

Influence of Parental Input on Learning Argument Structure Constructions

Nitya Sethuraman

Indiana University

1. Introduction

In learning syntax, children master argument structure patterns. Child-directed speech is suggested to provide information to children in ways that make learning argument structure constructions (form-meaning correlations) easier: mothers addressing younger children adjust their language to provide more cues for learning light verbs and constructions than they do for older children, who have had more experience with those verbs and constructions.

Two form-meaning correlations in argument structure (Goldberg 1995; Goldberg, Casenhiser, and Sethuraman 2004) are examined here: the Intransitive Motion construction (e.g., *I went to the store*), with the form [Subject Verb Oblique_{location}] and meaning "X moves to Y"; and the Caused Motion construction (e.g., *I put the book on the table*), with the form [Subject Verb Object Oblique_{location}] and meaning "X causes Y to move Z."

This study builds upon the findings of Goldberg et al. (2004), who show that parents use one central verb most predominantly in these argument structure patterns: *go* is used most frequently in the [Subject Verb Oblique_{location}] pattern and *put* is used most frequently in the [Subject Verb Object Oblique_{location}] pattern. Goldberg et al. argue that children can use this information to learn constructional meaning, by finding a correlation in the input between a syntactic pattern and the meaning of the verb(s) used most frequently in that pattern. Children learn to associate verb meaning with the syntactic patterns they are used in most frequently.

Parents have been found to use more complex features of language as their child's language ability grows, adjusting their speech to the proper level for their child, what Snow (1989) calls the fine-tuning hypothesis. Parents modify their language to children as their children's language becomes more sophisticated (e.g., Pan et al. 1993; Snow 1989, 1995; Sokolov 1993).

The present study examines changes in maternal input which may help children learn light verbs and constructions. Maternal speech directed to children age 20- months and 28-months are compared (Bates Corpus on CHILDES: Bates et al. 1988; MacWhinney 2000). The larger idea that motivates the study is that input from parents provides information to children in ways that make learning constructions easier.

In overview, the present study shows that mothers addressing younger children use a smaller vocabulary, smaller MLU, and fewer types of syntactic forms. Mothers addressing younger children rely more on highly informative and less varied cues than do mothers addressing older children: in particular, mothers addressing younger children use one central light verb in a particular construction more frequently than mothers addressing older children. In addition, for both age groups, these light verbs appear to be used in extremely restricted syntactic contexts, appearing most predominantly in only one pattern. Such input may assist younger children in acquiring the meanings of those particular light verbs and constructions more efficiently. Using light verbs more frequently in their respective constructions may enable younger children to lock onto the meanings of those particular constructions more efficiently, and older children who have mastered that stage are then provided with a larger variety of verbs in particular constructions. Using light verbs predominantly in one syntactic pattern helps children to further associate the meaning of the verb with the meaning of the pattern.

Evidence from Naigles and Hoff-Ginsberg (1995; 1998) suggests that the input mothers provide their verb-learning children offers reliable cues to the verbs' classes and provides

informative multiple frames, which might provide the type of information children need in order to learn new verbs. Other studies have also shown that children's use of verbs is highly related to their mothers' use of the verbs (e.g., DeVilliers 1985). Naigles and Hoff-Ginsberg (1995; 1998) argue that the use of verbs in diverse syntactic environments helps children learn the meanings of those verbs. This study documents consistency of verb use in syntactic patterns may also help children to learn argument structure patterns.

2. Methodology

The Bates Corpus on CHILDES (Bates et al. 1988; MacWhinney 2000) consists of transcripts of 15 minute free play sessions for 20-month-old children and 15 minute sessions for 28-month-olds divided equally into free play, snack time, and story time. Free speech from the same twenty-seven children and fifteen mothers addressing the children at both ages was examined.

The speech of the children and mothers addressing the children at both ages were coded for overall vocabulary types, MLU and syntactic form variety, and verb uses specifically in [(Subject) Verb Oblique_{location}] and [(Subject) Verb Object Oblique_{location}].

Word and sentence segmentation decisions were respected. Complete child and adult utterances containing a verb were included. Sentences with and without overt subjects were collapsed because the only major difference was sentences without subjects were predominantly commands. Variable word orders (questions, etc.) were ignored. Utterances considered ungrammatical to adults were included. Arguments and adjuncts were not distinguished.

Classifications were based on form: [(Subject) Verb Oblique_{location}] required a verb and some type of locative (e.g., PP or *down, in, there, here*). [(Subject) Verb Object Oblique_{location}] required a verb with an object NP and a locative. Please see Table 1 for examples.

All the data were hand-coded by the author for what verbs were used in what syntactic constructions for each participant at each age. In addition, data for the Intransitive Motion and Caused-Motion constructions produced by the 28-month-old children and their mothers was hand-coded independently by Devin Casenhiser. Roughly 60% of the data were independently coded by both coders, and reliability between the two coders was 96.5%. Aarre Laakso and Dan Jackson wrote computer programs to tabulate the data.

Table 1: Coding Examples

| Syntactic Pattern | Child | Verb | Utterance |
|---|----------|-------------|------------------------------|
| Verb Object Oblique _{Location} | GEO-FR28 | <i>put</i> | <i>I put him in</i> |
| Verb Object Oblique _{Location} | WAN-ST28 | <i>want</i> | <i>want you in the house</i> |
| Verb Oblique _{Location} | KEI-ST28 | <i>get</i> | <i>she get in her bed</i> |
| Verb Oblique _{Location} | CHU-FR28 | <i>go</i> | <i>it went in here</i> |

3. Results and discussion

3.1 Vocabulary development

As expected, the children's vocabulary size and verb size increases over time. Interestingly, the mother's speech also increases over time, with the mothers using a larger vocabulary in their speech to the older children. Mothers addressing 20-month-olds use 82 different verbs and 644 different words, a much smaller number compared to mothers addressing 28-month-olds who use 163 verbs and 1485 different words. In addition, mothers addressing 20-month-olds use a smaller

vocabulary than even the 28-month-old children: the older children produce 116 verbs and 872 words. The mothers are clearly tailoring their language to match their children's abilities.

The overall raw frequencies of the most frequent verbs used by each of the four groups are given below:

Table 2: Overall raw frequencies of most frequent verbs

| Group | # Verbs Used | Most Frequent Verbs Used | | |
|------------------|--------------------------|---|--|--|
| Children 20mo | 17 types 66 tokens | be 26%(17) go 17%(11) do 12% (8) | open 8%(5) see 8%(5) sit 6%(4) | can 5%(3) play 5%(3) |
| Children 28mo | 116 types 1216 tokens | be 19%(232) go 15%(184) do 13%(154) want 5%(61) get 4%(53) know 4%(47) | eat 4%(44) cry 3%(41) see 3%(35) play 2%(28) come 2%(27) | can 2%(26) make 2%(23) look 2%(22) have 2%(21) put 2%(21) |
| Mothers 20mo | 82 types 1341 tokens | be 19%(257) see 3%(37) go 11%(150) get 3%(35) do 10%(139) | let 2%(23) put 7%(94) play 2%(20) can 7%(88) take 2%(20) | look 6%(84) try 2%(20) want 4%(50) turn 2%(20) will 3%(41) |
| Mothers 28mo | 163 types 4104 tokens | be 26%(1071) will 2%(94) do 15%(605) see 2%(87) go 8%(315) look 2%(75) | can 3%(139) eat 2%(67) want 3%(132) say 2%(66) have 3%(137) | come 2%(63) put 3%(114) make 1%(57) get 3%(113) let 1%(51) |

Examining the lists of most frequent verbs, it is clear that many light verbs are highly frequent in both the children's and mother's speech. Verbs that are frequent in maternal speech are also frequent in their children's speech. After *be*, *go* and *do* are the most frequent verbs for all four groups. *Want*, *put*, *get*, and *make* are also highly frequent for both children and mothers. Many non-light verbs are also very frequent, including *see*, *look*, *eat*, *come*, and *play*, which occur even more frequently than several light verbs.

Light verbs have been shown to be important in learning certain central constructions (Goldberg et al. 2004; Ninio 1999; see also Clark 1978, 1990, 1996). The frequency of light verbs in adult language and their early appearance in children's speech are important factors in making light verbs central in syntactic acquisition.

3.2 Grammatical development

The table below gives the MLU and number of syntactic pattern types used by the four groups:

Table 3: Participants' syntactic knowledge at ages 20 and 28mo

| Group | Age | MLU | # of Syntactic Patterns |
|----------|------|-----|-------------------------|
| Children | 20mo | 1.3 | 6 |
| | 28mo | 2.0 | 20 |
| Mothers | 20mo | 3.5 | 17 |
| | 28mo | 4.0 | 23 |

The older children produce more types of syntactic patterns than the younger children. The mother's language also shows a developmental change—the mothers addressing younger children use a shorter MLU and fewer construction types. Mothers addressing 20-month-old children use only 17 different syntactic patterns as opposed to 23 patterns used by mothers talking with 28-month-olds. 28-month-old children are in the middle, producing 20 different syntactic patterns.

However, although using a smaller set of syntactic patterns, mothers addressing younger children still use a much higher MLU than the younger children: mothers use an average MLU of 3.5 when talking to 20-month-olds, as opposed to an MLU of 2.0 by 28-month-old children, and mothers addressing 28-month-olds use an even larger MLU, of 4.0. This suggests that mothers are fine-tuning their language to complement their children's development.

3.3 Use of verbs in particular constructions

Goldberg et al. (2004) found that *go* and *put* are the most frequent verbs that are heard used in [Subject Verb Oblique_{location}] and [Subject Verb Object Oblique_{location}], respectively. The specific light verb that occurs most frequently in those grammatical constructions is the light verb whose meaning is associated with that particular grammatical construction. The use of these patterns is reexamined here with the four age groups.

- **Intransitive Motion [Subject V Oblique_{loc}]**

The syntactic frame [Subject V Oblique_{loc}] is associated with the meaning of intransitive motion; this pairing of syntax and semantics is known as the Intransitive Motion construction. *Go* is the verb in English that codes the meaning of this construction most directly. Correspondingly, participants at all ages used the verb *go* most frequently in this syntactic frame. The participants at 20 months of age produced this frame a total of 6 times with 2 different verbs; they used the verb *go* in the frame 5 times (*come* was used in the remaining case).

More strikingly, out of 25 verbs used in this construction, *go* accounted for a full 54.02% (121/224) of the tokens in the children at 28 months of age. The next most frequent verbs were *get* 6.25%, *fall* 5.36%, *come* 4.91%, and *look, live, and sit* at 3.57% each.

A similar trend was observed in the mothers' speech. Mothers addressing 20-month-old children used *go* 67% (89/133) of the time out of 15 different verbs used in this construction. The next most frequent verbs were *come* 12% (16/133), *fit* 3% (4/133), and *drive* 3% (4/133).

Finally, mothers addressing the 28-month-olds as well showed a similar trend. They used 39 different verbs in this construction and *go* 38.5% (136/353) of the time. The next most frequent verbs were *come* 15%, *sit* 10.5%, and *live* 6%.

All four age groups use *go* most frequently in this syntactic pattern. Mothers addressing the younger children relied on the use of *go* in this construction much more than mothers addressing older children.

In addition, the use of *go* was found to be highly restricted to the [Subject V Oblique_{loc}] syntactic pattern by the older children and the two groups of mothers. The 20-month-old children only used *go* 8 times, and produced four [Subject V Oblique_{loc}] uses and four bare verb uses.

- **Caused-Motion [Subject V Object Oblique_{loc}]**

The syntactic frame [Subject V Object Oblique_{loc}] is associated with the meaning of caused-motion; this pairing is the Caused Motion construction. *Put* is the verb that is most closely associated with this meaning. Only one instance of this construction was used by the 20-month-olds, so it is not possible to make any sort of generalization. However, out of 12 verbs used in this construction, the participants at age 28 months used *put* 31.37% (16/51) of the time; the next most frequent verbs were *get* 15.69%, *take* 9.80%, and *do* and *pick* 5.88% each.

Mothers addressing their 20-month-old children used 18 verbs in this construction and *put* 61% (90/148) of the time, with *turn* 10% (9/148), *take* 10% (9/148), and *get* 7% (6/148) the next most frequent verbs.

Finally, a similar trend was observed in the speech of mothers addressing 28-month-olds: they used *put* 40% (100/250) of the time in this construction, with the next most frequent verbs *take* 7%, *get* 5%, and *have* 4%.

Get and *take* are also used in this construction, by both children and mothers, but do not occur as often as *put*. The meaning of *put* most closely matches the meaning of the Caused-Motion construction, and is also frequently used in parental input in commands.

As before, mothers addressing the younger children relied on the use of *put* in this construction more than mothers addressing older children.

The use of *put* was found to be highly restricted to the [Subject V Object Oblique_{loc}] syntactic pattern by the older children and the two groups of mothers. The 20-month-old children did not produce any utterances containing the verb *put*.

Table 4: Use of Verbs in Particular Syntactic Patterns

(VL = [(Subject) Verb Oblique_{location}]; VOL = [(Subject) Verb Object Oblique_{location}])

| Group | Age | Verbs in VL | Verbs in VOL | Uses of "GO" | Uses of "PUT" |
|----------|------|--|---|---|--|
| Children | 20mo | 6 uses, 2 verbs | 1 use | 8 uses, 2 patterns 50% VL 50% V | 0 uses |
| | 28mo | 195 uses, 25 verbs <i>go</i> 54.02% <i>get</i> 6.25% | 51 uses, 12 verbs <i>put</i> 31.37% <i>get</i> 15.69% | 142 uses, 3 patterns 75% VL 20% V | 21 uses, 2 patterns 76% VOL 24% VL |
| Mothers | 20mo | 133 uses, 15 verbs <i>go</i> 67% <i>come</i> 12% | 148 uses, 18 verbs <i>put</i> 61% <i>turn, take</i> 10% | 111 uses, 4 patterns 82% VL 8% V | 92 uses, 3 patterns 96% VOL |
| | 28mo | 353 uses, 39 verbs <i>go</i> 38.5% <i>come</i> 15% | 250 uses, 43 verbs <i>put</i> 40% <i>take</i> 7% | 182 uses, 6 patterns 76% VL 13% V | 114 uses, 4 patterns 94% VOL 5% VO, VL |

To summarize, mothers addressing the 20-month-old children used a smaller vocabulary, fewer verbs and verb types, a smaller MLU, and less syntactic variety than the mothers addressing the 28-month-old children. In addition, mothers addressing the younger children relied on central light verbs in specific syntactic patterns to a much larger extent than mothers addressing older children. The use of these central light verbs was in turn highly restricted to those specific syntactic patterns.

4. Conclusion

This study shows that children receive a less diverse and more informative input when they are younger, and a more diverse and less informative input when the children are older. In particular, mothers addressing younger children use a smaller vocabulary, smaller MLU, and fewer types of syntactic patterns. They rely more on highly informative and less varied syntactic cues than do mothers addressing older children. Mothers addressing younger children also rely more on central light verbs when using certain syntactic patterns.

Naigles and Hoff-Ginsberg (1995; 1998) argue that the use of verbs in diverse syntactic environments helps children learn the meanings of those verbs. However, consistency of verb use in syntactic patterns may also help children to learn argument structure patterns. One way to resolve this discrepancy is to think about the changing utility of different regularities. Early on a strong link between a particular verb and a construction may facilitate mastery of that construction's meaning, by linking it to a well-known verb. However, as Naigles and Hoff-Ginsberg rightly note, highly frequent verbs also occur in diverse frames and this diversity is important for learning verbs and syntactic patterns. *Put* occurs in [Subject Verb Object Oblique_{location}] but it will also occur in other patterns. This diversity may help the child latch onto the meaning of *put*, which then also helps the child comprehend the central meaning of the [Subject Verb Object Oblique_{location}] pattern.

Computational models also show that consistency of use helps in learning. Elman (1993) shows that neural networks are unable to learn some complex grammatical structures when trained on a "full adult" language. However, when the network is presented with data sets of gradually increasing complexity, the network is able to learn the task as well as more complex sentences (also see Plunkett and Marchman 1990).

The input that the younger children receive is more informative because since there is less variety in the input, the children are able to learn the constructions more easily and better. The use of more consistent cues may aid younger children, who are barely using either of these patterns, lock onto the meanings of those patterns more efficiently. Older children are using the patterns productively with a number of different verbs; parents may provide them with fewer cues than the younger children. This less diverse and more consistent input is argued to be more informative because it focuses young children on important cues.

References

- Bates, E., J. Bretherton, and L. Snyder (1988). *From First Words to Grammar: Individual Differences and Dissociable Mechanisms*. New York, NY: Cambridge University Press.
- Clark, E.V. (1978). Discovering what words can do. In *Papers from the Parasession on the Lexicon*, Chicago Linguistics Society **14**, 34-57.
- Clark, E.V. (1990). Speaker perspective in language acquisition. *Linguistics* **28**, 1201-1220.
- Clark, E.V. (1996). Early verbs, event types, and inflections. In C.E. Johnson and J.H.V. Gilbert (Eds.), *Children's Language*, Vol 9. Mahwah, NJ: Lawrence Erlbaum Associates, 61-73.

- DeVilliers, J. (1985). Learning how to use verbs: Lexical coding and the influence of the input. *Journal of Child Language* **12**, 587-595.
- Elman, J.L. (1993). Learning and development in neural networks: The importance of starting small. *Cognition* **48**, 71-99.
- Goldberg, A.E. (1995). *Constructions: A Construction Grammar Approach to Argument Structure*. Chicago, IL: The Chicago University Press.
- Goldberg, A.E., D. Casenhiser, and N. Sethuraman (2004). Learning argument structure constructions. To appear in *Cognitive Linguistics*.
- MacWhinney, B. (2000). *The CHILDES project: Tools for analyzing talk. Third Edition*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Naigles, L. R. and E. Hoff-Ginsberg (1995). Input to verb learning: Evidence for the plausibility of Syntactic Bootstrapping. *Developmental Psychology* **31**, 827-837.
- Naigles, L.R. and E. Hoff-Ginsberg (1998). Why are some verbs learned before other verbs? Effects of input frequency and structure on children's early verb use. *Journal of Child Language* **25**, 95-120.
- Ninio, A. (1999). Pathbreaking verbs in syntactic development and the question of prototypical transitivity. *Journal of Child Language* **26**, 619-653.
- Pan, B., H. Feldman, and C. Snow (1993). *Parental Speech to Low-Risk and At-Risk Children*. Manuscript. Harvard Graduate School of Education.
- Plunkett, K. and V. Marchman (1990). U-shaped learning and frequency effects in a multi-layered perceptron: Implications for child language acquisition. *Cognition* **38**, 43-102.
- Snow, C.E. (1989). Understanding social interaction and language acquisition: Sentences are not enough. In M.H. Bornstein and J.S. Bruner (Ed.), *Interaction in Human Development*. Hillsdale, NJ: Lawrence Erlbaum Associates, 83-103.
- Snow, C.E. (1995). Issues in the study of input: Finetuning, universality, individual and developmental differences, and necessary causes. In P.F. Fletcher and B. MacWhinney (Eds.), *The Handbook of Child Language*. Cambridge, MA: Blackwell Publishers, Inc., 180-193.
- Sokolov, J. (1993). A local contingency analysis of the fine-tuning hypothesis. *Developmental Psychology* **29**, 1008-1023.