

Demonstratives but not verbs cause non-culmination in Mandarin incremental-theme predicates: Evidence from children and adults

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1. Introduction

In the linguistics literature, there is a consensus that the description of the temporal contour of an event is semantically compositional: properties of the verb and properties of the object combine to build telic or atelic predicates, which are then modified by tense/aspectual markers in the clause, affecting the interpretation (Verkuyl 1972, Krifka 1998, Piñón 2008, among many others). For example, in (1), the incremental-theme verb *eat* takes a quantized direct object *three cookies*, and creates a telic predicate which describes a cookie-eating event with an inherent endpoint, i.e., the event ends when all three cookies are eaten. Therefore, denying the completion of the event is typically infelicitous.

- (1) # She ate three cookies, but didn't finish them.

However, the standard description of telic predicates has been challenged for Mandarin (Tai 1984, Zhang 2018, 2020, Martin 2019, among many others). Many researchers point out that despite having the “right” ingredients for a telic predicate, Mandarin allows the predicate with the perfective marker *le* (obligatory if the reading is to be non-generic in this case) to describe an incomplete event, as in (2), which is considered quite natural. This phenomenon is known as “non-culmination” (Bar-el et al. 2005).

- (2) *Ta chi-le san kuai binggan, mei chi-wan.*
3SG eat-LE three CL cookie NEG eat-finish
'She ate (some part of) three cookies, but didn't finish them'

Different accounts for the source of non-culmination in Mandarin have been proposed. The traditional account attributes it to the verb semantics (Tai 1984, Lin 2004, Koenig & Lian-Cheng 2008), arguing that Mandarin monomorphemic verbs are activity or manner verbs which do not encode a result component and therefore do not entail event culmination, regardless of the properties of the direct object. In contrast, other scholars suggest that Mandarin verbs in the non-culminating construals are not fundamentally different from their English counterparts. Instead, the source of non-culmination may lie in the perfective marker *le* (Smith 1991, Martin 2019, Marin et al. 2021) or the referential properties of the direct object (Zhang 2018, 2020).

In terms of event non-culmination in children, some researchers argue that Mandarin-speaking children and English-speaking children behave in opposite ways (Martin et al. 2020): while English-speaking children are less stringent than adults, accepting telic descriptions of incomplete situations more often than English-speaking adults (Jeschull 2007, Ogiela 2007, Anderson 2017, van Hout et al. 2017, van Hout 2018, Patt et al. 2020), Mandarin-speaking children are more strict than adults, rejecting telic descriptions of incomplete situations more than Mandarin-speaking adults (J. Chen 2017, Liu 2018, Li 2019). Some suggest English-speaking children neglect the ends of events in Truth Value Judgement Tasks (Patt et al. 2020), while others suggest that Mandarin-speaking children's verbs are more English-like (entailing culmination) (Li 2019). The cross-linguistic developmental claims are, however, difficult to compare due

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to the use of different materials and experimental setups across studies. Using experimental designs that control for verb-type and determiner-type of the direct object, the present study has two primary goals: first, to establish a comparison between English-speaking and Mandarin-speaking adults to provide a baseline for adults' interpretations of incremental-theme predicates; and second, to present a more detailed examination of the developmental patterns of aspectual interpretations in Mandarin-speaking children (aged 3-6). When controlling for all relevant aspectual factors and experimental methods, we find no significant difference between English and Mandarin incremental-theme verbs in adults, contrary to the traditional verb-based accounts (Tai 1984, Lin 2004, Koenig & Lian-Cheng 2008). Moreover, we observe a determiner-type difference in both Mandarin and English adults, which suggests some pragmatic accommodations associated to the demonstratives. Mandarin children's understanding of verbs aligns with adults', but they take longer to master the pragmatic use of demonstratives.

2. Previous acquisition studies

Previous studies have tested children's and adults' acceptance of telic descriptions in both complete and incomplete situations, using tasks such as Truth-Value Judgment-like tasks or picture-selection tasks. This line of research builds on the seminal work by van Hout 1998 and has been expanded in both English (Jeschull 2007, Ogiela 2007, Anderson 2017, van Hout et al. 2017, Patt et al. 2020) and Mandarin (J. Chen 2006, 2008, 2017, Liu 2018, Li 2019). However, these studies vary significantly across several dimensions, including the age of the child participants, the types of verbs used (incremental vs. non-incremental), the determiners in the direct objects, the number of object items (singular vs. plural), and the degree of incompleteness in the incomplete situations. A detailed summary of the methodologies employed in the acquisition studies on event culmination in English and Mandarin can be found in the Appendix. In this paper, we highlight two of these studies: Ogiela (2007) on English and Li (2019) on Mandarin, which employed similar methodologies.

2.1. Ogiela (2007)

Ogiela (2007) (and Ogiela et al. (2014), which reports the adult results only) tested English-speaking children (ages 3 to 6) and adults using a Truth-Value Judgment Task. Participants were shown video clips depicting either a complete situation (e.g., a man completely finishing two brownies) or an incomplete situation (e.g., a man finishing one brownie and taking a bite from the other). They were then asked to respond with "yes" or "no" to the test sentence in question form:

- (3) Did the man eat the brownies?

The experiment tested four incremental-theme verbs: *eat* and *drink* (referred to as "*eat*-type verbs"), and *build* and *fix* (referred to as "*build*-type verbs"). Additionally, two types of determiners were used for the direct objects: the definite determiner *the* vs. the numeral *two*.¹ Each test sentence was paired with two video clips, one showing a complete situation, and one showing an incomplete situation.

The results revealed that, across all verb-types and determiner-types, adults rejected the test sentences in the context of incomplete situations more often than children did. 3-year-olds accepted the test sentences most of the time, suggesting that they were less sensitive to the properties of the verb and the direct object in aspectual interpretation than the older children. However, even adults did not consistently give categorical "no" responses. They showed a verb-type effect in the incomplete situations, rejecting sentences with the *build*-type verbs more often than those with the *eat*-type verbs (98% vs. 56.75%). Ogiela attributes this to the partitive meaning associated with the *eat*-type verbs. For example, "eat the brownies" could be interpreted as "eat off/from the brownies", which allows for partial consumption of the brownies. In contrast, this partitive interpretation is not possible with the *build*-type verbs. For the *eat*-type verbs, adults rejected the sentences with a numeral direct object more often than those with a definite direct object (71% vs. 42.5%). Ogiela suggests that this effect might be due to the contextual accommodation of the referent for definite DPs, which is not possible for numeral DPs. Numeral DPs, such as *two brownies*,

¹ Ogiela (2007) also tested the non-incremental-theme verbs *carry* and *push*, as well as verbs with resultative particles including *eat up*, *build up*, *carry over*, and *push over*.

indicate a quantity quite explicitly. Therefore, sentence (3) with a numeral direct object (e.g., *Did the man eat two brownies?*) would always be rejected if the two brownies were not completely eaten. In contrast, definite DPs pick out the largest relevant set of objects in the context. Participants might accommodate the referents of the definite DPs based on the context. For example, they might consider eating one and a half brownies as sufficient to count as “eat the brownies”. No determiner-type effect was found with the *build*-type verbs in adults, as rejections were already at ceiling. Children did not make a statistically significant distinction between the *build*-type verbs and the *eat*-type verbs. However, like adults, they showed a determiner-type effect with the *eat*-type verbs, but not with the *build*-type verbs.

2.2. Li (2019)

Li (2019) tested Mandarin-speaking children (ages 4-6) and adults with a similar setting to Ogiela’s (2007) experiment. Participants first watched a video clip showing either a complete or an incomplete situation and were then asked to judge whether the statement as in (4) was true or false based on the video.

- (4) *Gege chi-le na-kuai binggan.*
brother eat-LE that-CL cookie
‘Brother ate that cookie.’

Li tested four incremental-theme verbs: *chi* ‘eat’, *he* ‘drink’, *da* ‘build’ and *hua* ‘draw’, along with two types of determiners in the direct object: the singular demonstrative *na* ‘that’, and the numerals *yi* ‘one’, *liang* ‘two’, and *san* ‘three’.² Each verb predicate was also paired with two video clips, one showing a complete situation, and one showing an incomplete situation. However, in contrast to Ogiela’s (2007) incomplete situations where only the second object was partially affected, in Li’s videos, each object was partially affected (e.g., a boy taking a bite from each of the two cookies).

The results showed that children rejected the test sentences in the incomplete situations more often than adults in general, which seems opposite to Ogiela’s (2007) findings. Li (2019) attributes this to the differences in how incremental-theme verbs are represented in Mandarin children and adults: while Mandarin adults’ incremental-theme verbs are result-implied and compatible with incomplete situations regardless of the properties of the direct object, Mandarin children’s incremental-theme verbs are result-entailed, similar to English.

However, a closer look at Li’s results reveals some parallels with Ogiela’s results. First, like English adults, Mandarin adults also appear to differentiate between determiners, rejecting sentences with numeral direct objects more often than sentences with demonstrative direct objects across all verbs (60% vs. 16.7%). This distinction also seems to be evident in the 6-year-olds but not in the 4- or 5-year-olds. Second, Mandarin adults also seem to make a distinction between the two verb-types. With demonstrative direct object, *chi* ‘eat’ and *he* ‘drink’ were always accepted (0% rejection), while *da* ‘build’ and *hua* ‘draw’ were rejected 33.3% of the time.³ Most importantly, none of the age groups gave categorical “true” or “false” responses to the incomplete situations. If the distinction observed between Mandarin and English adults, as well as between Mandarin children and adults, in the two studies were caused solely by differences in verb semantics, we would expect categorical-like levels of rejection of the incomplete situations from English adults and Mandarin children, and categorical acceptances from Mandarin adults. However, this is not the case. Given the determiner-type effect and the verb-type effect observed in both English and Mandarin adults, it is possible that there is no fundamental difference between the lexical semantics of incremental-theme verbs or the way these verbs combine with direct objects in the two languages. The differences might instead arise from methodological variations that trigger different degrees or types of pragmatic accommodation, leading to different judgments. In other words, if we were to use the same methods, videos, and types of verbs, while controlling for the fact that Mandarin lacks a definite determiner, the results might align more closely across the two languages.

² Li (2019) also investigated verbs with resultative particles, known as resultative verb compounds (RVC) in the Chinese literature, including *chi-guang* ‘eat-finish’, *he-guang* ‘drink’, *huahao* ‘draw-done’ and *da-hao* ‘build-done’, as well as bare noun direct objects.

³ Since Li (2019) did not provide statistical analyses, the differences are inferred from the raw percentage data by us.

3. The current study

3.1. Design and materials

We conducted a Truth-Value Judgment Task with English-speaking adults, and Mandarin-speaking children and adults, using the same verb-types, determiner-types, and videos across both languages. For each language, we tested four incremental-theme verbs, including two consumption verbs ‘eat’ and ‘drink’ (Mandarin: *chi* ‘eat’ *he* ‘drink’), and two creation verbs ‘build’ and ‘draw’ (Mandarin: *zao* ‘build’ *hua* ‘draw’). Since Mandarin does not have a definite article on a par with English *the*, demonstratives are considered to serve the functions of both the demonstratives and the definite article in English (P. Chen 2004). Therefore, we tested demonstratives (‘these’ and ‘those’) vs. the numeral ‘three’ in English and Mandarin. See sample test sentences as follows.

- (5) a. **Mandarin**
Wo chi-le {na-ji-kuai, san-kuai} binggan.
1SG eat-LE {that-how.many-CL, three-CL} cookie
‘She ate {those, three} cookies.’
- b. **English**
I ate {those, three} cookies.

In the Mandarin task, each test sentence was paired with two videos, one showing a complete situation (e.g., a boy eating three cookies completely) and the other an incomplete situation (e.g., a girl eating two cookies completely and taking a bite of the third one). Figure 1 displays scenes from a sample video of an incomplete situation. There were 16 videos/trials in the Mandarin task. In the English task, we did not test demonstratives with the complete situations. Sentences with demonstrative DP objects in the complete situation are quite odd since the use of demonstratives in English implies two contrastive sets (Clark & Marshall 1981), e.g., the complete vs. incomplete sets, which are not available in the complete situations. Therefore, the English task had 12 videos/trials in total. In each trial, participants first watched the video, and then judged whether the test sentence, uttered by the performer, was true or false based on the video. Fillers were included in each trial at a ratio of 3:1 for English adults and at a ratio of 1:1 for Mandarin children and adults.

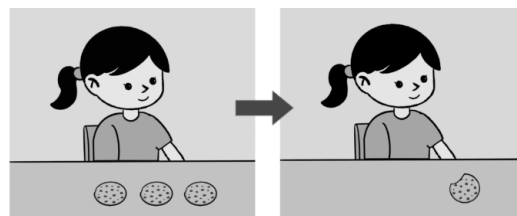


Figure 1: First and last scenes of a sample video of an incomplete situation.

3.2. Subjects

The participants were English-speaking adults ($n=17$) and Mandarin-speaking adults ($n=11$), and Mandarin-speaking children ages 3-6 ($n=68$). Five 3-year-olds and three 4-year-olds were excluded from analysis as they failed to meet the accuracy criteria on the filler questions (75%). Age ranges and mean ages of the valid participants in each child group are summarized in Table 1. Adults were tested online using the online experiment platform JATOS, while children were tested in person by an experimenter using a computer.

Age Group	Child <i>n</i>	Child Mean Age	Child Age Range
3-Y-O	13	3;7	3;3-3;11
4-Y-O	17	4;6	4;0-4;11
5-Y-O	15	5;8	5;1-5;11
6-Y-O	15	6;4	6;0-6;10

Table 1: Summary of Mandarin child participants

3.3. Results

We analyzed the rejection rates of test sentences across different conditions. The rejection rates for **complete situations** were very low across all groups, indicating near-ceiling performance: English adults: 1.1% Mandarin adults: 1.1%; 3-Y-O: 7.7%; 4-Y-O: 0%; 5-Y-O: 1.7%; 6-Y-O: 0.8%. To examine the participants' rejection of **incomplete situations**, we fitted the data to several mixed-effects logistic regression models including varying combinations of predictors and random effects structures. The predictors included verb-type (consumption vs. creation verbs, with consumption verbs as the referential level), determiner-type (numeral vs. demonstrative, with numeral as the reference level), and subject group (English adults, Mandarin adults, 3-Y-O, 4-Y-O, 5-Y-O, 6-Y-O, with Mandarin adults as the reference level). Random effects accounted for variability by subject and item. The model comparison indicated that the inclusion of verb-type did not contribute to a better fit. Therefore, verb-type was removed from the final model. The final model, which includes main effects of determiner-type, subject group, and their interactions, with subject and item as random effects, provides the best fit for the data. Table 2 shows the parameter estimates for the final model, showing the significant main effects and interactions. The significance of the intercept indicates a strong baseline effect (when Mandarin adults are presented with numerals). Demonstratives show a significantly lower rejection rate compared to numerals. The 3-Y-O group shows a significantly lower rejection rate compared to Mandarin adults. 4-Y-O, 5-Y-O, 6-Y-O, and English Adults do not show significant differences from Mandarin adults. The interactions between demonstratives and the 3-Y-O, 4-Y-O, and 5-Y-O groups are significant.

	Estimate	SE	z-value	p-value
Intercept	3.5344	1.2873	2.746	0.0060 **
Demonstrative	-4.4690	1.2240	-3.651	0.0003 ***
3-Y-O	-3.3327	1.6342	-2.039	0.0414 *
4-Y-O	-0.4077	1.5192	-0.268	0.7884
5-Y-O	1.8234	1.6936	1.077	0.2816
6-Y-O	1.0536	1.6200	0.650	0.5154
English Adults	-1.8338	1.4159	-1.295	0.1953
Demonstrative × 3-Y-O	4.0364	1.5683	2.574	0.0101 *
Demonstrative × 4-Y-O	3.8209	1.4992	2.549	0.0108 *
Demonstrative × 5-Y-O	4.9189	1.9765	2.489	0.0128 *
Demonstrative × 6-Y-O	1.6772	1.5596	1.075	0.2822
Demonstrative × English Adults	-0.7334	1.4087	-0.521	0.6026

Note:

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 2: Parameter estimates of the main effects from the best-fitted model

Figure 2 shows the mean rejection of incomplete situations by determiner-type and subject group. Table 3 shows the estimated marginal means for key contrasts. The comparisons between demonstratives and numerals across age groups reveal that significant differences are observed only in Mandarin and English adults, with numerals being more frequently rejected. In contrast, Mandarin children aged 3 to 6 do not show significant differences between demonstratives and numerals. When comparing each

subject group with Mandarin adults under demonstratives, only the 5-Y-O group exhibits a significant difference, rejecting demonstratives more frequently than Mandarin adults. No significant differences are found between the subject groups and Mandarin adults when numerals are the focus of comparison.

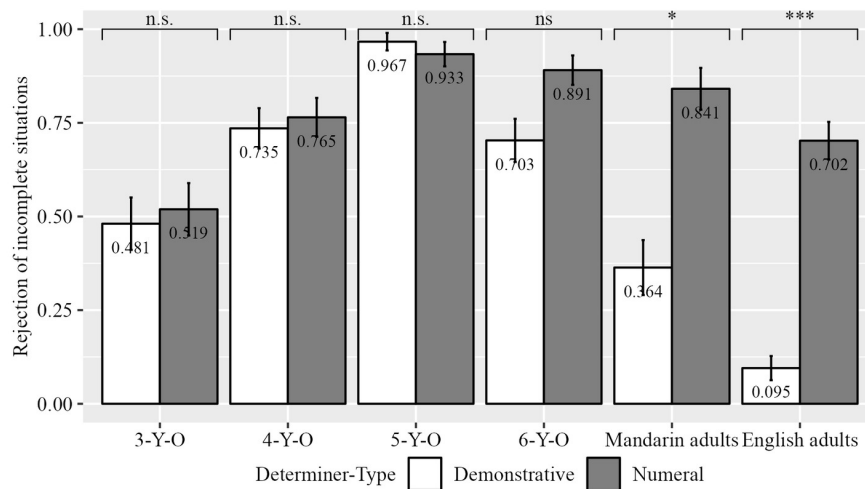


Figure 2: Mean rejection rates of incomplete situations by determiner-type and subject group.

Condition	Comparison	Estimate	SE	z-value	p-value
Mandarin Adults	Demonstrative vs. Numeral	4.4690	1.224	3.651	0.0172*
English Adults	Demonstrative vs. Numeral	7.0362	1.555	4.524	0.0004***
3-Y-O	Demonstrative vs. Numeral	3.7653	1.560	2.413	1.0000
4-Y-O	Demonstrative vs. Numeral	1.0559	1.580	0.668	1.0000
5-Y-O	Demonstrative vs. Numeral	-2.2733	1.987	-1.144	1.0000
6-Y-O	Demonstrative vs. Numeral	1.7382	1.542	1.127	1.0000
Demonstrative	3-Y-O vs. Mandarin Adults	-0.7037	1.269	-0.554	1.0000
Demonstrative	4-Y-O vs. Mandarin Adults	-3.4132	1.320	-2.585	0.6418
Demonstrative	5-Y-O vs. Mandarin Adults	-6.7423	1.797	-3.751	0.0116*
Demonstrative	6-Y-O vs. Mandarin Adults	-2.7308	1.267	-2.155	1.0000
Demonstrative	English Adults vs. Mandarin Adults	2.5672	1.195	2.149	1.0000
Numeral	3-Y-O vs. Mandarin Adults	3.3327	1.634	2.039	1.0000
Numeral	4-Y-O vs. Mandarin Adults	0.4077	1.519	0.268	1.0000
Numeral	5-Y-O vs. Mandarin Adults	-1.8234	1.694	-1.077	1.0000
Numeral	6-Y-O vs. Mandarin Adults	-1.0536	1.620	-0.650	1.0000
Numeral	English Adults vs. Mandarin Adults	1.8338	1.416	1.295	1.0000

Note:

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 3: Estimated marginal means for key contrasts (p -values adjusted by the Bonferroni correction).

4. Discussion and conclusion

The present study controlled for verbs, determiners, and visual stimuli, and found no difference in the judgments of telic descriptions of incomplete situations by English and Mandarin adults. If Mandarin monomorphemic incremental-theme verbs are manner verbs that do not entail event culmination (much like *push*-type verbs) (Tai 1984, Lin 2004, Koenig & Lian-Cheng 2008) and this is the source of “non-culmination”, in principle, both the demonstratives and numerals should be acceptable in descriptions

of incomplete situations. However, this contradicts our current findings. The overwhelming rejection of sentences with numeral direct objects in incomplete situations suggests that, like their English counterparts, Mandarin incremental-theme verbs are also sensitive to the quantity information in direct objects. This provides evidence for the same mode of combination between the verb and its direct object in English and Mandarin, supporting an identical treatment of incremental-theme verbs in both languages (Martin 2019, Zhang 2018, 2020). Moreover, both groups showed a determiner-type effect: rejecting sentences with numerals but accepting those with demonstratives. These results are also consistent with Ogiela's (2007) findings for the definite determiner in English adults, suggesting that our participants were also making accommodations for the demonstratives based on the context. When the character ate two and a half cookies, participants might interpret "those cookies" as referring only to the two fully eaten cookies. Unlike the definites, which pick out the unique maximal set in the context, demonstratives only pick out the contextually relevant set without imposing the maximality and uniqueness requirements (Lyons 1999). Therefore, it is not surprising that demonstratives can be easily accommodated.

Different from Ogiela's findings, our experiment did not show any verb-type effect. This is likely due to the difference in the number of object items used in the two studies. In Ogiela's study, each situation involved two object items. In the incomplete situation in which a character built one and a half bridges, the definite plural *the bridges* could not refer to a unique plural set, as only one bridge was fully built. However, in our study, where each situation had three object items, in the incomplete situation where two and a half bridges were built, the demonstrative DP *those bridges* could still refer to a plural set, namely the two fully built bridges.

Our adults rejected incomplete situations more frequently compared to the adults in Li's (2019) study, particularly when the verb took a numeral direct object. This difference could be attributed to the different visual stimuli used in the two studies. In Li's videos of incomplete situations, each object was partially affected. When judging whether the sentence "Brother ate three cookies" matches the video in which the boy took a bite of each cookie, participants might re-interpret the verb *eat* as quantity-insensitive (as *bite*, for example), as none of the cookies were fully eaten. Thus, they might have considered the sentence to match the video as long as each cookie was touched. However, this accommodation strategy was not applicable in our video context. Upon seeing two cookies fully eaten, participants had no reason to interpret *eat three cookies* in any other way but as a typical incremental-theme predicate, in which case the eating event was measured out by the direct object and ended when all the cookies were fully eaten. Therefore, participants may have expected the third cookie to be fully eaten and judged the sentence as false when it was not.

Regarding children, our results are consistent with Li's results in which children rejected incomplete situations more often than adults in general. However, by carefully controlling for the determiner-type of the direct object, we found that the rejection rates in children were mainly caused by their different treatment of demonstratives from adults'. Children treated demonstratives in the same way as numerals; none of our child groups made a statistically significant distinction between demonstratives and numerals. Like Ogiela's (2007) 3-year-olds, our 3-year-olds also allowed incomplete situations more than half of the time, suggesting that children at this age in both languages seem to be not yet sensitive to the role of the direct object in the telicity calculus of incremental-theme predicates. The increase in the rejection of incomplete situations by the 4- and 5-year-olds indicates that, by these ages, children are becoming aware of the role of the direct object. By age 6, children begin to show a tendency to reject demonstratives less than numerals, though their judgments are still not adult-like. These results point to a pragmatic difference between Mandarin children and adults in the use of demonstratives, instead of different verb representations. The results align with Munn et al.'s (2006) study in which English and Spanish children had difficulties with domain restriction for the definite determiners.

In summary, the present study provides a fine-grained examination of the aspectual interpretation of incremental-theme predicates in English adults, Mandarin adults, and Mandarin children aged 3–6. We find evidence for no radical differences between English and Mandarin incremental-theme verbs. Mandarin children do not have different verb representations from adults. Instead, the different judgements lie in children's developing ability to pragmatically accommodate for the demonstratives.

5. Appendices

5.1. Appendix A: Summary of previous acquisition studies on event culmination in English

Study	Child Age	Task	Verbs	Object <i>n</i>	Endstate
van Hout 1998	3-5	Picture selection	<i>eat drink</i>	1	Partly complete
Ogiela 2007	3-6	TVJT (binary choice)	<i>eat drink</i> <i>build fix</i> <i>push carry</i>	2	2nd item partly complete
Jeschull 2007	3-6	Picture selection	<i>eat drink</i> <i>fold wrap</i>	1	Partly complete
Anderson 2017	3-5	TVJT (binary choice)	<i>eat drink</i> <i>build fix</i> <i>cross empty</i> <i>unzip cut</i>	1	Partly complete
van Hout et al. 2017	5	TVJT (binary choice)	<i>break open</i> <i>shut destroy</i> <i>blow out</i> <i>cover up</i> <i>take off</i>	1	Zero result
Patt et al. 2020	5-8	TVJT (continuous scale)	<i>eat drink</i> <i>cover close</i> <i>draw open</i> <i>peel fill</i>	1	Partly complete (2/3 complete)

5.2. Appendix B: Summary of previous acquisition studies on event culmination in Mandarin

Study	Child Age	Task	Verbs	Object <i>n</i>	Endstate
J. Chen 2006, 2008, 2017	2-6	TVJT (binary choice)	<i>nao</i> 'make.noise' <i>chui</i> 'hammer' <i>dao</i> 'pour' <i>jia</i> 'hold.tightly' <i>da</i> 'shoot' <i>zhai</i> 'pick' <i>guan</i> 'close' <i>chui</i> 'blow'	1	Zero result
van Hout et al. 2017 & Liu 2018	3, 5	TVJT (binary choice)	<i>mai</i> 'bury' <i>zhe</i> 'cut' <i>jie</i> 'untie' <i>guan</i> 'close' <i>kai</i> 'open' <i>sha</i> 'kill' <i>sui</i> 'break'	1	Zero result
Li 2019	4-6	TVJT (binary choice)	<i>chi</i> 'eat' <i>chui</i> 'hammer' <i>he</i> 'drink' <i>da</i> 'build' <i>hua</i> 'draw'	1, 2, 3	Each object partly complete

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