those employed in previous studies. So, we need to establish that the observed differences in results between previous work and our own are due to our felicity manipulations alone. Experiment 2 serves this purpose.

### 4.2. Experiment 2

Our main goal in Experiment 2 was to demonstrate, using the task and materials from Experiment 1, that the generalized subject-object asymmetry reported in earlier studies resurfaces when we remove the necessary supportive context. On the basis of the results from Experiment 1, we suggested that children’s failure on object clefts in previous studies is due to an absence of necessary linguistic context satisfying the existence presupposition triggered by the cleft. We expect, then, that if we remove the linguistic context accompanying the first scene in our task, the effect of Felicity we found in Experiment 1 should disappear. To test this possibility, we used the same
materials as in Experiment 1, but with the crucial difference that the supportive linguistic context was replaced with the neutral, uninformative prompt, “Look!” Thus, the target cleft sentences in Experiment 2 is fully comparable to the out-of-context clefts employed in previous studies.

24 children (Mean Age = 5:3) participated in the experiment. We found that children were above chance—at rates of 77% and 78%—for subject clefts, but at chance—50% and 49% accuracy—for object clefts. Figure 4 presents side-by-side the results from Experiments 1 and 2. The crucial comparison is between “Match” object clefts in the two experiments: in Experiment 1, children performed at adult-like levels on this condition, but they appear to be guessing on the very same items when the preceding context is removed.

Figure 4: Comparison between Experiments 1 & 2

4.3. Experiment 3

Recall that in Experiment 1, all of the critical sentences were literally true with respect to the situation depicted. The goal of Experiment 3 was to demonstrate that our results from Experiment 1 are robust across Truth. In order to construct non-trivial False items, we modified the experimental scenarios so as to depict pairs of characters participating in two separate events of the same type. An example item is provided in Figure 5.

Figure 5: Sample item, Experiment 3

Look! Something is chasing the cat!  It’s a bird that is chasing the cat.
Methodology and materials were otherwise identical to Experiment 1. Moreover, the linguistic stimuli for the True items were the same as in Experiment 1. We therefore predicted to fully replicate Experiment 1 for the True cases. That is, we expected to find a Type by Felicity interaction in Accuracy rates and main effects of both factors on RTs. All things being equal, we also expected to find parallel effects for False items.

32 English-speaking children (Mean Age = 5;4) participated in Experiment 3. Accuracy rates for True and False items are presented in Figures 6 and 7, respectively. With True cases, children showed adult-like Accuracy rates of 86% for Match Subject clefts, 85% for Mismatch Subject clefts, and 88% for Match Object clefts. For Mismatch Object clefts, Accuracy dropped to 51%. For False cases, children consistently showed accuracy rates above 85% on all conditions. Statistical analyses (using logistic mixed-effects regressions) revealed a significant three-way interaction ($p < .001$) of Felicity, Type, and Truth: Felicity and Type interact, but only with the True cases.

**Figure 6: Accuracy, True Items**

**Figure 7: Accuracy, False Items**

Response time data were also collected and are represented in Figures 8 and 9. The general trends in response times are parallel across Truth and resemble those found in Experiment 1. First, we observe that children took longer to respond to infelicitous items than to felicitous ones. This trend was confirmed using a linear mixed-effects regression, which revealed a significant main effect of Felicity for both True ($p < .001$) and False ($p = .003$) items. Children also took longer to respond to object clefts than subject clefts, for both True and False items. Though the trend is present numerically, this was not found to be statistically significant.

Our predictions for Experiment 3 were not fully borne out. Most strikingly, we observed an interesting difference in Accuracy between True and False trials. With the True items, we find an asymmetry between infelicitous subject and infelicitous object clefts as in Experiment 1 (Figure 6). However, with False items, we find high accuracy across-the-board (Figure 7). One possible explanation for this pattern is that with False items, children can make use of additional contextual cues, which in turn lead them to the right answer. For instance, merely keeping track of the fact the two mentioned characters do not participate in the same event in the visual scene can lead one to respond with
“False”. Despite the availability of this potential strategy, the response time data, in particular the fact that children take longer to respond to infelicitous clefts (Figures 8/9), reassure us that children are sensitive to the pragmatic conditions on cleft-use, even when the accuracy data obscure this fact.

**5. Discussion**

The main novel finding from this series of experiments is that children show adult-like behavior on cleft sentences when their discourse constraints are satisfied. This is evident both in Accuracy and Reaction Time results. Children showed adult-like accuracy for clefts used in felicitous contexts, irrespective of type (subject vs. object; Experiments 1 and 3). Moreover, children’s reaction time patterns were strikingly similar to those of adults. Like adults, they took longer to respond to object clefts than subject clefts, suggesting that they, like adults, were constructing the appropriate filler-gap dependency (Experiment 1). They also took longer to respond to infelicitous clefts than to felicitous ones, suggesting adult-like sensitivity to the pragmatic conditions on cleft-use (Experiments 1 and 3). We conclude, based on these parallels, that children are likely not using a non-adult heuristic in their interpretation of clefts.

Taken together, our data, in particular the fact that accuracy rates on felicitous object-clefts were no different from the subject-cleft counterpart, suggest that children’s difficulties with object-clefts should not be taken to mean that they have not acquired these structures. Rather, as their behavior on Mismatch and out-of-context object-clefts reveal, children’s accuracy with object clefts drop precisely when the sentence involves a presupposition failure. We take our findings to support a view in which at least part of children’s grammar of clefts is in place: after all, to display sensitivity to presupposition failure, one needs to know that the construction triggers a presupposition in the first place.

We do, however, find an interesting variant of the subject-object asymmetry. We find that infelicitous subject clefts incur longer RTs than their felicitous counterparts, but are often given an accurate parse. On the other hand, infelicitous object clefts lead to longer RTs—in fact, the longest of the 4 conditions—and also lower accuracy. If we are on the right track in suggesting that children’s apparent failure on object clefts in previous studies is also due to
infelicitous experimental items, those data only serve to strengthen this asymmetry. Thus, we are faced with a revised question concerning the subject-object asymmetry: why do children asymmetrically fail on *infelicitous* object-extraction constructions?

In what follows, we present what we find to be a plausible explanation of this revised puzzle. It is well known that in real-time language processing, adults take longer to parse filler-gap dependencies with object-extraction than variants with subject-extraction (Wanner and Marastos 1978, Gibson 1998, Warren and Gibson 2002, a.o). Our response time results from adults in Experiment 1 offer further support for this idea: holding felicity constant, object clefts showed longer response times than subject clefts. Various metrics have been forwarded to explain the processing cost incurred by object extraction relative to subject extraction. For concreteness, we adopt here a proposal developed by Gibson (1998), which takes processing difficulty to increase with the *length* of the filler-gap dependency, calculated in terms of the amount of lexical material that intervene between the filler and the gap (see also Warren and Gibson 2002, Lewis et al. 2006). Filler-gap dependencies involve a constant effort by the processor to relate the filler to the appropriate resolution site. The greater the distance between the two and the longer the filler needs to be held in memory, the greater the burden on the processor. Additionally, we assume here that the processing of presupposition failure is also independently costly (see e.g. Schwarz 2007). This idea, too, finds support in our adult response time results: across cleft-type, infelicitous clefts took longer for adults to process than felicitous ones.

The additive effects of the two independent processing costs make infelicitous (i.e. those involving presupposition failure) object clefts the hardest to process, as demonstrated by the fact that this condition shows the longest RTs, for both adults and children (Experiments 1 and 3). We suggest that these aggregate costs might exhaust children’s more limited computational resources, essentially leading to a processing overload effect. With adults, similar sorts of effects are found in the processing of multiply-nested structures, which, though grammatical, can often lead to failed parses due to their high processing costs. In the case of children, we reason that the combined processing load associated with object extractions in infelicitous contexts suffices to cause such a breakdown.

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*The data here are compatible with a number of different proposals about processing cost. For instance, there are analyses that attribute these effects to a preference for initially assuming subject-extracted structures, resulting in later revisions for object extraction constructions (e.g. Clifton and Frazier 1989) or an interference from an intervening NP with similar syntactic and semantic properties as the filler (e.g. *the cat and the dog* are both animate lexical nouns) (Gordon et al. 2001, Lewis et al. 2006, Friedmann et al. 2009). Crucially, these accounts share in the assumption that object-extraction poses additional memory demands, either because of a need to revise or because of inference between the object and subject noun phrases.*
If children fail to parse a cleft sentences when they involve a combination of these two factors—processing cost associated with object-extraction and processing cost of presupposition failure—we expect that eliminating one or the other would result in higher performance. This is precisely what we find with felicitous object clefts, which eliminates costs associated with processing presupposition failure. This view is also consistent with two findings from the relative-clause acquisition literature. First, it has been shown that meeting the felicity conditions on relative clause use improves child accuracy (e.g. Hamburger and Crain 1982, Correa 1995). Second, manipulations shown to facilitate adult processing (e.g. mismatches in animacy between the two NPs, use of a pronominal intervener, etc.) have also been found to improve child performance (e.g. Arnon 2009, Adani 2011). A natural next step for us would be to establish that facilitating the processing of clefts also results in higher accuracy, even for infelicitous object clefts.

5.1. Reduced clefts

Before closing, we would like point out one potential issue that could call into question some of the conclusions drawn here. A consequence of the anaphoric nature of the presupposition associated with clefts is that in a felicitously used cleft, the cleft clause will contain old information. All of the relevant new information could be expressed by the pivot alone. The fact that the cleft-clause is old often allows for the elision of the clause altogether, forming what is typically referred to as “reduced-clefts” (6).

(6) The dog is chasing something, I wonder what it is!
   It’s a cat!

It is possible that in our Match conditions, children arrive at the right answer by parsing only the pivot. This type of behavior, if present, may be indicative of a more economical parsing strategy, in which case, we might expect adults to make use of it, as well. A more interesting possibility is that children parse only the pivot because they only have a partial knowledge of clefts, which amounts to understanding only reduced cleft-structures.

On the basis of our reaction time data, we do not believe that children are consistently relying on a reduced cleft strategy. A “pivot-only” approach should apply equally well to subject and object clefts, which then predicts no differences in RTs across cleft-type for Match items. The fact that we do find RT-differences based on cleft-type suggests that at least some children are parsing the entire structure. Nevertheless, we do find it plausible that a subgroup of children may be failing to parse the cleft-clause altogether. If so, we are left with a more nuanced picture of cleft acquisition. We might imagine, for instance, a stepwise developmental path in which understanding only reduced clefts constitutes a medial stage. We find this possibility worth examining further and will do so in future work.
6. Conclusion

This paper reported on a series of experiments investigating subject-object asymmetries in children’s behavior with cleft sentences. We found subject-object asymmetries to arise only when the clefts in question involved presupposition failures. Children behaved essentially adult-like on both subject and object clefts when they were used felicitously, but were at chance on infelicitous object clefts. We argued that children’s high sensitivity to presupposition satisfaction in clefts should be taken as indication that they know more about cleft syntax and semantics than previously thought. Furthermore, we argued that children often failed to give a full parse to infelicitous object clefts because both object-extraction and presupposition failure incurred independent processing costs, the combination of which over-burdened the child processor. On this view, children’s failure on object clefts, when it occurs, need not indicate a failure to comprehend object clefts generally.

We would like to end on a note about methodology. Since sentence comprehension is a complex task involving the interaction of various grammatical (syntactic, semantic) and extra-grammatical (pragmatic, processing) components, children’s failures in a comprehension task could reflect a failure on any one of these factors. Our experiments provide an illustrative case study: upon controlling for the various factors involved, a previously obscured developmental pattern is revealed.

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