

Economy of Representation: Ellipsis and NP Reconstructions

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1. Introduction

Based on acquisition data, economy of representation governs VP reconstruction and captures the child's first representation of ellipsis. This paper aims to cast light on children's knowledge of VP reconstruction and determiner phrase (DP) structure. VP ellipsis is exemplified in (1). "Did too" in the second conjunct stands for the

(1) John pushed his car, and Bill did too.

phonologically null VP to give the interpretation " John pushed his car and Bill pushed his car too." Specifically, "did" supports Tense which is not deleted because it is a bound node. Tense or Inflection governs the empty category which is a trace of the elided VP. In Arabic, however, IP instead of VP is elided. The Arabic surface word order VSO is derived by moving the head V to I. Because Tense and AGR features are bound morphemes, head V to I movement is obligatory at S-structure (Fassi Fehri, 1993). Raising the Subject NP to Spec IP to yield SVO order is optional. When ellipsis occurs, I which is occupied by V is elided. So what is left is the subject NP as in (2).

(2) Mohammad daf sayya:rtah we Ali ba?ad.

Mohammad push (3SM Past) car- 3SM, and Ali too.

(Mohammad pushed his car, and Ali did too.)

Within a minimalist projection theory, NP lexical projections are predicted to emerge before the functional projections, DP's (Perez-Leroux and Roeper, to appear). This is not a violation of UG, since NP is also a possible projection. This account follows from the bound variable reading phenomenon where children allow bound variable reading for bare nominals and restrict them to local antecedents (Perez-Leroux and Roeper, to appear). In VP ellipsis, children tend to give bound variable reading or "sloppy interpretation" to nominal constructions when unbound variable reading or "strict interpretation" is expected. Sloppy interpretation results when the elided pronoun is referentially dependent on the subject of the second conjunct and hence interpreted as a bound variable as in (3).

reference. Sloppy reading is similar to bound variable reading, whereas strict reading is parallel to unbound variable reading. If children give bound variable reading to the elided object DP, this indicates that they reconstruct a NP. However, if they provide unbound variable reading, a DP with independent reference is reconstructed. We propose that children undertake DP reconstruction as bare NP under ellipsis.

In section 2, we will present some of the theories of DP and NP projections that are compatible with child data. Two experiments, one on VP ellipsis and DP reconstruction and a second one on explicit DP constructions, are presented in sections 3 and 4. In 5, a discussion of the evidence and compatible theory is provided.

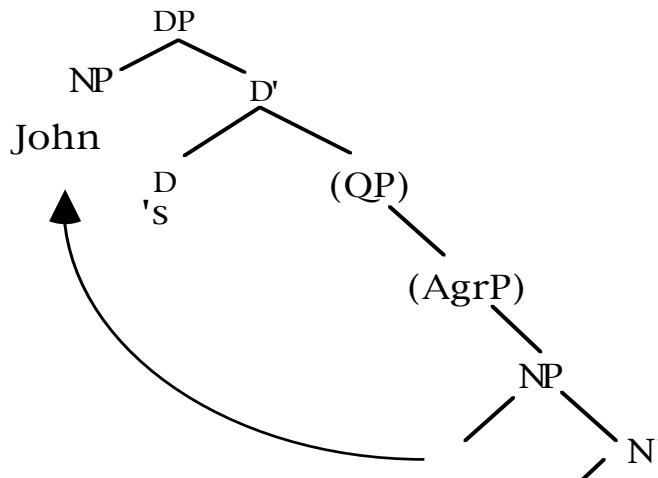
2. Issues in the acquisition of DP

In this section, we review some theories about the acquisition of NP and DP structures. Language acquisition theory makes a distinction between functional categories DP, with referential or specific feature, and NP, a set of lexical projections (Roeper, to appear). There are two groups of theories that provide two different phrase structural representations for DP-NP distinction; these are the following:

2.1 The DP representation (e.g. Abney, 1987; Johnson, et. al., 1996)

Under this representation, the possessor raises to Spec, DP to check D features, such as Case as in (5). Here, the possessor has definite reference. The possessor can be a full DP because it can have overt determiners, proper names, relative clauses and adjectives (Munn, 1995) as in (6).

(5)



2.2 The NP representation

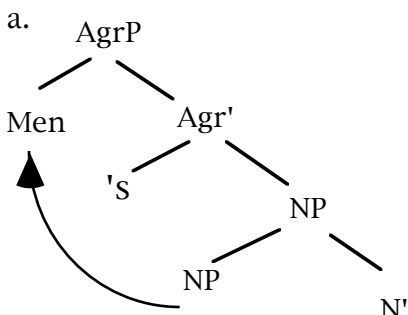
The second group of theories makes a distinction between NP and DP representations. In the NP, the position of the possessor is somewhere else lower than the Spec, DP. The possessor is not specific or referential. Some of the suggested positions are as follows:

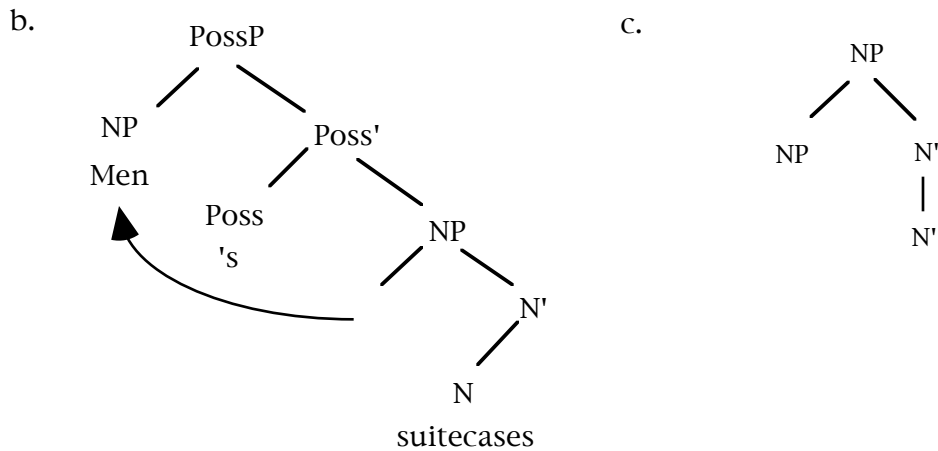
a. The possessor is in Spec, NP (e.g. Roeper, to appear; Perez-Leroux and Roeper, 1996; Munn, 1995). In (7a), the possessor NP might move to Spec, AgrP for Spec-head Agreement but not further because the NP does not bear D features since it is not specific. Under this representation, Roeper (to appear), for example, suggested that children project either bare nouns with a bound inherent variable, or a NP with an implicit possessor in Spec, NP which does not have independent reference. The bare NP is subject to binding via a PRO in the Spec of NP (Munn, 1995) in sentences like “Everyone went home”, which children of 4 years old command (Perez-Leroux and Roeper, 1996). Therefore a bare NP under ellipsis should also be subject-bound, and hence only bound reading is available to the child.

b. The possessor is in Spec, PossP as in (7b) (e.g. Fassi Fehri, 1993). Under this analysis, a PossP is assumed to be projected below D, and the possessor is generated in situ in the Spec position of PossP. This projection is possible in child grammar since there are still no D features which would otherwise make available the specific reference reading, that is unbound reading.

c. The possessor is in compound NP's as in (7c) (e.g. Demske, to appear; Johnson, et.al., 1996). D is still unavailable to give the specific reference feature. The expected interpretation is bound reading. As (a and b), this representation might account for the type of NP children reconstruct.

(7)





Predictions:

Under this view, we predict that children speaking English or Arabic should allow NP projections as minimal structures since DP's are subject to language specific triggers. The further assumption is that, after children acquire a DP, they may still reconstruct only a NP in VP/IP ellipsis. This also could be an indirect evidence of the sequence of development of NP before DP. Furthermore, we will show that children prefer bound variable reading of elided possessive pronouns. This provides acquisition evidence that children reconstruct NP's with a locally bound possessor represented below Spec, DP (as in 7 a, b or c) because the sentential subject is external to the NP projection (Perez-Leroux and Roeper, to appear).

If significant differences between Arabic and English speaking children were found, such variations could be accounted for, as suggested by Fassi Fehri (1993), in terms of the interlanguage morphological differences. For example, in English, but not in Arabic, the possessive marker ('s) is a suffix occupying the head of DP (de Villiers and Roeper, 1995) which realizes the Poss feature in the functional category D (Demske, 1995). In Arabic, however, D features are not phonologically realized, hence genitive is an abstract feature. At the same time the word order is different from English. The head N comes before the possessor (e.g. car John). The head N seems to be raised to Spec, DP for Spec-head agreement and to check the Poss feature in D. Such morphological triggers might account for some of the variabilities in the acquisition of the two languages.

The general conclusion that we will come to is that children derive functional maximal projections (DP) (as in 6) but might be delayed in their reconstructing these projections. Later when grammar is fully developed, the two derivations become

sentences were divided into the following:

3 sentences with definite articles as in (8 a and b).

- (8) a. The elephant hit the bear, and the giraffe did too.
 b. El-fi:l THarab el-dub w-el-zara:fah ba?ad.
 The-elephant hit(3SM Past) the-bear and-the-giraffe too

3 sentences with indefinite articles as in (9 a and b).

- (9) a. The cat hit a tree, and the dog did too.
 b. El-gaTwah THarabat shadgarah w-el-kalb ba?ad.
 The-cat hit(3SF Past) (a) tree, and the -dog too.

12 sentences with possessive pronouns in the DP of the first conjunct: 6 of these had subjects of both conjuncts agree in gender as in (10 a and b), and another 6 had subjects of different genders with variable order as in (11 a and b).

- (10) a. John pushed his car, and Bill did too.
 b. Mohammad daf sayya:rtah we Ali ba?ad.
 Mohammad push (3SM Past) car- 3SM, and Ali too.

- (11) a. John threw his ball, and Mary did too.
 b. Mohammad rama: ku:rtah we Sarah ba?ad.
 Mohammad throw(3SM Past) ball-3SM, and Sarah too.

4 sentences were constructed with a possessor proper name (and the possessive 's in English) in the DP of the first conjunct as in (12 a and b).

- (12) a. Tom lifted John's jeep, and Bill did too.
 b. Fawaaz rafa? dgeib Mansour we Mohammad ba?ad.
 Fawaaz lift (3SM Past) jeep Mansour, and Mohammad too.

The adult grammatical unbound interpretation for DP's with possessors as proper names or definite articles (as in 8), for example, in which the giraffe hit the same bear as the elephant did, was tested against the ungrammatical bound variable reading, in which each of the elephant and the giraffe hit a different bear. We

Two control matrix sentences (13 and 14) were administered to ensure that children understand that dolls can either act upon their or the other dolls' objects and that children are not depending on context for interpretation. The sentences were also for training the children on how to play the game. For these sentences children were redirected if they made an error.

(13) Bill pushed John's car.

(14) John pushed John's car.

3.2 Procedures

The experimenter first introduced to the child the dolls, dressed either in blue or red, and showed each have their own objects. Then the experimenter showed that sharing among the dolls was not restricted. The child was then asked to act out the control sentences. Then the experimenter removed all the toys and instructed the child to act out each sentence said by the experimenter with the dolls and toys presented to the child per sentence. By using acting out as a response method, a child was left to seek his own interpretation which could be a consistent biased reading or a random acting out (Koster, 1992). The characters for each sentence were introduced in a lead-in sentence (Here's John and Bill). A carrier phrase was used before each sentence to control voice level and also to prepare the child to what's coming next. Each child listened and acted out 22 test sentences. The session was videotaped.

3.3 Subjects

48 native English and Arabic speaking male and female children of the age ranges 3 to 7 years old participated in the study. Hearing screening was administered. The Arabic speaking children were either enrolled in a university daycare center or at a summer camp in Riyadh, Saudi Arabia. All the English speaking children were enrolled at a daycare center in Amherst, Massachusetts. 10 Arabic speaking adults were also tested. The distribution of subjects per age and language is in Table 1.

Table 1 Distribution of subjects per age range, language and gender (Male=M or Female=F)

4. Results

In general, the possible readings of DP structures in VP/IP ellipsis did not seem to be open to cross-linguistic variation. The contents of the D [the, NP's, POSS] were all without effect, except for the NP's for English. Bound reading was the preference in both languages for DP structures with possessive pronouns of the same or different gender, definite and indefinite articles. This is consistent with the view that only an NP is reconstructed. Table 2 depicts the bound variable reading responses per age group for English and Arabic speaking children. Percentages and means represent how much bound variable readings children gave for each type of DP structure in VP/IP ellipsis. Responses for DP structures with a possessor (and a possessive 's for English) had, however, more unbound variable readings or strict interpretations. Though the Arabic speaking children started with a high percentage of bound variable reading for the age ranges 3-4 (80%) and 4-5 (84%), they increasingly showed unbound variable reading as they got older. Though we did not obtain data from English speaking children of older ages, we observed a low bound variable reading for the possessor construct and predict that it would get closer to the adult grammar in subsequent age ranges.

Table 2 Mean percentages of bound variable reading responses for age group, language background and DP structure conditions by both English and Arabic speaking children.

Age group	Language Background	Possessive Pronoun Same Gender	Possessive Pronoun Different Gender	Definite Article	Indefinite Article	Possessor Name (in English Poss. 's)
3-4	Arabic	100% (6)	100% (6)	66.6% (2)	94.4%(2.8)	80% (3.2)
3-4	English	100% (6)	97% (5.8)	72% (2.2)	100% (3)	32.5%(1.3)
4-5	Arabic	98.5% (5.9)	100% (6)	69.7%(2.1)	93.9%(2.8)	84% (3.4)
4-5	English	90.5% (5.4)	92.9%(5.6)	76% (2.3)	95% (2.9)	32% (1.3)
5-6	Arabic	100% (6)	100% (6)	79%(2.4)	100% (3)	71.9%(2.9)
6-7	Arabic	100% (6)	96.7%(5.8)	80%(2.4)	100%(3)	47.5%(1.9)
Adults	Arabic	93.3% (5.6)	90% (5.4)	0%	83.3%(2.5)	5% (.2)

To find out whether there were significant effects of any of our tested variables

Source	SS	DF	MS	F	P
Between subjects					
Age group	0.078	3	0.026	0.443	0.724
Error	1.821	31	0.059		
Within subjects					
DP Structure	2.793	4	0.698	16.097	0.000
DP Structure					
*Age group	0.849	12	0.071	1.632	0.091
Error	5.379	124	0.043		

Table 4. Summary of repeated measures ANOVA for DP structure conditions for English speaking children (N = 13)

Source	SS	DF	MS	F	P
Between subjects					
Age group	0.051	1	0.051	0.304	0.592
Error	1.854	11	0.169		
Within subjects					
DP Structure	3.993	4	0.998	14.863	0.000
DP*Age group					
DP*Age group	0.242	4	0.061	0.902	0.471
Error	2.955	44	0.067		

Test of contrasts showed that DP with the possessor name was significantly different from the average of the other conditions at $p = < .05$.

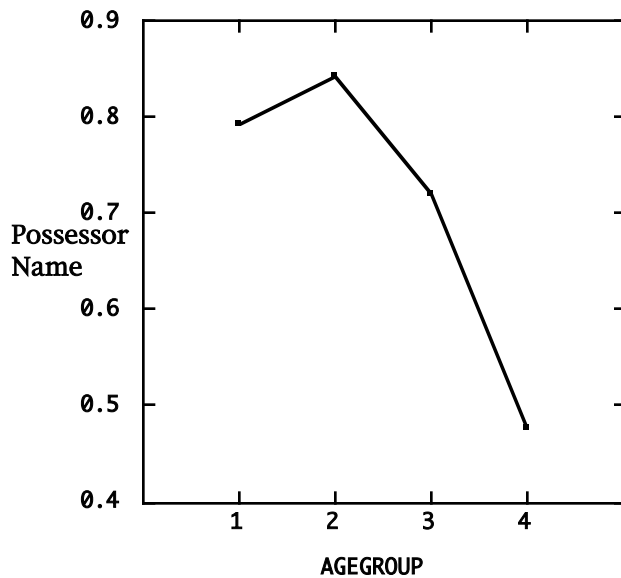
2. For Arabic data, the DP condition with the possessor name can be predicted from age.

We were also interested in finding whether there was a developmental regression of bound variable reading among the DP conditions. Results of trend analysis did not show significant developmental trend (as shown in Table 5). Since we observed a suggestive hint of developmental regression for the DP with the possessor name in the Arabic data, we ran a multiple regression model to find out whether the development of the reconstruction of DP with the possessor name in IP ellipsis was related to age.

Table 5 . Trend analysis of polynomial order 1 for developmental change in DP reconstructions among Arabic speaking children

Error	1.909	31	0.062		
Indefinite article	0.020	1	0.020	2.231	0.145
Error	0.274	31	0.009		
Possessor name	0.439	1	0.439	2.754	0.107
Error	4.947	31	0.160		

Figure 1. Regression of bound variable readings for DP with possessor names on age group is depicted in a line graph.



Regression equation was calculated for the data. Table 6 shows that the regression coefficient for age group (- .14) was statistically significant at $p = .033$ indicating that this estimate could be a reliable predictor of the population parameter (β_1). The regression equation (Possessor name = $.794 + (-) .14 * \text{Age group} + .369 * \text{Definite article}$) means that for every group (or year) of age, the percentage of bound variable readings for reconstructed DP structures with possessor names will decrease by 14% percent, i.e. children will give more unbound variable readings as they grow older as in the adult grammar.

Table 6. Summary of multiple regression analysis of DP with possessor name on age and DP with the definite article for Arabic speaking children

Dependent variable: Possessor name N:35
Multiple R: 0.388 Squared multiple R: 0.150
Adjusted squared multiple R: 0.097 Standard error of estimate: 0.390

Variable	Coefficient	Standard error	Stn coef	Tolerance	T	P(2 TAIL)
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significant ($p = .000$), as was the DP conditions by child/adult group interaction. When we performed simple ANOVA's, all structures were significantly different at $p < .05$. Children, for example, were more consistent with bound variable reading for DP condition with possessive pronouns of different gender than adults. Adults seem to perceive it as less ambiguous and prefer the unbound variable reading possibly because of the gender mismatch. This might be an indication that children regardless of gender differences reconstruct a bound variable.

Table 7. Summary of repeated measures ANOVA for DP structure conditions for Arabic speaking children and adults ($N = 45$)

SOURCE	SS	DF	MS	F	P
Between subjects					
Child/adult	4.452	1	4.452	88.455	0.000
Error	2.164	43	0.050		
Within subjects					
DP structure	12.332	4	3.083	78.354	0.000
DP structure					
*Child/adult	3.605	4	0.901	22.904	0.000
Error	6.768	172	0.039		

4. Only possessor name constructions were significantly different between the two languages. ($p = < .05$).

As for interlanguage differences, we compared the Arabic and English data from children of the same age range (3 to 5 years old). There was a significant language effect ($p = .029$) (Table 8). DP conditions had significant main effect. When we performed simple ANOVA's, we found out that only DP condition with the possessor name was significantly different between the two languages ($p < .05$). Unbound variable reading seem to emerge earlier among English speaking children than Arabic speaking children as was displayed in their percentages in Table 2. Other than that, children of both languages seemed to reconstruct DP structures in a similar manner.

Table 8. Summary of repeated measures ANOVA for DP structure conditions for English and Arabic speaking children ($N = 30$)

5. Experiment 2

To answer the question whether children would give sloppy reading to explicit DP constructions when ellipsis is not present, we administered a second experiment. Our prediction was that children would not give bound variable reading when the NP has a specific reference. It is only when ellipsis is used, the reconstructed DP is subject to general principles of economy of representation.

5.1 *Stimuli*

16 counterbalanced sentences consisted of the following:

4 conjoined sentences with the *it* used in place of the object DP in the second conjunct as in (14)

(14) John pushed his car, and Bill pushed it too.

4 conjoined sentences with the *that* used in place of the object DP in the second conjunct as in (15)

(15) Bill kicked his ball, and Mary kicked that ball too.

4 sentences with conjoined subjects and explicit possessor as in (16)

(16) John and Bill pushed Bill's car.

4 sentences with simple subject and explicit possessor as in (17)

(17) John lifted Mary's bag.

The conjoined subject structure (16) was provided to further test whether children would give such structures unbound variable readings. If they do, then children interpret the subject complex NP as one unit. This fact would indicate that conjunction

experimental sentences, two control sentences were conducted to ensure that children have experience that each character could possibly relate to his own thing as in (18a) and that they could pragmatically relate John to Bill's car as in (18b).

- (18) a. John lifted the red car, and Bill lifted the blue car.
 b. John pushed the red car, and Bill pushed the red car.

5.3 Subjects

8 native English speaking children of the age range 3 to 5 participated in the study.

6. Results

Our second experiment showed no general pragmatic factor dictating bound-variable interpretation when ellipsis is not present. English speaking children gave 97.7% (125/128) unbound readings for the DP in the second conjunct of the 16 sentences. Unlike DP reconstruction in ellipsis, children comprehended the overt DP in the second sentence. At the same time, children treated the conjoined subject NP as on complex unit, hence conjunction is represented differently from reconstruction. Table 9 shows the results of all the children. Percentages represent the amount of unbound variable readings children supplied.

Table 9. Unbound variable reading responses children supplied to the different DP types.

Age group	DP (it)	DP (that NP)	Explicit Possessor	Conjoined Possessor
3 (N= 2)	100% (8/8)	100% (8/8)	100% (8/8)	87.5% (7/8)
4 (N= 4)	87.5 % (14/16)	100% (16/16)	100% (16/16)	100% (16/16)
5 (N= 2)	100% (8/8)	100% (8/8)	100% (8/8)	100% (8/8)
Total	93.8% (30/32)	100% (32/32)	100% (32/32)	96.9% (31/32)

7. Discussion

Children in both languages showed preference for bound variable reading. Features of the core grammar seem to be universal. This evidence supports the hypothesis that a NP is reconstructed by children and not a DP. As for the possessor

In English, the unbound variable reading indicates this process to be satisfied at an earlier stage than in Arabic. However, in Arabic, the bound variable reading indicates that children do not raise the possessor to Spec-DP to get genitive features and hence independent reference. A possible mechanism that children in Arabic use is that the head N might move to a projection below D which is not available as a landing site. The motivation for this mechanism is to account for the word order in Arabic where the head N precedes the possessor. Roeper and de Villiers (1991) suggested that functional categories require specific triggers. A DP in a language where elements, such as the quantifier “all”, are uniformly to the left of the NP as in English is easier to acquire than a DP where a quantifier can occur on both sides as in Arabic.

A further support is lent to the hypothesis that children reconstruct a NP or bare nouns with implicit locally bound possessor (Perez-Leroux and Roeper, 1995; Roeper, to appear). We observed that when some children who gave bound variable reading to items with a possessor name were asked what the subject of the second conjunct did, they responded with a possessive pronoun (his/her) substituting the possessor name in the first conjunct.

In the second experiment, children did not reduce explicit DP's to bare NP's. This experiment showed that pragmatic level alone might not be sufficient to account for the type of reading children provide. The explanation seem to reside within the syntactic theory. Therefore, it follows that there is a distinction in child grammar between lexical projections which are triggered by virtue of the economy principle, and functional projections (de Villiers and Roeper, 1995).

How then do children move to the adult reconstruction of a full DP under ellipsis? The evidence suggests that the possessive [Bill's car] forces full reconstruction first, followed by the definite article, and the pronominal possessive. DP's reflect language particular features while NP's do not (Johnson et al,1996). Therefore it is expected that DP is reconstructed in ways sensitive to those features.

In conclusion, economy of representation captures the child's first representation of ellipsis. Full reconstruction reflects the earlier step-by-step acquisition of full representation of language-particular features of DP's.

Children also demonstrated knowledge of how null VP's are reconstructed. VP ellipsis represent the children's knowledge of ECP; the empty category VP is properly

instead of a DP. Given the difference between reconstructions in our ellipsis experiment and full interpretation of DP in our experiment with the explicit DP available at DS, reconstruction seems to be syntactic in nature and subject to economy of representation even in adult grammar when full reconstruction is otherwise not satisfied.

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