Learning Verb-Argument Structure: Rules and Construction Effects*

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1. Introduction

Researchers have long debated the mechanisms by which verb argument structure is acquired (e.g. Waryas & Stremel 1974, Cook 1976, Osgood & Zehler 1981, Roeper, Lapointe, Bing & Tavakolian 1981, Mazurkewich & White 1984, Pinker 1984, 1989, Gropen, Pinker, Hollander, Goldberg, & Wilson 1989, Randall 1992, Snyder & Stromswold 1997). Much of this research has focused on languages like English, where lexical semantics plays a role in determining, for example, which verbs undergo dative shift. This has lead some researchers to propose that young language learners have early access to the semantics of different verb classes and their corresponding thematic linking rules (e.g. Pinker 1989). Other researchers have recently challenged this view by proposing that young language learners are conservative, using individual verbs only in the syntactic frames in which they have been heard, and acquiring knowledge of the syntax of verb argument structure slowly, verb by verb (e.g. Tomasello 1992).

We suggest that some of the controversy surrounding these issues may arise from the language specific lexical characteristics of English, where clues to a verb's argument structure are embedded within the lexical semantics of the verb itself. That is, there are few morphological clues as to the semantic class of

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the verb.[1] In contrast, many languages overtly mark grammatical function changing operations with a specific morpheme. For example, Bantu languages have a productive applicative (or benefactive) morpheme *–el-* that adds another argument to the verb. This is shown in examples from the southern Bantu language Sesotho, where the animate object must be ordered immediately after the verb (1b,c).[2]

(1) a. Bana ba-pheh-a nama
children AGR-cook-FV meat
'The children are cooking meat'

b. Bana ba-pheh-el-a mme nama
children AGR-cook-APL-FV mother meat
'The children are cooking meat for my mother'

c. *Bana ba-pheh-el- nama mme
children AGR-cook-APL-FV meat mother

In languages where grammatical relations are overtly marked on the verb, lexical learning about word order restrictions should not be necessary. Rather, language learners should be able to apply appropriate word order across the entire class of verbs that is marked with a particular morpheme. We should therefore expect early error-free use of such constructions across the entire class of verbs to which they apply.

Examining the acquisition of verb argument structure in languages that overtly mark argument structure relations provides an ideal test case for evaluating the hypothesis that young language learners are conservative, learning word order restrictions on an item by item basis. Rather, we predict that learners will make early and robust syntactic generalizations, applying these across the board, regardless of lexical item. One of the most studied and best understood constructions in Bantu languages is the Double Object Applicative which has received intensive crosslinguistic examination. The purpose of this study was therefore to determine 1) when children show syntactic knowledge of postverbal word order restrictions in Sesotho Double Object Applicative constructions and 2) if there is any evidence of lexical learning effects.

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1. A possible exception would be those verbs that do not undergo the dative alternation in English. These are largely derived from Latinate stems that are typically mulitisyllabic.
2. A modified (more phonetically transparent) version of Lesotho orthography has been used. Glosses are as follows: ADJ = adjectival agreement, AGR = subject agreement, APL = applicative, CAUS = causative, FUT = future, FV = final vowel, OBJ = object marker, PERF = perfect. Well-formed target utterances are provided in parentheses as needed.

The rest of the paper is organized as follows: Section 2 provides a brief introduction to Sesotho Double Object Applicatives and discusses findings from previous studies. Section 3 outlines the experimental procedures used to examine children's knowledge of postverbal word order in Sesotho Double Object Applicatives. Section 4 presents the experimental results. Section 5 discusses the implications of the findings for learning the argument structure of verbs, and for language acquisition theory more generally. The paper concludes in Section 6.

2. The Acquisition of Sesotho Double Object Applicatives

Double Object Applicative constructions have been extremely well studied across a variety of Bantu languages (e.g. Sesotho - Morolong & Hyman, 1977, Machobane, 1989; Haya – Duranti & Byarushengo, 1977, Hyman & Duranti, 1982; Chichewa – Marantz, 1984, Baker, 1988, Alsina & Mchombo, 1990; Kichaga – Bresnan & Moshi, 1990; Chishona – Harford, 1993). Although there are differences among Bantu languages as to whether both objects or only the applicative object can show true object properties of passivization and becoming an object clitic, most languages exhibit the same postverbal word order, with the benefactive argument occurring immediately after the verb, followed by the theme. In Sesotho, the animate object (which is almost always the benefactive argument) must occur immediately after the verb. If the animacy of the objects is the same – i.e. both animate or inanimate, either order of objects is permitted, with resulting ambiguity (cf. Morolong & Hyman, 1977, Machobane, 1989). Importantly, these word order effects apply to all ditransitive applicative verbs.

A search of the Sesotho Corpus (98 hours of child-adult spontaneous speech) found that Sesotho-speaking two-and three-year-olds occasionally use Double Object Applicatives, and when they do so, they use correct word order, placing the benefactive/animate object immediately after the verb (cf. Demuth 1998, Demuth, Machobane & Moloi 2000).

(2) H (2;8) > K (1st author)
kilo nkela NtSelleng letsopa
(ke-ilo-nk-el-a NtSelleng letsopa)
AGR-FUT-take-APL-FV NtSelleng clay
'I'll grab some clay for NtSelleng.'

(3) N (2;8)
ebileng ke-tla-rek-el-a Tsebo le-leng
even AGR-FUT-buy-APL-FV Tsebo ADJ-another
'I'll even buy another one for Tsebo.'

(4) N (3;1) > K (1st author)
ke-ilo-lok-is-ets-a ngwana dikobo
AGR-FUT-get_ready-CAUS-APL-FV children blankets
'I am going to get the blankets ready for the children.'

(5) N (3;1)
…o-itse o-tla-rek-el-a ausi MantSo masale
…AGR-say/PERF/FV AGR-FUT-buy-APL-FV sister MantSo earrings
'…she said she will buy sister Mantsho earrings.'

Previous study found that three-year-olds performed at chance (50% correct) in placing the animate object immediately after the verb in forced choice elicited production tasks (Demuth et al. 2000). In contrast, four-year-olds were significantly above chance, showing that they were applying a syntactic rule. However, they still preformed significantly worse than adults, only exhibiting correct word order 64% of the time. These findings indicate that children have some understanding of the word-order restrictions on Double Object Applicatives. However, there still remains the question of why their performance was not perfect. If learners know the rule for Sesotho, why is it not applied across the board?

One possibility is that there is individual variation, with some learners having learned the rule, and others not. However, further investigation determined that this was not the case. Another possibility is that learners did better on some lexical items, and that this may be tied to the frequency with which certain verbs are found in the input children hear. There is some evidence that this may be the case (Demuth, Machobane & Moloi 2001). These findings must be treated with caution, however, since this previous study used only five verb stimuli. The purpose of the present study was to replicate the previous study, but with a larger number of verb tokens. If it is still found that there is a significant verb frequency effect on performance, this would provide support for the proposal that language learners are conservative. If, on the other hand, learners show no lexical frequency effects, this would indicate their lack of perfect performance is due to some other factor.

3. Forced Choice Elicited Production Task

The experimental methods used in this study were the same as those used in Demuth et al. (2001). One of the differences between the two experiments was that three other conditions were included in the new experiment to examine learners' knowledge of animacy hierarchy effects. Since these conditions were not part of the original study they will not be discussed here. A fourth condition involved two inanimate objects. Since either order of objects is permitted, this condition will also not be discussed here. The other difference was that the present study included 12 verbs for each condition rather than 5. It was hoped

that this increase in the number of verb tokens would permit a more in depth examination of possible lexical and rule learning effects.

3.1 Subjects

The experiments were conducted in the southern African country of Lesotho. Child subjects were drawn from Sesotho-medium pre-schools and primary schools in the capital city Maseru and the university area in Roma, and included 64 children, (16 in each of the following age groups: 4-, 6-, 8-, and 12-year-olds). Twelve adults were also tested at the National University of Lesotho in Roma and included lecturers, students and staff. The children were all monolingual speakers of Sesotho, English being introduced as a subject only in first grade. The adults were generally bilingual in Sesotho and English. Each age group was balanced for gender.

3.2 Stimuli

The stimuli contained two sentence pairs for each verb, one with grammatical Animate + Inanimate word order, and one with ungrammatical *Inanimate + Animate word order (e.g. 'I cooked the child the meat' vs. *'I cooked the meat the child'). All stimulus sentence pairs were composed of common Sesotho verbs used in the applicative. These were constructed to be as short as possible to facilitate processing and production by the younger children. The stimuli therefore contained null-subject sentences with 8-11 syllables, where the verb was inflected only for the applicative (i.e. no other verbal extensions such as perfect aspect, passive, causative or reciprocal were used) (cf. Demuth 1998; Idiata 1998).

The order of objects was counterbalanced across stimulus sentence pairs (e.g. half had the Animate + Inanimate order of objects mentioned first). These stimulus sentence pairs were then randomized along with the stimuli from the other four conditions (not discussed here) and divided into two blocks. Both blocks of stimuli were then audio recorded by the second author.

3.3 Procedure

The experiments took place in a quiet room at schools for the children and at the University for the adults. Subjects sat at a desk with the tape recorder, stereo speakers, a recording microphone and two or three experimenters. Subjects were familiarized with two hand puppets (a sheep and a panda bear whose mouths opened), and were explained the rules of the 'game'. They were told that both puppets came from another country and were learning Sesotho. Sometimes they spoke good Sesotho and sometimes not. The subjects were then asked to listen carefully as each puppet said a sentence. The prerecorded stimuli were played for the subjects out of speakers placed in front of them on a table. Each puppet was animated in turn by one of the experimenters - usually the third

author, while a second experimenter played the next sentence pair from the audio tape. Subjects were asked to point to the puppet that spoke Sesotho the best. The experimenter then asked the subjects *O-itseng?* "What did it say?" After five practice trials, the test sentence-pairs were presented. All subject responses were recorded on a second tape recorder and marked by the second experimenter on a coding sheet. Half of the subjects (balanced for gender) heard the first block of stimuli first, and half heard the second block first. The younger children were given a break between the two blocks of stimuli. The child subjects were given an orange at the conclusion of the experiment. The entire procedure took approximately 20 minutes – sometimes less for the adults and longer for some of the younger children. The children generally enjoyed the task, especially the interaction with the puppets. Any child who could not carry out the task (i.e. produce one of the modeled stimuli) after a repeat of the five practice trials was discarded from the study.

3.4 Coding

Each subject's elicited production responses were audio recorded and manually marked on a scoring sheet by a second experimenter. The first author was present at ten percent of the sessions, and also manually coded subject responses. Intercoder reliability on the hand-coded sheets was 96%. The tape recording was consulted in the few cases where residual questions remained, and the disagreements resolved. Responses that contained Animate + Inanimate word orders were coded as 'correct', and those with Inanimate + Animate word order as 'incorrect'.

Occasionally subjects did not repeat either of the sentence stimuli. If an object was changed but the animacy remained the same (e.g. *banana* 'girls' changed to *ngwana* 'child'), the response was analyzed for grammaticality along with the rest of the responses. However, if the animacy of the objects was changed these responses were classified as non-compliant errors and were excluded from the analysis. Although the younger children had more errors than the older children or adults, the total number of errors was low (only 14 out of a total of 336 stimulus responses, or 4%). That is, subjects generally had no difficulty carrying out the task.

3.5 Predictions

Since the experiment involved a forced choice between two options, chance performance was 50%. Performance at this level therefore shows no preference for postverbal word order in Sesotho Double Object Applicatives. However, if subjects performed above chance, this would indicate some knowledge/preference for a certain word order. We therefore predicted that, if subjects were aware of the word order restrictions on Sesotho Double Object Applicatives they would perform above chance (above 50%). Ideally, however, if they had learned the 'rule' we might expect them to perform at 100%. This

would indicate that they had learned the Sesotho grammatical rule for placing the animate object after the verb. However, if subjects performed significantly better on some lexical items than others, this would provide support for a more conservative, lexical approach to learning the argument structure of Sesotho Double Object applicatives.

4. Results

The results are presented in Table 1. One sample t-tests showed that all age groups are significantly above chance (0.50) at $p<0.0001$. Interestingly, both the four-year-olds and the six-year-olds showed better performance than that reported in the earlier study (four-year-olds: 64%; six-year-olds: 72% (Demuth, et al. 2001)). We suggest that the increase in number of stimuli (from 5 to 12) provided a more accurate picture of children's competence with these constructions. The fact that the standard deviation in the data is lower, and there were very few non-compliant errors overall, provides additional support for this position. It thus appears that the task was taping children's underlying knowledge of word order restrictions on Double Object Applicatives.

Table 1. Mean Percentage (and s.d.) of Animate Benefactive Arguments Correctly Placed Immediately after the Verb

Age Group	*Percent Correct Word Order*
4-year-olds	0.80 (0.04)
6-year-olds	0.82 (0.02)
8-year-olds	0.83 (0.04)
12-year-olds	0.94 (0.02)
Adults	0.99 (0.01)

Despite the younger children's better performance, however, there were still significant differences found between child age groups, indicating that the younger children were still not performing as well as adults. A one-way ANOVA (5 age groups) showed significant differences in performance between groups on this condition ($F(4,71)=7.58$, $p<0.0001$). Post-hoc tests (Bonferroni) show that twelve-year-olds performed significantly better than four-year-olds ($p=0.008$), and the difference between twelve-year-olds and six- and eight-year-olds approached significance ($p<0.1$ for both groups). However, no significant difference was found between the four-, six- and eight-year-olds. Adults performed significantly better than all child age groups except twelve-year-olds ($p<0.01$ for all groups). Thus, it would appear that by the age of 12 children have begun to show adult-like levels of performance on placing the animate object immediately after the verb in Sesotho Double Object Applicatives. This confirms the findings of Demuth et al. (2001) who suggested that learning the word order restrictions on Sesotho Double Object Applicatives takes several

years to master, and that eight-year-olds are not yet adult-like in their performance.

The second question addressed in this study was the possibility of lexical effects on performance: would subjects perform better on some stimulus verbs than others? And if so, would this be related to the relative frequency of the base verb stem or applicative verb stem in the everyday input that Sesotho learners typically hear? Regression analysis showed a marginally significant *negative* effect on performance when all the child data was taken together ($F(1,10)=3.49$, $p=0.0912$). However, this effect was extremely small, showing a decrease in performance of 9% for each occurrence of the applicative verb ($|t|=1.869$, $p=0.091$), and accounted for relatively little of the variance in performance ($R^2=0.26$). Regression analysis also showed a marginally significant negative effect on performance when only four-, six- and eight-year-olds were considered together ($F(1,10)=4.08$, $p=0.0711$) but again this effect was quite small - a decrease in performance of 11% per occurrence of the verb in the applicative ($|t|=2.019$, $p=0.071$), again accounting for relatively little of the variance in performance ($R^2=0.29$).

It would thus appear that 4-8-year-olds show robust knowledge of the language-specific rule placing the animate object immediately after the verb, despite the fact that they are not performing as well as adults. It also appears that only a small amount of the variance can be attributed to lexical frequency effects, arguing against a strong lexicalist or construction effect explanation of the data.

5. Discussion

Although the younger children performed much better in this study than they did in previous study, they still exhibited somewhat worse performance on those applicative verbs that most frequently occur in the input. Why should this be the case? We suggest that may be due to the fact that, in everyday speech, animate referents have often been previously mentioned in the discourse and therefore take the form of a preverbal pronominal clitic rather than a postverbal NP. Thus, the more frequently a ditransitive applicative verb is used, the more frequently it occurs in the surface syntactic frame with a cliticized pronomial (6b) rather than as part of a Double Object construction (6a).

(6) a. Bana ba-pheh-el-a mme nama SVOO
children AGR-cook-APL-FV mother meat
'The children are cooking meat for my mother'

b. Bana ba-mo-pheh-el-a nama SObj-VO
children AGR-OBJ-cook-APL-FV meat
'The children are cooking her some meat'

Young Sesotho-learners appear to be sensitive to the distributional properties of the input, and their expectations regarding the surface syntactic frames in which specific verbs typically occur marginally effects their performance on the elicited production task. That is, the higher the applicative verb frequency in the input the greater the competition between pronominalized and Double Object surface syntactic frames.

We suggest that competition from more frequent surface syntactic frames may contribute to parsing difficulties which in turn give rise to degraded performance on the elicited production task. That is, the greater the expectation that a particular applicative verb will occur in a different surface syntactic frame, the worse the performance on the Double Object elicited production task. Although rarely considered in language acquisition research, such 'competition' effects have long been recognized in the adult and infant psycholinguistic processing literature, where lexical frequency effects are well-known (e.g. Luce, Pisoni, & Goldinger 1990, Jusczyk & Luce 1994). It should not be surprising, then, to find that these also occur in the course of child language acquisition.

These findings pose a challenge for current theories of language acquisition which are polarized between proponents of rule-based syntactic learning (where individual lexical items play no role) versus advocates of lexical learning/construction grammar (where syntactic generalization is delayed). Rather, the results of the present study point to an intermediary position, where there is evidence of both robust syntax *and* weak lexical construction effects. This suggests that lexical learning/construction effects may be more wide spread than initially thought, and may account for some of the poorer performance typically reported for younger subjects. Theorists have long tried to tap children's syntactic competence through comprehension tasks, act out tasks and grammaticality judgement tasks (cf. McDaniel, McKee & Cairns 1996, Crain & Thornton 1998). Many of these tasks use only a very few sentence types, and a very few lexical items, drawing broad-based conclusions about children's linguistic competence based on relatively impoverished data. In addition, much of this testing is done in a linguistic vacuum, where issues of the discourse use of the test constructions (in both the input and the experiment) and the existence of surface syntactic competitors, is largely ignored. For example, some studies have noted that verbs that undergo Dative Shift most frequently occur in that form when the Recipient is a pronoun (e.g. *I gave her the book* vs. *I gave Sue the book*) (cf. Waryas& Stremel 1974). Others have noted lexical effects in learning these same constructions (e.g. Roeper, Lapointe, Bing & Tavakolian 1981). These findings suggest not only that learners are highly sensitive to the distributional properties of the input, but that we as researchers must be as well. Only by taking into account the larger linguistic context in which certain linguistic constructions are used can we more effectively design experimental stimuli and more accurately interpret the results. This is essential for providing breakthroughs in our understanding of how linguistic competence is achieved..

6. Conclusion

This study examined four- to twelve-year-olds knowledge of word order effects in Sesotho Double Object applicative constructions using a forced choice elicited production task. It found that all age groups performed significantly above chance in placing the animate object immediately after the verb, showing strong evidence of rule-based learning. However, the study also found a weak negative correlation with the frequency of the applicative verb in the input: the more frequent the verb, the worse the performance, especially for the younger children. These findings are less surprising once it is considered that ditransitive applicatives in everyday Sesotho discourse generally occur with the benefactive argument realized as a preverbal clitic rather than a postverbal NP. Learners appear to be sensitive to the distribution of lexical items in these alternate surface syntactic frames, and apparently expect verbs to occur in the frames in which they are normally heard. Thus, although subjects showed that they 'know' that the animate object should be placed immediately after the verb in Double Object constructions, their performance was slightly worse on those verbs that occur frequently in an alternate surface syntactic frame. It would therefore appear that rule-based syntactic knowledge can be effected by competition from alternate surface syntactic constructions. That is, both rules *and* construction effects influence learners' performance on tests of grammatical competence.

Much of the language acquisition literature has been concerned with how and when children begin to make syntactic generalizations, with much of the focus on when a particular linguistic structure has been 'learned'. There has been little attention given, however, to the process needed to attain mastery of a construction, nor to how to interpret levels of performance that may only reach 70% or 80%. We suggest that lexical and/or construction effects of the kind found in this study, which may lead to processing and production difficulty, may be responsible for some of the less than perfect performance on many experimental tasks. After all, if adults show slowed reaction times to less predictable stimuli, why shouldn't children show degraded performance as well?

The findings from this study hold both methodological and theoretical implications for the field. First, they suggest that we as researchers must become more aware of the larger linguistic context (syntactic, discourse) in which the constructions we investigate are typically used. We should then be able to design more effective experiments, and be able to interpret the results in a more parsimonious way, attributing greater rule-based knowledge to children, while at the same time realizing possible lexical and/or construction effects (Naigles 1996). Thus, although proposals that there is a lack of early rule-based learning are probably much too strong (Tomasello 1992), the fact that learners are very sensitive to aspects of the input, and are using this to construct their early grammars, needs to be taken seriously (cf. Demuth 1989, Lievin, Pine & Baldwin 1997). We know, of course, that children often generalize beyond the input they receive (e.g. Bowerman 1974, 1990), and recent research indicates

that this sometimes happens in unexpected ways (e.g. Hyams 1999, Roark & Demuth 2000, Strömqvist & Ragnarsdóttir 2000). Future research will need to examine children's acquisition of language more closely in an attempt to explain the course of language learning, and the factors that contribute to developing grammars over time.

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