A Small Fan and a Small Handful of Fans
Exploring the Acquisition of Count-mass Distinction in Mandarin

Becky Hsuan-hua Huang
Education and Information Studies
UCLA
405 Hilgard Avenue
Los Angeles, CA 90095-1521
beckyhua@ucla.edu

David Barner
Department of Psychology
Harvard University
33 Kirkland Street
Cambridge, MA 02138
barner@wjh.harvard.edu

Peggy Li
Department of Psychology
Harvard University
33 Kirkland Street
Cambridge, MA 02138
pegs@wjh.harvard.edu

Abstract

The count-mass distinction often served as a test case for asking how syntax and semantics are related, whether knowledge of one helps the acquisition of the other. Virtually no studies examined this distinction in classifier languages which supposedly lack the distinction. However, Cheng and Sybesma (1998) argued Mandarin as a classifier language encodes this distinction at the classifier level: classifiers can be categorized as "mass-classifiers" or "count-classifiers," which categories denote different semantic meanings and occur in different syntactical constructions. The current study undertook Cheng and Sybesma's framework to compare Mandarin adults' and children's interpretation of classifiers. Experiment 1 and 2 asked whether count-classifiers select individuals and mass classifiers non-individuals and sets of individuals. Adult data indicated that there is indeed such distinction in Mandarin, but 4- to 6-year-olds had not fully mastered the distinction. Experiment 3 tested participant's syntactic sensitivity. Participants saw two contrasting pictures and had to match the "one-ADJ-CL-de-N" mass phrase to one and the "one-CL-ADJ-N" neutral phrase to the other. Adults were near perfect whereas six-year-old children were evenly split between those who were at-chance and those who knew the syntax. Our experimental data with children suggests that the mastery of the distinction appears quite late (6- or 7-years of age) relative to English-speaking children.

1. Introduction

Natural language draws on representations of individuals and sets of individuals. Different languages encode individuation in different ways, thus presenting a problem to children acquiring language. In Indo-European languages like English, individuation is signaled by count-mass syntax. Count nouns (e.g., table) can co-occur directly with number words and be pluralized (five tables), while mass nouns (e.g., wood) cannot be pluralized or co-occur directly with number words, but require a classifier for counting (e.g., two pieces of wood). Mass and count nouns also co-occur selectively with different quantifiers (e.g., many/*much tables vs. *many/much wood). Semantically, count syntax specifies reference to individuals, while mass syntax is unspecified with regards to individuation (see Barner & Snedeker, 2005; Gillon, 1996). Thus, count nouns refer to individuals like *tables*, *chairs* and *ideas*, while mass nouns can refer to either individuals like *jewelry* and *mail* or non-individuals like *hope* and *mustard.*

Certain researchers have claimed that classifier languages like Mandarin lack a count-mass distinction (Allan, 1980; Chierchia, 1994, 1998; Krifka, 1995), and that in these languages all common nouns are mass nouns. In support of this, nouns in Mandarin cannot co-occur directly with number words, but require classifiers for counting, like English mass nouns. Classifiers provide information such as the shape, animacy, functionality, and the unit of measure for the noun's referent (e.g., san zhi bi = three stick pen, or "three pens"). Also, in Mandarin pluralization is not obligatory when referring to plural sets, and most quantifiers can be used with both nouns that individuate and those that do not.

Although Mandarin lacks a morpho-syntactic distinction between count and mass nouns, it makes an analogous distinction at the classifier level (Cheng & Sybesma, 1998, 1999; Doetjes, 1997). Cheng and Sybesma (1998, 1999) observe that classifiers in Chinese can be separated into two distinct subclasses: what they call "count" classifiers and "mass" classifiers. This distinction is made on the basis of three criteria. First, individual count-classifiers are related to nouns by rote memorization and thus form a closed-class, while mass-classifiers can be used productively with a range of nouns, and form an open class. Mass classifiers, unlike count-classifiers, can sometimes be used as nouns. For example, the word "wan" functions as a classifier in "yi wan tang" (a bowl of soup) and as a noun in "yi ge wan" (a bowl).

Second, Cheng and Sybesma note that the two types of classifiers occur in different syntactic environments: insertion of the modification marker "de" is grammatical in the classifier phrase number-CL-N for mass-classifiers but not for count classifiers (see example 1).

(1) a. san ping (de) jiu
three CL-bottle DE liquor
"three bottles of wine"

b. san ge (*de) ren
three CL-individual DE people
"three people"

(2) a. yi da ping jiu
one big CL-bottle liquor

b. *yi da ge ren
one big CL-individual person

Finally, the insertion of adjectives between the numeral and the classifier is only permissible for mass-classifiers, which relates to the fact that mass classifiers are derived from nouns, and nouns are also subject to adjectival modification (see example 2).

The fact that Mandarin makes a distinction between count and mass classifiers raises the question of how this distinction relates to the count-mass distinction in languages like English, and whether the task of acquisition is based on similar principles. This question is interesting not only from the perspective of language acquisition (Macnamara, 1972; Gordon, 1982; Bloom, 1990; Barner & Snedeker, 2005), but also to researchers interested in the relationship between language and thought (Quine, 1960; Soja, Carey, & Spelke, 1991; Lucy, 1992; Imai & Gentner, 1997). Do count and mass classifiers draw on the same underlying conceptual resources as count-mass syntax? Does having one distinction or the other alter the way speakers think about objects in the world? By exploring the developmental course of classifier acquisition, we stand to gain insight into the conceptual foundations of the distinction and determine whether learning it makes new conceptual resources available to children.

However, only one empirical study (Chien, Lust & Chiang, 2003, henceforth CLC) has explored Mandarin children's acquisition of count and mass classifiers. With the help of a puppet who requests things (*"I want one CL something"*), CLC asked children to select one of three objects, where only the intended object was consistent with the particular classifier used. CLC found that children performed better than chance for a number of classifiers at three years of age, the youngest age they tested. They also found that children were more likely to pick solid objects as referents for count classifiers and non-solid substances for mass classifiers. This is consistent with the common assumptions that solid objects (*balls*, *plates*) are good individuals and non-solid substances (*water*, *sand*) are not (e.g., Soja, Carey, & Spelke, 1991; Imai & Gentner, 1997). Based on these findings, CLC concluded that Chinese children honor the grammatical distinction between count and mass classifiers by as early as 3-years-old. However, based on the evidence presented, this conclusion is perhaps premature. Since CLC presented children with familiar and nameable items (which they name for the children), children may have solved the task using knowledge of the how particular familiar nouns are typically paired with classifiers, without actually knowing the meanings of the classifiers. As a result, it is impossible to know what, if anything, children knew about either the syntax or semantics of count and mass classifiers.

We thus performed three experiments to test Mandarin speaking children's understanding of count and mass classifiers in the context of novel referents. Experiments 1 and 2 used novel items to investigate children's semantic interpretation of count and mass classifiers in Mandarin. Experiment 3, in turn, examined children's knowledge of the classifier syntax in Mandarin.

2. Experiment 1: Count classifiers and reference to individuals

Count classifiers like *gen* (rod), *zhi* (stick), and *kuai* (chunk) encode information about the shape of noun phrase referents. In this experiment, we asked whether Mandarin-speaking children know how count classifiers encode shape information, and whether they prefer to extend count classifiers to solid objects relative to non-solid substances.

2.1 Methods

We recruited 23 children with mean age of 4;8 (range 3;8-5;1) and 16 children with mean age of 6;0 (range 5;8-6;4) from preschools in Chiayi, Taiwan. Previous studies (see CLC for a reivew) indicate considerable development in children's classifier knowledge between three and seven years of age. By seven, children are comparable to adults in knowing which classifiers to choose for *familiar* objects. We thus selected two groups of children within the three to seven range who are likely to know the shapes associated with some of the count classifier, and asked whether they would use these classifiers to pick out only solid objects and not non-solid substances. The children's performance was compared to that of 12 adults (M=20 years-old, 19-24) recruited from the student population at Toku University in Chiayi County, Taiwan. The adults participated voluntarily without compensation while all children were given a small gift for their participation.

Adapting CLC's methodology, three boxes were presented as choice options for each test trial. Each box contained an item. A puppet then asked for one of the items ("*I want one CL something*"). Based on the classifier (CL) used, the participant had to point to the requested item. The three options always included of an open box containing an unfamiliar solid object (canonical individual), an open box containing an unfamiliar non-solid substance (canonical non-individual), and a closed box. Participants were told that if the requested thing was not visible (i.e., inside one of the open boxes), it would be inside the closed box. The visible choices varied in whether they matched the classifier in shape requirement.

There were three test trial types: *no shape match* trials, *shape match solid* trials, and *shape match non-solid* trials. On *no shape match* trials, the shape of neither the solid object nor the non-solid substance matched the shape specified by the count classifier in the puppet's request. Thus, we expected that participants who knew the shape specified by the classifer should choose the closed box. On remaining trials the classifier matched the shape of either the solid object (*shape match solid* trials) or the non-solid substance (*shape match non-solid* trials), but not both. Thus, in the *shape match solid* trials, we expected that participants who knew the shape specification of the classifier would pick the shape-matched solid. Of particular interest was whether participants would accept the shape-matched non-solid substance for the *shape match non-solid* trials. To summarize, both the *no shape match* and *shape match solid* trials test the participants' knowledge of classifier shape specification. The comparison between *shape match solid* and *shape match non-solid* trials allowed us to determine participants' willingness to pick solid objects and non-solid substances when given count classifiers.

We tested six count classifiers: *gen* (rod), *zhi* (stick), *tiao* (line), *zhang* (sheet), *pian* (slice), and *kuai* (chunk). Each classifier was tested once for each type of trial (*no match*, *shape match solid*, and *shape match non-solid*), for a total of 18 test trials. Trials were presented in two random orders (one order was the reverse of the other). Distractor stimuli (that did not match the classifiers in shape) were randomly chosen from the shape-matches of the other classifiers with the restriction that the items for *gen*, *zhi*, *tiao* did not co-occur within one trial since these classifiers specify similar shapes. Likewise, items for *zhang* and *pian* did not co-occur within one trial. All items occurred with equal frequency in the 18 trials.

Prior to the actual test trials, four additional practice trials were conduted to familiarize participants with the instructions. Two of the trials involved picking the correct color from three different colored Legos and the other two involved picking the correct shape from a cube, a ball, and a triangular block. The closed box was correct for two of these trials. Unlike the test trials, feedback was provided in practice trials for incorrect responses, and the closed box was opened to reveal the contained item when the participants chose wrongly.

2.2. Results and Discussion

As expected, adults picked the closed box (100% of the time) for the *no shape match* trials and the solid object (99% of the time) for the *shape match solid* trials (see Figure 1a). Importantly, for the *shape match non-solid* trials, they overwhelmingly selected the closed box (picking it 89% of the time) while avoiding the non-solid substance (picking it only 11% of the time). Thus, their behavior corroborated Cheng and Sybesma's analysis that count classifiers refer to individuated entities – in this case, solid objects.

The children's choice pattern was similar to the adults' for the *no shape match* trials and the *shape match solid* trials (see Figure 1b & 1c). Like the adults, children most often selected the closed box for the *no shape match* trials and most often selected the solid object for the *shape match solid* trials. This suggests that children at these ages are aware of the classifier-shape associations. However, the children's pattern for *shape match non-solid* trials differed from adults; both groups of children were willing to pick the non-solids that matched the shape. Particularly, the 4- and 5-year-olds selected the non-solid shape match most often (i.e., 52% of the time) relative to the other two boxes and at above chance level of 33% ($p < .001$). The 5- and 6-year-olds were more adult-like and picked the closed box the most often. However, in contrast to adults, they did not choose the closed box significantly more than the non-solid substance box (53% vs. 40%, $p=.48$), and neither differed from chance ($p > .05$).

Overall, we see a developmental progression; 5- and 6-year-olds' judgments were more adult-like than 4- and 5-year-olds. Importantly, the results indicate that although children understand that classifiers categorize entities in the world by shape, they do not initially have the adults' generalization that count classifiers tend to select for solid objects, or good individuals. Looking at the glass half-full, however, 4-year-olds were likely not entirely insensitive to the adults' generalization. The children did not prefer the shape match and avoid the closed box for the *shape match non-solid* trials as frequently as they did for *shape match solid* trials. In other words, the fact that they chose the shape-match for the *shape match solid* trials significantly more often than the *shape match non-solid* trials showed that they were treating solids and non-solids differently when determining what could reasonably be picked out by the count classifiers (52% vs. 27%, p<.05).

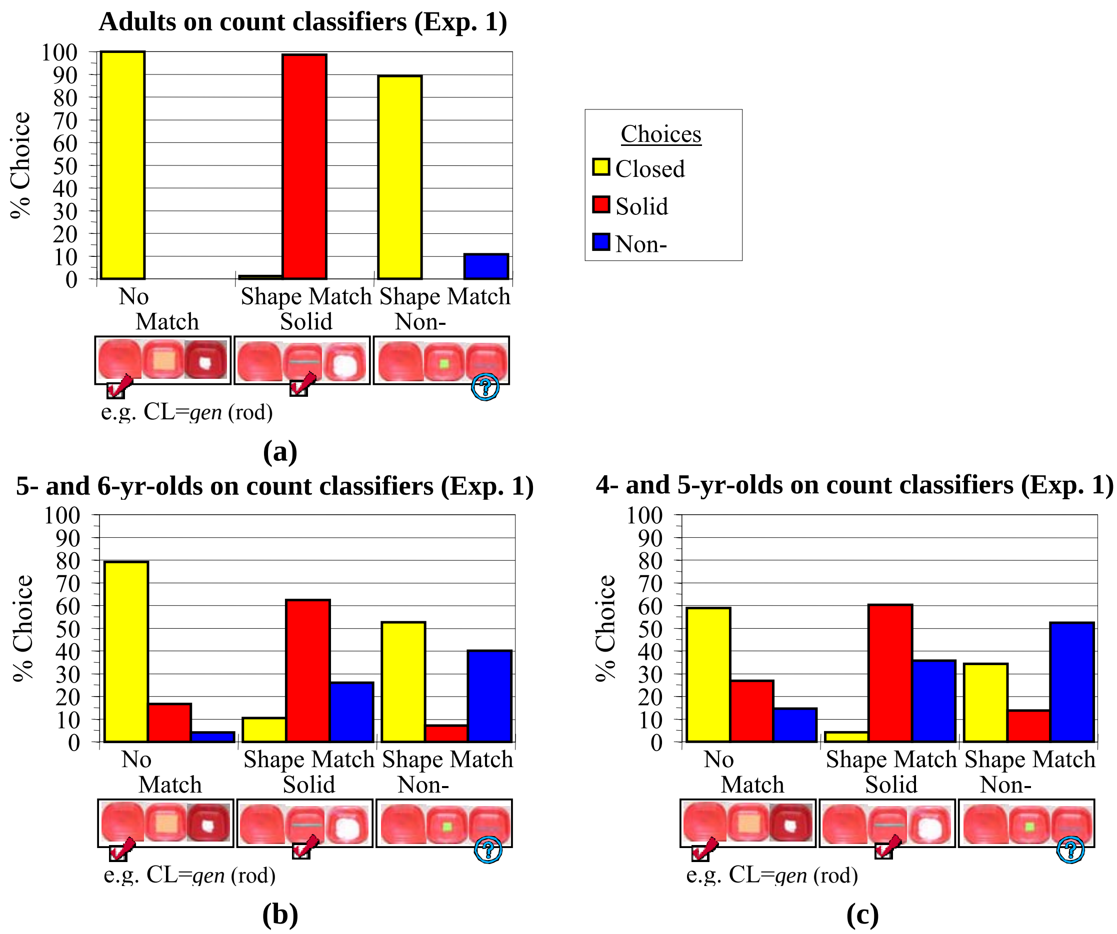


Figure 1. Percentage of participants choosing solid, non-solid, or closed box by trial type for count classifiers (Experiment 1).

3. Experiment 2: Mass classifiers and reference to non-individuals and pluralities

The second experiment tested children's and adults knowledge of shape and solidity information for both mass and count classifiers. As noted by Cheng and Sybesma, mass classifiers can pick out sets of individuals (e.g., one bowl of oranges) in addition to portions of non-solid stuff. Therefore, we tested whether children would choose a set of individuals as the referent for mass classifiers but not for count classifiers when the puppet requested "I want <u>one</u> CL something."

3.1. Methods

We tested 13 new children with mean age of 4;10 (range 4;5-5;1) and 16 new adults (M=20; range 19-22) recruited as in Experiment 1.

We used the same paradigm as Experiment 1, with the same three trial types: *no shape match*, *shape match solid*, and *shape match non-solid* trials.

Two shape-based count classifiers, *gen* (rod) and *pian* (slice), were tested and compared to two shape-based mass classifiers, *dui* (pile) and *tuan* (wad/ball). As in Experiment 1, we expected knowledgeable participants to pick the closed box for the *no shape match* trials for both count and mass classifiers. However, for the *shape match non-solid* trials, we expected participants to select the non-solid substance (e.g., a pile of unfamiliar non-solid substance for "dui") for mass classifiers. Of particular interest was whether participants would pick the closed box or the solid (e.g., a solid object in the shape of a pile/mound) for the *shape match solid* trials.

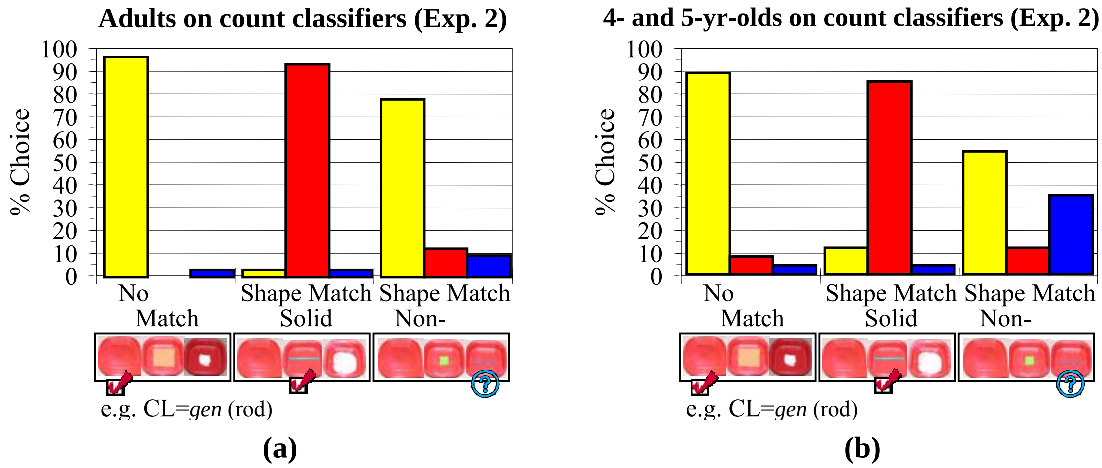
An additional test trial type (*shape match group* trials) tested whether children understand that the mass classifier in "one CL something" can refer to a set of individuals. The three options for the *shape match group* trials included an open box with multiple solids, an open box with a non-solid substance, and a closed box. Of the open boxes, the box with the multiple solids matched the shape specified by the classifiers. More specifically, the multiple solids box contained a set of identical solid objects whose aggregate shape matched the shape specified by the classifier. Each individual solid of the group, however, did not match the specified shape. For example, for the mass classifier *dui* (pile), the individual solid objects were rectangular blocks and the blocks were stacked into a pile. Performance for mass classifiers was compared to performance for count classifiers tested under the same conditions. For example, for the count classifier *gen* (rod), several individual one centimeter tubes with one centimeter diameters were aligned horizontally with tiny gaps between the tubes to create a rod shape. In the case of the mass classifiers, the multiple solids box should be the correct choice. The aggregate shape of the solid box matched the description of "one CL something". In the case of count classifiers, no one individual in the open boxes matches the shape requirement of the classifier even if the shape of the collective does. Consequently, participants should pick the closed box.

Each of the four classifiers was tested once for each of the four trial types, totaling 16 trials. The order of trials, selection of the non-shape match items, and the positioning of the boxes were randomized in the same way as Experiment 1.

3.2. Results and Discussion

3.2.1. No shape match, shape match solid, and shape match non-solid trials

The count classifier findings (Figure 2) were similar to Experiment 1 for both adults and children. Adults and children again differed most dramatically for the *shape match non-solid* trials. Although the 4- and 5-year-olds, like the adults, most often selected the closed box, they did not pick the closed box significantly more often than the non-solid shape-match (54% vs. 35%, $p = .36$). Furthermore, the likelihood of choosing the closed box also did not significantly exceed chance levels of 33% ($p > .05$). The fact that non-solid shape matches were acceptable to children again suggests that children initially take shape to be an important dimension for classifying entities when presented with count classifiers. Only later do they learn to be more restrictive to the kinds of entities – solid vs. non-solid – that they accept for count classifiers. However, the fact that children are not adult-like does not necessarily mean they are entirely ignorant that count classifiers apply differently across the solidity boundary. After all, their preference for the shape match for *shape match non-solid* trials was far lower than their preference for the *shape match solid* trials.



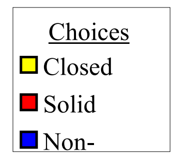
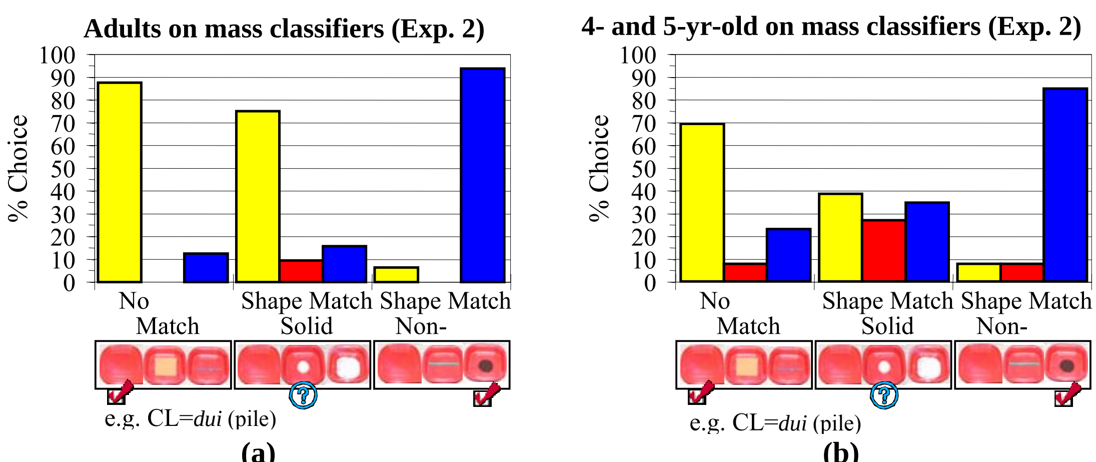


Figure 2. Percentage of participants choosing solid, non-solid, or closed box by trial type for count classifiers (Experiment 2).

For mass classifiers, adults performed as expected (Figure 3a). They overwhelmingly preferred the closed box for the *no shape match* trials, selecting it 88% of the time. They preferred the non-solids for the *shape match non-solid* trials, selecting it 94% of the time. Critically, they preferred the closed box and avoided the solid (75% vs. 9%) for the *shape match solid* trials. The pattern of results for mass classifier thus strikingly contrasts with the results for count classifiers, supporting the suggestion that count and mass classifiers pick out different types of entities in the world.



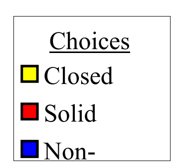


Figure 3. Percentage of participants choosing solid, non-solid, or closed box by trial type for mass classifiers (Experiment 2).

Children, on the other hand, performed similarly to adults on mass classifiers (Figure 3b) for the *no shape match* trials and the *shape match non-solid* trials; they most often selected the closed box (ie., 69% of the time) for the *no shape match* trials and most often selected the non-solid (85%) for the *shape match non-solid* trials. However, unlike adults, children did not choose the shape-matched solid most often for the *shape match solid* trials. In fact, they did not choose it any more often than the other two options. Children's performances on the mass clasifiers corresponded with their performances on the count classifiers. The children and adults differed most for the atypical situations (i.e. shape match non-solid presented with count classifiers and shape match solids presented with mass classifiers). Children were more willing than adults to choose the shape-match for the atypical situations.

All together, the findings from Experiments 1 and 2 show that children learn the classifier-shape relation early, as evidenced by their ability to pick out novel entities whose shapes matched the shapes specified by the classifiers in the puppet's request. Furthermore, children's initial classifier meanings are perhaps based mainly on classifier-shape relation and not sensitive to solidity. Seemingly, the acquisition of count/mass semantics in Mandarin classifiers is a relatively prolonged process; even at six years of age, when same age English speaking peers appear to have grasped count-mass semantics encoded in the nouns, Mandarin speaking children are not fully like adults.

3.2.2. Shape match group trials

Adults behaved as expected for the *shape match group* trials (Figure 4a); they treated count classifiers differently than mass classifiers by preferring the closed box for count classifiers (100% of the time) and the box with the multiple solids for mass classifiers (81%).

In comparison to the adults, the children were significantly different in their choice percentages (Figure 4a vs. 4b). However, the children's most frequent choices were the same as adults. The children picked the closed box most often for count classifiers (54%) relative to the non-solid and closed box choices. For mass classifiers, they picked the box with multiple solids most often (54%) relative to the other two choices. In line with previous data from Experiment 1 and 2, this finding again shows that children are not like adults at four and five years of age. However, the findings also provide further evidence that 4- and 5-year-olds are neither entirely ignorant of the fact that count and mass classifiers pick out different kinds of entities.

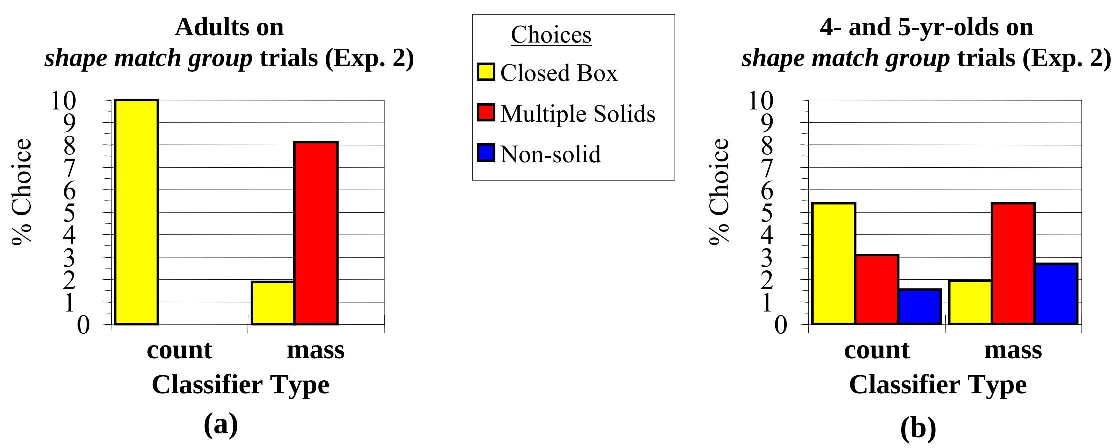
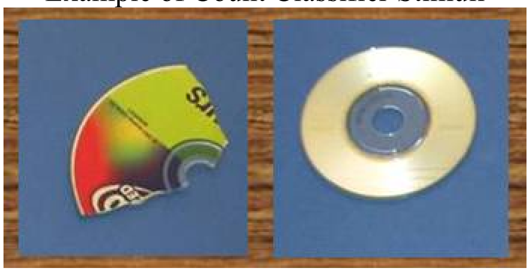


Figure 4. Percentage of participants choosing multiple solids, non-solid, or closed box by classifier type (Experiment 2).

4. Experiment 3: Classifier Syntax

Experiment 3 tested Mandarin-speaking children's knowledge of classifier syntax. More specifically, children were tested to see whether they would distinguish the meaning of mass syntax "one-ADJ-CL-de-N" from neutral syntax "one-CL-ADJ-N" by how they matched the two phrases to pictures.

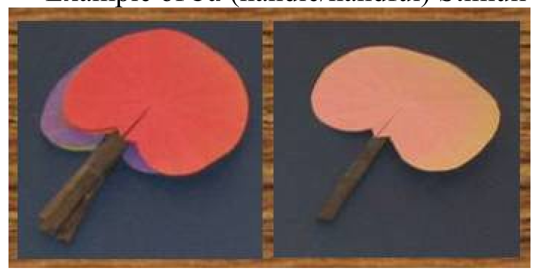
Example of Count Classifier Stimuli



yi xiao pian de CD — yi pian xiao CD
one small CL de CD — one CL small CD
"a small piece of CD" — " a small CD"

(a)

Example of *ba* (handle/handful) Stimuli



yi xiao ba de shanzi — yi ba xiao shanzi
one small CL de fan — one CL small fan
"a small handful of fans" — "a small fan"

(b)

Figure 5. Examples of stimuli from Experiment 3.

4.1. Methods

We tested 8 new children with mean age of 6;0 (range 5;7-6;5) and 16 new adults (M=20; range 19-22). The participants were drawn from the same subject pool as previous two experiments.

For each test trial, participants were presented with two pictures (see Figure 5 for examples). The experimenter would say "One side has one CL small Noun. The other side has one small CL DE Noun" and then posed the question in either neutral ("Which side has one CL small Noun?") or mass syntax ("Which side has one small CL DE Noun?"). The participant then had to point to the picture (of the two shown) that matched the queried sentence, while understanding that the other sentence would match the other picture.

Although count classifiers do not normally occur in mass frames, a count classifier used in a mass frame should force quantification over stuff just as an English count noun used in mass syntax ("There is dog all over the road"). Thus the two pictures for the count classifiers (Figure 5a) contrasted whether there was an entire object or part of one (i.e., a portion of the stuff). Thus, for each trial, the count classifier in the mass frame should be matched to a portion of the whole object and the count classifier in the neutral frame should be matched to the whole object.

The classifiers tested consisted of three count classifiers, *gen* (rod), *zhi* (stick), and *pian* (slice). We also included *ba*, a classifier that could either be a count- or mass-classifier (meaning "handle" or "handful" respectively).

For *ba*, the two contrasting picture always involved an individual object and a handful of that object. The rationale is that when used in a mass context, the *ba* classifier should take on its mass meaning (i.e., a set of individuals = a "handful"), and participants should thus select the handful option. The contrasting neutral sentence, on the other hand, should be matched to the count meaning (i.e., one individual = "handle" shape).

Each of the four classifiers was tested with three different nouns/picture sets, making 12 trials in total. Four additional irrelevant and easy trials checked whether the participants were paying attention. The attention check trials were interspersed among the actual test trials such that, starting with the first trial, every fourth trial was an attention check trials. The trials contrasted big and small. Specifically, the experimenter posed the following question: "One side has one CL small Noun. The other side has one big CL Noun. Which side has one CL small/big Noun?"

The order of the trials were randomized, and the positioning of the two contrasting pictures were randomly assigned with the constraint that half of the trials had the whole or one individual object on the right side, half on the left. Half of the participants always heard the mass syntax frame first and half heard the neutral frame first.

4.2 Results and Discussion

All participants were correct on the attention check trials, indicating that they understood the task and were paying attention.

As expected, adults more often selected a whole object to go with the neutral phrase and portion/pluralities of an object with the mass phrase (Mean correct percentage = 88%). If we use the criterion of nine or more out of twelve correct as passing (the probability of getting nine out of twelve is $p = .05$ by binomial distribution), fourteen out of the sixteen adults passed ($M = 94\%$) and were significantly above 50% chance level. The two non-passers were at chance ($M = 46\%$). Our group of 5- to 6-year-old children were evenly split between passers (4 out of 8 children, $M = 85\%$) and non-passers ($M = 47\%$), suggesting that some children at 6-years-old have not yet learned the syntactic distinction.

5. General Discussion

We compared adults' and children's interpretations of Mandarin classifiers to examine children's acquisition of the distinction between count and mass classifiers. Findings from Experiments 1 and 2 suggest that children understand the relationship between classifiers and the shapes they specify by 4-years of age. For both count and mass classifiers, children knew to select the closed box when there were no shape matches, and to choose the shape-match when made available (particularly for the typical case of solid for count classifiers, and non-solid for mass classifiers). This result extends many of the existing classifier studies which typically test children's knowledge of classifiers for familiar items; our children demonstrated their knowledge of the classifier-shape relation by correctly picking out novel items that matched in shape to the classifiers. It also extends previous studies by testing extensions of shape-based mass classifiers, as previous studies typically test only count classifiers (see CLC for review).

Contrary to CLC's conclusion that children as young as 3-year-olds understand the count-mass classifier distinction, our study showed that children between 4-6 years of age have not yet fully learned the mass-count classifier distinction, though our analyses did indicate some awareness of the distinction even in the 4- and 5-year-olds. Experiment 3 indicated that even some of 6-year-olds did not understand the subtleties of classifier syntax, providing further evidence that children do not fully understand the distinction between count and mass classifiers.

In sum, Mandarin-speaking children do not master the distinction until 6 or 7 years of age. This suggests that the mapping between individuation and natural language syntax is mastered much later in Mandarin than in languages like English, where individuation is mapped to count syntax by as early as 2;6 and is adultlike by 4;6 (Soja, Carey, & Spelke, 1992; Barner & Snedeker, 2005). Future work will thus involve spelling out how children learn the mapping between the syntax and semantics for this distinction.

Acknowledgements

We thank Rosie Williams for constructing the stimuli and pilotting Experiment 1, and Eva Xia for constructing Experiment 3 stimuli. We thank Yi-ting Huang for suggestions on how to run Experiments 1 and 2; Huang, Snedeker, & Spelke (2004) inspired our adaptation of CLC. Special thanks also goes to C.-T. James Huang, Susan Carey, and members of her laboratory for discussions on classifiers and count-mass syntax. Thanks to Toku Univeristy, LinShen Elementary School Kindergarten, JiaDian Kindergarten, and TseKuan Kindergarten for allowing us to test at their schools. This research was funded in part by an NRSA NIH post-doctoral fellowship to Peggy Li.

References

Allan, K. (1980). Nouns and countability. *Language*, *56*(3), 541-67.

Barner, D., & Snedeker, J. (2005). Quantity judgments and individuation: Evidence that mass nouns count. *Cognition, 97,* 41-66.

Bloom, P. (1990). *Semantic Structure and Language Development.* Ph.D. Dissertation, Massachusetts Institute of Technology.

Cheng, L. L.-S. and Sybesma, R. (1998). Yi-wan Tang, Yi-ge Tang: Classifiers and Massifiers, *The Tsing Hua Journal of Chinese Studies, New Series, 28*(3), 385–412.

Cheng, L. L.-S. and Sybesma R. (1999) Bare and Not-So-Bare Nouns and the Structure of NP, *Linguistic Inquiry, 30*(4), 509–542.

Chien, Y-C., Lust, B., and Chiang, C-P. (2003). Chinese children's comprehension of count-classifiers and mass-classifiers. *Journal of East Asian Linguistics, 12,* 91–120.

Chierchia, G. (1994). Syntactic Bootstrapping and the Acquisition of Noun Meanings: The Mass-Count Issue. In B. Lust, M. Suñer, and J. Whitman (eds.), *Syntactic Theory and First Language Acquisition: Cross-Linguistic Perspectives: Heads, Projections, and Learnability*. Hillsdale, NJ: Lawrence Erlbaum. 301–318.

Chierchia, G. (1998). Plurality of mass nouns and the notion of "semantic parameter". *Events and Grammar, 70,* 53-103.

Doetjes, J. (1997) *Quantifiers and Selection; On the Distribution of Quantifying Expressions in French, Dutch and English.* PhD dissertation, Leiden University.

Gillon, B. (1996, June). The lexical semantics of English count and mass nouns. Paper Presented at the Workshop on the Breadth and Depth of Semantic Lexicons, Santa Cruz.

Gordon, P. (1982). *The acquisition of syntactic categories: The case of the count/mass distinction.* Doctoral Dissertation, Department of Psychology, M.I.T.

Huang, Y. T., Snedeker, J., & Spelke, E. S. (2004). What exactly do number words mean? Cognitive Science Society, Northwestern University.

Imai, M., and Gentner, D. (1997). A cross-linguistic study of early word meaning: universal ontology and linguistic influence. *Cognition, 62,* 169–200.

Krifka, M. (1995). Common nouns: A Contrastive Analysis of Chinese and English. In G. Carlson and F.J. Pelletier (eds.), *The Generic Book*, Chicago: University of Chicago Press. 398−411.

Lucy, J.A. (1992) *Language Diversity and Thought: A reformulation of the linguistic relativity hypothesis.* Cambridge: Cambridge University Press.

Macnamara, J. (1972). The cognitive basis of language learning in children. *Psychological Review, 79,* 1–13.

Quine, W (1960). *Word and object: An inquiry into the linguistic mechanisms of objective reference.* Oxford, England: John Wiley.

Soja, N., Carey, S. and Spelke, E. (1991). Ontological categories guide young children's inductions of word meaning : Object terms and substance terms. *Cognition, 38* (2), 179-211.

Soja, N., Carey, S., and Spelke, E. (1992). Perception, ontology, and word meaning. *Cognition, 45,* 101-107.