

Verb Use in Chinese Children: Extensibility of Instrument*

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Abstract. The goal of this study is to investigate 5- and 7-year-old's (N = 48) willingness to extend a common verb to an action event incorporating an unusual instrument. Instrument specificity is defined as the number of instrument adult native speakers can identify within an experimental task setting. Six target verbs were chosen and grouped into two groups of verbs, Specified and Open, by their instrument specificity rated by native adult speakers. Half children received a prior familiarization to the names and functions of the unusual instruments in the experiment. All children heard one story for each verb and were asked to first paraphrase and then act out the action in the story. Results suggest that: Verbs with more specified instrument are harder to comprehend, but children's performance increases with age; furthermore, the performance of extension is not improved by a prior familiarization to their names and functions.

Keywords: instrument specificity, lexical development, verb extension, verb acquisition.

1 Introduction

According to Golinkoff *et al.* (1995), once children have learned the appropriate semantic elements specified in their language, they should also start to generalize verbs based on semantic elements rather than on the shape, or event appearance. Many efforts have been paid to find out the crucial semantic elements that influence children's extension of verbs. For example, Forbes & Farrar (1995) found that 3-year-olds failed to generalize the novel verbs to a changed agent whereas 10-year-olds had no problem with changed agents. For another, Behrend (1990) found that result changes made children (3-, 5- and 7-year-olds) less likely than manner changes to extend the novel verb.

The role of instruments in verb acquisition was first examined by Behrend (1990). His findings were that instrument changes in a verb, comparing to action and result changes, was relatively insignificant to the subjects (3-, 5-year-olds and adults) when using a novel verb to label an original event that has been modified in one of its semantic components. His interpretation was that instrument is not a very salient verb concept comparing to action and result. However, Seston *et al.* (2009) argued that children do perceive the difference in instrument. In their study, when the stimulus for instrument is more specified in its usage, children found it easier to extend it to a familiar verb. Their explanation to the results was that children's understanding of verb extensions is positively correlated with a verb's semantic concreteness (i.e. imageability) and shape. Nevertheless, it should be noted that Seston *et al.*'s study has the following limitations: (1) Limitation of production task. In their study, they only ask children to paraphrase the stories, and use these production responses to assess their comprehension of the verb extensions. However, since comprehension usually comes before

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production (Benedict, 1979), their result of production task may not fully reflect children's comprehension of the verb extensions. (2) Limitation of coding scheme for the production data. In their study, they included non-verbal responses such as pantomimes to be correct responses of paraphrase, confounding the responses of act-out with production. (3) Limitation in the chosen target verbs. Seston *et al.*'s chosen target verbs are the labels which also used as nouns to indicate their default instrument such as vacuum or fork. Since children also heard the labels when they are used as nouns, the influence of not only verb frequency but also nouns frequency is possible to interfere.

One goal of this study is to further examine Seston *et al.*'s hypothesis that verbs with more specified instrument were easier to comprehend. This study also aims to test their second conclusion, which involves the positive correlations between shape and the instrument extension task. Another goal of this study concerning instrument is children's knowledge of instrument involved in the story. Since a body of research (Gentner, 1981; Kersten and Smith, 2002) has pointed out that knowledge of the types of motion an object can perform (or be affected by) is prerequisite to understanding what a verb means, it is crucial to ensure that children have the same knowledge to the instrument involved.

Given the above concerns, the present study aims to explore the research questions as the followings: (1) Can 5- and 7-year-old Mandarin-speaking children properly paraphrase and act out familiar verbs with novel instrument extensions? To be exact, does the degree of instrument specificity affect their performance? (2) Does providing a prior familiarization to the extended instruments facilitate verb extension in production and act-out tasks?

The first goal of this study is to investigate the role of instrument specificity in the verb learning process. Instrument specificity is operationally defined as the number of instruments that adult native speakers can identify within an experimental task setting. The verbs which defined as taking only one default instrument are called "Specified verbs" whereas the verbs permitting more than one instrument are called "Open verbs," following Seston *et al.*'s terminology. Variations among all trials such as sentence frame and number of words are controlled, and there are also control and filler trials added for baseline comparisons.

The second goal of this study is to probe into how knowledge of instrument involved in the verb extension process. To achieve this, we used toy blocks to make our instruments, and then label each block-made instrument with a familiar noun label such as "ladder" or "fork." The reason why we do not use a real ladder or fork is to avoid children's individual differences of the knowledge of the instruments involved. The block-made instruments were in no way look like the names they were labeled, children can only access the knowledge of the instrument by the provided labels (i.e., names), not by their appearance. Also, half of the children were assign to the condition which were told the name and function of the instruments prior the test trials (i.e., the Familiar condition), and the other half did not undergo this prior familiarization session. It is designed to explore whether prior familiarization to instrument knowledge improve the performance of extension.

By manipulating the specificity of instrument, this study created two sets of verbs different in the number of instruments that adult native speakers can identify within an experimental task setting, and provided evidence that cannot be obtained from theoretical studies or observational studies. This study not only filled the research gap of the role of instrument specificity in verb acquisition process but also provided a refined procedure to test instrument specificity in a well-controlled context.

2 Method

2.1 Participants

Twenty-four children at each two age, half boys and half girls. The average age of five-year-olds was 5;6 with a range of 5;1 to 5;11. The average age of seven-year-olds was 7;3 with a range of 6;9 to 7;7. These children were native Mandarin speakers with normal language development and without reported cognitive or perceptual impairments. Children were tested individually in a quiet room of their own school.

2.2 Materials: Verb Stimuli

As Table 1 shows, four types of verbs were used as stimulus verbs: Specified, Open, Control and Filler verbs. Twenty-two native Mandarin-speaking adults were asked to do a free recall on the instruments that could be used in these verbs. From which two verb lists were derived, Specified verbs and Open verbs were shown to be significantly different between each other [$t_{(21)}=6.72, p < 0.05$] on the twenty-two adults' average types of instruments for these target verbs. The Control verbs serve as baseline for comparing with the performance of Specified and Open verbs in the result analyses. The Filler verbs are all serial verbs.

Table 1: The selected verb stimuli

Type of verbs	Words (Alphabetized form)	Gloss	Avg. inst. types ^a
Specified instrument verbs	撕(sī)	to tear	1.59
	折(zhé)	to fold	
	脫(tuō)	to take off	
Open instrument verbs	拆(chāi)	to take down	2.53
	挖(wā)	to dig	
	敲(qiāo)	to knock	
Control verbs	拔(bá)	to pluck	1.83
	揉(róu)	to knead	
	撿(jiǎn)	to pick	
Filler verbs	跳起來轉圈圈 (tiào qǐ-lái zhuǎn quān-quān)	to jump and turn around	-
	坐下來休息 (zuò xià-lái xiū-xī)	to sit down and rest	
	趴著睡覺 (pā-zhù shuì-jìào)	to lie face downwards and sleep	

^a Average instrument types were the average instrument types across the 22 adults.

2.3 Materials: Sentence Stimuli

There were twelve stimulus trials, three trials in each of the four types of verbs (Specified, Open, Control and Filler). The sentences in each trial were short descriptions of a puppet performing a familiar action with an unconventional instrument (Specified and Open trials) or a conventional instrument (Control and Filler trials). The context of why the puppet wanted to perform the action was provided in the sentence for children to interpret the appropriate verb meanings. For example, in one of the Specified trials, children heard the story:

“小熊想幫媽媽做資源回收，他有一個梯子，
媽媽叫他用來撕報紙，用來撕報紙，
可是他不知道該怎麼做，你可以告訴他要怎麼做嗎？”

“xiǎo-xióng xiǎng bāng mā-mā zuò zī-yuán-hu í-shōu, tā yǒu yī-gè tī-zǐ,
mā-mā jiào tā yòng lái sī bào-zhǐ, yòng lái sī bào-zhǐ,
kě-shì tā bù zhī-dào gāi zěn-me zuò, nǐ kě-yǐ gào-sù tā yào zěn-me zuò ma?”

“Little bear wants help Mama do recycling. He has one ladder.
Mama told him use (it) tear newspaper, use (it) tear newspaper.
But he not know how to do. You can tell him how to do?”

“Little bear wants to help his mother do the recycling. He has a ladder.
His mother told him to use it to tear the newspaper, to use it to tear the newspaper,
but he doesn't know how to do it, can you tell him how to do it?”

Besides, the number of words in each sentence had been carefully controlled. The average length of a sentence is 51.25 words, with a standard deviation of 1.91 words.

2.4 Materials: Instrument

The unconventional instruments for the act-out task were made of lego blocks in order to exclude the different influence of object shape in individual participants. Six instruments were made and a free naming task was conducted by nineteen native Mandarin adults. After the free naming task, each of the six instruments was labeled with a name not only absent from the free naming task but also an unconventional instrument for the assigned Specified or Open verb. These labels and the label of patient object in each trial were selected from the Mandarin-Chinese Communicative Development Inventory (Taiwan) (i.e, MDCI Taiwan) (Liu and Tsao, 2010) which listed the words children should know by age three. Thus, five- and seven-year-olds in this study should be acquainted with these labels and have no difficulty recognize them. Also, these extended unconventional instruments are instruments that native speakers normally do not use to it perform the action, but it can definitely be applied to achieve the proper action and generate visible outcome.

2.5 Procedure

The procedure of experiment is shown in Figure 1, the experiment for testing instrument specificity can be divided into 3 phases: (1) *the introductory phase*, (2) *the baseline training phase*, and (3) *the test phase*. In the first phase, all the participants were given a general introduction of the experiment and shown the puppets who served as agents in the following actions in the training and test phase, but only children in the Familiar Condition were shown the six instruments which would be exploited in the test phase. In Familiar Condition, the experimenter gave a label, which is a common noun, to each instrument and told children the function of each instrument according to the label of the instrument. In the second phase, all the participants listened to two trials of training stories, and children were asked to paraphrase and act out the action depicted in the story after listening to each story. This is to serve as warm-ups for the following test trials. Finally, in the third phase, the test phase, the participants were told twelve stories, including 6 test trials, 3 control trials, and 3 filler trials, and were asked to first paraphrase and then act out the action depicted in the story after listening to each story. That is, the participants were tested for their paraphrase and act-out of the extended verbs.

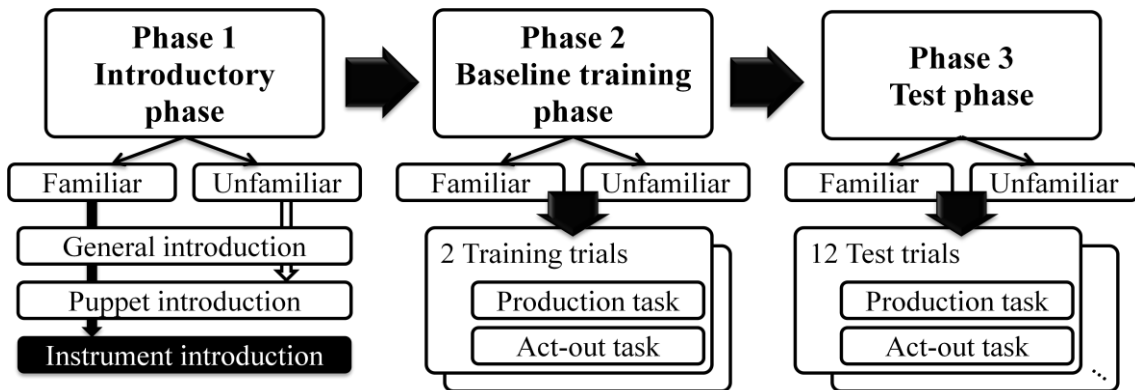


Figure 1: Flow of experiment

2.6 Coding Scheme

Children's responses in production task were grouped by five types: (i) Missing, (ii) Incorrect verb use (IC-V), (iii) Correct verb, and correct instrument (CV-CI), (iv) Correct verb, and new instrument (CV-NI), and (v) Correct verb, and omitted instrument (CV-OI).

The coding for act-out task was divided into three subparts: (i) Instrument correctly applying, (ii) proper Action, and (iii) visible Outcome. Children's act-outs were scored 1 or 0 to these three subparts. For instance, if a child used the instrument correctly, performed the proper action, but without visible outcome, 2 points would be gained from this trial. The experimenter is the first rater of the act-out task. To avoid biased rating, another rater was asked to rate 10% of the video clips and all codings were the same with the first coder's.

3 Results and Analyses

3.1 Results in production task

Figure 2 and Figure 3 illustrate the developmental trend for children's production types. As shown in Figure 2, Children increase the use of correct verb and correct instrument (CV-CI) from five to seven years old for both Specified verbs and Open verbs. Besides, Children tended to produce more CV-CI (correct verb and correct instrument) in Open verb than in Specified verbs. On the other hand, in Figure 3, Children decrease the use of correct verb but omitted instrument (CV-OI) from five to seven years old for both Specified and Open verbs, but the difference between Specified verb and Open verbs is not apparent in the production of CV-OI (correct verb but omitted instrument) shown in Figure 3. All in all, the data from the production (i.e., paraphrase) task reveals children's development of instrument specificity by showing an increase mentioning of correct instrument in their paraphrase.

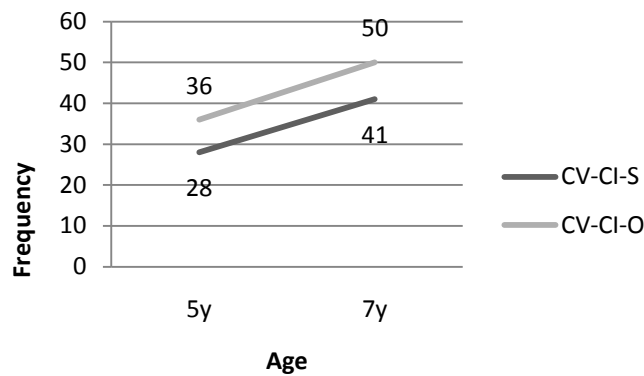


Figure 2: Correct oral response + Instrument in Specified and Open trials

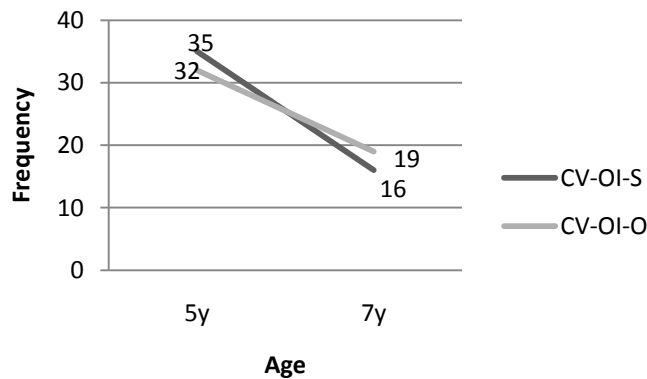


Figure 3: Correct oral response - Instrument in Specified and Open trials

3.2 Results in act-out task

In this section, for an estimation of children's overall performances in comprehension task, an analysis on their total scores was conducted. Participants' overall performance on three dimensions in total (i.e. the scores of Instrument plus Action plus Outcome for each response) were analyzed in a 2 (Age group: 5y vs. 7y) x 2 (Conditions: Familiar vs. Unfamiliar) x 4 (Verb types: Specified, Open, Control, Filler) repeated measures analysis of variance (ANOVA). Among the three factors, *age group* and *conditions* are between subject variables. The result shows: (1) The main effect of age group [$F(1,44)=3.728$, $p>0.05$] and conditions [$F(1,44)=0.128$, $p>0.05$] are both insignificant. However, age group appears to have a near-significance ($p=0.06$). (2) No interaction effects between age group and conditions [$F(3,44)=0.092$, $p>0.05$]. (3) The total scores for responses in different verb types are significantly different within each subject [$F(3,44)=28.641$, $p<0.01$].

Further pairwise comparisons suggest that for five-year-olds, children's overall performances (i.e., scores of I+A+O) of the four verb types (i.e., Specified, Open, Control, Filler) are all significantly different from each verb types, with Control scores the highest, Filler the second, Open the third, and Specified the last (i.e., $C > F > O > S$). However, for seven-year-olds, children's overall performances of Specified and Open verbs are significantly different from the other three verb types, but Control and Filler verbs are not significantly different from each other. That is, both Control and Filler scores the highest, Open the second, and Specified the last (i.e., $C = F > O > S$). To recap, age group and conditions did not influence participants' overall performance in act-out task, but age appears to have a marginal effect. Moreover, the overall scores in verb types are significantly different with the overall scores of Control and Filler verbs always higher than Open and Specified verbs, and the scores of Open verbs always higher than Specified verbs.

Now we move on to the most crucial question in this study; that is, what variables influence the specificity of Instrument? To explore this question, children's scores of correctly using instrument were analyzed in a 2 (Age group: 5y vs. 7y) x 2 (Conditions: Familiar vs. Unfamiliar) x 4 (Verb types: Specified, Open, Control, Filler) repeated measures analysis of variance (ANOVA). Among the three factors, *age group* and *conditions* are between subject variables. The result shows: (1) The main effect of age group [$F(1,44)=3.728$, $p=0.06$, $p>0.05$] and conditions [$F(1,44)=0.128$, $p>0.05$] are both insignificant. Nevertheless, age group appears to have a near-significance ($p=0.06$). (2) No interaction effects between age group and conditions [$F(3,44)=0.128$, $p>0.05$]. (3) The four verb types have significantly different scores within each subject [$F(3,44)=28.641$, $p<0.01$]. Further pairwise comparisons revealed that Specified verbs are significantly different from Open verbs [$p<0.05$], with significantly more correct uses of instrument for Open than Specified verbs. However, Control verbs and Filler verbs are not significantly different [$p=0.160 > 0.05$], suggesting no significant difference between the correctness of instrument uses. To conclude, age group and conditions did not influence participants' extension of instrument, but Specified and Open verbs resulted in significantly different instrument specificity.

Similar factorial design was conducted with Action and Outcome. However, children's action responses were not affected by age, familiarity of instruments, and verb types. On the other hand, Outcome is influenced by some variables. Results suggests that there are no significant between-subject variables for the performance in visible Outcome [Age: $F(1,44)=0.012$, $p>0.05$; Conditions: $F(1,44)=2.059$ $p>0.05$; Age x Conditions: $F(3,44)= 0.012$ $p>0.05$], but Outcome's scores in four different verb types are significantly different [$F(3,44)=18.445$ $p<0.01$]. Further pairwise comparisons reveal that the outcomes of Control verbs are the easiest to achieve, and the second easy outcomes are Filler verbs', the third Open verbs', and the least easy-attained outcomes are those of Specified verbs. However, the outcomes of Open and Filler verbs are not significantly different in their easiness of achieving. (i.e., $C \doteq F > O > S$) Thus, children's outcome responses were not affected by age and familiarity of instruments, but were significantly different across different verb types.

3.3 Comparison between Production and Act-out Task

Comparison between production and act-out task is illustrated in Table 2. In Table 2, we can find that for five-year-olds, there are in total 92.6% (33.3%+59.3%) of their production (oral) responses are correct, but there are only 70.4% (25%+45.4%) of them whose production (oral) and act-out responses are at the same time correct. However, the percentage of correct act-out response is 75.5%, in which 5.1% of the 75.5% do not come with correct oral output. Thus, it seems that for five-year-olds, correct act-out is strongly associated with correct production, but correct production is not strongly associated with correct act-out. Nevertheless, it should be noted that a 3 (3 Oral response types: Correct+Instrument, Correct-Instrument, Incorrect) x 2 (Act-out response types: Correct, Incorrect) Chi-square test showed that there's no significant difference between each cell for five-years-olds ($p>0.05$).

For seven-year-olds, there are 91.2% (55.6%+35.6%) of their production (oral) responses are correct, but there are only 81% (52.8%+28.2%) of them whose production (oral) and act-out responses are at the same time correct. However, the percentage of correct act-out response is 87%, in which 6% (of the total) does not come with correct oral output. Thus, it seems that for seven-year-olds, correct act-out is strongly associated with correct production, but correct production is not strongly associated with correct act-out. Moreover, a 3 (3 Oral response types: Correct+Instrument, Correct-Instrument, Incorrect) x 2 (Act-out response types: Correct, Incorrect) Chi-square test showed that there's a significant difference between each cell ($p<0.01$).

Taken together, in both age groups, a correct production is often a necessary condition for correct act-out, but the reverse is not true. That is, when children give a correct act-out response, they often also give a correct production response in the same trials, but the reverse is not true.

Table 2: Cross-tabulation of oral and act-out Instrument use responses

		Act-out				Total-5y	Total-7y
		Correct ^a		Incorrect ^b			
		5y	7y	5y	7y		
Oral	Correct +Instrument	54 (25%)	114 (52.8%)	18 (8.33%)	6 (2.78%)	72 (33.3%)	120 (55.6%)
	Correct - Instrument	98 (45.4%)	61 (28.2%)	30 (13.89%)	16 (7.41%)	128 (59.3%)	77 (35.6%)
	Incorrect	11 (5.1%)	13 (6%)	5 (2.31%)	6 (2.78%)	16 (7.4%)	19 (8.8%)
	Total	163 (75.5%)	188 (87%)	53 (24.5%)	28 (12.97%)	216 (100%)	216 (100%)

^a Correct: Correct uses of instrument in act-out task

^b Incorrect: Incorrect uses of instrument in act-out task

3.4 Summary of Results

To conclude, findings from this experimental study showed that when extending novel instrument extension of familiar verbs, verbs with Specified instrument are harder to be extended, comparing to verbs with Open instruments. Also, results from the ANOVA analyses suggest that prior familiarization to instrument names did not facilitate verb extension. In addition, although age factor is not significant in ANOVA analyses, findings from production (paraphrase) task found that seven-year-old children are more likely to mention instrument of a verb whereas five-year-old children tend to omit the instrument, indicating that children's lexical ability increases with age. Last but not least, cross-tabulations between production responses and act-out responses report a discrepancy between production and act-out correctness, and found that a correct production response is often a necessary condition for correct act-out response, but the reverse is not true.

4 Discussion and Conclusion

The present study aims to investigate Mandarin-speaking children's specificity of unconventional instruments. As mentioned in Section 1, two questions are addressed in the research. Discussion and conclusion are presented in this section.

4.1 Can 5- and 7-year old children properly paraphrase and act out familiar verbs with novel instrument extensions? Does the degree of instrument specificity affect their performance?

The result of the production (paraphrase) task suggests that not all of them can properly paraphrase the novel instrument extensions of familiar verbs. However, Paraphrase of Open verbs are achieved earlier (in age five) than that of Specified verbs (in age seven). Supporting evidence coming from the result in act-out task also reported that far more five-year-old participants extended instruments in Open trials than Specified trials, but seven-year-old participants did not show very significant differences in correct instrument use between Specified and Open trials. Both production (paraphrase) and act-out task reveal that verbs with Specified instrument are harder to extend their instruments than verbs with Open instruments.

Our conclusion is in conflict with Golinkoff et al. (1995) which states that "extension errors happened when children failed to recognize which semantic elements are conflated in the verb, so they extend on the basis of the overall shape of the main event." In other words, the specification of instrument has not been ready for five-year-old children, and this absent of specification caused five-year-olds to resort to the overall shape of the action event, leading to extension errors. Nevertheless, this account did not find support in this study since there is a

robust main effect for the difference of Specified and Open verbs. It is argued that children know the difference in Specified verbs and Open verbs from age five. That is, it seems that the specification of instrument has been there for five-year-old children.

Seston's study has several limitations and thus the present study had made adjustments in the experimental design as well as in the task procedure and scoring. These changes may explain the discrepancy between our results and their results. In their study, they reported that English-speaking six- and eight-year-olds found Open instrument verb extensions more difficult to comprehend than Specified instrument verb extension. The changes are: (1) *Change in experiment tasks*. In their study, the only stimuli were the stories narrated orally by the experimenter, whereas in our study, children were also provided with puppets, instruments, and patient objects to act out the described actions. Thus, either the discrepancy between production and act-out (comprehension) task or additional non-linguistic cues in act-out task may lead to different results of children's responses. (2) *Change in coding scheme for the production data*. In their study, they included non-verbal response such as pantomimes to be correct responses of paraphrase. However, in our study, production data were coded according to correct verbal responses of verb and instrument. The change in coding scheme for the production data also leads to different results. (3) *Change from sentence frame "with" to "用來 (yòng lái, use come, 'use...to')."* "With" in Seston *et al.*'s sentence frame is more ambiguous in meaning since it can refer to either interpretation of "use it to do something" or "carry it along with the agent." "用來 (yòng lái, use come, 'use...to') has only the interpretation of "use it to do something," and thus is less ambiguous. The difference in sentence frame ambiguity may also cause different results. (4) *Change in the chosen target verbs*. Seston *et al.*'s chosen verbs are verbs which take inanimate objects as default instrument and can also used as nouns such as vacuum or fork. However, in this study, the default instrument of each target verb is "hand", the most dominant body-part instrument in acquisition (Maouene *et al.*, 2006), and the verbs cannot be used as nouns at the same time. The difference in the default instrument and whether the verb can also use as nouns may result in different pattern of extensions. To be exact, the specificity of instrument in this study could be in relation with the domination of body-parts in early verb concepts, whereas the verbs chosen by Seston *et al.* may be interfered by the frequency of their noun counterparts.

4.2 Does providing a prior familiarization to the extended instruments facilitate verb extension in production and comprehension tasks?

The answer to the second research question is negative. Prior familiarization to the names and function of the unconventional instruments proved to be ineffective to the extensibility of unconventional instruments. Although knowledge of the types of motion an object can perform (or be affected by) is prerequisite to understanding what a verb means (Gentner, 1981; Kersten and Smith, 2002), a short introduction to each block-made instrument was not effective enough to influence children's willingness to extend the novel instruments. The result reveals that "knowledge of instrument" would not be acquired through brief exposure to the label and introducing its function and to the object itself. A longer exposure may result in a different pattern of extensibility. On the other hand, the discrepancy between the label of the object (e.g. ladder) and its novel lego-like appearance may also interfere with the effect of familiarization because the instrument look nothing like its label, and the introduced function could not be exploited in the extended action. The boundary of the effectiveness of "object knowledge" would be more limited than we had supposed.

4.3 Conclusion

By means of examining the extensibility of an unconventional instrument in a familiar verb, this study aims to discover the role instrument plays in the acquisition of Mandarin verbs. The main finding concerning instrument specificity, object knowledge, discrepancy between production and comprehension task are listed as the followings: First, for Mandarin-speaking children, verbs with more specified instrument are harder to extend than verbs with various possible instruments, especially for children under age five. Second, the extensibility of unconventional instruments is not influenced by a prior familiarization to their names and functions. Last but not least, failing to paraphrase a verb does not hinder children from performing it correctly, but correct paraphrase is often a prerequisite to correct act-out.

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