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VERB ACQUISITION IN ENGLISH AND JAPANESE*

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Three decades ago, Carol Chomsky (1969) reported finding surprising differences between child and adult uses of the verbs *ask*, *tell*, *look* and *see*. A later study by Deidre Gentner (1978) showed that children often confuse the verbs *mix* and *stir*. Melissa Bowerman (1978) reported that her daughters overextended words in unusual ways, including the verbs *kick* and *open*. Despite these early observations, most acquisition theorists contend that children are able to construct fairly accurate representations of verb meaning. Pinker (1984:28) asserts, ‘Presumably children encode most reliably the parts of sentences whose words they understand individually, and the whole sentences most of whose words they understand. This is a plausible variant of the assumption that children know the meaning of every word in the input sentences before syntax acquisition begins’ In a later book Pinker adds ‘The simplest possible assumption about how verbs are learned is that verb meanings correspond to concepts given by the child’s perceptual and cognitive mechanisms, and that to acquire them, the child simply has to map a sound uttered in the presence of an exemplar of a concept onto the mental representation of that concept’ (1989:253). Even Tomasello, who otherwise endorses a larger role for language input than Pinker, asserts that ‘Knowing the object labels and their appropriate referents must surely be a big help in this situation even if the child knows no syntax. This is quite simply because she can see the actual situation and who is doing what to whom (a syntax of action, as it were), which provides solid information to inform her hypotheses about the meaning of the verb.’ (1992:209).

Sorting out the correct meanings for verbs is an essential part of constructing sentences. The verb *ask* projects a sentence in which information flows from the indirect object to the subject while the verb *tell* projects a sentence with the reverse information flow from subject to indirect object. The verbs *trip* and *stumble* commonly refer to the same situation. The verb *trip* assigns two argument roles in the active voice—an agent (the entity controlling the action) and a theme (the entity undergoing the action), while the verb *stumble* only assigns one argument—a theme. While these prosaic details are obvious to any competent speaker of English, their very familiarity obscures the subtle orchestration of semantic and syntactic details that makes verbs the most refined tool of human cognition. Their linguistic differences (and a thousand more like them) show that far from being passive tools for recording our perceptions, verbs are dynamic mental constructs. Verbs impose a language-specific structure on the expression of events (Talmy 1985).

Despite the central role that verbs play in sentence construction, relatively little research has been devoted to the study of verb acquisition. In contrast to the situation for nouns, no viable accounts of the acquisition of verb meaning currently exist. While attention to shape plays a crucial role in constraining children’s use of nouns (Baldwin 1989; Clark 1973; Landau et al. 1988), shape cannot serve the same

*We would like to thank the children and adults who participated in this study.

function in the acquisition of verb meaning. Although Golinkoff et al. (1995) assert that their lexical principles apply to the acquisition of verbs as well as nouns, they do not provide any evidence for the operation of a shape bias in verb acquisition. Tomasello's (1992) verb schemas do not provide enough predictions about core aspects of verb meaning to be testable.

Pinker (1989) has proposed a more sophisticated model of verb acquisition that relies on two mechanisms: semantic structure hypothesis testing and syntactic cueing of semantic structure. Using the hypothesis testing mechanism, the child entertains a maximal possible conceptual representation that is compatible with the input for a given verb. The child adds new details to the verb's semantic representation as needed, and permanently erases details that contradict a current situation. Gopnik & Meltzoff (1997) offer a variant of the hypothesis-testing approach. Pinker (1984) lists seven problems that hypothesis-testing models must explain to account for the acquisition of inflections. His observations hold *mutatis mutandis* for verbs as well. One of these problems is accounting for morphemes that encode different sets of features. A type of verbal syncretism occurs in polysemous verbs. You can fix Fred a martini, but you cannot fix Sally a flat tire. Children relying on hypothesis testing would have to constantly revise their hypotheses about the semantic features of polysemous verbs. Constructing multiple entries for polysemous verbs defeats the purpose of hypothesis testing by allowing erroneous semantic features to remain in a verb's lexical entry. Another flaw in hypothesis testing is that it presupposes the learning that it is supposed to account for. Forming relevant hypotheses about verb meaning is no easier than detecting relevant verb meanings. It would be more parsimonious to assume that learners simply select verb meanings that they deem relevant to a given situation.

Pinker's syntactic cueing mechanism asserts that children use the structure of sentences they hear to refine the argument structures of their verbs. Hearing a sentence in which a verb appears with a direct object would provide a cue that the verb accepts a theme argument. Pinker acknowledges that syntactic cueing is similar to a previous mechanism he named "Direct Learning from Positive Evidence" (1984). Direct learning is identical to the syntactic bootstrapping mechanism proposed by Gleitman (1990) and Naigles (1990). Pinker, however, feels direct learning cannot provide a sufficient guide to verb meaning so he adds an intervening step that applies direct learning to the acquisition of verb conflation classes rather than individual verbs. At every step in the syntactic cueing process, Pinker maintains the child can fall back on semantic structure hypothesis testing to check the results of syntactic cueing. Thus, Pinker (1989) demotes direct learning/syntactic cueing to a secondary mechanism and awards primary status to hypothesis testing.

My colleagues and I have been exploring whether children's verb knowledge is as good as the theorists tell us, or whether children have as much to learn about meaning as the earlier studies suggest. The first question we faced was the issue of devising a test that would reveal the extent of children's verb knowledge rather than their familiarity with verb labels. We decided not to use novel or fake verbs because fake verbs do not display the rich semantic and syntactic constraints that are an essential part of verb acquisition. For example, if we tell you that wugging someone means 'to push them with your foot,' you have no intuitions about whether it is possible to say 'I wugged Ralph with my knee.' On the other hand, native speakers of English know that the sentence 'I kicked Joan with my knee' is semantically anomalous. English speakers can always translate the fake verb back into real English verbs and consult their intuitions about the use of the real verbs, but such translation defeats the original rationale for using fake verbs. We believe that significant advances in understanding children's verb representations can be made by exploring the rich texture of linguistic constraints on real verbs.

Our experiments exploit the rich texture of verb representations by eliciting speaker judgements

about the range of a verb's semantic extension. Speakers of English know that people, horses and insects can walk, whereas worms and balls cannot. On the other hand, horses can canter, while people and insects can hop. The set of objects that can undergo an action define a verb's semantic extension and provide significant clues to a speaker's mental representation of that action. This approach has to be used cautiously since it is always possible to squeeze a verb into a metaphorical extension. I would ordinarily use the verb *squeeze* to describe a physical action, but the previous sentence demonstrates that it is possible to use this verb metaphorically to convey the difficulty of fitting a verb into extraordinary contexts. We use concrete props in our experiments to help minimize metaphorical flights of fancy. Control groups of adult speakers also help us distinguish between conventional and unconventional verb usage.

Cross-linguistic comparisons of semantic extensions bring out clear differences in verb meanings. Consider the following examples from four languages. In the left-most column is a list of objects and in the other columns appear the verbs that the speakers of these languages would commonly use to describe the action of separating the object in some manner.

Objects	English	Japanese	Mandarin	Spanish
pen cap	take off	hazusu	na xia	quitar
apples	pick	toru	zhai	arrancar
cherries	pick	tsumu	zhai	cortar
paper	cut	kiru	jian (kai)	cortar
string	break	kiru	duàn	cortar
stick	break	oru	duàn	quebrar
paper	tear	yaburu	xi (kai)	romper
cracker	break	waru	bo (kai)	romper
peanut	break	waru	bo	pelar

English makes a critical distinction between taking off things for no particular reason, and picking items for consumption. Japanese uses the verb *toru* for simple actions of taking something off things and the verb *tsumu* for picking small objects such as cherries. The Japanese verb *hazusu* refers to unfastening an object such as unhooking or unbuttoning it. Mandarin makes many of the same distinctions that English makes, but allows an optional result verb (*kai* 'to open') that unites several actions. Latin American Spanish makes a three-way distinction between *quitar*, *arrancar* and *cortar*, but extends the cutting verb *cortar* in many directions. In asking our question about when children acquire the verb *take off*, we can observe when children acquire the specific set of constraints that apply to semantic extension of English verb.

In designing our experimental task, we put together a set of objects that fell in and outside of the semantic extension of the English verb *take off* and the Japanese verb *hazusu*. We begin by asking subjects whether it is possible to take off a sock or hat (both items that fall within the semantic extension of the English verb). We also ask if it is possible to take off a cherry. In each case we show the subject an example of the object we are asking about. We follow with a demonstration of taking a lid off of a pen, and ask the subjects what we did. They should respond 'You took it off' or 'Took it off.' We follow this with the question 'What did the pen lid do?' After demonstrating the action, we end by asking the subjects if we broke the pen and if we opened the pen. Thus, the protocol contains three parts: 1. questions about objects that can be taken off, 2. a verb elicitation task, and 3. questions about verbs that contrast with the target verb *take off*.

We looked for stimuli that would elicit similar reactions from children in Japan and the United States. We found that children in both countries would recognize apples and cherries, whereas only children in the United States were familiar with raspberries. In phrasing our test questions we became aware that the potential form of verbs in Japanese used to translate English phrases such as ‘Can you take off a hat’ is identical to the passive form in Japanese. Since passives are late acquisitions for children learning many languages, we made sure the Japanese toddlers could respond appropriately to questions in the potential form. We piloted the experiment with English and Japanese-speaking children in the United States to insure that the subjects would respond appropriately to our test questions, and to practice demonstrating the actions in an identical manner in English and Japanese. Afterwards, Aoki took the experiment to Japan, while Pye and Morikawa performed the experiment with American subjects.

We performed this task with three groups of American English speakers: 8 children between 3 and 4 years old, 9 children between 5 and 6 years old and 12 adults. The mean age for the three groups of American subjects was 3;11, 5;5, and 36 years respectively. We also performed the same task with three groups of Japanese speakers in Okayama, Japan. The Japanese subjects included 12 3-year-olds, 12 5-year-olds and 12 adult speakers. The mean age for the three groups of Japanese subjects was 3;7, 5;7, and 22 years respectively. The results appear in Table 1.

Table 1. Semantic extensions of the verbs *take off/hazusu* (proportion)

Age	Language	Semantic Extension Test Objects			
		pen cap	sock	hat	cherry
3	Japanese	.22	.33	.67	.67
3	American	1.0	1.0	1.0	.87
5	Japanese	.6	.64	.54	.92
5	American	.92	1.0	1.0	1.0
Adult	Japanese	.75	.33	.42	.42
Adult	American	.92	1.0	1.0	.08

Table 1 displays the proportion of subjects who responded positively to our questions about taking off pen caps, socks, hats and cherries. We eliminated any subjects who did not respond from this table. The responses to the pen cap were obtained in the verb elicitation portion of the experiment, while the other responses were made to the yes/no questions about the test objects, e.g., “Can you take off a sock?”

All the American subjects accepted the use of *take off* with pen caps, socks, and hats. These are all objects that fall within the semantic extension of the verb, and thus reflect well on the children’s knowledge of the verb’s meaning. The last set of data for *cherry*, on the other hand, reveals a dramatic difference between the American children and adults. Almost all the children accepted the verb *take off* for cherries, while only one adult said this was possible. Adult English speakers prefer to use the verb *pick* for this action. Thus, we conclude that while American children are familiar with the objects that fall within the verb’s semantic extension, they have not yet acquired all of the adult constraints on the verb’s semantic extension.

One possible explanation for the difference between the child and adult responses could be that children are more prone than adults to respond ‘yes’ to an adult experimenter asking them a yes/no question. We have three arguments against this hypothesis. The first is that the children’s responses to the pen cap stimulus were part of the verb elicitation probe rather than responses to yes/no questions.

The children were just as adamant about using the verb *take off* in this context as they were in responding positively to the yes/no questions about socks and hats. Our second argument is to take note of the discrepancies between the responses of the Japanese and American children. Surely, one would predict that Japanese children would be more prone than American children to respond positively to yes/no questions from a strange adult. We find just the opposite pattern held for the verb *take off*. Our third argument comes from the American children's responses to yes/no questions about the semantic contrasts in the third part of the experiment. The American and Japanese children had no hesitation about responding negatively to yes/no questions about breaking the pen cap (see Table 2). We have also added a question about the possibility of taking off a house. American children have no hesitation in responding negatively to this question. We conclude that the children's responses to the yes/no questions are valid measures of their semantic extensions for the verb *take off*.

The American and Japanese children produced a large number of semantic and syntactic overgeneralizations in our experimental task. Their responses, thus, appear to be at odds with records of children's verb use in daily conversation. Two-year-old language learners seem to be fairly astute verb users, and seldom misuse verbs. Maratsos et al. (1987) estimated that Bowerman's 100 or so examples of causative overgeneralizations were culled from approximately 750,000 utterances. While children's spontaneous verb errors may be relatively rare, children seldom venture far from familiar contexts of verb use. Our experimental procedures force our subjects to speculate about the use of verbs in unfamiliar contexts. Previous experimental investigations of verb argument structure have demonstrated that children will frequently alter verb argument structure inappropriately to conform with experimental demands (cf. Braine et al. 1989; Gropen et al. 1991). Our results suggest that experimental procedures can unmask uncertainty in children's verb representations that ordinarily remains hidden in everyday conversation.

Table 1 reveals significant differences between the responses of the Japanese and American subjects. The Japanese subjects were much less prone to use the target verb *hazusu* to describe the action of taking off a pen cap, and were far less prone to accept the use of *hazusu* for socks and hats than the American subjects. This pattern reflects Japanese constraints on the verb *hazusu*, and the availability of a wider set of verb labels for these actions. Japanese speakers prefer to use the verb *nugu* for taking off socks or shoes, and the verbs *nugu* and *toru* for taking off hats. As I mentioned earlier, Japanese uses the verb *tsumu* for picking cherries. The data shows that the adult Japanese speakers were still more prone to use the verb *hazusu* for taking off pen caps than for taking off socks, hats and cherries, even though the adults had the option of using the verb *toru* for this action.

The 3-year-old Japanese children were much less prone to use the verb *hazusu* than the 5-year-old and adult Japanese groups. The 3-year-old children substituted the verbs *akeru* 'to open', *toru* 'to pick', and *nuku* 'to pull out a plug' for *hazusu*. The 5-year-olds also substituted the verbs *akeru* and *toru*, while 3 adult speakers used the verb *toru*. The greater number and variety of verb substitutions for the 3-year-old subjects suggests that they have not acquired the full adult semantic representations for these verbs. The Japanese children's responses for socks and hats show that the children have some knowledge of the specialized verbs adults use for taking off these items. However, the responses for all three groups of Japanese subjects are close to the chance level of fifty percent. The children still appear to be in the process of refining their understanding of the distinction between *hazusu* and *nugu*. Finally, the Japanese children's responses for cherry indicate that they have not acquired the adult distinction between the verbs *hazusu* and *tsumu*.

The differences between the responses from the American and Japanese subjects reveal the

degree to which the children have acquired the distinctive set of semantic constraints on the verbs in their language. The American children were all willing to extend the verb *take off* to socks, hats and cherries, whereas the Japanese children were more prone to extend the verb *hazusu* to cherries than to socks and hats. There were also significant differences between the American and Japanese children's substitution patterns. The Japanese children produced a wider variety of verbs than the American children. Four Japanese children substituted the verb *akeru* 'to open', whereas the only American child who made a substitution used the verb *pull*. The differences in response rates and substitution patterns between the children underline the degree to which they have responded to the structural differences between the semantic domains of verbs in English and Japanese.

Table 2 displays the data we collected on semantic contrasts between verbs. The first column shows the subjects' responses to the question of whether it is possible to pick off/toru a pen lid. Here we see a dramatic difference between Japanese and American adult speaker judgements. Only two American adults accepted this use of the verb *pick*, while all the Japanese adults accepted *toru* for this event. The American children resembled the Japanese children in their extension of the verb *pick* to taking off pen caps. These results underline the degree to which the American children do not fully differentiate the verbs *take off* and *pick*.

Table 2. Semantic contrasts with the verbs *take off/hazusu* (proportion)

Age	Language	Semantic Contrasts		
		pick	open	break
3	Japanese	1.0	.83	.33
3	American	.87	.75	.12
5	Japanese	1.0	.8	.0
5	American	1.0	1.0	.0
Adult	Japanese	1.0	.42	.0
Adult	American	.17	.33	.0

The next two columns show the subjects' responses to the question of whether *open* or *break* (*nuku* 'to pull out a plug' and *oru* 'to stick break') can be applied to the action of taking off a pen cap. The children accepted *open/nuku* as an alternative label for this event, but rejected *break/oru*. Few adults were willing to use *open/nuku* for this action. All of these results amplify our finding that children lack a full adult semantic representation for the verb *take off/hazusu*. They extend the verb beyond the normal adult usage, and they do not control the adult distinction between taking something off and picking or opening it. The Japanese and American children did recognize that taking off a pen cap does not break the pen.

Table 3 shows the subjects' responses to the verb elicitation section of our experimental protocol. The first column displays the subjects' use of the verb *take off/hazusu* in response to our question 'What did I do?' The American subjects had little difficulty using the target verb in a transitive sentence, while

the Japanese children showed considerable difficulty in using the verb *hazusu* in their responses. Seven of

Table 3. Verb elicitation responses for *take off/hazusu* (proportion)

Age	Language	Syntactic Forms			OG*
		Transitive	Intransitive	Passive	
3	Japanese	.22	.0	.0	.4
3	American	1.0	.0	.0	.5
5	Japanese	.6	.08	.0	.17
5	American	.92	.58	.08	.08
Adult	Japanese	.75	.42	.17	.17
Adult	American	.92	.64	.09	.0

* Indicates the subjects overgeneralized the transitive verb form to the intransitive context.

the Japanese 3-year-olds used another verb in response to our question and two of them did not reply. The Japanese subjects that used other verbs in their replies all used the verbs in a transitive form.

The next three columns in Table 3 report different forms of the subjects' responses to the question 'What did the pen lid do?' This question was designed to elicit a use of the target verb in an intransitive context (Braine et al. 1990; Loeb et al. 1998). In the case of the verb *take off*, adults commonly responded by saying the pen cap came off. The verb *hazusu* takes the form *hazureru* in intransitive contexts. Three Japanese adults used a different verb in the intransitive context.

The results indicate that the adults were much more successful than the children at producing intransitive responses. The adults produced more intransitive responses and more passive responses than the children, although the American 5-year-olds were more successful than their Japanese counterparts at producing intransitive and passive responses. The children showed a marked tendency to overgeneralize the transitive verb form to the intransitive contexts. Two of the six American 3-year-old children who responded to this question answered 'It took off.' Two of the five Japanese 3-year-olds who responded used the transitive form of the verb. These results underline the degree to which three and five-year-old children are still in the process of acquiring important syntactic constraints on verbs.

We turn next to the question of whether a causal relation exists between the children's indistinct knowledge of the verb's semantic extensions and their difficulty in altering the verb's argument structure in an intransitive context. While we cannot at present rule out a causal relation completely, our data suggest that the relation between knowledge of verb meaning and verb argument structure is less than perfect during acquisition. Recall that our data on the verb's semantic extension indicated that both the three and five-year-old American subjects were prone to extend the verb beyond the adult limits. The data on the children's replies in intransitive contexts, on the other hand, indicates a significant advance in the five-year-olds' control of the intransitive verb form. Thus, the five-year-olds display some awareness of significant syntactic constraints on verb use despite an abysmal knowledge of the semantic extension for the verb.

The correlation between the semantic and syntactic representations in children's verbs is important because it is necessary for both semantic structure hypothesis testing and syntactic cueing mechanisms. Without a high degree of correlation between verb meaning and argument structure, children cannot use one to acquire the other. Our data appear to be at odds with both of these proposals

in that for the verb *take off/hazusu* the children become aware of syntactic constraints on verb use before refining their knowledge of semantic distinctions between verbs. Evidently, they did not depend on semantic bootstraps to begin constraining the verb's argument structure. The developmental gap between the acquisition of syntactic constraints and the acquisition of adult semantic representations for this verb is significant. This gap suggests that whatever syntactic bootstraps may exist, they are too weak to advance children's knowledge of verb meaning very quickly. Children are able to learn syntactic constraints on verbs independently of their knowledge of verb meaning.

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We examined the individual responses to see how many of the subjects who offered an intransitive response also responded negatively to the question about the use of *take off/hazusu* with cherries and its contrast with *open/nuku*. If there was a close tie between the development of a semantic representation for verbs and the acquisition of alternative verb argument structures, we would expect the subjects who successfully produced an intransitive verb form would not overextend the verb semantically. We also looked at the individual data to see if there was a relation between the production of the transitive overgeneralizations and semantic overextensions. As Table 4 indicates, we did not find a clear distinction between the semantic responses of the individual children producing the adult intransitive forms and the children who produced other syntactic forms. If the children had constrained the semantic extension for the verb before acquiring the adult syntactic form, we would expect to find more of the 5-year-olds responding negatively to the semantics questions. Just the opposite seems to be the case; more 3-year-olds responded negatively.

Table 4. Number of individual subject responses by syntactic form and semantic choice

Syntactic Response	Semantic Response cherry				Semantic Response open			
	yes	no	yes	no	yes	no	yes	no
3-year-olds	Japanese (n = 12)				American (n = 8)			
intransitive	-	-	-	-	-	-	-	-
overgeneralization	2	-	2	-	3	-	2	1
other	6	4	8	2	4	1	4	1
5-year-olds	Japanese (n = 12)				American (n = 12)			
intransitive	1	-	1	-	4	-	3	-
overgeneralization	1	1	1	-	1	-	1	-
other	9	-	6	2	7	-	7	-

Lack accurate assessments of verb meaning.

Take off–dictionary definition (hard to come up with a definition)

Children are developing the metalinguistic skills needed to define words

Recent work on the meaning of nouns pairs a referent with a non-referent and asks subjects to choose between the two

Verbs aren't amenable to the same procedure—it's hard to compare 2 actions

The work on nouns does not probe knowledge of the word's semantic extension

We elicited judgements about the verb's semantic extension

Ask what things you can or cannot take off.

Start with a prototypical exemplar—taking a cap off of a pen

Compare reaction to taking off a sock, a hat, and a cherry.

Find that over 90% of 3-year-olds, 5-year-olds and adults take off pen caps, socks and hats

While only 8% of adults use 'take off' for cherries, 87% of 3-year-olds and 100% of 5-year-olds take off cherries.

This result suggests that children have much to learn about the meaning of 'take off'.

In fact, children face a rather nasty learnability problem—they cannot use positive evidence to restrict their usage of the verb.

Why not? Although they might hear adult speakers use the verb 'pick' with cherries, they cannot rule out a partial synonymy between 'pick' and 'take off' similar to the synonymous relation between the verbs 'slip' and 'slide' or 'fall' and 'drop'.

Besides, if children heard adults using the verb 'pick' for cherries, that observation alone wouldn't prevent a child from using the verb 'take off' for apples, walnuts or ornaments

There are a potentially infinite number of possible semantic extensions for the verb 'take off', and children do not have time to test all possible hypothetical solutions.

Another potential answer would be to adopt a conservative learning strategy. A child might only use verbs with objects that she had observed other speakers using the verb with.

Our data showing robust overextensions among 3 and 5-year-old children suggests that children are not conservative learners. They never appear at a loss for words, even if it means taking a plunge into the semantic depths.