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When Do Children Acquire Verbs?

Clifton Pye, Diane Frome Loeb
Sean Redmond & Lori Zobel Richardson

The University of Kansas

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Verbs play a crucial role in the organization of sentence structure. They provide an interface between the semantic and syntactic modules of the grammar and set the stage for long-distance movement rules, control relations and parasitic gaps. Each verb comes with its own particular expectations about the number of noun phrases (arguments) it will associate with. Semantically similar verbs (e.g., "shudder" and "shake") may have different argument structures. (One can shake a jar, but not shudder a jar). Children must learn both the semantic representation for verbs and their argument structure to produce grammatical sentences. Given the delicacy of this process, it is not surprising to find that children occasionally make mistakes, producing sentences like: 'The ball threw' or 'Come it over here.' The wonder is that such mistakes are so rare, given the thousands of sentences children construct each day.

Children could save themselves a lot of work if they just used verbs the way other speakers use them. This is conservative learning, and as Pinker (1989) has observed, children's mistakes with verb argument structure provide one piece of evidence that children occasionally abandon conservatism. Pinker hypothesizes, instead, that children make use of universal regularities in the way semantic components of verbs are linked to argument structure. Children could use a form of indirect negative evidence to infer that an entire subclass of verbs sharing the same semantic components does not allow certain argument structures. For example, children learning English might decide that verbs of ballistic motion such as **throw** do not permit the theme to occur in the subject position (e.g., *the ball threw).

Linguists such as Fillmore, Hale, Levin and Rappaport Hovav have attempted to account for the restrictions on verb argument structure in terms of rules that link the semantic representations of the verbs to argument structure. Thus, change of state verbs, but not ballistic motion verbs allow the theme to occur as a subject because the change of state verbs have a semantic feature of external control whereas the ballistic motion verbs have the feature internal control.

All of these approaches require children to be remarkably observant about the structure of events and note the particular semantic features that are relevant to each argument structure. A canonical tale of verb acquisition might go something like this. A toddler observes a cup falling off the table and breaking on the kitchen floor. Her significant other might say something like 'Oh great, the cup broke' in describing the result of the action. The child can then extract the lexeme **break** and use the information from this situation to attach the word to the concept BREAK. By accessing this concept, our toddler can build a semantic representation for the verb

that contains the information that this is a change of state verb that names a particular result. The toddler would then be justified in inferring that as a typical change of state verb, **break** could participate in the passive and causative alternations, but not the conative alternation. With this much information, our toddler should be able to use the verb happily ever after.

Put this way, the process of verb acquisition seems easy, but there are several places where the process can break down. First, it is not obvious that toddlers have instant access to the 'right' concept when they construct a semantic representation for a new verb. English is an impoverished language when it comes to expressing the possibilities for breaking things (Pye 1993), but a few might be: CUP-BREAKING, HARD_OBJECT-BREAKING, CYLINDRICAL_OBJECT-BREAKING, LIQUID_HOLDER-BREAKING, OBJECT_WITH_HANDLE-BREAKING, ARTIFACT-BREAKING, GRAVITY-BREAKING, ACCIDENTAL-BREAKING, BREAKING_ON_FLOOR, BREAKING_DOWNWARDS, or BREAKING_FROM_UP_HIGH. An innate array of concepts is not going to help a child in deciding which concept fits the scene they just witnessed. Since one breaking scene is never identical to another in the natural world, children have an infinite hypothesis space to draw upon in conceptualizing the event. Just hearing a word in context does not guarantee that children will fast map the word correctly.

Second, children will have to learn what argument structure changes occur in the adult language. Not every language has a causative, conative or antipassive alternation, and not every causative alternation is alike. Children have to learn which alternations exist in their language and which nonlinguistic situations such alternations describe. Presumably, children can do this on the basis of positive evidence. Finally, children will have to learn any restrictions that apply to the verb alternations. The solution to this problem might reside in syntactically relevant features of the verb's semantic representation (to use Pinker's expression). A child that had not yet noticed these features in a particular verb's meaning or had not noted their relevance to a particular alternation would be in trouble.

It is depressing to note that after 30 years we have learned little about children's construction of semantic representations for verbs. Thanks to the pioneering work of Melissa Bowerman (1974) we know that children start to overgeneralize the causative alternation around 2;4 and persist in this behavior until they are at least 11 years old. This observation suggests, at the very least, that children may not have recognized the appropriate semantic features, and possibly that children as old as 11 years are still in the process of fleshing out the semantic representations of specific verbs.

The results that we will report today bear on this matter in two respects. First, we tested children's ability to name various actions when confronted with prototypical exemplars. Second, we determined the degree to which the children's expressive naming abilities correlated with their ability to alter the verb's transitivity by means of the causative alternation. The results from these two tasks suggest that if children are fast-mapping verbs, they are using temporary semantic representations that undergo significant restructuring over time.

The data we will report comes from elicitation studies with 3 groups of seven normally developing children. The first group of children ranged in age between 2;6 and 4;0. The second group of children ranged in age between 5;1 and 6;6. All of these children were learning English and had scores within the normal to high normal range on an expressive vocabulary test (***Expressive One-Word Picture Vocabulary Test***, Gardner 1990). The third group of children was learning the Mayan language K'iche' and ranged in age between 3;4 and 6;8. Each child participated in the verb elicitation test and a causative alternation test.

We used the same set of 46 verbs in the verb elicitation and causative alternation tasks. These verbs are shown in Table 1.

Table 1. Verb Selection According to Semantic Class and Alternation.

Alternation	Semantic Class				
	Change of State	Contained Motion	Volitional Action	Express	Directed Motion
Fixed Transitive	cut		put, throw		
Fixed Intransitive		stay	look, walk, sleep, dance, swim	talk, cry, laugh, roar	go, come, enter
Causative Alternate	break, open, pop, stop, tire, close, tear, smash, boil, loosen, fold	turn, drop move, roll, float, bounce, wind	fly	quiet, mad(den)	return
Antipassive	wash		eat, drink, sweep, follow	sing	leave, climb

The verbs fall into 4 distinct syntactic classes. The alternating verbs (break, open, float, etc.) occur in both transitive and intransitive sentences. In transitive contexts the alternating verbs have an agent as subject and patient as object. In intransitive contexts the patient becomes the subject and the agent is not expressed. The fixed transitive verbs (cut, put, throw) do not participate in the causative alternation. These verbs have to be passivized before they can appear in intransitive contexts, e.g. 'The ball was thrown.' The fixed intransitive verbs (walk, go, dance, etc.) also do not undergo the causative alternation. English speakers must use a periphrastic construction to use these verbs in 'transitive' contexts, e.g. 'We got the horse to dance.' The last set, the antipassive verbs (climb, eat, leave), also do not participate in the causative alternation. These verbs can be passivized or used in periphrastic constructions to alter their transitivity.

We also divided the verbs into 5 semantic subgroups. These groups correspond roughly to the narrow range verb subclasses Pinker (1989) theorizes might be relevant to the causative

alternation in English. Finally, we divided the verbs into two groups based on frequency. We used a frequency count for children's language samples (Hall, Nagy & Linn 1984) and divided our verbs at the mid-frequency point.

Verb Elicitation

We devised our verb elicitation task as a test of the naturalness of the stimuli we used in our causative alternation task. We made the verb elicitation scenarios as simple as possible to speed up the task and hold the children's interest. We relied upon prototypical scenes in an effort to give the children every possibility of using the target verbs. This task elicited intransitive forms of the fixed intransitive verbs and transitive forms of the fixed transitive verbs. We counted the children's response as "correct" on this task if we succeeded in eliciting our target verb. The results from the verb elicitation task appear in Table 2.
The young English-speaking group had a mean of 23 target responses on the verb elicitation task while the older English-speaking group had a mean of 36 target responses. The K'iche' children had a mean of 23. An analysis of variance showed a significant difference between the totals of the two English-speaking groups. All 3 groups did better on the set of transitive verbs, although the older English-speaking group did much better on this verb set than the other two groups of children.

Frequency played a large role in the children's ability to produce the target verbs. A two-way MANOVA revealed significant effects of the groups and verb frequency. Both the young and older English-speaking groups produced the high frequency verbs more often than the low frequency verbs ($F=213$, $p<.05$). The older English-speaking group produced more verbs in both the high and low frequency sets than the young group (Newman-Keuls, $p<.05$). The frequency data for the verb elicitation task is shown in Table 3.

Table 2. Verb Elicitation Results

Older English	I ⇒ T	T ⇒ I	Total
5;1	17/28 = .6	17/18 = .9	34/46 = .7

5;1	17/28 = .6	15/18 = .8	32/46 = .69
5;3	21/28 = .75	18/18 = 1.0	39/46 = .8
5;8	19/28 = .67	15/18 = .8	34/46 = .7
5;9	22/28 = .78	17/18 = .9	39/46 = .8
6;2	19/28 = .67	18/18 = 1.0	37/46 = .8
6;6	22/28 = .78	16/18 = .88	38/46 = .8
Total	137/196 = .69	116/126 = .9	253/322 = .78
Young English	I ⇒ T	T ⇒ I	Total
2;6	9/28 = .3	4/18 = .2	13/46 = .28
2;6	6/28 = .2	7/18 = .38	13/46 = .28
2;10	12/28 = .4	10/18 = .55	22/46 = .47
3;5	13/28 = .46	14/18 = .77	27/46 = .58
3;6	14/28 = .5	14/18 = .77	28/46 = .6
3;7	14/28 = .5	15/18 = .8	29/46 = .6
4;0	15/28 = .5	15/18 = .8	30/46 = .6
Total	83/196 = .4	79/126 = .6	162/322 = .5
K'iche'	I ⇒ T	T ⇒ I	Total
3;4	10/28 = .36	10/18 = .55	20/46 = .4
3;6	10/28 = .36	6/18 = .3	16/46 = .3
5;2	17/28 = .6	6/18 = .3	23/46 = .5
5;2	14/28 = .5	16/18 = .89	30/46 = .6
5;6	11/28 = .39	9/18 = .5	20/46 = .4
5;7	12/28 = .4	9/18 = .5	21/46 = .4
6;8	19/28 = .67	15/18 = .8	34/46 = .7
Total	93/196 = .47	71/119 = .59	164/322 = .5

Table 3. Verb Elicitation as a Function of Verb Frequency.

	High Frequency		Low Frequency	
Older	Number	Proportion	Number	Proportion
1	27	.90	11	.687
2	27	.90	11	.687
3	28	.933	11	.687
4	26	.867	9	.563
5	26	.867	7	.438
6	26	.867	8	.50
7	25	.833	8	.50
Mean	26.42	.881	9.23	.50
Young	Number	Proportion	Number	Proportion
1	19	.633	6	.375
2	22	.733	5	.312
3	22	.733	3	.187
4	11	.367	1	.062
5	17	.567	5	.312
6	10	.333	3	.187
7	20	.667	5	.312
Mean	17.29	.576	4	.25

The children often used substitute verbs in their responses. Their substitute verb responses fall into three distinct categories (Table 4). One set of scenarios (that we referred to as the "pig set" since we relied upon a family of pigs to elicit the verbs) caused the most trouble for all of our subjects. Two of the pig verbs were **come** and **go**. Most of the children in all three groups responded with the verb **walk**. This response is predictable in that our pig scenarios for **come** and **go** also feature pigs walking. Other verbs such as **smash** and **tear** have close synonyms (**smush** and **rip**) that the children would used.

Table 4. Types of Verb Substitutions

	Colloquial	Synonymous	Idiosyncratic
Older English	leave - go, walk go - walk come - walk enter - go, walk return - go, walk	turn - spin smash - squish tear - rip	sweep - brush laugh - tease turn - twist wind - roll, twist
Young English	leave - walk, go go - walk come - walk, go enter - come, go return - walk climb - walk	close - shut turn - spin drop - fall move - push smash - squish, smush tear - rip	fold - bend, break cut - scissor pop - crush, break, splat float - swim loosen - pull, break drink - eat fly - flap sweep - brush cry - laugh stop - go bounce - drop, fall turn - screw break - rip, take off smash - tear tear - break wind - roll, wrap, turn
K'iche'	leave - walk, come return - walk follow - walk	cut - chop loosen - untie	fold - wind, shrink cut - tear pop - go out float - walk move - crunch smash - pop, shrink, pack tear - chop

The more interesting category of responses were made by individual children who seemed unable to produce the more typical responses. A majority of the English-speaking children referred to winding string on a yoyo as rolling. Two young English-speaking children referred to dropping as falling and moving as pushing. Different young English-speaking children referred to cutting as scissoring, folding as breaking, popping as breaking or crushing, floating as swimming, loosening as breaking, stopping as going, bouncing as falling, turning as rolling, breaking as ripping or taking off, and tearing as breaking or taking off. We gave the children several opportunities to revise their responses. In some cases they eventually came up with the target response, but in most cases they stuck to their guns. A developmental trend is apparent in our data in that more of the younger group of English-speaking children produced such

'idiosyncratic' responses.

These responses are all the more interesting when we compare the English-speaking children with their K'iche' counterparts. We discovered a consistent pattern of different responses between the two language groups, suggesting the degree to which our actions may have been more prototypical for one or the other language. The K'iche' children had much more difficulty with the paper manipulation verbs. They referred to folding as winding and shrinking, cutting as chopping and tearing, and tearing as chopping. On the other hand, they were better at the string manipulation verbs **loosen** and **wind** than the English-speaking children. The K'iche' children also did much better with the two pig verbs **enter** and **leave**.

The Causative Alternation

Following the verb elicitation task we assessed the children's ability to alternate verbs in the causative alternation, following the procedure described by Braine and his colleagues (1990). We modelled each experimental verb in a sentence and then asked the children to use the verb in a different linguistic context. Results from this causative alternation task for the alternating verbs are shown in Table 5. English uses a lexical alternation as the predominant form for the causative alternation. K'iche' uses a causative and antipassive verb suffix (c.f. Pye 1994).

Once again we find a significant difference between the older English-speaking children and the other two groups. The older English-speaking children used the causative alternation with 67% of the alternating verbs whereas the younger English-speaking children used the causative alternation with 40% of the alternating verbs (Newman-Keuls, $p<.05$, tv|iv). The K'iche' children used their alternations with 37% of the alternating verbs. Both sets of English-speaking children used the causative alternation more frequently in the iv|tv direction than in the opposite (tv|iv) direction.

The children had a variety of options to chose from when they failed to use the causative alternation (Table 6). In the iv|tv alternation the children used a periphrastic sentence consisting of the verb **make** and another verb, e.g. 'You made it stop', some other response, or failed to alternate the verb. 29 of the older English-speaking children's responses in the iv|tv direction were periphrastic constructions (Newman-Keuls, $p<.05$). The other two groups of children used other responses or failed to alternate the verb. In the tv|iv direction the older English-speaking children used the passive construction more frequently (Newman-Keuls, $p<.05$), while the other two groups of children again used their other options more frequently.

Table 5. Causative Alternation Results for Alternating Verbs

Older English	I ⇒ T	T ⇒ I	Total
1 - 6;6	3/10 = .3	9/11 = .8	12/21 = .57
2 - 6;2	5/10 = .5	7/11 = .6	12/21 = .57

3 - 5;9	7/10 = .7	8/11 = .7	15/21 = .7
4 - 5;1	4/10 = .4	7/11 = .6	11/21 = .5
5 - 5;3	3/10 = .3	9/11 = .8	12/21 = .57
6 - 5;8	8/10 = .8	11/11 = 1.0	19/21 = .9
7 - 5;1	6/10 = .6	11/11 = 1.0	17/21 = .8
Total	36/70 = .5	62/77 = .8	98/147 = .67
Young English	I ⇒ T	T ⇒ I	Total
1 - 3;5	5/10 = .5	5/11 = .4	10/21 = .47
2 - 4;0	7/10 = .7	5/11 = .4	12/21 = .57
3 - 3;6	4/10 = .4	9/11 = .8	13/21 = .6
4 - 2;6	1/10 = .1	5/11 = .4	6/21 = .28
5 - 2;10	5/10 = .5	2/11 = .18	7/21 = .3
6 - 2;6	0/10 = .0	3/11 = .27	3/21 = .1
7 - 3;7	5/10 = .5	9/11 = .8	14/21 = .67
Total	27/70 = .38	38/77 = .49	66/147 = .4
K'iche'	I ⇒ T	T ⇒ I	Total
1 - 6;8	10/14 = .7	4/6 = .67	14/20 = .7
2 - 3;4	6/14 = .4	0/6 = .0	6/20 = .3
3 - 5;7	6/14 = .4	2/6 = .3	8/20 = .4
4 - 5;2	6/14 = .4	2/6 = .3	8/20 = .4
5 - 5;2	3/14 = .2	0/6 = .0	3/20 = .15
6 - 5;6	5/14 = .35	4/6 = .67	9/20 = .45
7 - 3;6	3/14 = .2	1/6 = .17	4/20 = .2
Total	39/98 = .39	13/42 = .3	52/140 = .37

Table 6. Other Responses for the Alternating Verbs

		I ⇒ T			T⇒ I	
Older	Periphr	NA	D+NR	Passive	NA	D+NR
1	7			1		1
2	4		1	4		
3	3			3		
4	4		2			4
5	6		1	1	2	
6	1		1			1
7	4					
Total	29		5	9	2	6
		I ⇒ T			T ⇒ I	
Younger	Periphr	NA	D+NR	Passive	NA	D+NR
1			5			6
2	2		1	5		
3	4		2		1	1
4		7	2		3	3
5		1	4		3	5
6		2	8			8
7		1	4			2
Total	6	11	26	5	7	25
		I ⇒ T			T ⇒ I	
K'iche'	Periphr	NA	D+NR	Passive	NA	D+NR
1			4			2
2		1	5		1	4
3		1	7		1	2
4			8			4
5			11	1	2	3
6		1	8			2

7			11			4
Total		3	54	1	4	21

We would argue that such results support the data obtained from our verb elicitation task. None of the children in our study exhibit a complete understanding of the semantic and syntactic properties for this verb set. Their responses indicate difficulties with two parts of verb representation - the semantic representation and the verb argument structure. The differences between the younger and older groups of English-speaking children point to an interesting progression in verb development.

At this point it is reasonable to ask whether there is a connection between the children's success on the verb elicitation task and the causative alternation task. Table 7 shows the results of a comparison between the verb elicitation task and the causative alternation task for each alternating verb. All three groups used the causative alternation more successfully with the verbs that we elicited on the verb elicitation task (comparing the first two columns). The younger English-speaking children and the K'iche' children had more trouble producing the causative alternation for the verbs that we failed to elicit (columns three and four). The older English-speaking children did not show this effect. We conclude that the ability to produce a verb in our verb elicitation task is related to the ability to alternate the argument structure of the verb in the causative alternation task.

Table 7. Comparison of Verb Elicitation and Verb Alternation

Group	+ Elicit + Causative	+ Elicit - Causative	- Elicit + Causative	- Elicit - Causative
Older	82	37	14	14
Younger	44	29	22	52
K'iche'	31	19	5	30

These comparisons may be significantly influenced by verb frequency. An analysis of the children's success on the causative alternation as a function of verb frequency revealed a significant frequency effect, but no differences between the young and older English-speaking groups ($F=8.75$, $p<.05$). Both groups used the lexical alternation more frequently with the high frequency verbs. These results are shown in Table 8.

Table 8. Verb Alternation as a Function of Verb Frequency.

	High Frequency		Low Frequency	
Older	Number	Proportion	Number	Proportion
1	9	.818	5	.625
2	5	.455	5	.625
3	8	.722	6	.75
4	6	.545	4	.5
5	7	.636	5	.625
6	9	.818	7	.875
7	9	.818	6	.75
Mean	7.57	.687	5.43	.786
Younger	Number	Proportion	Number	Proportion
1	5	.455	5	.625
2	5	.455	4	.5
3	9	.818	4	.5
4	6	.545	0	0
5	5	.455	2	.25
6	3	.273	0	0
7	7	.636	5	.625
Mean	5.71	.52	2.86	.357

A number of the children overgeneralized the causative alternation to verbs that do not permit it. These overgeneralizations indicate that the children had reached a point in development where they would actively apply the causative alternation beyond the range of their parents. Table 9 lists the number of overgeneralizations made by each group of children, the verbs they overgeneralized and the individual subjects who produced these overgeneralizations.

Table 9. The children's causative overgeneralizations.

Groups (by Subject)	I ⇒ T	T ⇒ I
Older (4 of 7 children)	walk (S2), leave (S2)	cut (S5,6), sweep (S7) throw (S7)
Younger (6 of 7 children)	swim (S3,7), sleep (S2) walk (S1,3,5,7)	throw (S4)
K'iche' (3 of 7 children)	swim (S1,5), stay (S2) sing (S1)	

The overgeneralization data support our other observations of a development between the younger and older English-speaking children. The younger children produced three times as many overgeneralizations as the older children, and produced most of their overgeneralizations in the iv|tv direction. None of our subjects overgeneralized verbs in both directions. Since Bowerman's original study of the causative construction researchers have debated whether children are learning a causative rule with an inherent direction or a rule that is bidirectional (Lord 1979; Pinker 1989). Our results indicate that one feature of the development of the causative alternation is the awareness that verb argument structure may change in either direction. Younger children tend to overgeneralize the rule most frequently in the iv|tv direction while older children work on extending the rule in the opposite direction from tv|iv.

This observation accounts at once for the discrepancy between Bowerman (1974) and Lord (1979). Both report results from diary studies of their own children. Bowerman found that her daughters almost always produced overgeneralizations from intransitive to transitive sentences, while Lord found that her children frequently overgeneralized in the opposite direction from transitive to intransitive sentences. Both investigators may be right in reporting differences between individual children in the direction and frequency of causative overgeneralization. Maratsos et al. (1987) report that their subjects exhibited stable individual differences in the rates they extended a novel intransitive verb to transitive sentence contexts. Our pilot results thus paint a much richer picture than the existing literature and suggest individual children decide how frequently and in which direction to employ the causative rule.

Even more surprising may be the degree of cross-linguistic similarity in the children's overgeneralized verbs. There are many grammatical differences between English and K'iche' that include the means of causative alternation (lexical in English, morphological in K'iche') and the verbs that participate in the alternation (**dance**, **sleep** and **walk** do not in English but do in K'iche'). We were astonished to find that both English and K'iche'-speaking subjects overgeneralized the verb **swim**. In a previous study, Pye (1991) found that K'iche' children frequently overgeneralized **swim** and another locomotion verb similar to **walk** (-**wakatik** 'to stroll'). The K'iche' translations of the English verbs **leave**, **sleep** and **walk** all undergo the regular causative alternation in K'iche'. These results provide support for a set of universal constraints that determine which verbs are most likely to participate in the causative alternation as well as the verbs that children are most likely to overgeneralize the causative alternation to.

In sum, our data show the degree to which verbs act as a lexical filter for the grammar. The fact that children produce verbs does not insure that they have acquired a complete lexical entry for their verbs. Acquiring verbs is a process of approximation. Semantically, children develop finer distinctions about the use of each verb. Syntactically, children develop additional argument structures for each verb. With the right kinds of experiments we may locate the gaps in children's lexical representations. We would take the radical step of asserting that the answer to our question, "When do children acquire verbs?" is never. Even adults will disagree about the grammatical status of such sentences as:

I dined my cousin in Milwaukee.
Ichabod swam his horse across the river.
Floyd chevy'd her to Kansas City.
This sentence decausativized by itself.

One consequence of the lexical filtering principle is that the grammar of a language will change as verbs acquire new senses or lose old ones.

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