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The Acquisition of Breaking and Cutting*

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Any language acquisition theory must account for the acquisition of verbs. Verbs establish the fundamental syntactic aspects of a language and constitute the only major lexical category that is universal (Jelinek & Demers 1995). One peculiar feature of verbs is their transitivity. Some verbs require direct objects while other verbs do not. For example, it is possible to describe a situation in which a stick breaks as, "The stick broke." It is not possible to describe an event of cutting paper as, "The paper cut." Two features of this situation are remarkable. The first is that the verbs "break" and "cut" have such different argument structures. Since both verbs describe physical change, the simplest prediction would be that they would have the same verb argument structures. The second remarkable feature is that English speakers so readily agree on the appropriate labels for these events.

Our ability to instantly find an appropriate label for such events is remarkable because our labels ignore most of the information in the events. We abstract away from the entity performing the action, how quickly the action happened, how much effort was put into the action, and the component force vectors. Instead, English behaves as if the presence of an instrument were the only significant distinction between breaking and cutting.

Hale & Keyser (1986) appeal to a level of word meaning they label **Lexical Conceptual Structure** (LCS) to account for the argument structure of "break" and "cut." They claim that the LCS for "cut" contains the semantic feature **contact** since cutting requires a sharp-edged implement. Pinker (1989:199) picks out a similar semantic feature to account for the fixed transitivity of the verb "cut." In effect,

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these analyses predict that children learning English must observe that contact is the one feature (out of a thousand) that distinguishes breaking from cutting.

Such analyses rely upon undefined semantic markers to distinguish meanings—in the worst cases incorporating the very verbs they are supposed to define. Feature analyses inherit all of the problems endemic to markerese (cf. Fodor 1977). The features are treated as necessary and sufficient to an understanding of the concept when, in reality, each feature can be overridden by environmental and contextual factors (Labov 1973). The features provide a decomposition of a given concept without an explicit account of how to reconstitute the original concept from its parts (Fodor 1970). Such accounts imply cutting is equivalent to "breaking with a sharp edge," and therefore predict that the sentence "Bob broke the paper with the scissors" would be acceptable since the adjunct phrase supplies the necessary information.

Crosslinguistic comparison shows that event perception cannot provide an explanation for the syntactic behavior of "break" and "cut." These verbs translate into K'iche' as *-q'upi:j* and *-qopi:j* respectively. K'iche' is a Maya language spoken in the western region of Guatemala (Pye 1992). We provide transitive stems for both verbs. It is possible to use both verbs in intransitive sentences by adding an antipassive affix. The result is:

1.a. *x-Ø-q'upi-n-ik* *lee che'*
ASP-3A-**break**-AP-TIV the stick
'The stick broke.'

b. *x-Ø-qopi-n-ik* *lee wuuj*
ASP-3A-**cut**-AP-TIV the paper
'The paper cut.'

Chinese provides a different perspective on this problem. The Chinese verb *duàn* 'break' does not alternate. Instead, Chinese combines a process verb with a result verb like *duàn* to form a Resultative Verb Compound (RVC). The verb *duàn* cannot be used in transitive sentences without the addition of a 'helping' verb. Another Chinese breaking verb (*pò*) is used with the verb *qie* 'cut' to form an intransitive RVC that refers to cutting things.

2.a. *wo nòng-duàn le gùn-zi*
I make-break ASP stick
'I broke the stick.'

b. *zi qie-pò le*
paper cut-break ASP
'The paper cut.'

The usual explanation for such crosslinguistic differences is that the Chinese and

K'iche' verbs do not really mean "break" and "cut." If the syntactic behavior of verbs is tied to the LCS of verbs, we could assume that the Chinese and K'iche' verbs have different LCSs and thus exhibit different syntactic behaviors. Table 1 provides information on the referential extensions of "breaking" verbs in English, Mandarin and K'iche'. We asked adult speakers to describe a variety of breaking actions in their language. Table 1 shows that English speakers are adamant about the distinction between breaking and tearing while Mandarin speakers are equally adamant about the distinction between *pò* and *duàn*. Acquiring verb argument structure is more complicated than observing an action and inferring a LCS since children have to determine if they are observing a breaking, *duàn*, or *q'upinik* event. There is no substitute for learning verb argument structure independently of verb meaning.

Table 1. Crosslinguistic Comparison of breaking

	Bubbles	Plates	Sticks	Ropes	Clothes
English	pop	break	break	break	tear/rip
Mandarin	pò	pò	duàn	duàn	pò
K'iche'	poq'ik	paxik	q'upinik	t'oqopinik	rach'aqinik

Such observations show that both semantic and syntactic bootstrapping theories (Pinker 1984; Gleitman 1990) make overly simplistic assumptions about the uniformity of the mapping between verb meaning and verb argument structure. The crosslinguistic differences suggest that children cannot simply view an event and extract the relevant semantic features. At a minimum, children would have to decide whether they were viewing a break, *duàn* or *q'upinik* event, and these are just 3 out of 5,000 human languages. Acquisition theories that rely upon semantic or cognitive features, e.g., semantic and syntactic bootstrapping, must explain how children learn to make such distinctions. The missing component in all such studies is an adequate semantic theory.

We investigated the cut/break distinction with children acquiring Chinese, English and K'iche'. There were 16 children learning English, 6 learning K'iche' and 8 learning Chinese. The children were all between 3 and 5 years old. We asked speakers for their intuitions about the meaning of *cut* and *break* by offering them a series of event types that range over the actions, instruments and results of breaking and cutting. Our experimental objects included playdoh, peanuts, crackers, paper and dental floss. Our instruments included hands, rulers, scissors, string and a pencil. Finally, our actions included a scissors action with the hand and a cutting action with the ruler and string. We have carried out this experiment with both children and adults. A subset of their responses are shown in Tables 2, 3 and 4.

Table 2. Percentage of children (adults) responding with break/q'upi:j/duàn.

% break	hand	ruler	scissors	string	pencil
English	.56 (-)	.44 (-)	.31 (-)	.37 (-)	.56 (-)
K'iche'	.30 (-)	.17 (-)	.17 (-)	.30 (-)	.17 (-)
Mandarin	- (-)	.25 (-)	.25 (-)	.25 (-)	.12 (-)

Table 3. Percentage of children (adults) responding with cut/qopi:j/qie.

% cut	hand	ruler	scissors	string	pencil
English	.25 (.27)	.31 (.18)	.69 (1.0)	.31 (.18)	.25 (-)
K'iche'	.17 (-)	.17 (-)	.50 (1.0)	.17 (-)	- (-)
Mandarin	.25 (.23)	.50 (.15)	.12 (-)	.12 (.08)	.25 (-)

Table 4. Percentage of children (adults) responding with tear/rach'aqi:j/pò.

% tear	hand	ruler	scissors	string	pencil
English	.19 (.73)	.25 (.82)	- (-)	.31 (.82)	.19 (1.0)
K'iche'	.30 (.40)	.30 (.80)	.17 (-)	.17 (.80)	.50 (.80)
Mandarin	- (.08)	.12 (.77)	.12 (.38)	.12 (.61)	.12 (.77)

Table 2 shows the percentage of children (the adult percentages appear in parentheses) responding to our paper manipulation stimuli with the verb *break*, and its equivalents in K'iche' and Mandarin. All of the English-speaking children and adults used *break* to label the prototypical action of breaking a toothpick by hand. The results in Table 2 show that the children did not agree with adults about the proper range of uses for *break*. Many children used *break* to describe the events using paper. No adults used *break* for these actions.

The difference between child and adult responses raises the issue of how children acquire the meaning of *break* and *cut*. The acquisition of word meaning is just as difficult as learning syntactic constraints since there are an infinite number of ways to cut and break things and no clear boundary that separates these domains. One possibility is that children begin with a universal concept of breaking. We can

test this theory by comparing children's responses in different languages. All the subjects viewed a breaking toothpick as the best exemplar of breaking. However, English-speaking children were much more willing to extend *break* to other actions than Chinese and K'iche'-speaking children. And while 30% of the K'iche'-speaking children used *-q'upi:j* to describe two sheets of paper, none of the Chinese-speaking children used *duàn* to describe this result. Such data is a strong indication that children do not rely upon universal concepts to acquire word meaning.

The group data does not begin to do justice to the individual variation we found in this task. The children show more variation than the adults, but there are still significant differences between adults in the types of actions they consider to be breaking or cutting. To give some indication of the range of individual differences we provide each of the children's responses for the paper manipulation events in Table 5. There are no clear developmental trends in the 3 to 5-year-old age range. The youngest English-speaking subject (#8) as well as the oldest (#14) used *break* to label all of these events. Other children used *cut* or *rip*. The Chinese and K'iche' children have a greater range of verbs to choose from, but demonstrate the same variation. Along the way we discovered that some parents are disturbed to learn that their children mislabel events to this degree. We had to reassure them that this behavior is perfectly normal and something that children eventually grow out of.

Given this degree of variation in the children's responses, one might predict that the children would be equally confused about verb argument structure. An earlier study that we conducted (Pye et al., 1995) showed that 11 of 14 two to six-year-old children learning English applied the causative alternation to *break*, but only 2 of the 14 children used the alternation with *cut*. K'iche' children displayed a similar ability. We would not expect so few overgeneralizations from children who were struggling to identify the referents of *cut* and *break*. We conclude that however children acquire constraints on verb argument structure, they do so independently of referential extensions of word meaning.

We think this is further evidence, if any were needed, in support of Frege's (1892) thesis distinguishing reference from word meaning. Frege's "morning star" and "evening star" example illustrates the fallacy of referential semantics. Words with different meanings can refer to the same entity in different ways. Hilary Putnam (1988) offers some additional arguments against a referential

Table 5a. English-speaking children's paper manipulation verbs.

Subject	hand	ruler	scissors	string	pencil
7 (3;10)	cut	cut	cut	cut	break
8 (2;2)	break	break	break	break	break
1 (4;8)	rip	rip	cut	rip	rip
2 (5;0)	cut	rip	cut	rip	rip
3 (3;10)	break	break	cut	rip	rip
5 (4;4)	break	rip	cut	break	break

6 (4;4)	break	break	break	break	break
8 (4;0)	tear	tear	cut	rip	cut
9 (5;2)	cut	cut	cut	cut	break
10 (3;9)	break	break	break	break	break
11 (4;5)	tear	cut	cut	cut	cut
12 (4;2)	break	break	cut	break	break
13 (4;10)	cut	cut	cut	cut	cut
14 (5;5)	break	break	break	break	break
15 (5;2)	break	cut	cut	cut	cut
16 (4;9)	break	break	break/cut	tear	break

Table 5b. Chinese-speaking children's paper manipulation verbs

Subject	hand	ruler	scissors	string	pencil
18 (4;0)	qie-duàn	qie-duàn	jian-duàn	qie-duàn	nong-huai
19 (5;5)	huai	huai	huai	huai	huai
20 (4;9)	pò-diao	nong-pò	nong-pò	nong-pò	nong-pò
21 (4;9)	huai-diao	qie-huai-diao	qie-diao	huai-diao	huai-diao
22 (3;0)	pò-diao	huai-diao	huai-diao	huai-diao	huai-diao
24 (3;9)	jian-xia	lai qie	jian	jian	qie
25 (3;5)	qie-diao	qie-diao	qie-diao	fen-kai	qie-diao
26 (4;3)	jian-duàn	qie-duàn	jian-duàn	nong-duàn	chuan-duàn

N.B., chuan 'twist'; diao 'drop'; fen 'separate'; huai 'break down'; jian 'scissor'; kai 'open'; lai 'come'; xia 'down'

Table 5c. K'iche'-speaking children's paper manipulation verbs

Subject	hand	ruler	scissors	string	pencil
1 (4;6)	xt'ub'in	kat'ub'i:j	kaqopi:j	xpi'nik	rach'aqin
7 (4)	qopin	qopin	qopin	qopin	q'ipin
8 (4)	q'upin	q'upin	q'upin	q'upinik	q'upin
13 (4)	xq'upin	katz'upin	kaqopin	q'upin	kat'ubin
27 (4;7)	xt'ub'in	rach'aqin	t'ub'in	t'ub'inik	t'ub'in
30 (4;8)	t'oqopin	t'oqopin	t'oqopin	xpi'nik	t'oqopin
23 (5)	rach'aqin	xt'ub'in	xqopin	rach'aqin	rach'aqin
12 (5)	rach'aqin	rach'aqin	rach'aqin	rach'aqin	rach'aqin

N.B., -pi'nik 'break s.t. soft'; -q'ipin 'chip'; -t'oqopin 'break string/rope/wire'; -t'ub'inik 'rip/tear'; -tz'upinik 'a leaf coming off a tree'

theory of semantics. He notes that reference is a social phenomenon that is ultimately dependent on the current scientific knowledge of experts. The reference of the word "gold" changes as our knowledge of chemistry changes, but the meaning of the word does not change. Putnam refers to the role of experts in fixing reference as "the division of linguistic labor." Obviously children are not referential experts.

Putnam's famous "Twin Earth" thought experiment provides another argument against referential semantics. Putnam's Twin Earth is like Real Earth in every respect except that on Twin Earth "water" has the chemical constituency of XYZ rather than H_2O. The Twin Earth example demonstrates the contribution of the environment to referential meaning. Finally Putnam cites Quine's (1960) arguments in support of "meaning holism." Quine's holism thesis asserts that word meaning inherently depends on the totality of meanings and beliefs in the society. Thus, word meaning would not be fixed by a single observation.

Current research on the acquisition of word meaning is almost wholly based on referential semantics. Invariably, test subjects are presented with prototypical exemplars of English words and the results indicate that the subjects have acquired the relevant concepts. No explanation is offered of exactly what the concept is, or how it extends throughout time and space. When we test subjects' ability to apply words in a wider range of contexts we find a great deal of variation between speakers (Labov 1973). Referential theories would interpret such variation as evidence that the speakers do not attach the same meaning to their words. We would agree with Quine and Putnam that such variation is another reason to embrace a non-referential theory of word meaning (cf. Green 1983).

We suggest distinguishing between word meaning and our concepts of word referents. Word meaning is established within a linguistic system that is not directly tied to referents. The linguistic system includes semantic fields and semantic contrasts as well as the syntactic properties of words. We tie words to real life referents through our theories of how to identify the referents for words. These theories incorporate Putnam's causal chains to connect words to things. Such chains are subject to all the variation in our experience with the world and thus give rise to prototype effects when speakers are called upon to identify referents for words. Words have meaning within the linguistic system that speakers share, but exhibit variable meaning when we actually attempt to tie words to referents. Word meanings are indirectly tied to our perceptions of the world. The causal chain is stronger for some words (e.g., *triangle*, *prime number*), but weaker for others (e.g., *break*, *superconductivity*). The reason children can acquire words without an understanding of quantum physics is that they are exposed to a linguistic system and causal chains. Word meaning is insolated from changes in our conceptual paradigms.

An important implication of this scheme is the separation of referential semantics from syntax. Children cannot simply view a situation and deduce syntactic features for the words that refer to the event. In other words, our approach rules out semantic and syntactic bootstrapping in the ordinary sense. A child watching someone cutting paper with scissors would not have enough evidence available to distinguish between a *cut*, *qopinik*, *qie* or a *jian* interpretation.

Children might be in a better position to fix a verb's meaning after they have heard the verb used in a number of contexts. However, if experience is required to fix verb meaning, it is also available for limiting verb argument structure. Such a process resembles distributional learning more than semantic bootstrapping. Keeping verb reference separate from verb meaning and verb argument structure would allow children to establish the subcategorization requirements for verbs long before they have constrained verb referents.

This still leaves the original problem of how children decide to restrict the causative alternation to particular verbs. We think the best solution lies along the lines of paradigm construction. Pinker proposed paradigm construction as a means children could use to acquire inflections (1984). Children presumably note the formal similarities and differences between the words *play*/*played*, *jump*/*jumped* and *break*/*broke*, to construct a paradigm for the regular and irregular past tense inflection. Children overgeneralize the regular past tense inflection *-ed* to the irregular verbs until they realize that the irregular past tense forms displace the regularized forms.

A similar solution suggests itself for the acquisition of the causative alternation (c.f. Lord 1979). Children could construct paradigms for intransitive and transitive uses of verbs on the basis of positive evidence. Paradigm construction would capture the acquisition of suppletive causative pairs in exactly the way it accounts for the acquisition of irregular past tense forms. At first, children would fail to realize that *die*/*kill*, *come*/*bring*, *eat*/*feed*, *stay*/*keep*, etc. form a suppletive relation with respect to the causative alternation. Roughly 90 percent of children's causative overgeneralizations involve such suppletive pairs, so paradigm construction would explain a major proportion of the children's errors.

One difficulty for a paradigm account are verbs with fixed transitivity and no suppletive partners. Intransitive verbs such as *disappear*, *glimmer* and *shiver*, and transitive verbs such as *cut*, *put* and *throw* do not have a lexical means to express an event from another transitivity perspective. They require a syntactic device such as the periphrastic or passive constructions to alternate transitivity. At first glance, such syntactic constructions appear to lie outside the scope of lexical paradigms, but Williams (1994) suggests otherwise. He notes that adjectives have a paradigm that mixes inflectional and syntactic constructions, e.g.,

	Plain	Comparative	Superlative
regular	simple	simpler	simplest
suppletive	good	better	best

syntactic regular more regular most regular

The lesson Williams draws from such examples is that the lexical entries may contain more syntactic information than the individual part of speech. Significantly, this additional information includes phrasal constructions that the word appears in. The exceptional causative paradigms would then include entries like the following:

intransitive	NP2 disappear	NP2 was cut
transitive	NP1 make NP2 disappear	NP1 cut NP2

As an explanation for language acquisition, paradigm construction has the obvious advantage that it makes no distinctions between lexical, suppletive, morphological and phrasal alternations. Languages are free to use any of these means to express the causative alternation and do. Indeed, languages like English and K'iche' use multiple means to express the causative alternation. Paradigm formation also explains children's overgeneralizations in a uniform manner. A significant prediction may be that all such errors of commission may be attributed to an insufficiently structured lexicon.

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