

## **Noun and Verb Learning in Mandarin-acquiring 24-month-olds**

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Decades of research have revealed that although young children are exquisite word-learners, their ability to acquire verbs lags behind their ability to learn nouns. For example, developmental studies of word-learning in the lab reveal that although infants as young as 12- 14 months successfully map novel nouns specifically to individual objects and object categories (Waxman & Booth, 2001; Waxman & Markow, 1995), it is not until 24 months that they successfully map novel verbs to event categories (Arunachalam & Waxman, in press; Waxman, Lidz, Braun & Lavin, 2009). Indeed, there is some evidence to suggest that children's difficulty mapping verbs to event categories may persist well into the preschool years (Imai, Haryu, & Okada, 2005; Imai, Li, Haryu, Okada, Hirsh-Pasek, Golinkoff, & Shigematsu, 2008; Kersten & Smith, 2002; Maguire et al., 2002; Poulin-Dubois & Forbes, 2002).

There has been extensive debate about the source of this developmental decalage that favors the acquisition of nouns over verbs. (For recent reviews, see Gleitman, Cassidy, Nappa, Papafragou, and Trueswell (2005) or Waxman and Lidz (2006); also see Gentner (1982).) Some researchers have attributed it to the informational requirements underlying word learning. This view is based on the observation that the meaning of a verb depends upon the arguments that it takes, and the relation among them. Because nouns and noun phrases constitute those arguments, it is reasonable to assume that learners will require access to the meaning of the arguments (or nouns) before they can establish the meaning the verb they correspond to (Fisher, Hall, Rakowitz, & Gleitman, 1994; Gillette, Gleitman, Gleitman, & Lederer, 1999; Gleitman et al., 2005; Landau & Gleitman, 1985; Lidz, Gleitman, & Gleitman 2003; Piccin & Waxman, 2007; Snedeker & Gleitman, 2004; Waxman & Lidz, 2006; Waxman, Lidz, Braun & Lavin, 2009).

Others have taken a different view, claiming that the decalage favoring nouns over verbs reflects features of English and other so-called “noun friendly” languages, which stand in contrast to “verb friendly” languages like Mandarin and Japanese (Au, Dapretto, & Song, 1994; Choi, 2000; Choi & Gopnik, 1995; Gopnik & Choi, 1995; Kim, McGregor, & Thompson, 2000; Tardif, 1996; Tardif, Gelman, & Xu, 1999). This claim is based on the observation that verbs are relatively more frequent in the input in these languages than in languages like English. “Verb friendly” languages license noun ellipsis quite freely, with nouns being dropped from the surface of a sentence when there is sufficient support from the context to retrieve their meaning (Huang, 1984). As a result, nouns are produced less frequently in conversation, and verbs more frequently occur alone or in a salient phrase-final position (Kim et al., 2000; Lee & Naigles, 2005; Tardif, Shatz, & Naigles, 1997). This prominence of verbs in the input is proposed to offer greater support for verb learning than is available in English. In other words, when nouns are favored in the input, as in English and other so-called “noun friendly” languages, young children more rapidly acquire nouns than verbs. But in languages where verbs are favored in the input, the “noun advantage” in early lexical development may be attenuated, or even reversed.

Unfortunately, there is little cross-linguistic evidence that permits us to tease apart these alternative interpretations. Thus far, the evidence from “verb friendly” languages comes primarily from reports of the nouns and verbs that 2 ½- to 3-year-old children have acquired, as measured by their production (either from corpus analyses of children’s productive language or from check-lists completed by parents) (Au et al., 1994; Choi, 2000; Choi & Gopnik, 1995; Kim et al., 2000; Tardif, 1996; Tardif et al., 1999). Evidence like this, though intriguing, cannot address the developmental question at hand, because what it offers is essentially a count of the nouns and verbs that the child already knows. The real issue, however, is when, and how

quickly, children from these distinct language communities are able to acquire new nouns and verbs. Addressing this question requires experimental evidence from young children in word-learning tasks.

The experimental evidence from word-learning tasks in both “noun friendly” and “verb friendly” languages reveals some surprising verb learning failures (Imai et al., 2005, 2008), even in children well into their preschool years. For example, Imai et al. (2008) found, in a cross-linguistic investigation of 3- and 5-year-olds, that children’s abilities to correctly map and extend a novel verb varied by language, but perhaps not in the way that would be expected. This study included children acquiring English, Mandarin, and Japanese (the latter two being languages often characterized as verb friendly). Participants were presented with novel verbs embedded in one of two contexts: verbs in isolation (e.g., “Pilking!”), and verbs surrounded by pronouns (e.g., “He’s pilking it”). The results revealed that 3-year-olds uniformly failed to learn novel verbs across languages and contexts. Japanese- and English-acquiring 5-year-olds did succeed in certain contexts (Japanese-acquiring 5-year-olds successfully mapped and extended verbs when presented in isolation and not when surrounded by pronouns; English-acquiring 5-year-olds succeeded in pronoun contexts and not with verbs in isolation), but the Mandarin-acquiring children had difficulty in both linguistic contexts. These results underscore that not all “verb friendly” languages are alike; although Japanese and Mandarin both have “verb friendly” characteristics (e.g., both license argument dropping), children acquiring these languages were not uniformly successful in learning new verbs. Moreover, children’s demonstrated difficulty in this study, at an age long after they have begun producing verbs in their own speech, suggests that a different method may better capture their abilities.

In the current study, we extend a paradigm that documented successful noun and verb learning in English-acquiring 24-month-olds (Arunachalam & Waxman, in press) to children acquiring Mandarin. This method builds on a task developed by Waxman, Lidz, Braun, and Lavin (2009) to examine verb learning in young children. In the current study, children were either exposed to novel nouns or to novel verbs presented with fully lexicalized noun phrases in full sentences (e.g., “*The boy is pilking the cup*”). Performance in the noun condition was compared to performance in the verb condition, to determine whether children were sensitive to the grammatical category of the novel word, and whether they could successfully map novel verbs to action categories. The results reveal the first laboratory demonstration of successful verb learning in Mandarin-acquiring children.

## **Experiment**

### **Methods**

*Participants.* Forty typically-developing children (21 males; mean age of 24.5 months, ranging 20.7 to 27.6 months) were included in the final sample. They were recruited from Beijing, China, and all were acquiring Mandarin Chinese as their native language. Parents completed the Mandarin adaptation of the MacArthur-Bates Communicative Inventory: Words and Sentences (toddler long form) (Fenson et al., 1993). Mean production vocabulary was 593.9 words (range: 79 to 799); there were no differences among conditions in vocabulary. To be included in the final sample, children had to a) point correctly on at least two (out of four) pointing games and training trials, and b) point clearly on at least one test trial. One child who failed to meet these criteria was excluded.

### **Materials**

*Video Stimuli.* All videos were digitized recordings of live actors, edited to create the sequences described in Table 1. In the Dialogue scenes, two actors were seated next to each other at a table. In the Action scenes, actors performed continuous actions on inanimate objects. The actors and actions in these latter scenes were the same as in Waxman et al. (2009). Videos were presented to participants on a laptop computer.

*Auditory Stimuli.* Actors in Dialogue scenes were female native speakers of Mandarin. They adopted a child-directed speech register, and maintained approximately the same speech rate across conditions. Speech stimuli for Action scenes were recorded by a female native Mandarin speaker in a child-directed speech register. These utterances were edited to control duration and amplitude, and were synchronized with the visual stimuli.

### **Apparatus and Procedure**

Children and their caretakers were welcomed to the study. Before beginning the experiment, the caretaker was asked to complete a vocabulary checklist. The child was then seated in the parent's lap in front of the laptop screen to watch the video. The caretaker was instructed not to talk to the child while the video was playing. The experimenter, seated next to the child, elicited pointing responses. Children's pointing behavior was recorded by the experimenter on a coding sheet. Sessions lasted approximately 10 minutes and included a pointing assessment followed by the experiment proper.

To begin, children were engaged in a game designed to encourage them to point to a scene on the screen. Children viewed two side-by-side dynamic video clips and were asked to point to one. On two trials, they were asked to point to a particular person or object in the scene (e.g., a bear), and on another two they were asked to point to a particular action (e.g., dancing). If the infant was reluctant to point, the video was paused and she was encouraged to point to her

nose, her shoes, etc. Children who pointed to the incorrect scene were corrected gently and asked to point again.

In the experiment proper, each infant participated in six trials, each featuring a different target object and action (e.g., waving a balloon). Each trial included a Dialogue, Familiarization, and Test phase. Trials were presented in one of two random orders, balanced across conditions. The left-right position of the test scenes was counterbalanced across trials. Children were randomly assigned to one of the four conditions, all of which featured the same visual materials; only the auditory stimuli varied. See Table 1.

*Dialogue phase.* Children first viewed a video scene (presented at the center of the screen) involving two young women in conversation, seated at a table. Their dialogue included a total of eight utterances of the novel word, presented either as a novel noun or verb.

*Familiarization phase.* (40 s) For each trial, children saw four different examples of a given event category, presented one at a time on alternating sides of the screen. In each scene, the same actor (e.g., a man) performed the same action (e.g., waving) on one of four objects of the same kind (e.g., four different balloons). The accompanying audio varied by condition. In the Verb condition children heard, e.g., “*zhe wei shu shu zheng zai **áng** yi ge qi qiu,*” ‘The man is **anging** a balloon’; in the Noun condition, they heard, e.g., “*zhe wei shu shu zheng zai hui dong yi ge **áng**,*” ‘The man is waving an **ang**’.

Next, children viewed two scenes, presented one at a time in the center of the screen, both featuring the same actor (e.g., the same man). In the first, the actor performed a novel action on a novel object (e.g., playing a saxophone), with the accompanying audio in the Verb condition, “*Uh-oh! Ta bu zai **áng** na yi ge,*” ‘Uh-oh. He’s not **anging** that’. Like Waxman et al. (2009) and Booth and Waxman (2009), we included this scene to introduce the idea that the

novel word cannot apply to all scenes. But because this scene depicted both a novel action and a novel participant object, it did not reveal whether the novel word referred to an action or an object. Next, children saw one of the now-familiar scenes (e.g., the man waving a balloon). The accompanying audio in the Verb condition was, “*Yay! Ta zai **áng** na ge!*” ‘Yay, he is **anging** that!’

*Test phase.* (13.5 s) Finally, children viewed two test scenes, presented simultaneously on either side of the screen. Both involved the familiar actor (e.g., the man). In the Familiar Object scene, the man performed a novel action (e.g., tapping) on the familiar object (e.g., the balloon). In the Familiar Action scene, the man performed the now familiar action (e.g., waving), but on a new object (e.g., a rake).

The test phase began with an initial inspection period in which children in all conditions viewed both test scenes, hearing, “*Xian zai kan, ta men bu tong le,*” ‘Now look, they’re different’. After 4 seconds, the screen went blank (1.5 s); while the screen was blank, a test question was posed (e.g., “*Ta zai na li **áng** dong xi?*” ‘Where is he **anging** something?’). The two test scenes then reappeared in their original locations (8 s) and the test question was repeated. The experimenter, seated next to the child, repeated the test question and encouraged her to point. Children who pointed were provided with neutral feedback regardless of where they had pointed.

### **Coding and Analysis**

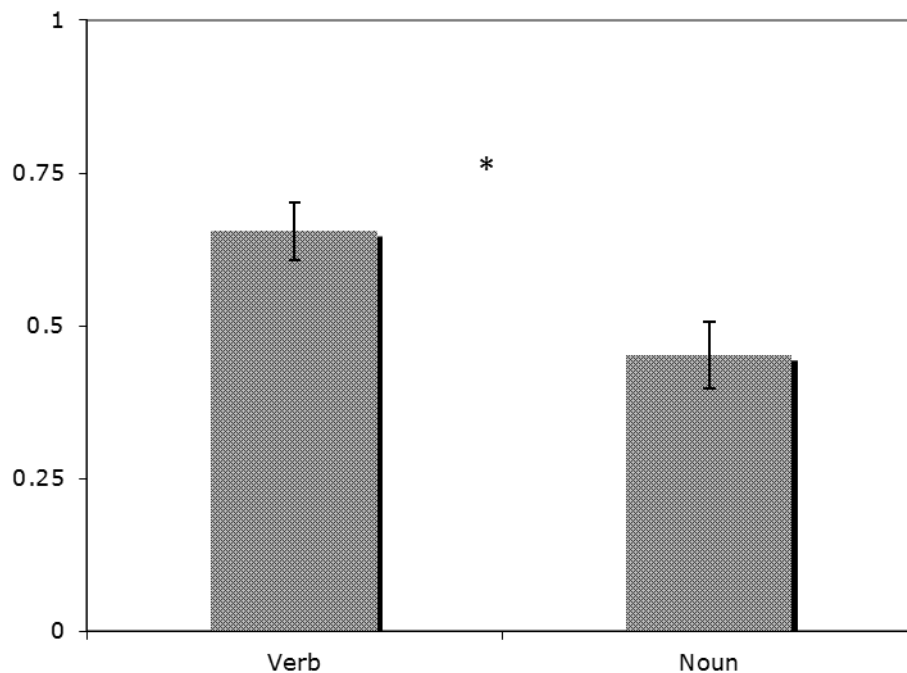
We calculated, for each infant, the number of trials on which that infant pointed to the Familiar Action scene (e.g., waving a rake), and divided this by the total number of trials on which that child pointed. Performance in the Verb condition was then compared to performance in the Noun condition.



*Predictions.* If Mandarin-acquiring children are able, like English-acquiring children, to map novel verbs onto an event category, they should choose the Familiar Action scene more often in the Verb condition than the Noun condition.

## Results

As predicted, children in the Verb condition chose the Familiar Action scene 66% of the time, significantly more often than children in the Noun condition (45%;  $t(38)=2.79$ ,  $p < 0.01$ ). See Figure 1. This indicates that 24-month-old Mandarin-acquiring children, like English-acquiring children, are sensitive to the grammatical cues in their language that distinguish verbs from nouns. They reliably point to the Familiar Action scene in the Verb condition, and not the Noun condition, indicating their ability to establish a verb-action category mapping.



*Figure 1.* Mean proportion of points to the familiar action scene.

To examine individual performance, we counted the number of children who chose the Familiar Action scene on half or more of the trials on which he or she pointed. In the Verb condition, this pattern held for 17 of the 20 children; in the Noun condition, it held for 10 of the 20. The difference between conditions is significant,  $\chi^2(1) = 4.103, p = .043$ . In the Verb condition, the number of children who select the Familiar Action scene on half or more trials is different than chance  $\chi^2(1) = 9.8, p < .01$ ; in the noun condition, this number is not different than chance.

### **Discussion**


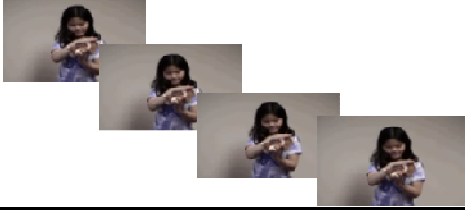


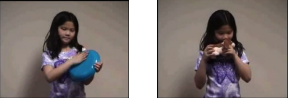
These results, which constitute the first experimental evidence of novel verb learning in Mandarin-acquiring 24-month-olds, converge well with the evidence from 24-month-olds acquiring English (Arunachalam & Waxman, in press). In short, 24-month-olds acquiring either English or Mandarin can successfully map novel verbs onto an action category. This finding contrasts starkly with Imai et al.'s (2008) reports of verb learning failures in Mandarin-acquiring 3- and in some cases even 5-year-olds. In our view, children's success in the current experiment makes two important contributions.

First, the current results amplify the importance of linguistic and observational support in verb learning. Indeed, we propose that 24-month-olds successful verb learning, in contrast to 3- and 5-year-olds' difficulty in Imai et al. (2008), illustrates this point. We presented children with more observational and linguistic support for verb learning (see also Waxman et al., 2009; Arunachalam & Waxman, in press). Children heard the novel verbs several times in dialogues, and then viewed multiple positive exemplars (as well as a contrastive negative exemplar) of the referent event. This rich exposure provided ample opportunity to hear the novel verb, extract it from the speech stream, and determine that it mapped onto a relation in the scene they were

viewing. Their success reveals that verb acquisition is aided by rich observational and linguistic information.

Second, the successful verb learning in Mandarin- and English-acquiring 24-month-olds provides a foundation for tracing in detail the developmental trajectory underlying noun and verb learning across languages. If we are to identify whether and how verb learning is shaped by features of the language that children are *in the process of acquiring*, it will be essential that we focus on children younger than 24 months.

**Table 1.** The structure of a representative trial in the verb condition. Trials included dynamic scenes with accompanying audio.

<u>Dialogue</u>	<u>Familiarization</u>	<u>Contrast</u>		<u>Test</u>
				 <p data-bbox="1604 467 1892 526">Familiar Action    Familiar Obj New Obj            New Action</p>
<p data-bbox="184 532 592 613">Na wei xian sheng <i>juán</i> le na ge maozi. That <i>Cl</i> man <i>larp Pst</i> that <i>Cl</i> hat <b>The man was larping the hat.</b></p> <p data-bbox="184 643 592 724">Zhen de ma? Ta <i>juán</i> le na ge maozi? Really <i>Qst?</i> He <i>larp Pst</i> that <i>Cl</i> hat <b>Really? He was larping the hat?</b></p>	<p data-bbox="592 532 1073 613">Kan ah! Look! <b>Look!</b></p> <p data-bbox="592 643 1073 724">Zhe ge jie jie zheng zai <i>juán</i> yi zhi gou. <i>Intj</i> this <i>Cl</i> sister <i>Prog larp</i> one <i>Cl</i> dog <b>The girl is larping a dog.</b></p> <p data-bbox="592 753 1073 834">Zhe ge jie jie zheng zai <i>juán</i> ling wai yi zhi gou. This <i>Cl</i> sister <i>Prog larp</i> another one <i>Cl</i> dog <b>The girl is larping another dog.</b></p>	<p data-bbox="1073 532 1371 613">Uh-oh! Uh-oh <b>Uh-oh!</b></p> <p data-bbox="1073 643 1371 724">Ta bu zai <i>juán</i> na yi zhi. She not <i>Prog larp</i> that one <i>Cl</i> <b>She's not larping that.</b></p>	<p data-bbox="1371 532 1598 613">Yay! Yay! <b>Yay!</b></p> <p data-bbox="1371 643 1598 724">Ta zai <i>juán</i> na hi! She <i>Prog larp</i> that <i>Cl</i> <b>She is larping that!</b></p>	<p data-bbox="1598 532 1906 613">Xian zai kan, Now look, <b>Now look,</b></p> <p data-bbox="1598 643 1906 724">tamen bu tong le. they not same <i>Pst</i> <b>They're different.</b></p> <p data-bbox="1598 753 1906 867">Ta zai na li <i>juán</i> dong xi? She at where <i>larp</i> something <b>Where is she larping something?</b></p> <p data-bbox="1598 896 1906 971">Ta zai <i>juán</i> na yi zhi? She at <i>larp</i> which one <i>Cl</i> <b>Which one is she larping?</b></p>

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