Mandarin-Speaking Toddlers’ Acquisition of Unaccusativity

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1. Introduction

Unaccusativity describes complex properties of intransitive verbs, which offers a finer specification of verb classes than transitivity. Since Perlmutter (1978) formulated the Unaccusative Hypothesis, the studies of unaccusativity have made substantial contribution to the investigation of verb semantics, argument structure, and syntax. The hypothesis of splitting intransitivity was adopted by Burzio (1986), which took the Generative perspective to explain the syntactic difference between unaccusative verbs and unergative verbs. Although the two types of intransitive verbs have similar S-structure with a single argument as the subject, they differ in the D-structure (Rosen, 1984; Burzio, 1986). As (1) illustrates, for unaccusative verbs, such as fall in English, the S-structure subject leaves is the logical object, generated in the V complement position in the D-structure. It goes through A-movement to appear in the Spec, IP position, i.e. the subject in the S-structure. For unergatives, such as cry, the S-structure subject babies is the logical subject, generated in the Spec, VP position in the D-structure and then moves to the Spec, IP (subject) position. There are also accounts of the unaccusative-unergative distinction that focus on semantic features such as telicity, agentivity and mode of causation (e.g., Lee & Lu, 2018a; Zaenen, 1988; Van Hout, 2004; Van Valin, 1990; among others).
The unaccusative-unergative distinction is morphologically marked in different languages. For example, in some Germanic languages such as Dutch, only unergative verbs can appear in the impersonal passive construction but not unaccusative verbs (Zaenen, 1988; Hoekstra, 1984). In French, unaccusative verbs select the auxiliary BE, while unergative verbs select HAVE (Levin & Hovav, 1995).

Apart from morphological means, the distinction of unaccusative and unergative verbs is also reflected in word order. In Italian, for instance, an indefinite NP can stay in situ in the post-verbal position in unaccusative structures, and thus forms a VS word order (see (2)). In contrast, unergative verbs cannot take the VS word order, as the argument NP is generated in the Spec, VP position preceding the V head, and generally has no motivation to move to a post-verbal position.

(2) *Arriva un ippopotamo alla festa* (Venice & Guasti, 2015)
*Arrive a hippo at-the party*
*A hippo is arriving at the party.*

The same word order phenomenon emerges in Mandarin, a language with no overt morphology. Unaccusative verbs can occur in the VS order as in Italian, while unergative verbs can only take the SV order (see (3) and (4)).

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1 The motivation for the A-movement in unaccusative structures is generally considered to be related to case assignment (for detailed illustration, see Burzio, 1986; Belletti, 1988).
(3) Unaccusative

\[
\text{la}i \; \text{le} \; \text{yi-ge} \; \text{ke-ren}
\]

\begin{itemize}
  \item come \; LE \; one-CL \; guest
\end{itemize}

‘A guest came.’

(4) Unergative

\begin{itemize}
  \item a. \text{yi-ge} \; \text{ke-ren} \; \text{xiao} \; \text{le}
  \item one-CL \; guest \; laughed \; LE
\end{itemize}

‘A guest laughed.’

\begin{itemize}
  \item b. * \text{xiao} \; \text{le} \; \text{yi-ge} \; \text{ke-ren}
  \item laugh \; LE \; one-CL \; guest
\end{itemize}

Intended meaning: ‘A guest laughed.’

The post-verbal NP construction with the perfective aspect marker \textit{le} is regarded a diagnostic for Mandarin unaccusativity (Huang, 1987; Gu, 1992; Pan & Han, 2005, 2008). Other diagnostics in Mandarin include lexical causativization (Shibatani, 1976; Huang, 1989), which predicts that the alternation with lexical causatives is only possible with unaccusative verbs but not unergative verbs. Apart from structural diagnostics, semantic features such as telicity also function in Mandarin in distinguishing unaccusative and unergative verbs (Lee & Lu, 2018a, b): telic intransitive verbs tend to be unaccusative, while atelic ones can be unaccusative or unergative.

A number of studies have investigated children’s knowledge of unaccusativity. As unaccusativity has morphological representations in many languages, children’s use of correct morphological markers is considered as evidence for their knowledge of the unaccusative-nergative distinction. Studies have found that children generally behave well in both spontaneous speech and experiments before age 5. Snyder et al. (1995) examined spontaneous production of 2-to-3-year-old French and Italian children in CHILDES. Children at this age showed good mastery of AUX-selection: correct auxiliaries were used with different verbs with nearly no mistake in their spontaneous speech. Babyonyshev et al. (2001) used case marking in Russian to test 3-to-6-year-old children’s understanding of unaccusativity. It was shown that children older than 4 had mastered genitive of negation in unaccusative structures.

Studies manipulating word order show that children are sensitive to the interaction between unaccusativity and word order. Friedmann & Costa (2011) tested 1-to-4-year-old children of Hebrew, European Portuguese, Palestinian Arabic, and Spanish using sentence repetition and story retelling tasks. In all four languages, children had good production performance with VS order unaccusatives. A similar task was adopted by Vernice & Guasti (2015) which showed that Italian-learning children of 4-5 years were sensitive to the word order difference between unaccusative and unergative verbs, with a better accuracy of repeating VS order unaccusatives (grammatical) than that of repeating VS order unergatives (ungrammatical).
The acquisition of unaccusativity in Mandarin lacks the help of morphology. Li (2008) studied Mandarin-learning children’s naturalistic production data, and found that children produced both SV order and VS order sentences with unaccusative verbs before age 2, suggesting that children at this age are aware of the word order varieties of unaccusative structures. The experimental studies by Lee & Lu (2018a, b) revealed that overall, Mandarin-speaking 4-to-6-year-olds’ comprehension of QP-stranding, telicity, and mode of causation in unaccusative structures was similar to that of adults, with only the youngest group of 4-year-olds showing some misunderstandings. Children seem to have adult-like knowledge of the semantic differences between unaccusative and unergative verbs by age 5.

The present study attempts to better understand the acquisition of unaccusativity by testing Mandarin-learning children’s use of word order as the indicator of this structure. Besides, since some previous studies have shown that children are able to distinguish unaccusative verbs from unergative verbs as early as age 2, we further inquire whether this ability emerges in infants below 2 years of age.

2. The experiment

We tested 20-month-old Mandarin-learning children’s knowledge of the unaccusative-unergative distinction in an eye fixation task. This task examines children’s natural looking/listening behavior and thus has low requirement on their responsive abilities, making it a good method to test speech perception and language comprehension in infants and younger children. Previous studies have used the method to test phonemic and phonetic discrimination (e.g. Burns et al., 2007), word-object association (e.g. Werker et al., 1998), the acquisition of functional morphemes (e.g. Marquis & Shi, 2012), and so on in infants and toddlers. Two directions of looking preference are possible in this task. The familiarity effect describes the pattern in which looking time in familiar trials is longer, while the novelty effect shows the opposite: looking time in unfamiliar trials is longer. Either direction of preference indicates a discrimination of different trials.

2.1. Methodology
2.1.1. Participants

Participants were 24 monolingual Mandarin-learning 20-month-olds (mean age: 1;8;8, range: 1;6;30-1;8;24), with no hearing problems or language disorders reported. Their knowledge of the words used in the test was examined through a questionnaire filled by their caretakers. Those who were able to understand the words used in the test would be taken as valid participants, so that vocabulary would not affect their processing of the test sentences.
2.1.2. Stimuli

Test items included four verbs: two unaccusative verbs *lai* ‘come’ and *diao* ‘fall’, and two unergative verbs *ku* ‘cry’ and *xiao* ‘laugh’. A survey of the BJCELA corpus shows that the four verbs are all frequently used in adult input, and thus are familiar to children before 2.\(^2\)

The two unaccusative verbs were selected using the unaccusativity diagnostics (i.e., word order and telicity) for intransitive verbs in Mandarin mentioned earlier. The verb *lai* ‘come’ and *diao* ‘fall’ can both occur in the VS order structure with the perfective aspect marker *le* and are both telic, making them typical unaccusative verbs in Mandarin. On the other hand, *ku* ‘cry’ and *xiao* ‘laugh’ do not pass those unaccusativity tests, and are thus unergative verbs.

Test sentences were in the form of “V + LE + numeral-CL + N” consisting of grammatical sentences with unaccusative verbs and ungrammatical ones with unergative verbs. According to Chen (1987), numeral NPs are generally indefinite in Mandarin, and thus are allowed to appear in the post-verbal position in unaccusative structures. Nouns occurring in the test sentences were names of animals that are common in early child-directed language. See (5) for examples of each type of test sentences.

(5) a. Grammatical sentences (with unaccusative verbs)

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  lai le yi-zhi da-xiang
  come LE one-CL elephant
  ‘An elephant came.’
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b. Ungrammatical sentences (with unergative verbs)

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  *ku le yi-zhi xiao-gou
  cry LE one-CL little dog
  Intended meaning: ‘A little dog cried.’
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A female native Mandarin speaker recorded the stimuli. She was instructed to speak in a vivid and gentle way as if talking to a baby. In order to avoid unnatural intonation of ungrammatical sentences, the stimuli in this experiment were recorded and edited with the method of splicing. Specifically, each stimulus sentence (either grammatical or ungrammatical) was part of a longer grammatical sentence when being recorded. For example, the ungrammatical (6a) and grammatical (7a) stimuli were spliced out from the recorded longer grammatical sentences (6b) and (7b). The recorded sentences shared the same prosodic characteristics.

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\(^2\) The corpus was built as part of a Chinese early language project led by Prof. Thomas Lee at the Chinese University of Hong Kong. The corpus consists of longitudinal naturalistic data of four Beijing-born children with the first observation starting when the children were around age 1.
In all, the spliced stimuli contained 32 test sentences, 8 sentences for each of the four verbs. Sentences with the same verb formed a test trial, and thus there were four trials in total, namely two grammatical trials with *lai* ‘come’ and *diao* ‘fall’ and two ungrammatical trials with *ku* ‘cry’ and *xiao* ‘laugh’.

During test trials, the animation of a talking puppet was played on the screen synchronized with the auditory stimuli, as if the puppet was uttering the test sentences. Between trials, the video of a spinning windmill together with a piece of light music served as the attention getter.

Participants were divided into two groups. Half of the children (Group 1) listened to the unaccusative *lai* (‘come’) trial and the unergative *xiao* (‘laugh’) trial, while the other half (Group 2) listened to the unaccusative *diao* (‘fall’) trial and the unergative *ku* (‘cry’) trial. Verbs in the same group (e.g. unaccusative *lai* ‘come’ and unergative *xiao* ‘laugh’ in Group 1) took the same set of numeral phrases and nouns, so that the only difference between grammatical trials and ungrammatical trials was in the verb itself (see Table 1). The length of each trial was around 24.1 s, with an inter-stimulus interval of 1.25 s.

For each participant, grammatical trials and ungrammatical trials were played in alternation for a maximum of 12 trials. The order of the trials was also counterbalanced, so that half of the participants listened to the grammatical trial first while the other half listened to the ungrammatical trial first.
Table 1. Test stimuli and design (take Group 1 as an example)

<table>
<thead>
<tr>
<th>Grammatical trial</th>
<th>Ungrammatical trial</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>lai</strong> (come)</td>
<td><strong>xiao</strong> (laugh)</td>
</tr>
<tr>
<td><strong>le</strong> (LE)</td>
<td><strong>le</strong> (LE)</td>
</tr>
<tr>
<td>yi-zhi da-xiang</td>
<td>yi-zhi da-xiang</td>
</tr>
<tr>
<td>(one-CL elephant)</td>
<td>(one-CL elephant)</td>
</tr>
<tr>
<td><strong>le</strong></td>
<td><strong>le</strong></td>
</tr>
<tr>
<td>wu-zhi shan-yang</td>
<td>yi-qun qi-e</td>
</tr>
<tr>
<td>(five-CL goats)</td>
<td>(one-CL penguins)</td>
</tr>
<tr>
<td><strong>le</strong></td>
<td><strong>le</strong></td>
</tr>
<tr>
<td>yi-qun qi-e</td>
<td>san-zhi lao-hu</td>
</tr>
<tr>
<td>(one-CL penguins)</td>
<td>(three-CL tigers)</td>
</tr>
<tr>
<td><strong>le</strong></td>
<td><strong>le</strong></td>
</tr>
<tr>
<td>liu-zhi mi-feng</td>
<td>ji-zhi hu-li</td>
</tr>
<tr>
<td>(six-CL bees)</td>
<td>(several-CL foxes)</td>
</tr>
<tr>
<td><strong>le</strong></td>
<td><strong>le</strong></td>
</tr>
<tr>
<td>yi-zhi da-xiang</td>
<td>si-zhi shi-zi</td>
</tr>
<tr>
<td>(one-CL elephant)</td>
<td>(four-CL lions)</td>
</tr>
<tr>
<td><strong>le</strong></td>
<td><strong>le</strong></td>
</tr>
<tr>
<td>shi-zi</td>
<td>liang-zhi xiong-mao</td>
</tr>
<tr>
<td>(two-CL pandas)</td>
<td>(two-CL pandas)</td>
</tr>
</tbody>
</table>

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lai trial and xiao trial were presented in alternation for a total of 12 trials

2.1.3. Procedure

The child sat on the parent’s lap in front of a TV in an acoustic booth. The visual stimuli were presented on the TV screen, and the auditory stimuli were played through loudspeakers on both sides of the TV. The experimenter, who was blind to all stimuli, was in another room observing the children’s looking performance through a video camera hidden under the TV set. During the whole test, the parent wore a headphone which played masking music so that they did not guide children’s looking behavior.

This experiment was run with an in-house computer program. All trials were started by children when they looked at the screen, and ended when they looked away for over 2 s or when the full trial was played. When children looked at the TV screen, the experimenter pressed a computer key, and the looking time was automatically recorded by the computer program for later analysis.
2.2. Predictions

If children are able to distinguish unaccusative verbs from unergative verbs, their looking behavior should be different between grammatical trials (with unaccusative verbs) and ungrammatical trials (with unergative trials). In trials they prefer, looking time should be longer.

2.3. Results

To assess whether children could differentiate between unaccusative and unergatives, we compared mean looking time during grammatical trials (with unaccusative verbs) and ungrammatical trials (with unergative verbs). Overall, looking time to ungrammatical trials was longer (mean: 14.515 s) than to grammatical trials (mean: 12.292 s), as shown in Figure 1. Paired $t$-Test results show that there was a significant difference in looking time between these two verb types ($t(23) = -2.536, p < 0.05$, two-tailed), indicating that children treated unaccusative verbs and unergative verbs differently in the test. This pattern of responses confirms our prediction. It is possible that to our infants, the post-verbal indefinite NP in the unaccusative sentence is normal whereas the structure for the unergative verbs is odd. Our results thus show the novelty effect that infants prefer “new” and odd trials as opposed to normal ones.

![Figure 1. Mean looking time of grammatical and ungrammatical trials](image)

To assess whether different verb items influenced children’s looking behavior, we conducted a 2*2 ANOVA, with Grammaticality as the within-subject factor (grammatical vs. ungrammatical), and Group (lai & xiao group vs. diao & ku group) as the between-subject factor (see Figure 2). A significant main effect was found in Grammaticality ($F(1, 23) = 4.952, p = .038$), consistent with the results of the paired T-test. However, there was neither a significant main effect of Group ($F(1, 23) = 0.32, p = .578$), nor a significant interaction between Grammaticality and Group ($F(1, 23) = 0.597, p = .449$). This indicates that children did not treat items differently within the same verb
class. Children of this age not only recognize the underlying differences between individual verb items, but might also show certain level of verb categorization.

![Figure 2. Mean looking time of grammatical and ungrammatical trials in Group 1 and Group 2](image)

2.4. Discussion and conclusions

This study aimed at examining Mandarin-learning children’s knowledge of the unaccusative-unergative distinction in VS order sentences using the eye fixation task. Results of the experiment reveal that 20-month-old children show different looking behavior towards grammatical and ungrammatical trials: looking time during ungrammatical trials (with unergative verbs) was longer than that during grammatical trials (with unaccusative verbs). This indicates that children are able to distinguish unaccusative verbs from unergative verbs in VS order sentences, which can be seen as evidence for toddlers’ emerging sensitivity to the unaccusative-unergative distinction. Without overt morphological markers as salient cues, Mandarin-learning children still manage to understand the splitting of intransitive verbs, and treat them differently.

Comparing the individual verb items, we found no significant difference in looking time between verb items within the same verb class: looking time of unaccusative *lai* and *diao* was similar; so was looking time of unergative *ku* and *xiao*. It indicates that our participants not only distinguish individual verb items, but might also group some verbs together and treat them similarly using the knowledge of general verb classes. It is not clear, however, whether the grouping ability children represented in the experiment reflects systematic categorization of intransitive verbs. Further studies are needed to investigate their ability to categorically distinguish unaccusative and unergative verbs.

Our findings are consistent with previous acquisition studies of unaccusativity manipulating word order: children seem to be sensitive to the
interaction between unaccusativity and word order from a quite young age (Friedmann & Costa, 2011; Vernice & Guasti, 2015). Previous studies showed that Mandarin-speaking children are generally sensitive to word order. It has been found that one-year-old Mandarin-speaking children revealed an emerging understanding of the canonical SVO order (Candan et al., 2012) and that children before age 2 are able to productively use sentences of non-canonical word order in their spontaneous speech (Fan & Song, 2016). Our findings further indicate that for languages like Mandarin, word order might be an indicator of the unaccusative-unergative distinction and is registered early in child grammar.

In conclusion, we provide empirical evidence that 20-month-old Mandarin-learning children are able to distinguish unaccusative verbs from unergative verbs in the VS order structure. Despite the lack of overt morphological cues in Mandarin, Mandarin-speaking children’s awareness of the unaccusative-unergative distinction emerges early before age 2.

References


