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Novel Noun and Verb Learning in Chinese-, English-, and Japanese-Speaking Children

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When can children speaking Japanese, English, or Chinese map and extend novel nouns and verbs? Across 6 studies, 3- and 5-year-old children in all 3 languages map and extend novel nouns more readily than novel verbs. This finding prevails even in languages like Chinese and Japanese that are assumed to be verb-friendly languages (e.g., T. Tardif, 1996). The results also suggest that the input language uniquely shapes verb learning such that English-speaking children require grammatical support to learn verbs, whereas Chinese children require pragmatic as well as grammatical support. This research bears on how universally shared cognitive factors and language-specific linguistic factors interact in lexical development.

Understanding how children learn nouns and verbs is crucial for our understanding of lexical development. Nouns typically designate objects that are visually stable across time and are individuated from the environment. In contrast, verbs typically denote actions that are more ephemeral and more difficult to individuate than objects. How do children learn nouns and verbs in the face of these conceptual differences?

This question is deeply related to the issue of whether noun learning is favored over verb learning across languages. Gentner (1982) proposed that nouns are easier to learn than verbs independent of the structural and distributional properties of the native language. However, this proposal has been challenged by results showing that early lexicons may contain equal numbers of nouns and verbs if verbs predominate in the input (e.g., Choi & Gopnik, 1995; Tardif, 1996). In languages including Chinese, Korean, and Japanese, both subjects and objects are often dropped from the sentence, having the effect of making verbs more prevalent in the input. Importantly, verbs appear more frequently than nouns in the maternal input (e.g., Choi & Gopnik, 1995; Kim, McGregor, & Thompson, 2000; Ogura, 2001; Tardif, 1996).

The question of whether Chinese, Korean, and Japanese children learn verbs earlier or at the same time as nouns is far from settled as mixed results have been reported. Some studies suggest that verbs predominate in the early production vocabularies of

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Mandarin- and Korean-speaking children (Choi, 2000; Tardif, 1996). Other studies report approximately equal proportions of nouns and verbs (Choi & Gopnik, 1995). Still other studies note that the proportion of nouns is *higher* than verbs in Korean (Au, Dapretto, & Song, 1994; Bornstein & Cote, 2004; Kim et al., 2000) and in Japanese (Ogura, 2001; Yamashita, 1997) children's vocabularies.

Given the results reported in the literature, the issue of noun–verb dominance remains open. Additional investigations of some of the ''verb-friendly'' languages such as Navaho (Gentner & Boroditsky, 2005) and Tzeltal (Brown, Gentner, & Braun, 2005) as well as microlevel analyses of Chinese children's noun and verb vocabulary through different periods of lexical development are underway (Tardif, 2006). Nevertheless, a different approach is needed to corroborate the research using the checklists or corpus data because data from these methodologies have limitations.

Checklist and Corpus Data: Limitations

Methods of data collection that involve checklists and corpora provide us with rich and important information on the nature of early vocabularies. At the same time, each of these methods raises a number of issues that need to be addressed. First, context matters for corpus data. In studies using production data, the relative proportion of nouns and verbs in children's early vocabulary is taken to be an index of the relative difficulty of noun and verb learning. However, the relative proportion of nouns and verbs varies depending on the context in which the production data are collected even within a single language (Choi, 2000, Ogura, 2001; Tardif, Gelman, & Xu, 1999). For example, Japanese mothers produced more verbs in a toy-play context, whereas more nouns were produced in a picture book reading context (Ogura, 2001). Thus, samples collected in different contexts may yield different results.

Second, what counts as a ''word'' may differ across languages, and this may influence the number of nouns and verbs appearing on checklists or coded from production data. This problem influences the count for verbs more than for nouns because verbs tend to be more polysemous and crosslinguistically variable in their meanings (e.g., Gentner, 1982). For example, 开 (kāi) is a monosyllable verb in Chinese. Its meaning includes the rough equivalent of ''to open,'' ''to start,'' ''to operate/drive,'' and ''to release,'' among others. Even though 开 has its own entry as a verb in Chinese dictionaries, Chinese dictionaries usually list each word combination as a separate lexical entry (e.g., 开门 (kāimén) ''open (a/the) door,'' 开会 (kāihuì) ''have (a/the) meeting,'' 开车 (kāiche) ''to drive''). In contrast, in English, although frequent verbs such as ''run'' and ''take'' are also polysemous, English speakers do not consider different senses of these words to be different lexical items. Thus, in constructing a checklist inventory in English, a polysemous verb is usually listed only once as a single lexical item.

Third, the use of a word (as indicated on a checklist or in production) does not guarantee full mastery of the meaning of the word. Children may use a particular word in a particular situation appropriately, but the total number of situations in which they could use the word appropriately may be much more limited than situations in which the word is used by adults (Bowerman, 1980; Dromi, 1987). For example, a child may use the verb ''throw'' when she sees someone throwing a ball, but she may not fully understand that one can throw any object that can be held with one's hand and one can throw things in many different ways (e.g., with two hands or one hand, underhand, or overhand, etc.; Forbes & Poulin-Dubois, 1997; see also Huttenlocher, Smiley, & Charney, 1983). Thus, although the age of an entry on a checklist or in production has been a popular measure of acquisition of word meaning, it may take a long time for children to acquire an adult-like understanding of the meaning of a word after it is first entered in the child's vocabulary (Theakston, Lieven, Pine, & Rowland, 2002).

Considering these issues, it is difficult to conclusively determine whether nouns or verbs are learned more ''easily'' based on the checklist and production data alone. Furthermore, characterizing noun and verb learning along the dimension of ''ease/difficulty'' of learning may not be the best way to deepen our understanding of the *nature* of the early lexicon and of the *mechanisms* that undergird early lexical development.

Here, we investigate the nature of early noun and verb learning from a different perspective. Specifically, we ask whether children from three different language groups are able to map and extend novel nouns and novel verbs, and how conceptual differences between nouns and verbs interact with the linguistic and distributional properties of a target language. Using a laboratory-based, novel word-learning paradigm, we supplement what is known about the process involved in the learning of novel nouns and verbs. Importantly, this is a different (and perhaps complimentary) way to approach these issues as both checklists and production data assess words that are already evident to some extent in

children's vocabulary. Studying how readily young children from three language groups map and extend novel nouns and verbs adds a new dimension to our understanding of the mechanisms that support word learning and to how a child's native language interacts with these mechanisms.

Mapping and Extending Novel Nouns and Verbs

Tests of word extension (e.g., knowing that a cup refers to more than the original cup) clarify the construal children give for a particular lexical item. For example, if extension is inappropriately limited, it suggests that children have an overly narrow meaning for the novel word that might be limited to a particular context. Further, names for objects are often generalized on the basis of the sameness of shape (Imai, Gentner, & Uchida, 1994; Landau, Smith, & Jones, 1988). Names of substances (like sand and water), however, must be generalized on the basis of the sameness of the material alone. Temporary configuration of the substance is irrelevant for generalization (Imai & Gentner, 1997; Imai & Mazuka, 2003, 2007; Soja, Carey, & Spelke, 1991). The meaning of a noun—whether it is a name of an object or of a substance—is independent of how the referent entity is acted upon. A ball is a ball whether it is thrown, kicked, rolled, etc.

Verbs are extended to categories of relations. An action can be done with many different objects. We can throw a ball, a Frisbee, a stone, a disk, or almost anything we can lift up with our hands. Thus, in generalizing a verb, children need to align relevant components of action events, compare across different scenes, and focus only on the sameness of the higher order relation between the objects while ignoring the sameness of the objects (Imai, Haryu, & Okada, 2005).

How do children map novel nouns and verbs onto nonlinguistic conceptual categories? Childers and Tomasello (2002) examined whether 2-year-old English-speaking children appreciate both the noun–object link and the verb–action link. They showed 2.5-year-old English-speaking children three different novel objects and taught their noun labels. In another condition, they demonstrated three novel actions performed with three novel objects and taught three novel verbs corresponding to the three actions. Their results indicated that children learned the noun–object link more readily than the verb–action link. Their study, however, did not ask how children extend novel nouns and verbs.

Golinkoff, Hirsh-Pasek, Bailey, and Wenger (1992) and Golinkoff, Jacquet, Hirsh-Pasek, and Nandakumar (1996) studied fast-mapping and extension of novel nouns and verbs. In the first study with nouns (Golinkoff et al., 1992), children were asked to select a novel object amid three familiar objects when it was requested with a novel noun. On the next trial, they were asked to extend the novel noun, selecting from among two familiar exemplars (e.g., a shoe and a block), another novel exemplar, and the original exemplar in another color. At 28 months, children could learn and extend a novel noun in this task. Using cards with Sesame Street characters depicting familiar and novel actions, it took an additional 6 months for young children to learn and extend novel verbs (Golinkoff et al., 1996).

Imai et al. (2005) asked how Japanese children differentially learn and extend nouns and verbs. Imai et al. showed a video of an action event involving a woman, a novel action, and a novel object. Half of the children heard a novel noun, and the remaining children heard a novel verb while they were watching the video. The children were presented with two variants of the standard event: In one, the same woman was doing the same action with a different object; in the other, the same woman was doing a different action with the same object as the standard event. Children were asked to indicate to which scene the word (the newly introduced noun or verb) would apply. Both 3- and 5-year-olds successfully mapped a novel noun to an object, generalizing it to the same object used in a different action. In stark contrast, only 5-year-olds, but not 3-year-olds, showed understanding that verbs are extended on the basis of the sameness of actions and the objects are variables that can be changed across different events (see Kersten & Smith, 2002, for converging results with English-speaking children).

These studies suggest that children more readily map and extend novel nouns than novel verbs. However, none of these studies included a comparison across different language groups. A crucial issue for our understanding of the nature of early lexical development is how word learning interacts with the nature of the language children are learning. It is thus extremely important for us to consider how children's performance in novel noun and verb learning in the same experimental settings interacts with linguistic and distributional properties of their language.

Comparing Word Learning Across Languages: The Present Research

Comparing children learning English, Japanese, and Chinese is theoretically interesting because the three languages differ from one another on

dimensions thought to affect the relative difficulty of verb learning. One dimension on which the languages differ is whether they allow argument dropping in the production of the sentence. In Japanese and Chinese, verb arguments are frequently dropped (e.g., the nouns surrounding the verbs are not expressed). In fact, in Japanese, when the speaker thinks that the hearer can infer the arguments from the context, as a default, the arguments are dropped. This means that, in Japanese and Chinese, it is possible that a verb is the only word in the sentence. For example, when you see someone drop a wallet from her purse, in Japanese, you are likely to say ''otoshi (drop)-mashi (honorific)-ta (past)-yo (emphatic sentence-final particle)'' ''(you) dropped (it).'' Here, the subject and the object of the sentence are both omitted. In English, this kind of argument dropping virtually never occurs.

The second dimension on which the languages differ is in the presence of morphological inflection as in verbs. Here, Chinese contrasts with not only English but also with Japanese. Although verbs conjugate in both English and Japanese, they do not in Chinese. Thus, nouns and verbs are not *morphologically* distinguished in Chinese (Erbaugh, 1992). In Chinese and Japanese, where verb arguments are often dropped, the verb alone can constitute a sentence in the utterance. In Japanese, even when this occurs, verbs can be identified by inflectional morphology. That is, when a verb is produced without the arguments, as in ''Mite (Look), X-teiru (X-ing),'' one can tell by the presence of the ''teiru'' ending that the word X is a verb. However, in Chinese, when a word is produced on its own (and this happens occasionally in conversational discourse), it is difficult to tell whether it is a noun or a verb (Li, Jin, & Tan, 2004). A novel word can be identified as a verb *only when* it is embedded in the argument structure of the prior discourse (see Li, Bates, & MacWinney, 1993, for discussion of how Chinese-speaking adults determine grammatical classes in sentence processing).

This research extends Imai et al.'s (2005) study to examine two questions. First, we probe whether the noun advantage found in Imai et al.'s (2005) study holds across children learning very different languages. Second, we ask whether children speaking languages that have been noted as verb friendly such as Japanese and Chinese more readily learn and extend novel verbs than children speaking English, reputed to be a ''noun-friendly'' language. Some researchers have claimed that Chinese and Japanese are more verb-friendly languages than English, mainly because of their grammatical as well as lexical distributional properties (Choi & Gopnik, 1995; Ogura, 2001; Tardif, 1996; cf. Gentner, 1982). With argument dropping, verbs should be relatively more frequent in Chinese and Japanese than in English. Additionally, the morphological simplicity of Chinese verbs might give an advantage to Chinese verb learners, as children do not need to learn various inflectional forms of the same verbs (Tardif, 1996).

From a different theoretical perspective such as syntactic bootstrapping hypothesis, the opposite prediction can be made. The syntactic bootstrapping hypothesis asserts that children rely on the syntactic structures in which verbs appear to infer their meanings (e.g., Fisher, 1996; Gleitman, 1990; Naigles, 1990). Granting that Chinese does not have much in the way of morphology, Lee and Naigles (2008) argue that syntactic bootstrapping is possible in Mandarin Chinese because children hear verbs in multiple sentence frames and can rely on regularities in how verbs are used syntactically. For example, certain verb classes are more likely to occur with locative or prepositional phrases, and transitive verbs are reliably signaled by the use of postverbal noun phrases—when they appear. In natural discourse, however, children may not hear a new verb used in different phrasal frames at that very occasion; it is more likely that children hear a verb but in a single frame—as in the present study—at a time. Here, Chinese children may be at a serious disadvantage relative to English-reared children who can exploit the argument structure that is usually present in English for learning and extending a novel verb.

According to the syntactic bootstrapping hypothesis, which emphasizes the role of argument structure for the inference of verb meaning, Chinese and Japanese children might be at an equal disadvantage for *novel* verb learning. On the other hand, if morphological information distinguishing verbs from nouns also matters, the disadvantage for Chinese children may be more serious than for Japanese children.

In the present research, to examine how the richness of morphosyntactic cues affects novel verb learning, we examined variability in argument structure both within and across languages. In English and Japanese, even when the information about argument structure was not provided, the word's form class could be inferred from the morphological information. Chinese thus presents an interesting test case for the use of argument structure and for how the absence of argument structure influences object versus action word mapping because the words without morphology are so ambiguous with respect to form class. In languages that use distinct morphology for nouns and verbs, once children learn the relation between word forms and word meanings (e.g., Golinkoff, Hirsh-Pasek, & Schweisguth, 2001), it is not possible to test whether they are more willing to map a new word to

an object or to an action without being influenced by the form in which the word is presented. In Chinese, this is perfectly possible.

Within language, in English and Japanese in particular, we set up two conditions where verbs are introduced with or without arguments. In previous studies with Japanese children (Imai et al., 2005), novel verbs were presented without arguments (e.g., ''Mite, X-teiru! ''Look!, X-ing!''). The verb was offered in the present progressive tense, which clearly indicated that the word was a verb—at least to adults. However, children might profit from explicit specification of the arguments of the verb even when they can be inferred from contextual cues.

In summary, this research should illuminate the question of what is universal and what is language specific in young children's noun and verb learning, and how children' use of argument structure interacts with linguistic properties of the input language. Six studies were conducted across three languages.

Study 1: Japanese Children's Novel Noun and Verb Learning

Study 1 examined how monolingual 3- and 5-year-old Japanese children map a novel noun and a verb and how they extend it to a new situation, presenting a word in one of the three conditions: novel noun, bare verb, and verb with arguments. Study 1 was in part a replication of Study 1 in Imai et al. (2005), with additional specification of verb arguments. Of particular interest here is whether Japanese children still learn novel nouns more readily than novel verbs when the verbs were presented in full argument structure.

Method

Participants. Forty-one 3-year-old (M = 3.6, range = 3.0 – 4.1) and forty-two 5-year-old (M = 5.5, range = 5.0 – 6.0) monolingual, normally developing Japanese children participated in the study. Six additional 3-year-olds were tested but eliminated from the final sample for a side bias (2), for failing to complete the study (2), and for being bilingual (2). (Children were judged to be ''side biased'' when they selected the video on the same side, either left or right, throughout the six trials.) Within each age group, children were randomly assigned to one of the three conditions: noun, verb with arguments, and bare verb conditions. The proportion of boys and girls was approximately equal within each age group, and the age distribution (the mean age and range) was the same across the three conditions. Children lived in a suburban city in the Greater Tokyo area and were mostly from middle-class families.

Stimulus materials. Six sets of video action events that were identical to those used in Study 1 of Imai et al. (2005) served as stimulus materials. Each set consisted of a standard event and two test events, each lasting approximately 10 s. In the *standard* event, a young woman did a novel repetitive action with a novel object (e.g., a woman holds a brown plastic drainpipe in her right hand and pushes it outward with a punching motion). The two *test* events were variants of the standard event. In one, the same person did the same action, but the object was replaced with an object that was distinctively different from the standard in all perceptual dimensions, particularly in shape (action-same-object-change, henceforth AS). In the other test event, the theme object was the same but the action was distinctively different from the action in the standard event (object-same-action-change, henceforth OS). In both test videos, the actor was the same as the one in the standard picture. We made the action as perceptually stable and salient as possible to assure that young children would be able to decompose the action event into agent, action, and object components. (See Table 1 for the list of the actions and objects used in the six sets.)

Procedure. Participants were tested individually at the preschool they attended by a female native speaker. The experimental procedure was the same as that in Imai et al. (2005) except that the stimulus presentation was controlled by PowerPoint.

As in Imai et al. (2005), children received four warm-up trials to make sure that they could indicate what they thought to be the correct answer by pointing to one of the two test video clips. Care was taken so that the practice trials would not lead to any attentional bias toward the object or action in the event during the test trials. In the first two practice trials, they were shown two familiar objects (e.g., a cat vs. a dog) and were asked to identify the object the experimenter referred to ''e.g., a dog.'' In the next two practice trials, they were shown a person doing two familiar actions. In one trial, for example, a woman was jumping in one video and clapping hands in the other, and children were asked, ''Where is she jumping?'' The last warm-up trial first presented an actor doing a novel action with a novel object, followed by two test events shown simultaneously and side by side. One was exactly the same as the standard; the other was totally different both in the action and in the object, although the actor was the same. As in the test trials, a novel word (either a noun or a verb,

Table 1
Description of the Actions and Objects Used in Studies 1–6

	Standard	Action for the object same test	Object for the action same test
Set 1	A woman is rolling the object (a football-shaped orange Frisbee with fins) between the palms of her hands.	A woman is lightly tossing and catching the object with both hands.	A blue candleholder in the shape of a cup with a long stem.
Set 2	A woman is holding the object (a long blue plastic arch-shaped object) behind her back, pulling it up and down.	A woman is holding the object in front with both hands, twisting her torso from side to side.	A long narrow meshed black band made of rubber.
Set 3	A woman is holding the object (a brown plastic drainpipe) in her right hand and pushing it outward with a punching motion.	A woman is holding the object in her right hand and tapping it against her left shoulder.	A round metallic timer.
Set 4	A woman is holding the object (a blue rubber dog toy consisting of two large loops), both hands at chest level, twisting the object so that it bends in the middle.	A woman is holding the object in her right hand and slightly moving her hand so that the object flops up and down.	An octagon-shaped rubber Frisbee ring with blue/black stripes.
Set 5	A woman is holding the object (a green metal spherical trellis on a long, thin stem) in her right hand, pushing it out with a stabbing motion.	A woman is holding the object in her right hand and tapping it against her right knee, which she is raising at the same time as she is lowering the object.	A narrow white cylindrical plastic trellis.
Set 6	A woman is tapping the object (a donut shaped plastic toy for cats) against her thigh.	A woman is holding the object with the index fingers of each hand stuck into the hole in the center and rolling the object around her fingers.	A large gray plastic curved pipe.

depending on the condition the child was assigned to) was introduced. The child was asked to which movie the novel word applied.

After the warm-up trials, children received six test trials. The standard event was presented for 30 s during which a novel word was presented. Table 2 gives the instructions for each language. The target word was introduced approximately 2 s after the standard movie began to make sure that the word was said while the actor was doing the action. The word was repeated (in the appropriate frame for the condition) three times for each scene (see the Appendix for a list of the nonsense words).

Two test events were then offered simultaneously and side by side on the same monitor. The participant was asked to which of the two events the target word should be extended. Presentation order of the six sets was randomized, and the location of the AS and OS test events was counterbalanced across the six sets within each participant.

Conditions and instructions. Novel words were presented either as a noun or as a verb. In the *noun* condition, children heard, ''Look, this is (a) X!'' In Japanese, no singular–plural distinction is made. Thus, in the actual Japanese instruction, children heard, ''Kore (this) wa (topic) X desu (IS),'' where there is no number marking (see Imai & Haryu, 2001). Verbs were presented in two different forms: one with full arguments (*verb with arguments* condition) and the other with no arguments (*bare verb* condition). In the verb with arguments condition, the word ''oneesan ('girl')'' is used for the subject, and ''nanika ('something')'' was used to refer to the novel object (''Oneesan ga nanika o X-teiru'' ''The girl is X-ing something''). In the *bare verb* condition, the subject and the object were not specified in the sentence, but a novel word could be identified as a verb by the morphological affix ''-teiru.''

Results

The proportion of the AS responses is shown in Table 3. Children's performance in the noun and bare verb conditions replicated that in the noun and verb

Table 2
Conditions and Instructions for Studies 1–6

Language	Condition	Instruction during verb presentation	Instruction for test
English	Noun (Study 2)	''Look! This is a X!''	''Where is the X? Can you point to the X?''
	Bare verb (Study 2)	''Look! X-ing''	''Where is X-ing?''
	Verb with arguments (Studies 2, 6)	''Look! She is X-ing it''	''Where is she X-ing it?''
Japanese	Noun (Study 1)	''Mite (look)! X-ga (Nominal particle) aru (exist)'' ''Look! There is (a) X''	''X-ga aru (exist)-no (Nominal particle)-wa (Topic particle) docchi (which movie)?'' ''In which (movie) is there (a) X''
	Bare verb (Studies 1 and 6)	''Mite (look)! X-teiru (X-progressive)'' ''Look, X-ing''	X-teiru-no(Genetive particle)-wa (Topic particle) docchi (which movie)?'' ''In which (movie) is (she) X-ing?''
	Verb with arguments (Study 1)	''Mite (look)! Oneesan (girl) ga (Nominal particle) nanika (something)- wo (Accusative particle) X-teiru (X-progressive)'' ''Look, she is X-ing something''	''Oneesan (girl) ga (Nominal particle) nanika (something)- wo (Accusative particle) X-teiru (X-progressive) no (Genetive)-wa (Topic) docchi (which movie)?'' ''In which (movie) is she X-ing something?''
Chinese	Noun (Studies 3, 3A, 5)	''Ni (you) kan (look)! Nali (there) you (exist) ge[a] (classifier) X'' ''Look! There is (a) X''	''Na (which) zhang (the quantifier) tu (picture) li (within) you (exist) ge (classifier) X?'' ''In which picture is there (a) X?''
	Verb with arguments: ''zai'' only (Studies 3, 3A, 4)	''Ni (you) kan (look)! Ayi (girl) zai (progressive) X yi (one) ge (classifier) dongxi (thing) ne (mode marking particle)'' ''Look (a) girl is X-ing one thing''	''Na (which) zhang (classifier) tu (picture) li (within) ayi (aunt) zai (progressive) X yi-(one) ge (classifier) dongxi (thing)?'' ''In which picture is she X-ing something?''
	Verb with arguments: three sentences with different auxiliaries (Studies 4, 5)	''Ni (you) kan (look)! Ayi (girl) zai (progressive) X yi (one) ge (classifier) dongxi (thing) ne (mode marking particle)'' ''Look (a) girl is X-ing one thing'' ''Ni (you) kan (look)! Ayi (girl) zhengzai (progressive) X yi (one) ge (classifier) dongxi (thing) ne (mode marking particle)''''Look (a) girl is X-ing one thing'' ''Ni (you) kan (look)! Ayi (girl) yizhizai (progressive) X yi (one) ge (classifier) dongxi (thing) ne (mode marking particle)''''Look (a) girl is always X-ing one thing''	''Na (which) zhang (classifier) tu (picture) li (within) ayi (aunt) zai (progressive) X yi-(one) ge (classifier) dongxi (thing)?'' ''Ayi (aunt) zai (progressive) X yi-(one) ge (classifier) dongxi (thing) de (progressive) tu (picture) shi (is) na (which) yi-(one) ge(classifier)'' ''In which picture is she X-ing something?''
	Bare word (Studies 3, 3A, 5)	''Ni (you) kan (look)! X!'' ''Look, X!''	''Na (which) ge (classifier) tu (picture) zhi (indicate) de (Nominal particle, auxiliary word) shi (is) X? '' ''Which picture shows X?''

[a]Note that in the Japanese instructions, the noun (either the novel noun in the noun condition or ''nanika'' (something) in the verb with arguments condition) was not accompanied with a classifier, whereas in Chinese, these nouns were accompanied by the generic classifier ''ge.'' In Japanese, the number of the object is mentioned only when it is pragmatically important in the discourse. Thus, it was very unnatural to use a classifier in this situation. In contrast, in Chinese, ''yi-CL-X (noun)'' phrase roughly corresponds to English ''a X.'' In our instructions, it was more natural to say ''yi (one)-ge (CL)-X'' than to say the bare noun without a classifier. Also, the classifier made it clear that X was a noun in the noun condition. However, the presence of the classifier does not highlight the object in the sentence in Chinese.

conditions in Study 1 of Imai et al. (2005): Both the Japanese 3- and 5-year-olds were able to map novel nouns to the OS scene, 93% and 100%, respectively. In the bare verb condition, 5-year-olds selected the AS response significantly above chance (77.4%), $t(13) = 2.43$, $p < .05$, two-tailed, but 3-year-olds were at chance level (38.1%), $t(13) = -1.072$, $p > .05$. In the verb with arguments condition, both 3-year-olds (39.3%) and 5-year-olds (69%) were at chance levels, $t(12) = -0.90$ and $t(13) = 1.56$, both ps $> .05$, respectively.

To examine whether the pattern of the results of the group analysis holds for the distribution of individuals, we counted the number of the children who selected the AS test four or more times as AS choosers (see Table 4). The results of the individual analysis converged with the group analysis; the number of AS choosers was significantly below chance by the binomial criterion in the noun condition for both ages, $p < .01$. For the 3-year-olds, the number of the AS choosers did not exceed chance either in the bare verb or in the verb with arguments condition. For the 5-year-olds, it exceeded chance in the bare verb condition in 5-year-olds, $p < .05$, but not in the verb with arguments condition, $p > .1$. In this and the following studies (Studies 2–6), the proportion of the AS choosers with the results of the binomial tests against chance is reported in Table 4.

A 2 (age) $\times$ 3 (condition) analysis of variance (ANOVA) was conducted on the proportion of the AS responses to examine the contribution of the two factors of age and the syntactic frame in which the novel word was presented (condition). A main effect for age, $F(1, 77) = 6.79$, $p < .05$, and condition, $F(2, 77) = 19.27$, $p < .01$ emerged, but the main effects were qualified by a significant Age $\times$ Condition interaction, $F(2, 77) = 3.16$, $p < .05$. To decompose the interaction, three separate 2 (age) $\times$ 2 (condition) ANOVAs were conducted. The Age $\times$ Condition interaction emerged in the analysis directly contrasting the noun and bare verb condition, $F(1, 51) = 8.02$, $p < .01$, as well as that contrasting the noun and verb with argument condition, $F(1, 51) = 4.37$, $p < .05$, but not in the one contrasting bare verb and verb with arguments conditions, $p > .05$. In the last analysis, the main effect of condition was not significant, either, $p > .05$.

Discussion

Replicating the results of Imai et al. (2005), both 3- and 5-year-old Japanese children mapped a novel noun to a novel object in an event and applied the word to the scene in which the same object appeared in a different action. Another way in which this

Table 3

Proportion of Action-Same-Object-Change Responses in Study 1 (Japanese), Study 2 (English), Study 3 (Chinese), and Study 6 (Japanese- and English-Reared Children Tested on Stimuli in Which the Object-Holding Segment Was Removed)

			Condition			
Language	Study	Age	Noun	Bare verb	Verb with argument	Bare word
Japanese	Study 1	3-year-olds	0.07**,[a] (0.11)	0.38 (0.41)	0.39 (0.44)	—
		5-year-olds	0.00** (0.00)	0.77* (0.42)	0.69 (0.45)	—
	Study 6	3-year-olds	—	0.52 (0.33)	—	—
English	Study 2	3-year-olds	0.14** (0.15)	0.49 (0.39)	0.42 (0.35)	—
		5-year-olds	0.09** (0.12)	0.56 (0.42)	0.70* (0.33)	—
	Study 6	3-year-olds	—	—	0.53 (0.27)	—
Chinese	Study 3	3-year-olds	0.15** (0.23)	—	0.08** (0.15)	0.15** (0.23)
		5-year-olds	0.06** (0.19)	—	0.20* (0.38)	0.22* (0.33)
	Study 3A	Adults	0.29* (0.37)	—	1.00** (0.00)	0.73* (0.24)

[a]If the number is smaller than .5 and has * or **, the object-same response was significantly above chance.
$^{*}p < .05$. $^{**}p < .01$.

Table 4
Proportion of the Action-Same Choosers in Study 1 (Japanese), Study 2 (English), Study 3 (Chinese), and Study 6 (Japanese and English, Tested on Stimuli in Which the Object-Holding Segment Was Removed)

Language	Study	Age	Condition			
			Noun	Bare verb	Full argument verb	Bare word
Japanese	Study 1	3-year-olds	0**[a] (0/14[b])	0.49 (5/13)	0.39 (6/14)	—
		5-year-olds	0** (0/14)	0.79* (11/14)	0.64 (9/14)	
	Study 6 (Object-holding segment removed)	3-year-olds	—	0.39 (6/14)	—	—
English	Study 2	3-year-olds	0** (0/18)	0.35 (6/17)	0.32 (6/19)	—
		5-year-olds	0** (0/20)	0.5 (9/18)	0.76* (16/21)	—
	Study 6 (Object-holding segment removed)	3-year-olds			0.38 (6/16)	
Chinese	Study 3	3-year-olds	0.08** (1/12)	—	0** (0/12)	0.17** (2/12)
		5-year-olds	0.08** (1/12)	—	0.17** (2/12)	0.17** (2/12)
	Study 3A	Adults	0.17** (2/12)	—	1.0** (12/12)	0.6 (12/18)

[a]If the number is smaller than .5 and has * or **, the object-same response was significantly above chance.
[b]The numerator represents the number of the action-same choosers; the denominator is the *n* in the condition.
*$p < .05$. **$p < .01$.

research replicated and extended the previous results was in demonstrating that 3-year-olds could not map and extend novel verbs to the same action in the face of an object change, whether the verb was presented with or without the specification of the arguments. It was somewhat unexpected that Japanese 5-year-olds failed to extend a novel verb to the same action scene reliably above chance when the verb was presented with the arguments but succeeded when the verb was presented without the arguments. Given that the difference between the two verb conditions (verb with arguments and bare verb) did not reach the level of statistical significance, we could not confidently conclude that Japanese children learn verbs better when unnecessary arguments are dropped. However, what is clear is that Japanese children did not gain from the specification of argument structure *when the arguments could be easily inferred from the context.* The action events used in our research involved only three elements: an actor, an action, and an object. From the Japanese point of view, it was obvious that the subject was the actor and the theme object was the novel object; hence, it was more natural that the arguments be dropped. Japanese children, in fact, could have been distracted by hearing this unnecessary information.

In Study 2, we test English-speaking 3- and 5-year-olds in the same three conditions (noun, bare verb, and verb with arguments) to compare their performance. Even though English has been characterized as a noun-friendly language, it is possible that English-speaking children learn verbs more readily than, or as readily as, Japanese children, as English offers an important structural cue to novel verb meaning, namely, argument structure. Furthermore, English-speaking children should learn and extend novel verbs more readily when the verb is presented with the arguments but not when it is presented in the bare form, as the former is much more ''natural'' than the latter for English speakers.

Study 2: English-Speaking Children's Novel Noun and Verb Learning

Method

Participants. Fifty-four 3-year-old ($M = 3.5$, range = 3.0–3.11) and fifty-nine 5-year-old ($M = 5.2$, range = 4.5–5.11) monolingual, normally developing English-speaking children in the suburban Greater Philadelphia area, mostly Caucasian from middle-class to upper-middle-class families, participated. An additional 21 children were tested but were not included for experimenter error (5), parental interference (4), bilingual knowledge (3), and failure to cooperate (9). The children were tested individually by a native speaker of English in two Northeastern University laboratories and were randomly assigned to the three conditions: noun, bare verb, and verb with arguments. Gender distribution and age distribution (the mean age and the age range) were approximately equal within each age/condition group.

Stimuli and procedure. The stimuli and the procedure were the same as those used for the Japanese children in

Study 1. In the noun condition, a novel word was presented as a noun ("Look, this is a X!"). In the bare verb condition, novel verbs were presented with a present progressive /ing/ ending, but the subject and the object of the sentence were dropped ("Look, X-ing!"). In the verb with arguments condition, the pronoun "she" served as the subject and "it" as the object of the sentence (e.g., "Look, she is X-ing it"). For the test, the experimenter asked the children "Where is the X?" "Where is X-ing?" "Where is she X-ing it?," respectively.

Results and Discussion

Table 3 shows the mean proportions of the AS responses by 3- and 5-year-old *English-speaking* children in all three conditions. Both the 3- and the 5-year-olds in the noun condition successfully mapped novel nouns to novel objects, reliably selecting the OS event, 85.9%, $t(17) = 9.88$, $p < .001$, for the 3-year-olds, and 89.8%, $t(19) = 14.5$, $p < .001$, for the 5-year-olds. In extending novel verbs, the 5-year-olds in the verb with arguments condition successfully selected AS events 70.1% of the time, $t(20) = 2.8$, $p < .02$. However, the 5-year-olds in the bare verb condition performed at chance, 55.6%, $t(17) = .56$, $p > .1$. The performance of the 3-year-olds did not differ from chance, whether they were in the verb with arguments condition or in the bare verb condition, 42.3%, $t(18) = 1.18$, $p > .1$ and 48.5%, $t(16) = .35$, $p > .1$, respectively. Individual analyses were also conducted, and the results converged with those of the group analysis (see Table 4).

We then examined whether English-speaking children's AS responding differed across the three conditions, and whether the effect interacted with age. The effect of condition was significant, $F(2, 107) = 23.13$, $p < .001$, as well as the Age × Condition interaction, $F(2, 95) = 3.83$, $p < .05$. As in Study 1, we conducted three 2 (age) × 2 (condition) ANOVAs to directly examine the source of the significant Age × Condition interaction. In the ANOVA contrasting the two verb conditions, the Age × Condition interaction was significant, $F(1, 71) = 4.01$, $p < .05$. In the analysis contrasting the noun and the verb with arguments condition, the interaction was also highly significant, $F(1, 71) = 7.34$, $p < .01$. However, in the analysis contrasting the noun and the bare verb condition, the Age × Condition interaction effect did not reach the level of significance.

Thus, the results of ANOVA analyses were consistent with the overall pattern suggested by the means for each age and condition. English-speaking 3- and 5-year-olds could fast-map a novel noun to an object, just as the Japanese children did in Study 1. In contrast, 3-year-old English-speaking children were not willing to extend a novel verb to an event in which the same action was performed with a different object, paralleling the findings with the Japanese 3-year-olds. The English-speaking 5-year-olds could extend a novel verb properly but only when verbs were presented with the full argument structure and not when they were presented in the bare frame. In other words, 5-year-old children from both language groups would extend a novel verb only when the verb was presented in the structural form that was most typical in their language. These results suggest that language specificity matters for the acquisition of verbs. In learning and extending verbs, children's responses are affected by the type of verb input they hear.

Study 3: Chinese Children's Novel Noun and Verb Learning

We now consider how Chinese children, learning a language that does not differentiate between nouns and verbs through the use of inflectional morphology, perform in this task. Of particular interest is whether Chinese children are able to map and extend novel nouns as well as Japanese- and English-speaking children and whether they do so at a rate better than that achieved with novel verbs, even though they tend to hear fewer nouns in the input than English-reared children. If Chinese children do manifest the noun advantage, this will provide strong support for the view that universal cognitive factors are more prominent than language-specific factors in influencing the ease and willingness with which children learn novel words. The Chinese data will also illuminate the role of syntactic cues in novel verb learning. Chinese children are offered syntactic cues less systematically than children learning either Japanese or English, both in terms of the absence of morphological marking on verbs and the occasional absence of argument structure.

Because nouns and verbs are not morphologically distinguished, the condition equivalent to the bare verb condition in Studies 1 (Japanese) and 2 (English), in which both the subject and the object of the sentence are omitted, is not achievable; a novel word cannot be presented as a verb in its bare form. Unless embedded in argument structure, it is unclear how to assign a word to a form class (see the Discussion section). We thus did not have the bare verb condition for the Chinese group. Instead, we included a *bare word* condition, in addition to the noun and the verb with arguments condition because the bare word condition in Chinese presents an ideal case to address a different but related issue. That is, Chinese allows us

to ask whether young children have a predisposition to name a novel object rather than a novel action (Gentner, 1982; Golinkoff et al., 1992; Markman, 1989). If Chinese children map the novel word to the object rather than the action, it suggests that children wish to name objects in the environment independent of the frequency of verbs in the linguistic input. On the other hand, if Chinese children map the word to the action, it suggests that the type of the concept that young children are most willing to name depends on the input language.

Method

Participants. Thirty-six 3-year-old (M = 3.5) and thirty-six 5-year-old (M = 5.6) monolingual, normally developing Mandarin Chinese–speaking children living in Beijing, China, participated. Three other 3-year-olds were tested but were not included in the analysis because they were unwilling to cooperate. The participants attended a university preschool in Beijing. Their parents were mostly from middle and upper-middle class, which is comparable to the demographic background of the Japanese and American children tested in Studies 1 and 2. The children were randomly assigned to one of the three conditions: noun, verb with arguments, bare word. Gender distribution and age distribution (the mean age and range) were approximately equal within each age/condition group. They were tested individually by two female native speakers of Mandarin Chinese in a quiet room.

Stimuli and procedure. The stimuli and the overall procedure (except for the conditions and instructions) were the same as those used for the Japanese children and English children in Studies 1 and 2.

Conditions and instructions. Chinese children were randomly assigned to one of the three conditions: noun, verb with arguments, and bare word. The instructions are given in Table 2. In the noun and the verb with arguments conditions, special care was taken so that there was no ambiguity over whether the target word was a noun or a verb, respectively. In the verb with arguments condition, an auxiliary verb "zai," which marks the imperfective aspect and is usually used in expressing an ongoing action, accompanied the verb along with the subject "ayi ("the auntie [woman older than the hearer]") and the theme object "yi- (one) ge (generic classifier) dongxi (thing)." We confirmed with several preschool teachers that 3-year-old children would easily understand this construction.

Because most Chinese words consist of two syllables, we constructed two-syllable nonsense words created from combinations of existing morphemes (see the Appendix for the list of the words). When spoken, the nonsense words were not similar to existing words.

Results

As shown in Table 3, Chinese children at both ages selected AS events significantly below chance in all three conditions, all ps $< .05$ (see also Table 4 for the results of the individual analysis.) The rate of AS responding did not differ across the two age groups or across the three conditions. The interaction between the two factors was not significant. The results indicated that Chinese-speaking children, both 3- and 5-year-olds, have a strong tendency to fast-map a novel word to a novel object, whether the word was presented as a noun or a verb, or as a bare word, whose grammatical form class was not revealed.

Study 3A: Chinese Adults

Given the unexpected results from Chinese children, we tested Chinese-speaking adults to see how they would perform. If the children's strong bias to map a novel word to a novel object even in the verb with arguments condition was due to some unexpected factors in the instruction, Chinese-speaking adults may also show difficulty in mapping the word to the action in this condition.

Method

Participants. Forty-two undergraduate students of Peking University, all whom were native speakers of Mandarin Chinese, were individually tested. Eighteen were tested in the bare word condition and 12 each in the noun and verb with arguments conditions.

Stimuli and procedure. The stimuli and the procedure were the same as in Study 3 except that the warm-up trials were omitted. The instructions and the novel words were the same as those used for Study 3 with preschool children.

Results

Chinese adults mapped a novel noun to a novel object (70.8%), $t(11) = 2.55$, $p < .05$ (see Table 3). In sharp contrast to the preschool age children, adults in the verb with arguments condition selected the AS test 100% of the time. Also different from the children, adult Chinese speakers in the bare word condition made AS response 73% of the time, mapping the class-ambiguous word to the action rather than to the object, $t(17) = 4.03$, $p < .01$.

Discussion of Study 3 and Study 3A

The novel word presented in the verb with arguments condition was construed as a verb by Chinese adults 100% of the time. It is also interesting that the Chinese adults preferred to interpret the word as referring to the action rather than the object when the word's form class was ambiguous in the bare word condition. With the current data, it is not clear whether this apparent action-naming bias in Chinese adults is a consequence of a genuine preference for action-naming over object-naming: Chinese adults may have thought that the verb interpretation was more likely than the noun interpretation because they could come up with a good-enough name for the object (e.g., a superordinate category name such as ''tool'' or ''toy''), but not for the action, for example. In any case, interpreting a novel word as a verb, given our stimuli and instructions in the verb with arguments condition is a perfectly reasonable course of action for adults. Even in the absence of syntactic information for verbhood (morphology or argument structure) in the bare word condition, adults did not make an object-name interpretation. In this light, Chinese children's strong object-naming bias is striking.

Taken together, it seems that noun learning is privileged independent of the properties of the language children are learning (e.g., Gentner, 1982). These results indicate that the linguistic properties of Chinese—argument dropping and morphological simplicity—that have been said to foster verb learning (Tardif, 1996, 2006; cf. Gentner, 1982) do not necessarily lead to more readiness to map and extend novel verbs in young Chinese children when compared to English- and Japanese-speaking children.

Why did Chinese children fail to learn verbs in our task, although they have many verbs in their vocabulary? What aspects of our task made it so difficult for Chinese children to learn novel verbs? We had no concern that the sentence construction used was a problem. When we embedded familiar words in the same construction, children had no problem understanding the sentence. One possible concern is that the instruction in the full argument structure condition may not have been ''natural'' to Chinese children, given that Chinese is also an argument-dropping language like Japanese. We originally considered a condition in which the target verb was presented with the aspect-marking auxiliary ''zai'' but without the arguments, which parallels to the bare verb condition in Studies 1 and 2. However, Chinese native speakers all objected to this idea, saying that presenting a *novel* word as a *verb* only with the aspectual auxiliary without both the subject and the object dropped in this situation was too ''unnatural.'' Dropping both arguments occurs occasionally when presenting a familiar verb. Introducing a novel word without both arguments and at the same time making clear that it was a *verb*, however, would be difficult. This is probably due to the fact that unlike Japanese, Chinese lacks verb-inherent morphology. We had run a condition in which the object of the sentence (yi-ge-dongxi ''a thing'') was dropped but the subject was explicitly said, with 3- and 5-year-olds (12 in each age group). Performance was virtually identical to that in the verb with arguments condition. Given this, we think it unlikely that the poor performance of the Chinese children in the verb with arguments condition could be because unnecessary arguments were provided with the verb in the instruction sentence.

One thing we did note, however, was that the phonological structure of the words may have biased children against a verb interpretation. We constructed two-syllable nonsense words because bisyllabic words are most frequent in Chinese and are neutral with respect to whether they are nouns or verbs. However, verbs denoting simple and basic motions such as ''run'' and ''jump'' tend to be monosyllabic. Perhaps, then, the use of bisyllabic words biased children against the verb interpretation.

To test this possibility, in Study 4, we replicated the verb with arguments condition using monosyllabic nonsense words. Given the extreme difference between the Chinese preschoolers and the adults in the verb with arguments condition, we also tested 6- and 8-year-olds.

Study 4: Chinese Children's Novel Verb Learning With Monosyllabic Words

Method

Participants. Twelve 3-year-old (M = 3.6, range = 3.1–3.11), twelve 5-year-old (M = 5.7, range = 5.2–5.11), fifteen 6-year-old (M = 6.9, range = 6.5–7.2), and fifteen 8-year-old (M = 8.8, range = 8.3–9.3) Chinese middle-class children who were normally developing, monolingual native speakers of Mandarin Chinese, participated. Three- and 5-year-olds were from the same preschool in Beijing as the children in Study 3 but had not participated in it; 6- and 8-year-olds were from an elementary school in Beijing. The children were tested by a native speaker of Mandarin Chinese.

Stimuli and procedure. The stimuli and the procedure were the same as that used in the verb with arguments condition in earlier studies except that the nonsense words were monosyllabic. Nonsense words were made of existing phonemes in Chinese so that

they sounded like Chinese words, but a nonexisting tone for the phoneme was applied (e.g., jin2, see Appendix for a list of the words used).

Results and Discussion

As shown in Table 5, the use of monosyllabic nonsense words did not drastically change the preschoolers' performance in novel verb learning: Three-year-olds still made AS responses only 25% of the time, $t(11) = 2.63$, $p < .05$, and 5-year-olds did so 33% of the time, $t(11) = 1.17$, $p > .05$. Six-year-olds' performance still did not exceed chance level (52%), $t(11) = 0.19$, $p > .1$. At 8 years of age, Chinese children finally made AS choices significantly above chance (72%), $t(14) = 2.17$, $p < .05$. A significant age difference was found, $F(3, 50) = 3.35$, $p < .05$, and post hoc pairwise comparisons (Tukey) detected a significant difference between 3-year-olds and 8-year-olds, $p = .035$, and a marginally significant difference between 5-year-olds and 8-year-olds, $p = .095$. The results of the individual analysis (i.e., the distribution of children classified as the AS choosers) are provided in Table 6.

Study 4A: Chinese Preschoolers' Verb Learning With Monosyllabic Words Presented in Three Sentence Frames

The results from Chinese children so far indicate that they have a strong object-naming bias. This bias may contribute to making novel verb mapping and extension less readily available in Chinese relative to Japanese and English.

However, it is hard to believe that Chinese 5-year-olds, if not 3-year-olds, cannot succeed in our task. Even granted that they are biased toward object-naming, there must be conditions in which they can correctly interpret the novel word as a verb and extend it to the same action. Perhaps, even though our instructions worked with Chinese-speaking adults, Chinese children need more linguistic scaffolding. In Study 4A, we tested whether Chinese 3- and 5-year-olds were able to map and extend novel verbs to the same action when additional linguistic cues were provided.

Method

Participants. Fifteen 3-year-old ($M = 3.6$, range = 3.1–3.10) and fifteen 5-year-old ($M = 5.3$, range = 5.1–5.8) monolingual Mandarin Chinese–speaking children who had not been tested in the earlier studies participated.

Linguistic cues. In the verb with arguments condition in the main study, the novel word could be unambiguously identified as a verb by the structure of the sentence, in particular, by the word order and the presence of the aspect marker ''zai.'' However, this linguistic cue may not have been strong enough to indicate the word was a verb, given that the form of the word could not be distinguished from a noun by morphology. We thus presented the verb in three different sentences using three different auxiliaries, namely, ''zai,'' ''zhengzai,'' and ''yizhizai,'' all which mark the progressive aspect, to provide even clearer and stronger clues that the novel word was a verb (see Table 2 for full instructions).

Stimuli and procedure. The stimuli were the same as those in the main study, except for the linguistic stimuli.

Results and Discussion

As shown in Table 5, even when the novel verb was presented in three different sentence

Table 5
Proportion of Action-Same Responses in Chinese Children in Studies 4–5

		Condition			
Stimuli	Age	Full argument verb one syllable word ''zai'' only	Full argument verb one-syllable word three sentence frames	Bare word	Noun
Original	3-year-olds	0.25*[a] (0.33), Study 4	0.34 (0.299), Study 4A	—	—
	5-year-olds	0.33 (0.49)	0.39 (0.43)	—	—
	6-year-olds	0.52 (0.45)	—	—	—
	8-year-olds	0.72* (0.39)	—	—	—
Object-holding segment removed	3-year-olds	—	0.41 (0.30), Study 5	0.28* (0.12), Study 5	0.33* (0.14), Study 5
	5-year-olds	—	0.88** (0.15)	0.37 (0.41)	0.27* (0.37)

[a]If the number is smaller than .5 and has * or **, the object-same response was significantly above chance.
*$p < .05$. **$p < .01$.

Table 6
Proportion of the Action-Same Choosers in Studies 4–5 With Chinese Children

		Condition			
Stimuli	Age	Full argument verb one syllable word "zai" only	Full argument verb one syllable word 3 sentence frames	Bare word	Noun
Original	3-year-olds	0.25*[a] (3/12[b]), Study 4	0.27* (4/15), Study 4A	—	—
	5-year-olds	0.33 (4/12)	0.33 (5/15)	—	—
	6-year-olds	0.53 (8/15)	—	—	—
	8-year-olds	0.73* (11/15)	—	—	—
Object-holding segment removed	3-year-olds	—	0.19** (3/16), Study 5	0** (0/15), Study 5	0* (0/15), Study 5
	5-year-olds	—	0.93** (14/15)	0.4 (6/15)	0.25* (4/16)

[a]If the number is smaller than .5 and has * or **, the object-same response was significantly above chance.
[b]The numerator represents the number of the action-same choosers; the denominator is the *n* in the condition.
*$p < .05$. **$p < .01$.

constructions to highlight the word's form class, Chinese 3- and 5-year-olds could not succeed. Three-year-olds still made AS choices marginally below chance (34.4%), $t(14) = -2.018$, $p = .063$, and 5-year-olds responded at chance (38.9%). Children's performance was no different from that in Study 4, in which the same monosyllabic verbs were presented in a single sentence frame. No age difference was found as well (see also Table 6 for the results of the individual analysis).

Results suggest that Chinese children as old as 5 years of age could not interpret a novel word as a verb and extend it to the same action. It appears that the lack of morphological distinction between nouns and verbs makes Chinese children map and extend novel verbs *less* rather than *more* readily. Furthermore, we suspected that the lack of morphological marking to distinguish the word's form class may lead Chinese children to rely relatively more heavily on *extralinguistic* cues.

One property of our stimuli may have given children a subtle cue that the object was the focus in the event. The standard video clips showed an actor holding an object for a moment (for about half a second) before starting the action. We shot the videos this way to make sure that children saw the object clearly. It should be stressed that the object was not unnaturally highlighted in the original stimuli, and it did not seem to affect Japanese- or English-speaking children. However, if Chinese children are particularly sensitive to extralinguistic cues because linguistic cues to form class are weaker than in Japanese or English, this first segment of the video might have lead Chinese children to think that the object was in a way "topicalized." We tested this possibility in Study 5.

Study 5: Can Chinese Preschoolers Map and Extend Novel Verbs When Actions Are Highlighted?

Would Chinese 3- and 5-year-olds map and extend novel verbs more readily when the action was highlighted by reducing the salience of the theme object? Even if we observe that the Chinese children perform better with the action-highlighted video, however, it may be because the action was made more prominent than the object. If true, children should select the action when the novel word is presented as a noun or a class-ambiguous word as well. To exclude this possibility, we also tested children in the noun and bare word conditions.

Method

Participants. Forty-six Chinese 3-year-olds (M = 3.4, range = 3.1–3.11) and forty-six 5-year-olds (M = 5.4, range = 4.9–5.11) were randomly assigned to the noun, bare word, or the verb with arguments condition. Children were normally developing, monolingual Mandarin-Chinese speakers living in Beijing. There were approximately equal numbers of boys and girls within each age and condition group, and none of them had been tested in the earlier studies.

Stimulus materials and procedure. The brief object-holding segment of the video was removed so that the object was already in motion at the start of the video. Other than this manipulation, the videos were exactly the same as those used in earlier studies. The procedure, instructions, and words used for the verb with arguments condition were identical to that in Study 4A. Thus, we presented monosyllabic nonsense words with three different aspect-marking auxiliaries in order to highlight that the word was a verb. The

procedure, the instructions, and the novel words used in the noun and bare word conditions were identical to the corresponding conditions in Study 3.

Results and Discussion

Removing the object-holding segment brought about a drastic change in Chinese children's novel verb learning. In sharp contrast to the failure in the earlier studies, Chinese children's verb-learning performance was now equivalent to the level of performance by Japanese- or English-speaking children. Chinese 3-year-olds were now at the chance level, just like Japanese- and English-speaking 3-year-olds (40% AS responding). The 5-year-olds now made AS selections above chance level, just like their Japanese- and English-speaking age counterparts (88%), $t(15) = 9.934$, $p < .001$. On the individual analysis, 93% of the 5-year-olds were AS choosers, $p < .01$ (see Table 6).

Children's performance in the verb with arguments condition was compared with that in Study 4A, in which the same linguistic cues were provided but the initial object-holding section was present in the video clip. Results indicated that the children performed better with the videos in which the object-holding segment was removed than with the previous version of the video, $F(1, 57) = 11.91$, $p < .01$, and the magnitude of the gain by the video manipulation was larger for the 5-year-olds than for the 3-year-olds, as suggested by the significant Age × Video Type interaction, $F(1, 57) = 7.16$, $p < .01$.

Given that the manipulation of the videos made a dramatic difference in the performance in the verb with arguments condition, it is critical to see whether the children were influenced by this manipulation only in the verb learning context or whether their AS choices also increased in the noun and bare word conditions. In those conditions, AS choices should not predominate. Both 3- and 5-year-olds mapped the novel noun to the same-object video significantly above chance level, 67% and 73% OS responding, $t(15) = 2.44$, $p < .05$, and $t(14) = 4.58$, $p < .01$, respectively, and there was no difference across the two age groups, $F(1, 29) = .36$, $p > .1$. Thus, when children made AS selections in the verb with arguments condition, they did not do so solely because the action was made perceptually more salient than the object. However, when we compared the performance of the noun condition in this study to that in Experiment 3, there was a significant decrease in the proportion of OS responding, $F(1, 51) = 7.76$, $p < .01$, with no main effect or interaction involving age. The 3-year-olds in the bare word condition still mapped the class-ambiguous word to the object, making OS choices at test 72.2% of the time, $t(14) = 7.14$, $p < .01$, and the 5-year-olds did so 63.3% of the time, $t(14) = 1.26$, $p > .1$. The children's performance here was not different from their performance in the bare word condition with the original stimuli in Study 3, $F(1, 50) = 2.80$, $p = .1$.

When we compared the children in the bare word condition and those in the verb with arguments condition on the rate of AS responding, the children in the latter condition made AS choices much more frequently, $F(1, 57) = 56.10$, $p < .01$, but this was qualified by the Age × Condition interaction, $F(1, 57) = 20.08$, $p < .01$: The difference between the two conditions was highly significant in 5-year-olds, $F(1, 28) = 20.72$, $p < .01$, but not in 3-year-olds, $F(1, 29) = 2.34$, $p > .1$.

In summary, when the action was made salient by removing a short object-holding segment, Chinese 5-year-olds were able to map and extend novel verbs to the same action. However, this shift did not create an action-naming preference in the bare word case. Although this manipulation caused a significant decrease in the noun–object mapping, Chinese children still mapped novel nouns to the object rather than the action. These results suggest that Chinese children were affected by perceptual salience to some degree in novel verb learning as well as in noun learning but that the influence of this extralinguistic cue is much stronger for the former case.

The fact that the Chinese children performed on a par with their Japanese and English same-age peers in mapping and extending novel verbs allows us to rule out another artifact. Chinese children's prior performance in the earlier studies cannot be blamed on the fact that the task was unnatural or the instructions were inappropriate for Chinese children.

The removal of the brief object-holding segment from the original stimuli strongly helped Chinese 5-year-olds. Would this manipulation also help Japanese- and English-speaking 3-year-olds, who could not map and extend novel verbs? Study 6 used the edited videos with Japanese and English 3-year-olds, who were at chance level in Studies 1 and 2.

Study 6: Can Japanese- and English-Speaking 3-Year-Olds Map and Extend Verbs When the Actions Are Highlighted?

Method

Participants. Fourteen Japanese 3-year-olds (M = 3.6, range = 3.0–4.0) from monolingual families living

in a suburban city in the Greater Tokyo area and 16 American 3-year-olds (M = 3.6, range = 3.0–3.11) from monolingual English-speaking families living in the Greater Philadelphia area participated. The demographic and ethnic backgrounds of the children were the same as those in Study 1 (Japan) and Study 2 (United States), although none participated in earlier studies. One Japanese child (side bias) and two American children (parental interference and failure to cooperate) were also tested but excluded from the final sample. The gender distribution was approximately equal within each language.

Stimuli and procedure. The edited stimuli from Study 5 were used. Because the Japanese children in Study 1 seemed to prefer the bare verb instruction over the verb with arguments condition, we used the same procedure, instructions, and novel words as those in the bare verb condition in Study 1. On the same logic, the American children were tested with the same procedure, instructions, and novel words as those in the verb with arguments condition in Study 2.

Results and Discussion

Japanese-speaking children. As shown in Table 3, the Japanese children performed at chance, making AS selections 52.4% of the time. Of the 14 children, 6 (39%) children were AS choosers, which was not different from chance by the binomial criterion, $p > .1$ (Table 4). The performance of these children was compared to that of the Japanese 3-year-olds in the bare verb condition in Study 1. No difference was found between the two groups.

English-speaking children. English-speaking 3-year-olds also responded at chance (53.1%). Of the 16 children, 6 children were AS choosers, $p > .1$. Children's performance was not different from that of the English-speaking 3-year-olds in the verb with arguments condition in Study 2 (42.3%).

Thus, unlike the case with Chinese 5-year-olds, the removal of the brief object-holding segment from the original stimuli did not improve Japanese or English 3-year-olds' performance in mapping and extending novel verbs. Of course, the results do *not* suggest that Japanese- or English-reared children do not use extralinguistic cues *in general*, nor that they are less sensitive to extralinguistic cues than Chinese children. With the linguistic cues available to them that signal verbhood, however, Japanese- and English-reared children did not need to notice whether a half second object-holding segment preceded the action event. We elaborate on this point in the General Discussion.

General Discussion

The present research examined whether children learn novel nouns more readily than novel verbs across different languages, and how a language's linguistic properties influence novel verb learning. This article empirically evaluated these questions using a novel word-learning paradigm across three very different languages (English, Japanese, and Chinese), the latter two of which have been purported to favor the learning of verbs in the literature (e.g., Choi & Gopnik, 1995; Ogura, 2001; Tardif, 1996, 2006).

Evidence for a Potential Universal Noun Advantage

The finding that 3-year-olds in all three languages succeeded in novel noun learning but not in novel verb learning supports the view that children universally map and extend novel nouns more readily than novel verbs (Gentner, 1982; Golinkoff et al., 1992, 1996; Imai, Haryu, Okada, Li, & Shigematus, 2006; Imai et al., 2005). In our task, it was not enough for children to form a mapping between an action and a verb. To succeed, children needed to *extend* the novel verb to another exemplar, a stringent test of verb learning. Thus, the results tell us that 3-year-old children are able to map and extend a novel noun to new instances after a single word-referent pairing (e.g., Golinkoff et al., 1992; Haryu & Imai, 2002; Imai & Haryu, 2001, 2004). However, they are not able to do so as readily for novel verbs (e.g., Golinkoff et al., 1996).

Additionally, the pattern of these results from Chinese children suggests that, given the choice, young children expect novel objects to be named over actions (Golinkoff et al., 1992; Markman, 1989). The bare word condition in Chinese offered an ideal case to examine the object-naming bias as the equivalent of a linguistic projective test: What meaning would children give to a novel word presented in the absence of syntactic support? Chinese children strongly favored an object-name interpretation for a novel word. Indeed, this result was all the more impressive given that Chinese children mapped the bare word to the object even when the object was deemphasized in the action event (Study 5), and given that Chinese adults preferred to map the bare word to the action rather than the object (Study 3A). Taken together, the fact that nouns get extended more readily than verbs and the fact that children seem to have a bias to label objects corroborate prior claims for a universal noun advantage (e.g., Bornstein & Cote, 2004; Gentner, 1982; Imai et al., 2005; Kersten & Smith, 2002).

Verb Learning: Differences Across Languages

Intriguing differences emerged across language groups in what cues children used. Although Japanese- and English-speaking 5-year-olds succeeded in the verb mapping and extension task, they did so under different linguistic conditions.

Verb learning in Japanese. Replicating the results of Imai et al. (2005), 5-year-old Japanese children reliably extended a novel verb to the same action when the verb was presented with the arguments dropped, although they did not succeed when the verb was presented with its arguments. For Japanese speakers, it is natural to drop verb arguments when they can be inferred from context. From the Japanese point of view, it was obvious that the subject was the actor and the theme object was the novel object in the bare verb condition. It is possible that Japanese children were distracted by hearing this unnecessary information. At the least, Japanese children did not appear to gain from information about argument structure in this particular context, in which the subject and the object could have been easily inferred from the video, in sharp contrast to English-speaking 5-year-olds.

Verb learning in English. English-speaking 5-year-olds successfully mapped and extended the verb to the same action only when it was accompanied by its arguments. Argument dropping does not occur nearly as often in English as in Japanese or in Chinese. By age 5, children seem to be sensitive to this fact. When the novel verb was presented in an unusual structural form, even though it was marked by the progressive /ing/, and even though the arguments of the verb could have been inferred from observation, children failed. This reliance on argument structure is consistent with research demonstrating that English-reared children exploit the argument structure surrounding verbs to infer verb meaning (Fisher, 1996; Fisher & Song, 2006; Hirsh-Pasek & Golinkoff, 1996; Naigles, 1990, 1996).

Verb learning in Chinese. There has been a common assumption in the literature that learning an argument-dropping language confers an advantage on verb learning (Choi & Gopnik, 1995; Gentner, 1982; Tardif, 1996). Indeed, previous research suggests that Chinese children have more verbs in their early lexicons than do English children, for example (Tardif, 2006).

From this point of view, Chinese and Japanese children might have been expected to perform better than English-speaking children. Furthermore, Chinese children might have exceeded Japanese children because of the morphological simplicity of Chinese verbs (Tardif, 1996). In contrast, Chinese children did not perform better than Japanese- or English-speaking children. In fact, Chinese 3- and 5-year-olds both bluntly failed to map a novel verb to a novel action. Chinese children were extremely sensitive to subtle contextual cues when learning novel verbs for action events. Unless the object was deemphasized, Chinese 5-year-olds were not able to map a novel verb to the action.

One might conclude from these data that the Chinese children relied solely on perceptual cues to assign a novel word to a form class. This, however, was not the case. Using the edited videos that downplayed the salience of the object, Chinese children in Study 5 were still able to map novel nouns onto objects. Crucially, this outcome demonstrates that children are using *multiple cues* to determine word reference. At present, we can only speculate about why Chinese children demonstrated such a strong object-naming bias and why they were so sensitive to contextual cues in our task. Indeed, the linguistic cues that Chinese-speaking adults readily detect were overridden in the face of a subtle extralinguistic cue that is a half second of an object-holding scene before the start of the action. The key linguistic property that sets Chinese apart from Japanese and English is the lack of morphological distinction between nouns and verbs. Thus, unlike the case with Japanese or English, Chinese speakers cannot determine the grammatical form class of a word by inflectional morphological markings. Of course, linguistic cues such as aspect-marking auxiliaries that accompany verbs (e.g., ''zai'' for progressive, ''le'' for perfective) are salient cues to indicate verbhood for adults but they are not inherent to the word nor are they obligatory. The present research indicated that even the presence of ''zai'' right before the verb may not be a strong enough cue for verbhood for young children when the following word is *novel*, even though they understand the ''zai + verb'' construction for familiar verbs. It is possible that other auxiliaries such as ''le'' signal verbhood more strongly than ''zai'' and might lead children to identify a novel word as a verb sooner. However, this is an empirical issue that requires future investigation.

In any event, in Chinese, even though word order provides a cue for determining the form class of each word in the sentence, it is only probabilistic: Although the basic word order is subject-verb-object, there are other word orders (object-subject-verb, subject-object-verb, and verb-object-subject) that also appear in spoken language (Li et al., 1993). Thus, to identify a word's grammatical class, Chinese speakers have to coordinate semantic and grammatical cues, both at the global (such as argument structure) and at the local (such as auxiliary verb) levels, in ''a complex system of mutual constraints'' (Li et al., 1993, p. 193).

Chinese also has a large number of words that can be used as both nouns and verbs. In addition, as

mentioned earlier, in Chinese, the notion of ''word'' is much less transparent than in English and in Japanese (cf. Chao, 1968). For Chinese children, then, more sophisticated linguistic knowledge may be required to identify a verb and its argument structure than for Japanese- and English-speaking children. Perhaps because linguistic cues are less easily accessible in Chinese, extralinguistic cues might be weighted more heavily in early verb learning.

Universally Shared Cognitive Factors and Language-Specific Linguistic Factors

The crosslinguistic results suggest that universally shared cognitive factors and language-specific linguistic factors both matter for early word learning. Universal biases, such as the bias to label objects, appear to characterize early word learning given the striking similarity in the developmental pattern across the three languages. However, language-specific factors come into play as well, influencing the ease with which children can map novel verbs to novel actions and factors they rely on in this process.

The pattern of crosslinguistic data here fits nicely with the emergentist coalition model (ECM) proposed by Hollich, Hirsh-Pasek, and Golinkoff (2000; Maguire, Hirsh-Pasek, & Golinkoff, 2006). The ECM makes several predictions, each of which was confirmed by the crosslinguistic data presented here. First, given the perceptual prominence of stable objects relative to relational concepts, children should universally assume that words label objects before they label actions (verbs) or properties (adjectives; Gentner, 1982; Waxman & Booth, 2003). This pattern bears out for a number of languages (e.g., Bornstein & Cote, 2004), such as English (this research; Waxman & Markow, 1995), Spanish (Waxman, Senghas, & Benveniste, 1997), and Japanese and Chinese (this research). The fact that Chinese-speaking children assumed that a class-ambiguous word was an object name rather than an action name provides additional evidence for this prediction.

Second, because children move from a reliance on perceptual to social to linguistic cues for learning words, children's movement away from the object bias to label actions will be a function of the properties of the input language. Languages that contain only subtle linguistic cues to form class should require more linguistic knowledge. In their place, children should evince continued reliance on social cues. Because Chinese children appear to have fewer clear linguistic cues to verbhood than Japanese- or English-reared children, the ECM would predict that they rely on linguistic cues later than children learning these other languages.

All in all, our results suggest that word-to-world mapping seems to be influenced by linguistic characteristics of the input language. Further, they call for a reconsideration of the linguistic factors that have been assumed to contribute to verb meaning acquisition. Morphological simplicity, for example, may not offer the toehold into verb learning once posited. Here, however, we underscore the need for future research with more fine-grained analysis of linguistic properties that might affect verb learning. For example, even though Japanese and Chinese are both argument-dropping languages, the situations and frequencies in which argument dropping occurs may differ across the two languages, in addition to differences in the morphological marking associated with verbhood: Chinese speakers may drop arguments only when the referents have been explicitly established by prior discourse, whereas arguments may be dropped in Japanese whenever the speaker thinks that the hearer can recover the arguments from context. If this is the case, it is important to examine how these potential difference influences verb learning in Japanese and Chinese children. Future research should also examine how semantic factors such as imagability and concreteness of meanings influences verb learning (Ma, Golinkoff, Hirsh-Pasek, Macronough, & Tardiff, 2008).

Discrepancy Between Our Results and Results From Production Data and Checklists: The Demanding Nature of an Extension Task

Why did children as old as 3 fail in our task even though they comprehend and produce many verbs (e.g., Choi & Bowerman, 1991; Choi & Gopnik, 1995; Fenson et al., 1994; Golinkoff et al., 2001; Ma, Golinkoff, Song, & Hirsh-Pasek, 2008; Tardif, 1996)? Importantly, we are *not* claiming that verb learning does not occur until children are 5 years old. Early appearance of verbs in children's lexicon is universally evident. Yet, the appearance of verbs in the lexicon does not mean that children appreciate the full meanings of the verbs they use. Verb meanings develop progressively, and linguistic experience is necessary to finally obtain fully adult-like representations of verb meanings (Gallivan, 1988; Imai et al., 2005, 2006; Theakston et al., 2002).

Children's early verb meanings seem to be narrowly contoured. Children first seem to associate a novel causal action to a novel label at around 18 months of age (Casasola & Cohen, 2000). However, it is highly unlikely that 18-month-olds would be willing to extend a newly learned verb to the same action when one or both of the two objects (either the agent

or the patient) are changed. Maguire et al. (2002) reported that English-speaking 18-month-olds were not willing to extend a newly learned verb to the same intransitive action when the actor was changed even after they had been trained on the verb–action association with four different agents. In fact, Maguire, Hirsh-Pasek, Golinkoff, and Brandone (2008) report that children at 30–38 months do best on extending a novel verb after viewing a single agent; they cannot extend a new verb after seeing multiple agents. The bulk of the evidence suggests that 3-year-olds are reluctant to extend a novel verb to new exemplars (e.g., Behrend, 1995; Forbes & Farrar, 1995; Imai et al., 2005; Kersten & Smith, 2002).

In summary, although children may be able to associate a novel verb with a novel action as early as 18 months, their representation of verb meanings is incomplete, as revealed by their failure to extend a newly introduced verb to a situation to which it is obviously extendable for adults. Extension is an excellent test of whether a child has truly learned a verb meaning because it requires flexibility and generative use. Thus, although 2-year-olds may say a verb, it may not be until much later that they come to possess adult-like representations of the verb (see also Imai et al., 2006). Our task required verb mapping and extension. Thus, given the task demands, children should reveal proficiency later than on checklists or from production data.

Why Is Verb Learning So Slow?

This article leaves us with an unresolved question: Why are children not willing to extend verbs, and why is verb learning so slow? We alluded to perceptual and conceptual factors: Objects are easier than actions to parse from the environment (Gentner, 1982; Gentner & Boroditsky, 2001; Maguire et al., 2006). Furthermore, although objects are temporally stable, actions are ephemeral. Object boundaries are easy to find. In contrast, the beginning and the ending of an action is not clearly marked, and the action itself often undergoes change as it proceeds. Our prior work (Imai et al., 2005; Study 4) indicates that children encode and remember objects more easily than actions. On the first day, children watched each of the six original videos for 30 s in the absence of verb labels. The next day, when children were asked to say which videos they had seen before, either the object or the action was changed. Even without language, Japanese 3-year-olds experienced more difficulty encoding and remembering novel actions than encoding and remembering novel objects. The fact that actions are less easily encoded than concrete physical entities (Gentner, 1982; Golinkoff et al., 1996; Maguire et al., 2006) may well contribute to the slowness of verb learning.

Yet, difficulty in encoding actions per se cannot be the sole reason for the slowness of full mastery of verb meanings. To extend a newly learned verb, children must learn the *semantic criteria* for generalization. An action can be done with many different objects. For example, we can throw a ball, a Frisbee, a stone, a disk, or almost anything we can lift up with our hands. Suppose that a child hears the verb ''throw'' while watching her father throw a ball at one time and sees her father lightly *toss* a ball at another time. At still a different time, the child sees a boy throw a Frisbee to a dog. The second scene is very similar to the first because the objects—the father and a ball—are the same. To fully learn the verb ''throw,'' she needs to not only extend the word to the similar scene but also to an event in which the actors and objects are different. In other words, to extend a verb to other instances, children need to know that agents and objects can change as long as the action is the ''same.'' Finding the invariants in the action across exemplars is discovering an action's ''verbal essence'' (Golinkoff et al., 2002). The mastery of this concept is a first step toward adult-like verb meanings and it is long in coming (Behrend, 1995; Forbes & Farrar, 1995).

We are not arguing, however, that 3-year-olds never generalize verbs when the patient object is changed. Perceptual salience as well as relative novelty between the object and the action in a given action event may well influence the ease with which children extract the invariants of the action from the whole scene. Given that there is no metric for measuring relative salience or novelty of objects and actions, we cannot conclude that our results are generalizable to any situation in which children must infer the meaning of a novel verb from observing an action event. In fact, in a different series of studies, we found that children's performance in verb generalization tasks improves when the changed patient object was perceptually similar to the original object or a familiar object (Haryu, Imai, & Okada, 2003; Imai, Haryu, & Okada, 2003; see also Kersten & Smith, 2002). Also, young children may extend a verb to a new exemplar (e.g., the same action with a new actor and/or new object), when they are trained with multiple different objects and/or with linguistic contrasts (cf. Bernal, Christophe, Waxman, Braun, & Lidz, 2005). However, the story is complicated. Children may need to have a firm representation of an action, possibly even in a specific context, before they can profit from seeing multiple, more varied exemplars (Maguire et al., 2008). At some point, however, multiple exposures must be essential for verb learning.

Coming to the insight that an action can be carried out with many different objects is only the first step for verb meaning generalization. In addition, word learners need to discover that different types of verbs employ different criteria for extension. Some verbs should be extended on the basis of sameness of manner, whereas others should be extended solely on the sameness of goals or results. Still others should be extended on the basis of the sameness of direction or trajectory of motion. Which semantic component is most likely to be packaged into verb meanings also differs across languages; therefore, children need to learn this distributional pattern (e.g., Choi & Bowerman, 1991; Talmy, 1985).

In the end, the question of whether noun learning is easier than verb learning may not prove to be the central question. The real issue is identifying the universal cognitive constraints on event interpretation and studying how these constraints and the semantic and syntactic structure of a lexical category in a particular language interact with the processes used to learn words. Given the structure of the noun (object names) lexicon, fast-mapping and extension with a single instance generally works fairly well, enabling children to build up a sizable vocabulary quickly. Given the complexity involved in the process of extracting the criteria for extension of a verb, it may be more adaptive to learn and extend verbs slowly, only after hearing the same verb used to describe similar actions with different objects across different situations.

Conclusions

This article has accumulated evidence informing three issues in language acquisition. First, it has complemented the evidence found with checklists and production data in showing that nouns are mapped and extended more readily (over verbs) across three languages with different linguistic properties. Second, because this is a crosslinguistic study employing the same paradigm, the data reveal that verb learning is a protracted process very much influenced the linguistic properties of the child's language. Finally, although perceptual, social, and linguistic cues are always available to verb learners, we have discovered that when a language offers minimal linguistic cues for identifying the form class membership of a novel word, children rely for a longer time on social cues.

References

Au, T. K.-F., Dapretto, M., & Song, Y. K. (1994). Input vs. constraints: Early word acquisition in Korean and English. *Journal of Memory and Language*, *33*, 567–582.

Behrend, D. A. (1995). Processes involved in the initial mapping of verb meanings. In M. Tomasello & W. E. Merriman (Eds.), *Beyond names for things: Young children's acquisition of verbs* (pp. 251–273). Hillsdale, NJ: Lawrence Erlbaum.

Bernal, S., Christophe, A., Waxman, S. R., Braun, I., & Lidz, J. (2005). *Syntactic and semantic cues to verb acquisition in 23 month-old infants: Evidence from French and English*. Poster presented at the biennial meeting of the Society of Research in Child Development, Atlanta, GA.

Bornstein, M., & Cote, L. R. (2004). Cross-linguistic analysis of vocabulary in young children: Spanish, Dutch, French, Hebrew, Italian, Korean, and American English. *Child Development*, *75*, 1115–1139.

Bowerman, M. (1980). The structure and origin of semantic categories in the language learning child. In M. L. Foster & S. H. Brandes (Eds.), *Symbol as a sense: New approaches to the analysis of meaning*. New York: Academic Press.

Brown, P., Gentner, D., & Braun, K. (2005, July). *Early acquisition of nouns and verbs in Tzeltal*. Paper presented at the 10th International Conference for the Study of Child Language, Berlin, Germany.

Casasola, M., & Cohen, L. B. (2000). Infants' association of linguistic labels with causal actions. *Developmental Psychology*, *36*, 155–168.

Chao, Y. R. (1968). *A grammar of spoken Chinese*. Berkeley, CA: University of California Press.

Childers, J., & Tomasello, M. (2002). Two-year-olds learn novel nouns, verbs, and conventional actions from massed or distributed exposures. *Developmental Psychology*, *37*, 698–705.

Choi, S. (2000). Caregiver input in English and Korean: Use of nouns and verbs in book-reading and toy-play contexts. *Journal of Child Language*, *27*, 69–96.

Choi, S., & Bowerman, M. (1991). Learning to express motion events in English and Korean: The influence of language-specific lexicalization patterns. *Cognition*, *42*, 83–121.

Choi, S., & Gopnik, A. (1995). Early acquisition of verbs in Korean: A cross-linguistic study. *Journal of Child Language*, *22*, 497–529.

Dromi, E. (1987). *Early lexical development*. Cambridge, UK: Cambridge University Press.

Erbaugh, M. (1992). The acquisition of Mandarin. In D. S. Slobin (Ed.), *The cross-linguistic study of language acquisition* (Vol. 3, pp. 373–456). Hillsdale, NJ: Lawrence Erlbaum.

Fenson, L., Dale, P. S., Reznick, J. S., Bates, E., Thal, D., & Pethik, S. J. (1994). Variability in early communicative development. *Monographs of the Society for Research in Child Development*, *59* (Serial Number 242).

Fisher, C. (1996). Structural limits on verb meaning: The role of analogy in children's interpretations of sentences. *Cognitive Psychology*, *31*, 41–81.

Fisher, C., & Song, H. (2006). Who's the subject? Sentence structure and verb meaning. In K. Hirsh-Pasek & R. M. Golinkoff (Eds.), *Action meets word: How children learn verbs* (pp. 392–425). New York: Oxford University Press.

Forbes, J., & Farrar, M. (1995). Learning to represent word meaning: What initial training events reveal about

children's developing action verb concepts. *Cognitive Development*, *10*, 1–20.

Forbes, J., & Poulin-Dubois, D. (1997). Representational change in young children's understanding of familiar verb meaning. *Journal of Child Language*, *24*, 389–406.

Gallivan, J. (1988). Motion verb acquisition: Development of definitions. *Perceptual & Motor Skills*, *66*, 979–986.

Gentner, D. (1982). Why nouns are learned before verbs: Linguistic relativity versus natural partitioning. In S. A. Kuczaj (Ed.), *Language development: Vol. 2. Language, thought, and culture* (pp. 301–334). Hillsdale, NJ: Erlbaum.

Gentner, D., & Boroditsky, L. (2001). On individuation, relativity, and early word learning. In M. Bowerman & S. Levinson (Eds.), *Language acquisition and conceptual development* (pp. 257–283). Cambridge, UK: Cambridge University Press.

Gentner, D., & Boroditsky, L. (2005, April). *Noun and verbs in early Navajo acquisition*. Paper presented at the biennial meeting of the Society for Research in Child Development, Atlanta, GA.

Gleitman, L. (1990). Structural sources of verb meaning. *Language Acquisition*, *1*, 3–55.

Golinkoff, R., Chung, H., Hirsh-Pasek, K., Liu, J., Bertenthal, B., & Brand, R. (2002). Young children can extend motion verbs to point-light displays. *Developmental Psychology, 38*, 604–615.

Golinkoff, R., Hirsh-Pasek, K., Bailey, L. M., & Wenger, N. R. (1992). Young children and adults use lexical principles to learn new nouns. *Child Development*, *28*, 99–108.

Golinkoff, R., Hirsh-Pasek, K., & Schweisguth, M. (2001). A reappraisal of young children's knowledge of grammatical morphemes. In J. Weissenborn & B. Höhle (Eds.), *Approaches to bootstrapping: Phonological, lexical, syntactic and neurophysiological aspects of early language acquisition*. Amsterdam: John Benjamins.

Golinkoff, R., Jacquet, R. C., Hirsh-Pasek, K., & Nandakumar, R. (1996). Lexical principles may underlie the learning of verbs. *Child Development*, *67*, 3101–3119.

Haryu, E., & Imai, M. (2002). Reorganizing the lexicon by learning a new word: Japanese children's inference of the meaning of a new word for a familiar artifact. *Child Development*, *73*, 1378–1391.

Haryu, E., Imai, M., & Okada, H. (2003, April). *The role of object in young children's understanding of action verb meaning*. Paper presented at the biennial meeting of the Society for Research in Child Development, Tampa, FL.

Hirsh-Pasek, K., & Golinkoff, R. (1996). *The origins of grammar*. Cambridge, MA: MIT Press.

Hollich, G., Hirsh-Pasek, K., & Golinkoff, R. (2000). Breaking the language barrier: An emergentist coalition model for the origins of word learning. *Monographs for the Society for Research in Child Development*, *65*(3, Serial No. 262).

Huttenlocher, J., Smiley, P., & Charney, R. (1983). Emergence of action categories in the child: Evidence from verb meanings. *Psychological Review, 90*, 72–93.

Imai, M., & Gentner, D. (1997). A cross-linguistic study on constraints on early word meaning: Linguistic influence vs. universal ontology. *Cognition*, *62*, 169–200.

Imai, M., Gentner, D., & Uchida, N. (1994). Children's theories of word meanings: The role of shape similarity in early acquisition. *Cognitive Development*, *9*, 45–75.

Imai, M., & Haryu, E. (2001). Learning proper nouns and common nouns without clues from syntax. *Child Development*, *72*, 787–802.

Imai, M., & Haryu, E. (2004). The nature of word learning biases and their roles for lexical development: From a cross-linguistic perspective. In D. G. Hall & S. R. Waxman (Eds.), *Weaving a lexicon* (pp. 411–444). Cambridge, MA: MIT Press.

Imai, M., Haryu, E., & Okada, H. (2003, November). *The role of argument structure and object familiarity in Japanese children's verb learning*. Paper presented at the 28th Annual Boston Conference on Language Development, Boston University, Boston.

Imai, M., Haryu, E., & Okada, H. (2005). Mapping novel nouns and verbs onto dynamic action events: Are verb meanings easier to learn than noun meanings for Japanese children? *Child Development*, *76*, 340–355.

Imai, M., Haryu, E., Okada, H., Li, L., & Shigematus (2006). Revisiting the noun-verb debate: A cross-linguistic comparison of novel noun and verb learning in English-, Japanese- and Chinese-speaking children. In K. Hirsh-Pasek & R. Golinkoff (Eds.), *Action meets word: How children learn verbs* (pp. 450–476). New York: Oxford University Press.

Imai, M., & Mazuka, R. (2003). Re-evaluation of linguistic relativity: Language-specific categories and the role of universal ontological knowledge in the construal of individuation. In D. Gentner & S. Goldin-Meadow (Eds.), *Language in mind: Advances in the issues of language and thought* (pp. 430–464). Cambridge, MA: MIT Press.

Imai, M., & Mazuka, R. (2007). Revisiting language universals and linguistic relativity: Language-relative construal of individuation constrained by universal ontology. *Cognitive Science*, *31*, 385–413.

Kersten, A. W., & Smith, L. (2002). Attention to novel objects during verb learning. *Child Development*, *73*, 93–109.

Kim, M., McGregor, K. K., & Thompson, C. K. (2000). Early lexical development in English- and Korean-Speaking children: Language-general and language-specific patterns. *Journal of Child Language*, *27*, 225–254.

Landau, B., Smith, L., & Jones, S. (1988). The importance of shape in early lexical learning. *Cognitive Development*, *3*, 299–321.

Lee, J., & Naigles, L. (2008). *Mandarin learners use syntactic bootstrapping in verb acquisition. Cognition*, *106*, 1028–1037.

Li, P., Bates, E., & MacWinney, B. (1993). Processing a language without inflections: A reaction time study of sentence interpretation in Chinese. *Journal of Memory and Language*, *32*, 169–192.

Li, P., Jin, Z., & Tan, L. H. (2004). Neural representations of nouns and verbs in Chinese: An fMRI study. *Neuroimage*, *21*, 1533–1541.

Ma, W., Golinkoff, R. M., Hirsh-Pasek, K., Macronough, C., & Tardif, T. (2008). *Imageability predicts age of acquisition of verbs in Chinese children*. Manuscript submitted for publication.

Ma, W., Golinkoff, R. M., Song, L., & Hirsh-Pasek, K. (2008) *Chinese children's comprehension of extensions of familiar verbs*. Manuscript submitted for publication.

Maguire, M., Hennon, E., Hirsh-Pasek, K., Golinkoff, R., Slutzky, C., & Sootsman, J. (2002). Mapping words to actions and events: How do 18-month-olds learn a verb? In B. Skarabela, S. Fish, & A. H. Do (Eds.), *Proceedings of the 27th Annual Boston University Conference on Language* (pp. 371–382). Somerville, MA: Cascadilla Press.

Maguire, M., Hirsh-Pasek, K. Golinkoff, R. (2006). A unified theory of word learning: Putting verb acquisition in context. In K. Hirsh-Pasek & R. M. Golinkoff (Eds.), *Action meets word: How children learn verbs* (pp. 364–391). New York: Oxford University Press.

Maguire, M., Hirsh-Pasek, K., Golinkoff, R. M., & Brandone, A. (2008). Focusing on the relation: Fewer exemplars facilitate children's initial verb learning and extension. *Developmental Science*, *11*, 628–634.

Markman, E. M. (1989). *Categorization in children: Problems of induction*. Cambridge, MA: MIT Press.

Naigles, L. (1990). Children use syntax to learn verb meanings. *Journal of Child Language*, *17*, 357–374.

Naigles, L. (1996). The use of multiple frames in verb learning via syntactic bootstrapping. *Cognition*, *58*, 221–251.

Ogura, T. (2001). *Meishi yuui, doushi yuui ni oyobosu hahaoya no gengo nyuryoku no kentou* [Influence of maternal input in the distribution of nouns and verbs in early vocabulary] Ministry of Education and Science grant report. Kobe University, Japan.

Soja, N., Carey, S., & Spelke, E. (1991). Ontological categories guide young children's inductions of word meanings: Object terms and substance terms. *Cognition*, *38*, 179–211.

Talmy, L. (1985). Lexicalization patterns: Semantic structure in lexical forms. In T. Shopen (Ed.), *Language typology and syntactic description* (Vol. 3, pp. 57–149). New York: Cambridge University Press.

Tardif, T. (1996). Nouns are not always learned before verbs: Evidence from Mandarin speakers' early vocabulary. *Developmental Psychology*, *32*, 492–504.

Tardif, T. (2006). But are they really verbs? Chinese words for action. In K. Hirsh-Pasek & R. M. Golinkoff (Eds.), *Action meets word: How children learn verbs* (pp. 477–498). New York: Oxford University Press.

Tardif, T., Gelman, S., & Xu, F. (1999). Putting the ''noun bias'' in context: A comparison of English and Mandarin. *Child Development*, *70*, 620–635.

Theakston, A. L., Lieven, E. V. M., Pine, J. M., & Rowland, C. F. (2002). Going, going, gone: The acquisition of the verb 'go.' *Journal of Child Language*, *29*, 783–811.

Waxman, S. R., & Booth, A. (2003). The origins and evolution of links between word learning and conceptual organization: New evidence from 11-month-olds. *Developmental Science*, *6*, 128–135.

Waxman, S. R., & Markow, D. B. (1995). Words as invitations to form categories: Evidence from 12 to 13-month-old infants. *Cognitive Psychology*, *29*, 257–302.

Waxman, S. R., Senghas, A., & Benveniste, S. (1997). A cross-linguistic examination of the noun-category bias: Its existence and specificity in French- and Spanish-speaking preschool-aged children. *Cognitive Psychology*, *32*, 183–218.

Yamashita, Y. (1997). The effect of saliency in input on the acquisition of nouns and verbs: Innate constraints or language-specific input? *Naruto Eigo Kyoiku* (Naruto College of Education Research Papers), *11*, 177–188.

Appendix

Lists of Nonsense Words Used for Experiments 1–7

	1	2	3	4	5	6
Japanese	neke(-tteiru)[a]	yachi(-tteiru)	chimo(-tteiru)	nuhe(-tteiru)	ruchi(-tteiru)	heku(-tteiru)
English	dax(ing)[b]	jav(ing)	blick(ing)	twill(ing)	glorp(ing)	modi(ing)
Chinese bisyllabic	dang1[c]pa4	wan4cu4	fa2ku1	suo3han4	mou2da2	wa1mo4
Chinese monosyllabic	jing2	gui2	jiong4	kuo2	lia1	pan3

[a]The morpheme in the parenthesis is the one marking the progressive aspect when the word was presented as a verb.
[b]-ing was added when the word was presented as a verb.
[c]The numbers indicate the tone corresponding to the morpheme.