The Development of Coherence in Narratives: Causal Relations

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Abstract

This study explored Mandarin-speaking children's ability in maintaining narrative coherence. Thirty Mandarin-speaking five-year-olds, 30 nine-year-olds and 30 adults participated. The narrative data were elicited using *Frog, where are you?* Narrative coherence was assessed in terms of causal networks. The results displayed children's development in achieving narrative coherence by establishing causal relations between narrative events. Results were considered in relation to capacities for working memory and theory of mind. Narrators' differences in communicative competence and cognitive preferences were also discussed.

1 Introduction

Previous research relied on a variety of schemes to explore how narrators relate categories of information in a narrative (e.g., Berman and Slobin, 1994; Trabasso et al., 1992). Some researchers examine narrative structure (Peterson and McCabe, 1983); some concern more about the conceptual basis for relating narrative information (Trabasso and Nickels, 1992; Trabasso et al. 1992). Regarding cognitive processing, capacities for working memory and theory of mind were considered relevant to a narrator's ability to organize and integrate narrative information (Trabasso et al., 1992). Given the significant role of narratives in children's development (Chang, 2004), the present work aimed to explore Mandarin-speaking children's progress in relating events and hence in maintaining coherence in narratives.

One intriguing assumption of the research by Trabasso et al. (1992) is that narrators tend to encode a protagonist's actions as relevant to a goal plan. They suggested that knowledge of goal/plans serves as the conceptual basis underpinning narrative representations. Children, with increasing age, were found to be more advanced in applying knowledge of goal/plans to integrate narrative events coherently.

Acknowledging the significance of goal/plan knowledge aside, Trabasso et al. (Trabasso and Sperry, 1985; Trabasso and van den Broek, 1985) indicated that it is causal inferences that unite elements (such as goals, actions, and outcomes) in a goal-plan. Similarly, Stein and Albro (1997) suggested that causal reasoning is required to organize content and structure coherently. In other words, causal relation is regarded as a basic mechanism for integrating episodic and thematic information. As Karmiloff-Smith (1985) indicated, coherence refers to global representation of story meaning and connectedness, which is embodied in the temporal and causal structure of a story.

Given the significance of causal relations for narrative construction, Trabasso and Sperry (1985) outlined procedure to identify causal networks so as to assess causal connectivity between linguistic units in a narrative. Research has shown that causal networks provide explanations for variance in story recall (Trabasso et al., 1984). In particular, compared with measures of story grammar, causal networks were found to be a more reliable predictor of story recall (Trabasso and van den Broek, 1985). Research has also shown that the derived causal connections correlated with the importance ratings for narrative events (Trabasso and Sperry, 1985). Additional credence of the predictive power of causal networks is given by Diehl et al.'s (2006) research, which revealed that the system of causal networks is a potential tool to assess narrative coherence.

In recent decades, most developmental research of Mandarin-speaking children's narrative ability has focused on typically-developing preschool children (e.g., Chang, 2004; Chen et al., 2011; Li, 2012). Many of these studies used high-point analysis or story grammar to analyze preschoolers' narrative structure. However, very little is known about older Mandarin children's ability to relate

narrative events. Even less is known about Mandarin children's progress in maintaining narrative coherence. Much prominent research on other languages adopted a cross-sectional research paradigm to investigate narrative development by examining data based on the frog story (e.g., Bamberg and Marchman, 1990; Berman and Slobin, 1994); nevertheless, only a few studies (Chang, 1995; Li, 2012; Sah, 2013) on Mandarin-speaking children followed this paradigm. Among them, Chang's (1995) and Sah's (2013) research included both preschool and school-age children, while the other studies focused on only preschoolers (Li, 2012). Nevertheless, we still lack of knowledge about Mandarin children's development in maintaining narrative coherence. It is, however, important for us to understand more about this, for such ability is integral to narrative construction. To extend the line of frog-story-based research and to replicate previous findings based on causal networks, the present study explored how Mandarin-speaking children maintain narrative coherence by posing the following research questions.

(1) Is there any difference in Mandarin-speaking five- and nine-year-olds' ability to encode events in the causal chain?

(2) Is there any difference in five- and nine-year-olds' ability to establish causal connections between narrative events?

(3) Is there any difference between the two groups of children in encoding events with different levels of causal connectedness?

2   Method

2.1   Participants

Participants included 60 children and 30 adults. The children were divided into two age groups: 30 five-year-olds (M_{age}= 5;8) and 30 nine-year-olds (M_{age}= 9;6). They were all typically developing children, with no learning disabilities, or speech or hearing problems. Additionally, 30 college students (M_{age}= 19;5) participated in this study. There were an equal number of participants of each gender in each group. All the participants were from similar middle-class socio-economic backgrounds.

2.2   Material

Much research of narrative development has focused on data based on the picture book *Frog, where are you?* (Mayer 1969), considered a reliable tool to tap children's narrative abilities (Bamberg and Marchman, 1990; Berman and Slobin, 1994). To control the content of the narrative data, we also used the frog story to elicit narratives. This book depicts an elaborate series of events which allow narrators to provide various links among events, so it is suitable to our research goal.

2.3   Procedure

The interviews were carried out individually, and consisted of an initial warm-up conversation followed by a narrative task based on *Frog, Where are You*. Participants were first asked to look through the entire book and then asked to tell a story while looking at the pictures. The interviews were audio-taped and transcribed.

2.4   Data Analyses

Clauses were used to quantify story length. A clause consists of a verb and its arguments, and corresponds roughly to a single event. Children's ability to maintain narrative coherence was examined in terms of events in the causal chain and causal connections (Diehl et al., 2006; Trabasso and Sperry, 1985).

A causal connection was established between a pair of events when the criterion of necessity was satisfied.[1] The necessity was tested by using counterfactual argument of the form: If not A then not B. In other words, if event A had not happened in the story, then event B would not have happened. Accordingly, the two events are considered causally connected. For instance, in the story, event A is "the dog smashed the jar"; the ensuing event B is "the boy was angry with the dog". If the dog had not smashed the jar, the boy would not be angry with it. As such, these two events are judged as causally connected. Based on this criterion, we identified inter-connections between events, which not only signal causal dependency between events but quantify relative importance of story events.

Apart from causal connections between events, we examined the causal chained events encoded by narrators. Causal chained events form the gist of a story (Trabasso and Sperry, 1985). To determine these, we first identified

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[1] The criterion of necessity was originally proposed by lawyers (Hart and Honoré , 1959) and reviewed by Mackie (1980). It provides reliable identification of causal relations in stories and has been used extensively (Diehl et al., 2006; Trabasso and Sperry, 1985).

opening and closing events. The opening events include setting information, which introduces the protagonist, time and place, and the initiation part, which triggers the ensuing episodes. The closing events refer to protagonists' goal attainment/failure. The events with causes and consequences which can be traced from the opening through closing of the narratives belong to the causal chain (Appendix).

The pattern of causal connectedness within each narrative was also examined. To this end, four types of causal connectedness were differentiated, namely, C_0, C_1, C_2, and C_{3+}. C_0 type refers to the discrete event which has no connection with other events in the story; the C_1-event has connection with only one other event; the C_2-event has connections with two other events. And events with three or more connections were collapsed into the category C_{3+} because they were used infrequently.

3   Results

Since analyses regarding causal chains and causal connections were considered in relation to story length, the overall story length for three groups of participants was first established. To this end, the number of clauses was used as an indication of story length. The mean numbers of clauses were, respectively, from the youngest to oldest group, 35.93, 41.23 and 72.03. Kruskal-Wallis test indicated a significant age main effect, χ^2 =43.46, $p < .001$. Post-hoc Mann-Whitney tests revealed significant pair-wise differences: adults produced significantly more clauses than both nine-year-olds ($U = 81.50$, $p < .001$) and five-year-olds ($U = 62.50$, $p < .001$). The mean numbers of different words were, from the youngest to oldest group, 113.80, 139.87 and 228.63. A significant age main effect was also obtained here, χ^2 =45.71, $p < .001$. Post-hoc Mann-Whitney tests revealed significant pair-wise differences between adults and nine-year-olds ($U = 106.00$, $p < .001$) and between adults and five-year-olds ($U = 34.00$, $p < .001$). For both story length and variety of words, the differences between the two groups of children, however, were non-significant.

Causal chained events and causal connections were relied on to infer children's development of narrative coherence. In the analysis based on 'plot' components, researchers found developmental increases in children's ability to establish global plotline (Aksu-Koç and Tekdemir, 2004; Berman and Slobin, 1994). In

light of this, we predicted that, compared with nine-year-olds, five-year-olds would be less sensitive to the global plotline so they might encode less causal chained events. In addition, previous research also found age-related increases in applying knowledge of goal/plans to relate narrative information (Sah, 2013; Trabasso et al., 1992). Given this, we presumed that, along with advancement in knowledge of goal/plans, children would be more likely to encode causal relations between narrative events. Thus narratives produced by nine-year-olds would be more causally connected, and more coherent than those by five-year-olds.

Regarding the first research question, our data revealed age-related increases in mean number of causal-chained events. One-way ANOVA (analyses of variance) yielded a significant age main effect for it. Post-hoc analyses further displayed significant pair-wise differences: adults encoded significantly more chained events than nine-year-olds; nine-year-olds, more than five-year-olds. The reverse pattern, however, is shown for the density of causal-chained events.[2] Regarding this, one-way ANOVA yielded a significant age main effect. The post-hoc analysis revealed significant differences: children outperformed adults. The difference between two groups of children did not reach significant level (Table 1).

With respect to the mean number of causal connections, as predicted, one-way ANOVA yielded a significant main effect of age. Post-hoc analyses confirmed the developmental trend: adults encoded significantly more causal connections than did children; nine-year-olds outperformed five-year-olds. For the density of causal connections, a significant age main effect was again obtained from ANOVA. Subsequent analyses revealed that densities of causal connections for both adults and nine-year-olds were significantly larger than that for five-year-olds. Measures of causal connections suggested that, with increasing age, children were more likely to establish causal relations between narrative events, hence, more skillful in enhancing narrative coherence (Table 1).

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[2] To control overall story length, we also measured story connectedness in terms of the density for causal chained events and that for causal connections (Diehl et al., 2006). The densities were obtained through dividing the total number of causal chained events and that of causal connections in each story, respectively, by the total number of clauses in that story.

	5-year-old (N=30) M (SD)	9-year-old (N=30) M (SD)	Adult (N=30) M (SD)	F
Number of chained events	14.27 (4.96)	18.4 (3.86)	23.13 (3.56)	33.97[*]
Density of chained events	.41 (.09)	.46 (.09)	.34 (.09)	11.64[*]
Number of causal connections	25.86 (12.93)	41.73 (13.04)	65.93 (17.67)	55.47[*]
Density of causal connections	.65 (.28)	1.00 (.12)	.93 (.12)	29.82[*]

[*] p< .001   Table 1: Number and density of causal chained events and causal connections

Fig.1 Distribution of events for each
type of causal connectedness

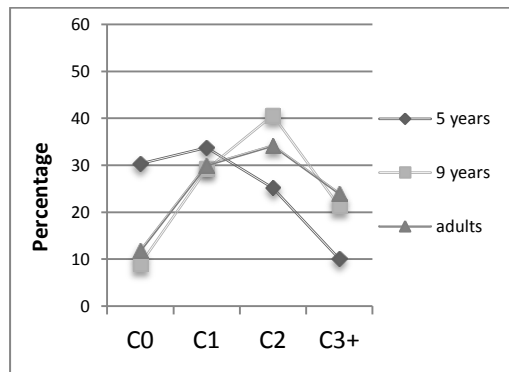|	5-year-old	9-year-old	Adult	F
C_0	30.32	8.92	11.82	15.34[*]
C_1	33.73	29.20	29.99	3.94[*]
C_2	25.15	40.61	34.18	13.75[*]
C_{3+}	10.8	21.26	24.01	20.56[*]

[*] p < .001   Table 2. Proportions of events for each
type of causal connectedness (%)

Next, four types of causal connectedness were differentiated: C_0, C_1, C_2, and C_{3+}. We calculated proportions of events for each type within each story. Arc sine transformations were applied to the percentage data to normalize the distribution; two-way ANOVA were performed.

The statistical analyses yielded significant Age x Type interaction, $F(6, 261) = 14.65$, $p<.001$, $\eta^2_{partial} = .25$. Further examination shows age-related preferences for encoding events with different types of causal connectedness. Figure 1 reveals that five-year-olds were far more likely to encode discrete events (C_0 events) than did nine-year-olds and adults. Reverse patterns were shown for the use of C_2 and C_{3+} types of events; namely, nine-year-olds and adults tended to encode events with more causal connections than did five-year-olds. ANOVA yielded significant age main effects for all types (Table 2). Post-hoc analyses displayed age-related differences for each type. For C_0 events, five-year-olds were significantly more likely to employ them than did nine-year-olds and adults. A reverse pattern, however, is shown for C_{3+} events. While C_1 event is the dominant type for five-year-olds, C_2 event was preferred by nine-year-olds. C_{3+} events were encoded more by both adults and nine-year-olds.

4   Discussion

Most cross-sectional narrative studies on Mandarin-speaking children focused on preschoolers' narrative performance (e.g., Chang, 2004; Chen et al., 2011; Li, 2012). Scarcity is the research included both preschool and school-age children (Chang, 1995; Chang, 2001; Sah, 2013). Given so, we know little about Mandarin children's progress in establishing narrative coherence from preschool to school years. Another limitation of previous studies is that only a few of them based on the frog story to tap Mandarin children's narrative ability (Chang, 1995; Chen et al., 2011; Li, 2012; Sah, 2013). The present work thus aimed to fill the gap by examining development of coherence in narratives by including both preschool and school-age children and by eliciting narratives based on the frog story, which combined makes it possible to compare findings of other cross-sectional research out of similar research paradigms (e.g., Trabasso et al., 1992).

Though developmental differences in basic narrative measures were not significant, age-related increases manifested in number of causal chained events, which suggest that, with increasing age, children were more sensitive to the relative causal importance of narrative events. On the other hand, the density of chained events reversed the above pattern in which children outperformed adults. Given the fact that adults produced far more clauses than did children, the seemingly contradictory pattern of density is explicable since adults' markedly larger amount of clauses might lead to their lower density.

Consistent with our prediction, the results revealed children's developmental progress in inferring and establishing causal relations,

which is largely compatible with findings in previous studies on English-speaking children (Trabasso and Nickels, 1992; Trabasso et al., 1984). The increasing ability in establishing causal relations gains additional support from the preferred types of events used by participants of different age groups. While the youngest group preferred C_0 and C_1 events, nine-year-olds and adults were more likely to encode events with more causal connections. To sum up, with increasing age, children appear to be more capable of encoding essential narrative elements and of integrating them into a coherent whole via causal relations.

Among earlier endeavors, only Chang's (1995) research examined Mandarin children's narrative development by means of causal networks. The researcher relied on causal connections to assess narrative coherence, but did not detect significant age effect for it. Unlike Chang's work, we included a larger sample with wider age span, and confirmed the age-related progress in enhancing narrative coherence found in English-speaking children (Trabasso and Nickels, 1992; Trabasso et al., 1992).

The developmental progress detected here might be explicated from an information processing standpoint. Working memory is an integral part of the information-processing system (Baddeley and Hitch, 1974). Its storage and processing components are presumably relevant to constructing narratives based on a picture book, since narrators need not only to understand individual events portrayed in pictures but also to integrate and store the information as a memory representation. Better performance in narrating a picture-book story, therefore, would require larger working-memory capacity. In the narrative study by Trabasso et al. (1992), one finding is suggestive: younger children's insufficiency in encoding planning components was partly attributed to their limited working-memory capacity. As Gathercole et al. (2004) noted, age-related increases in working-memory capacity manifested for participants from age four through fifteen. In view of this, adults would be expected to have larger working-memory capacity than do children, and nine-year-olds would have an advantage over five-year-olds. As such, the developmental difference in working-memory capacity is likely to contribute to the age-related differences found in the present study. This interpretation is, however, open to further empirical inquiry.

Other than storing and organizing information, a successful narrator needs to possess communicative competence, which ensures the narrator to construct a narrative that is understandable to listeners by selecting what is relevant based on the listener's needs. The knowledge about listeners' needs may embody in the extent to which a narrator conforms to the Gricean maxims (Grice, 1989). Children of different ages may have different assumptions about communicative necessity. Trabasso et al. (1992), for instance, reported that older children showed a better understanding of Grice's maxim of quantity than did younger children. They presumed that younger children's limited communicative competence related to the absence of certain essential information in narratives. Likely, in this study, five-year-olds' less causally-connected narratives may be relevant to their difficulty in adhering to the maxims, for they may have insufficient knowledge about what their listeners need. Further research is needed to test such speculation.

Apart from working-memory capacity, children's ability in theory of mind (ToM) is also relevant to how well they relate narrative information (Colle et al., 2008). As indicated by Tager-Flusberg and Sullivan (1995), ToM is essential to narrative construction, for a successful narrator relies on ToM not only to elaborate the internal states of story characters to account for their actions, but also to take account of listeners' needs. The intertwined relationship between ToM ability and narrative representation is also noted in Sah's (2013) research, in which the absence of emotion attribution by five-year-olds was considered reflecting their limited ToM ability. In view of this, we speculate that five-year-olds' limited ability in ToM might relate to their insufficient communicative competence, which presumably led to less causal connections encoded by them, and, hence, contributed to the developmental differences exhibited in this study.

Children's progress in enhancing narrative coherence implies their increasing ability to integrate essential narrative information. It is a cognitive tendency to integrate elements into a higher level of organization (Frith and Happé, 1994). The gradual unfolding of the ability to integrate relevant information is evident in research of narrative development (e.g., Bamberg and Marchman, 1990; Trabasso et al., 1992). For instance, it is noted that, initially, preschoolers are likely to encode narratives in

terms of discrete events; gradually, they evolve to infer and establish proper interrelationships between events (Berman and Slobin, 1994). The progress from differentiation to integration may relate to cognitive preferences of children in different ages. According to Piaget (1969), children between ages four and seven belong to the intuitive period of cognitive development. During this period, their understanding of objects or events mainly relies on the most salient perceptual features of the target items, rather than on logical or rational thinking processes. This cognitive preference is also evident in Perner's (1991) research of distinction between appearance and reality, in which preschoolers' responses were mostly based on apparent perceptual features. Nine-year-olds, however, belong to a different developmental stage, the concrete operational stage, and they perform better in providing logical links between things. Such difference in cognitive preferences helps to explain why children of different ages performed differently in the present study: five-year-olds mostly valued salient details so they preferred to encode C_0 and C_1 events; comparatively, nine-year-olds focused more on relations between events, so they constructed narratives with more causal connections, hence their narrations more coherent. Put another way, the tendency to value piecemeal details at the expense of the whole picture of things may presumably render five-year-olds' narrative less coherent.

To sum up, the present study advanced our knowledge about Mandarin-speaking children's development of maintaining coherence in narratives. It also demonstrated that the system of causal network provides an alternative to quantitatively assess narrative coherence.

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Appendix. Causal Chain and Causal Connections by One Child
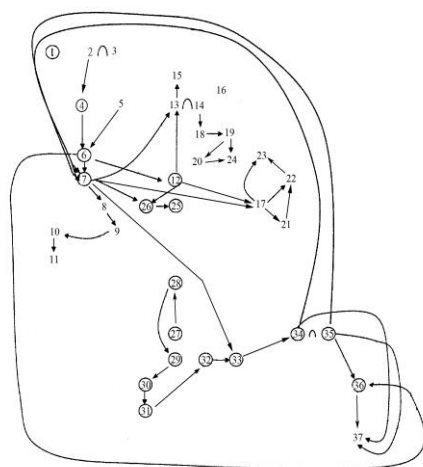
Note: Each number in the map stands for one story event. Circled numbers are the events on the causal chain; causal connections between events are represented by arrows. And arches connect co-occurring events. The story events corresponding to the numbers in the map are given below.

1. xiao nanhai you liang ge chongwu
   '(One) little boy has two pets.'
2. you yi tian xiao nanhai zai shuijiao
   'One day when the little boy is sleeping,'
3. han xiaogou zai shuijiao
   'and his dog is sleeping,'
4. qingwa jiu cong guanzi li pao chulai le
   'the frog runs out of the jar.'
5. ranhou tian liang le
   'Then the sky gets brighter,'
6. tanmen jiu faxian qingwa bujian le
   'they realize the frog has gone.'
7. tamen jiu daochu zhaozhaokan
   'They look everywhere.'
8. tamen dakai chuanghu
   'They open the window'
9. zhao qingwa
   'to look for the frog.'
10. ranhou xiaogou buxiaoxin diao xiaqu le
    'Then, the dog falls down out of its carelessness.'
11. ba qingwa de quzi shuaihuai le
    '(It) breaks the frog's house.'
12. ranhou tamen dao senlin fujin zhao
    'Then they search nearby the forest.'
13. xiao nanhai zai dongkou li zhao
    'The little boy searches inside the hole.'
14. nage xiaogou kan shu shang de fengwo
    'That dog looks at the beehive in the tree.'
15. di limian pao chu yi zhi yanshu
    'A gopher runs out of the hole on the ground.'
16. fengwo li you mifeng
    'There are bees inside the beehive.'
17. xiao nanhai pa shang shu
    'The little boy climbs up to a tree.'
18. xiaogou buxiaoxin yao shu
    'The dog carelessly shakes the tree.'
19. ba fengwo neng diao le
    '(It) knocks down the beehive.'
20. mifeng dou pao chulai le
    'All the bees run out.'
21. xiao nanhai dao shu shang de dong li zhao
    'The little boy searches (the frog) in the tree-hole.'
22. yi zhi maotouying jiu fei chulai
    'One owl flies out.'
23. xiao nanhai jiu die xiaqu le
    'The little boy then falls down.'
24. mifeng jiu zhui zhe xiaogou pao
    'The bees then chase the dog.'
25. xiao nanhai pa shang shitou
    'The little boy climbs up a rock'
26. zhaozhaokan qingwa
    'to look for the frog.'
27. ranhou yi zhi lu pao chulai
    'Then a deer runs out.'
28. xiao nanhai jiu die dao ta shen shang
    'The little boy then falls onto the deer.'
29. lu jiu dai zhe xiao nanhai pao
    'The deer then carries the little boy around.'
30. ranhou tanen diao jin shanggu li le
    'Then they fall into the valley.'
31. zuihao tamen die jin chitang li
    'Finally they fall into the pond.'
32. tamen qilai dao an shang
    'They get up onto the bank.'
33. ranhou dao mudui qianmian zhao
    'Then (they) look for (it) in front of a pile of woods.'
34. zhaodao le liang zhi qingwa

'(They) find two frogs'
35.   haiyou zhaoao shengxia de xiao qingwa
      'and find the rest of the little frogs.'
36.   xiao nanhai jueding ba qingwa dai huijia
      'The little boy decides to take the frog home'
37.   jiu gen naxie qingwa shuo zaijian
      'Then (he) says good-bye to those frogs.