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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 developmental progress in achieving narrative coherence by establishing causal relations between narrative events. Results were considered in relation to discourse tendency and capacities for working memory. Narrators' differences in communicative competence and cognitive preferences were also discussed.

Key words: narrative development, coherence, causal relation, Mandarin-speaking children

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1. INTRODUCTION

Narrative discourse has long been of interest to researchers, since it provides rich information about children's development of literacy and socialization (Chang 2000; Snow 1991). Previous research relied on a variety of schemes to explore how narrators relate categories of information in a narrative. Some researchers start from the premise of narrative structure (Berman and Slobin 1994; Peterson and McCabe 1983; Stein and Glenn 1979); some are more concerned with the conceptual basis for relating narrative information (Trabasso and Nickels 1992; Trabasso and Rodkin 1994; Trabasso, Stein, Rodkin, Munger, and Baughn 1992).

Trabasso and his colleagues (1992) noted that narrators tend to encode a protagonist's actions as relevant to a goal/plan and suggested that knowledge of goal/plans serves as the conceptual basis underpinning narrative representations.[1] In addition to acknowledging the conceptual basis of narrative construction, Trabasso and his colleagues (Trabasso and Sperry 1985; Trabasso and van den Broek 1985; Trabasso, van den Broek, and Suh 1989) indicated that it is causal inferences that unite elements in a goal/plan (such as goals, actions, and outcomes) into an integrated whole. Similarly, Stein and Albro (1997) and Habermas and Bluck (2000) suggested that causal inferences are essential to organize narrative content and structure into a coherent unit, and they acknowledged the significance of causal coherence. Put another way, previous research has considered causal relations to be an essential means to integrate episodic and thematic information and hence to create narrative coherence (Karmiloff-Smith 1985; Stein and Albro 1997; Stein and Glenn 1979; Trabasso and van den Broek 1985; Trabasso et al. 1989).

Causal relations can be expressed in terms of overtly marked causal statements and non-overtly marked ones. For overtly marked causal statements, causal connectives serve as the signals to explicitly encode

[1] Trabasso and Nickels (1992) observed that five-year-olds could encode and trace goals and plans of story protagonists in narratives. With increasing age, children were found to be more advanced in applying knowledge of goal/plans to integrate narrative events (Trabasso et al. 1992).

causal relations between related propositions. For non-overtly marked causal statements, however, no causal connectives are required to link propositions. Every language has specific means to encode causal relations. In English, causal connectives, such as *because*, are the canonical device to indicate causality and to achieve coherence (Schiffrin 1987). McCabe and Peterson (1985) examined the use of *because* and *so* in narratives about personal experiences by children aged 3 to 9. Though no significant age differences were found for the accurate use of these two connectives, the researchers suggested that adults' narrative productions should be included in future research to ensure a more comprehensive understanding about the developmental trend in the use of causal connectives. One intriguing finding in their study is that children occasionally used connectives to mark causal relations for non-adjacent sentences. Regarding the non-overtly marked statements, one recent finding about the discourse tendency in the use of causal language is worth noting. According to Chang and Su (2012), the total number of non-overtly marked causal statements significantly outnumbered that of overtly marked ones in the discourse by Taiwanese adult speakers. This finding supports Matthews and Yip's (1994) description about Cantonese speakers in that clauses are often juxtaposed without explicit use of connectives. In view of all these, future research needs to examine not only overtly marked but also non-overtly marked causal relations for adjacent and non-adjacent sentences in order to gain more insight into children's abilities to encode causal relations.

To assess causal relations, Trabasso and Sperry (1985) outlined procedures to identify causal networks in narratives. Causal networks consist of causal chains and causal connections, which includes both overtly and non-overtly marked causal relations and examines causal connectivity between adjacent or non-adjacent sentences. Rather than being confined to semantic relations between propositions, causal networks are established on the basis of the criterion of necessity (detailed explanation in Section 2.4). Research has shown that causal networks provide explanations for the variance in story recall (Trabasso, Secco & van den Broek 1984). In particular, compared with measures of story grammar, causal networks have been found to be a more sensitive predictor of story recall and of the importance ratings for narrative

events (Trabasso and Sperry 1985; Trabasso and van den Broek 1985; Trabasso et al. 1989). Through analyses based on causal networks, Diehl, Bennetto and Young's (2006) and Sah and Torng's (2012) research give additional credence to this framework by displaying the insufficiency of children with autism in maintaining narrative coherence. In light of this, the system of causal networks may serve as an alternative tool to assess narrative coherence.

In recent decades, most developmental research of Mandarin-speaking children's narrative ability has focused on preschool children (e.g., Chang 2004; Chen, Chang, and Chen 2011; Li 2012; Wang 1998). 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-speaking children's progress in establishing narrative coherence from preschool to school years. 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., Berman and Slobin 1994; Trabasso and Rodkin 1994); nevertheless, only a few studies on Mandarin-speaking children have followed this paradigm (Chang 1995; Li 2012; Sah 2013; Wang 1998). Among them, Chang's (1995) and Sah's (2013) research included both preschool and school-age children, whereas the other studies focused on only preschoolers (Li 2012; Wang 1998). Though Sah (2013) revealed children's increasing ability in encoding goal-structured components to enrich narrative representations, we still lack knowledge about Mandarin children's development in maintaining narrative coherence.

The present work thus aims to fill the gap by examining the development of coherence in narratives by including both preschool and school-age children and by eliciting narratives based on the frog story, which when combined makes it possible to compare and validate findings of the previous, frog-story-based studies out of the cross-section research paradigm (Trabasso and Nickels 1992; Trabasso and Rodkin 1994). The purpose is twofold. Firstly, it attempts to examine whether Mandarin-speaking children exhibit a similar discourse tendency as found in Taiwanese and Cantonese adult speakers. Secondly, it aims to

extend the line of frog-story-based investigation and to confirm and amend previous findings based on the analysis of causal networks. To this end, we based our analysis on causal networks, which measure overtly and non-overtly marked causal statements, causal-chain events and causal connections, to address the following research questions:

(1) Are non-overtly marked causal statements used more often than overtly marked ones in narratives by Mandarin-speaking children? Are there any age differences regarding this discourse tendency?

(2) Are there any age differences in the ability to encode events in the causal chain?

(3) Are there any age differences in establishing causal connections between narrative events?

(4) Are there any age differences in encoding events with different types of causal connectedness?

Based on previous research findings, we hypothesized that our children would exhibit a discourse tendency similar to that of Taiwanese and Cantonese speakers. Previous research 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 hypothesized that, compared with school-age children, preschool children would be less sensitive to the global plotline so they might encode less causal-chain events. Given that age-related increases were shown for applying goal-plan knowledge to integrate narrative information (Sah 2013; Trabasso et al. 1992), we presumed that, along with advancement in this conceptual ability, children would be more likely to use causal reasoning to build up causal relations between narrative events. Accordingly, the school-age children would be more likely to establish causal connections in narratives than the preschool children do and hence the narratives by school-age children would be more coherent. Age influences would also be exhibited for the types of causal connectedness encoded in narratives.

2. METHOD

2.1 Participants

Previous research has indicated that five-year-olds and nine-year-olds display different abilities to relate narrative events and to elaborate narratives (Bamberg and Damrad-Frye 1991; Berman and Slobin 1994; Sah 2007). Ukrainetz and colleagues (2005) suggested that five-to-six-year-olds and seven-to-nine-year-olds are two age clusters displaying age effect in the use of evaluative expressions. In addition to this, age-related differences have been reported in research of developmental psychology (e.g., Piaget and Inhelder 1972). To explore narrative development of Mandarin-speaking children and to make comparisons with previous research findings, the present study therefore chose five-year-olds and nine-year-olds as our participants.[2]

The 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. In addition, 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 children were from similar middle-class socio-economic backgrounds.

2.2 Materials

Much research of narrative development has focused on data based on the wordless picture book *Frog, Where are You?* (Mayer 1969), because it is considered to be a very reliable tool to tap children's budding narrative abilities (Bamberg and Marchman 1990; Berman and Slobin 1994). To control the content of narratives, we also used the frog story to elicit narrative productions. This book depicts an elaborate series

[2] Based on the developmental data from a variety of languages, researchers have indicated that five- and six-year-olds can already produce well-ordered narratives (Bamberg and Damrad-Frye 1991, Peterson and McCabe 1983). Thus, we included five-year-olds as our youngest group with the assumption that they may be beginning to display ability in presenting extended narratives.

of events which allow narrators to provide various links among events. It is, therefore, suitable for our research goal in exploring how children relate narrative events.

2.3 Procedure

The interviews were carried out individually with each participant and consisted of an initial warm-up conversation followed by a narrative task based on *Frog, Where are You?* The 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 subsequently transcribed.

2.4 Data Analyses

Length. Clauses were used to quantify story length. A clause consists of a verb and its arguments, and corresponds roughly to a single event.

Overtly and non-overtly marked causal statements. The overtly marked causal statements were quantified in terms of numbers of causal connectives used in narratives (Tager-Flusberg 1995; Tsou and Cheung 2007). Causal connectives were used to explicitly encode cause-consequence relations in the story. For instance, in *yin1wei4 fa1xian4 xiao3 qing1wa1 bu2jian4 le0, ta1 fei1chang2 shang1xin1* 'because (he) realizes the little frog has gone, he is very sad,' the word *yin1wei4* was coded as a causal connective. (The connective *suo3yi3* of Event 20 in the Appendix is another example.)

Non-overtly marked causal statements were identified based on the following criteria: (1) a cause-consequence relation exists between clauses but is not explicitly marked by a causal connective; (2) this causal relation does not change even if a causal connective is inserted; (3) the two causally related clauses can be either adjacent or non-adjacent (Chang and Su 2012). For instance, in *po1li1ping2 po4 le0, xiao3hai2 hen3 sheng1qi4* 'the glass jar was broken; the child was very angry,' the causal relation is non-overtly stated. Similar clausal relations can be found between Events 10 and 11 in the Appendix.

Causal-chain event. Causal-chain events form the gist of a story.

Following Trabasso and Sperry's (1985) method, we determined the causal chain by first identifying opening and closing events in a narrative. The opening events include: the setting information which introduces protagonists, time and place, and the initiation part which triggers the ensuing episodes (e.g., "the frog escapes"). The closing events refer to goal attainment/failure of the protagonists (e.g., "the boy found his pet frog"). The events with causes and consequences which can be traced from the opening through closing of the narratives were regarded as causal-chain events, as indicated by the circled numbers in the Appendix.

Causal connection. A causal connection was established between a pair of events when the criterion of necessity was satisfied.[3] 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, event A is a cause of, or a condition for event B, and 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 the relative importance of an event to the story. Causal connections are represented by arrows in the Appendix.

To control overall story length, we followed the method of previous research (Davis, O'Neil-Pirozzi, and Coon 1997; Diehl et al. 2006) and measured narrative coherence in terms of the density for causal-chain events and that for causal connections. The densities were obtained through dividing the total number of causal-chain events and that of causal connections in each story, respectively, by the total number of clauses in that story.

Types of causal connectedness. To examine the pattern of causal

[3] The criterion of necessity was originally proposed by lawyers (Hart and Honoré 1959) and reviewed by the philosopher Mackie (1980). This criterion provides reliable identification of causal relations in stories and has been used extensively by researchers (e.g., Cevasco and van den Broek 2008; Diehl et al. 2006; Trabasso and Sperry 1985).

connectedness within each narrative produced by participants, we differentiated four types of causal connectedness on the basis of the number of connections one event has in relation to other events in the story, namely, C_0, C_1, C_2, and C_{3+}. The C_0 type refers to the individual, discrete event which has no connection with other events in the story. An illustration of the C_0 type of event is Event 1 in the Appendix. The C_1 type refers to the event which has connection with only one other event; Event 5 represents an example of this type. Because the sky becomes lighter (Event 5), the boy and his dog realize that the frog has gone (Event 6). Events of the C_2 type have connections with two other events; Event 10 in the Appendix belongs to this type, which relates to Events 9 and 11: Event 9 functions as the condition for Event 10, while Event 11 presents the consequence following the dog's carelessness in Event 10. Finally, events with three or more connections were collapsed into the C_{3+} type because they were used infrequently across all participants. The C_{3+} type of event is illustrated by Event 22 in the Appendix, in that Event 22 connects to three other events, Events 17, 21, and 23. Here, Events 17 and 21 provide the condition for Event 22, while Event 23 is the consequence of Event 22.

Following Diehl et al.'s (2006) method, we calculated the proportion for events of each connectedness type within each participant's story. Because the data were in percentages, arcsine transformations were carried out on the percentage data to normalize the distribution.[4]

Reliability. Coding was carried out by one trained coder. A second coder coded 30% of the narratives, selected at random, for reliability (Chang 2000; Reilly, Losh, Bellugi, and Wulfeck 2004). Cases of disagreement were resolved through discussion.

3. RESULTS

Basic narrative measures were first established by calculating the mean number of clauses and that of different words of each age group,

[4] We used the ASIN function in Microsoft Excel to do arcsine transformations in order to normalize the distribution of data and to stabilize variances. For the formula syntax and usage of the ASIN function, please refer to Microsoft Excel.

namely, the five-year-olds, nine-year-olds and adults. The mean numbers of clauses were, respectively, from the youngest to oldest group, 35.93, 41.23 and 72.03. The Kruskal-Wallis test indicated a significant age main effect, χ^2 (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 and five-year-olds. The mean numbers of different words were, respectively, from the youngest to oldest group, 113.80, 139.87 and 228.63. A significant age main effect was also obtained here, χ^2 (2) = 45.71, $p < .001$. Post-hoc tests revealed significant pair-wise differences between adults and nine-year-olds and between adults and five-year-olds. For both narrative measures, the differences between the two groups of children, however, failed to reach significance.

The first research question concerns Mandarin-speaking children's discourse tendency in using overtly and non-overtly marked causal statements. The mean numbers of causal connectives were, respectively, from the youngest to oldest group, 1.5, 3.1 and 6.5. Based on these, analyses of variance ANOVA yielded a significant age main effect for the overtly marked causal statements, $F(2, 87) = 22.17$, $p < .001$. Post-hoc analyses indicated that adults were significantly more likely to use overtly marked causal statements than children did; however, the difference between nine-year-olds and five-year-olds is non-significant. Similarly, an age main effect was obtained for the non-overtly marked causal statements, $F(2, 87) = 42.57$, $p < .001$. Post-hoc tests showed that adults were significantly more likely to use non-overt statements than did children, and nine-year-olds outperformed five-year-olds in this regard (Figure 1).

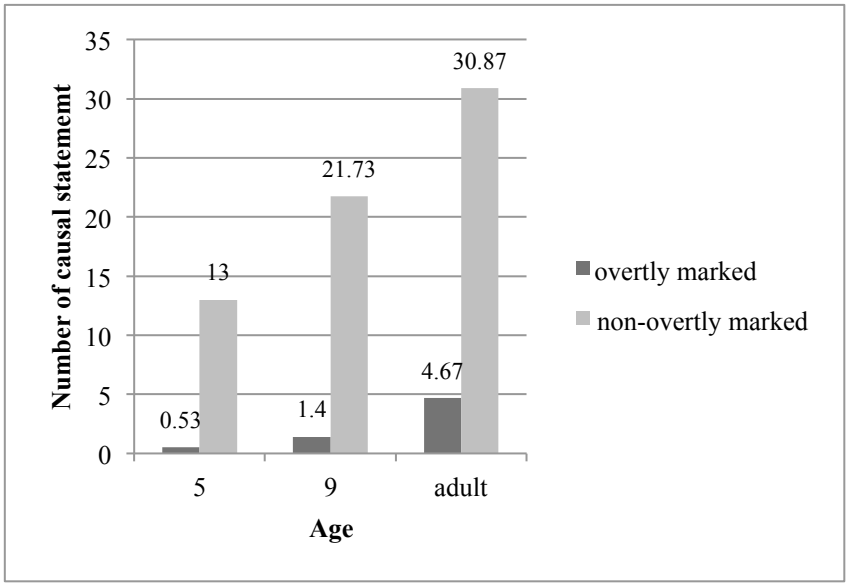

Figure 1. Mean numbers for overtly and non-overtly marked causal statements

With regard to discourse tendency, within each age group, the participants used significantly more non-overtly marked causal statements than the overtly marked statements (Figure 2). Take, for instance, the proportions for the two kinds of causal statements by five-year-olds: 96% of their causal statements are non-overtly marked, while only 4% are overtly marked. It is interesting to note that subtle developmental changes unveiled this skewed distribution. As displayed in Figure 2, age-related increases were exhibited in the proportions of the overtly-marked causal statements, whereas a reversed trend is shown in the proportions of the non-overtly marked statements. Kruskal-Wallis confirmed the age impact for the overtly marked causal statements, $\chi^2(2) = 16.82$, $p < .001$. Post-hoc Mann-Whitney revealed that the proportion of the overtly marked statements in adults' narratives is significantly larger than that in children's. The decreasing trend for the non-overtly marked causal statements is substantiated by a significant age effect, χ^2

(2) = 16.82, p < .001. Post-hoc tests indicated that the proportion of the non-overtly marked statements in adults' narratives is significantly smaller than that in children's narratives. The proportional differences between the two groups of children for either overtly or non-overtly marked causal statements, however, are not significant.

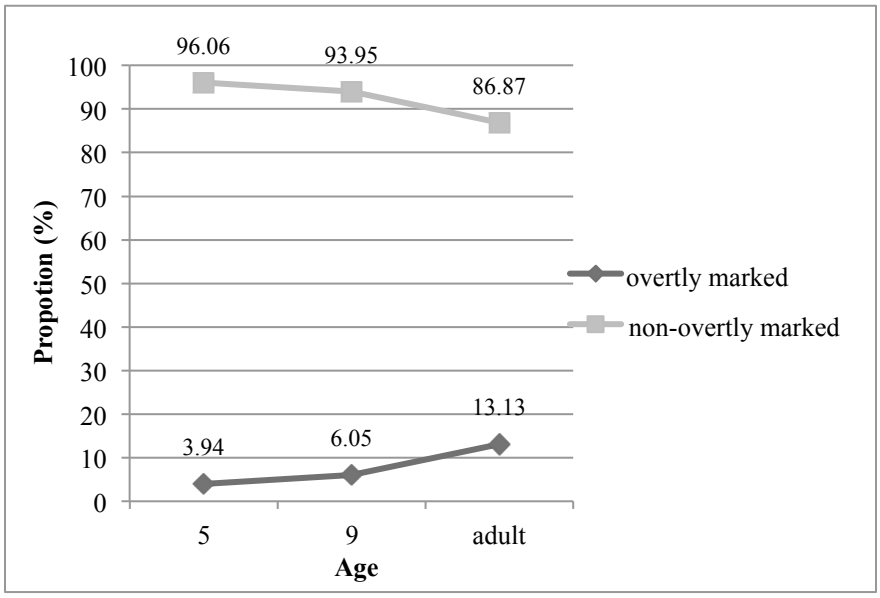

Figure 2. Proportions for overtly and non-overtly marked causal statements by age group (%)

The second research question pertains to the encoding of causal-chain events. ANOVA yielded a significant age main effect for the density of causal-chain events, $F(2, 87) = 11.64$, $p < .001$. Contrary to the hypothesis, however, post-hoc analysis revealed that both nine-year-olds and five-year-olds outperformed adults by having larger density in this regard. Despite that, the age-related difference between the two groups of children is not significant (Figure 3).

The third research question focuses on the establishment of causal connections between narrative events. As hypothesized, ANOVA

yielded a significant age main effect for the density of causal connections, $F(2, 86) = 29.82$, $p < .001$. Subsequent analyses revealed that adults and nine-year-olds were significantly more likely to encode causal connections than were five-year-olds (Figure 3).

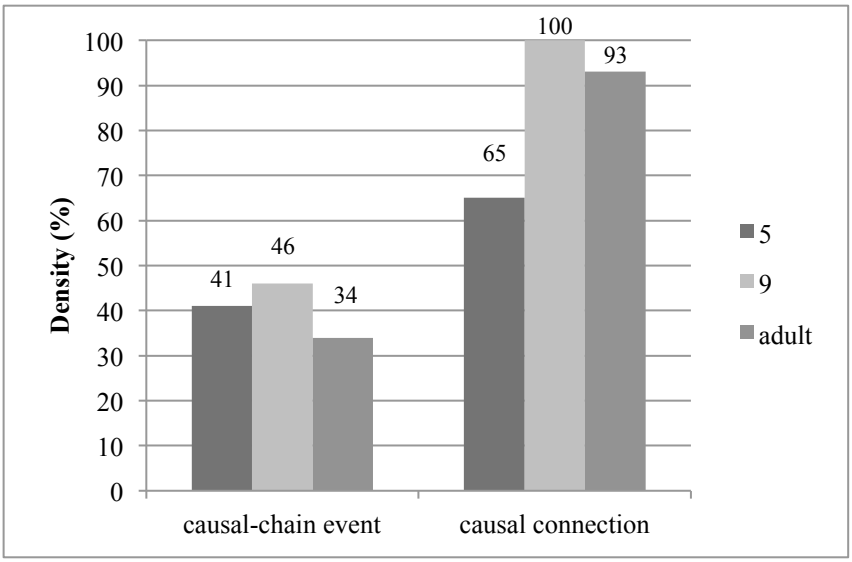

Figure 3. Density of causal-chain events and that of causal connections

The last research question examines the pattern of causal connectedness within stories. ANOVA yielded significant age main effects for all types of events (Table 1) and a significant Age x Type interaction, $F(6, 261) = 14.65$, $p < .001$. Post-hoc analyses revealed age-related differences for each type. As displayed in Figure 4, for C_0 events, five-year-olds were significantly more likely to employ them than were nine-year-olds and adults. A reverse pattern is shown for C_{3+} events, which were encoded more by both adults and nine-year-olds than by the younger children. While the C_1 event is the dominant type used by five-year-olds, the C_2 event was preferred by nine-year-olds. Put together, nine-year-olds and adults tended to encode events with higher causal connectedness.

Table 1. Proportions for each type of causal connectedness by each age group (%)

	5	9	19	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*

* $p < .001$

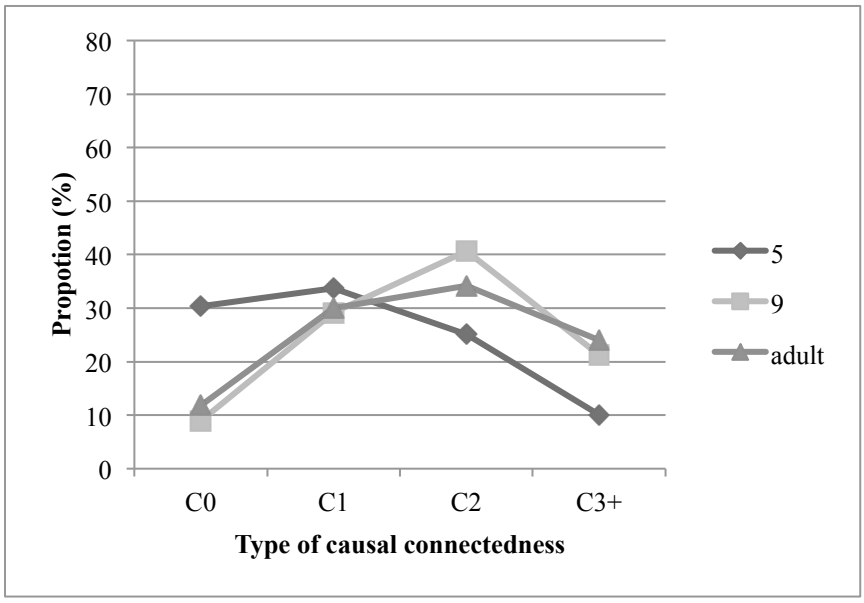

Figure 4. Distribution for each type of causal connectedness

4. DISCUSSION

This study displays significant differences between adults and children in basic narrative measures; however, the advancement from five-year-olds to nine-year-olds is non-significant. Similar results were obtained for the use of the overtly marked causal statements, in which the difference between nine-year-olds and five-year-olds failed to reach

significance. Unlike the overtly marked causal statements, significant and age-related increases were manifested in the non-overtly marked causal statements.

The discourse tendency noted in Taiwanese (Chang and Su 2012) and Cantonese (Matthews and Yip 1994) adult speakers gains support from the present study in that the non-overtly marked causal statements significantly outnumbered the overtly marked ones across all age groups. Such a discourse tendency suggests that causal connectives would not be the first choice for Chinese speakers to indicate causality in discourse. It also implies that explicit connectives may not be obligatory for a listener's comprehension of meaning (Chaudron and Richards 1986), though further research is needed to test this speculation. As Chang and Su (2012) indicated, when the propositional and causal relation between utterances is self-evident, a speaker may choose not to encode the relation with an explicit marker. This skewed distribution may presumably lead to the scarce instances of causal connectives found here and may have limited our power to detect age difference between the two groups of children in overtly-marked causal statements. In view of this, measures of causal connectives seem not to be a sensitive indicator of the developmental progress in the ability to achieve narrative coherence. The subtle developmental change in the increasing proportions of the overtly marked statements is worth noting. It shows that, despite the preponderance of the non-overtly marked causal statements, children appeared to increase their use of the overtly marked statements to a certain extent to ensure a proper elaboration of causal connectivity within stories.

Contrary to the hypothesis, our data did not yield developmental progress for the density of causal-chain events; actually, children outperformed adults in this regard. In contrast to our finding, however, Trabasso et al. (1984) revealed age-related increases in recall of the causal-chain events by English-speaking children. This discrepancy in research findings may be attributed to several factors. To begin with, previous research that examined causal chains in narratives mostly based on the story-recall task (e.g., Diehl et al. 2006; Trabasso et al. 1984), while the present study used the story-telling task. Because story recall is memory-demanding, it is unclear whether the age-related increases in

causal-chain events detected in the previous research is due to children's advance in working memory capacity or improvement in narrative ability per se. Another concern is that the previous studies did not control story length, the confounding variable (Trabasso et al. 1984; Trabasso et al. 1992). As a result, the reported developmental progress in causal-chain events may not truly reflect children's advance in this ability; rather, it is likely to misestimate narrative ability due to the failure to account for the confounding factor. In the present study, we noted that age-related increases in mean numbers of causal-chain events were manifested, which suggests that, with increasing age, children were more sensitive to the relative causal importance of narrative events. Given the fact that the story length of adults' narratives was significantly longer than that of children's, the seemingly contradictory pattern of density is explicable because adults' markedly longer narratives (i.e., larger number of clauses) might lead to their lower density in causal-chain events. Finally, while research on narrative performance of English-speaking children has examined age impact in the encoding of causal-chain events, the present work is the only attempt so far to explore Mandarin-speaking children's development in this regard, which thus limits the possibility to relate discrepancies in research findings to typological differences. To address these concerns and to make cross-linguistic comparisons viable, therefore, more studies on narrative development of Mandarin-speaking children are required.

Among earlier endeavors, only Chang's (1995) research examined Mandarin-speaking children's narrative development by means of causal networks. The researcher relied on causal connections to assess narrative coherence, but did not detect a significant age effect for it. Unlike Chang's research, the present work included a larger sample with a wider age span. Our results revealed children's significant advancement in inferring and establishing causal connections, which is consistent with our hypothesis and largely compatible with previous findings 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. In other words, with increasing age, children appeared to be more capable of establishing causal relations between narrative elements and of integrating them into a coherent whole.

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 a narrator needs 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 study by Trabasso and colleagues (1992), one finding is suggestive: younger children's insufficiency in encoding narrative components was partly attributed to their limited working-memory capacity. As Gathercole, Pickering, Ambridge, and Wearing (2004) noted, age-related increases in working-memory capacity were manifested for participants from age four through fifteen. In view of this, the working-memory capacity of adults would presumably be larger than that of children, and nine-year-olds would have an advantage over five-year-olds. As such, the developmental differences in working-memory capacity are likely to contribute to the age-related differences found in the present study. This interpretation is, however, speculative and open to further empirical inquiry.

Other than storing and organizing information, a successful narrator needs to possess communicative competence which ensures the narrator is able to provide sufficient information and construct a narrative that is understandable to listeners by selecting what is relevant based on the listeners' needs. The knowledge about listeners' needs may be embodied in the extent to which a narrator conforms to the Gricean maxims (Grice 1989). Children of different ages were found to have different assumptions about communicative necessity (Bamberg and Marchman 1990; Trabasso et al. 1992). For instance, Trabasso et al. (1992) reported that older children showed a better understanding of Grice's maxim of quantity than did younger children. They indicated that younger children's limited communicative competence was related to the absence

of certain essential information in narratives. Likely, in the present study, five-year-olds' less causally-connected narratives may be relevant to their difficulty in adhering to the maxims, because they may have insufficient knowledge about what their listeners need to know. Further research is needed to test this relationship.

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 (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 (differentiating individual events) to integration (integrating individual things into higher-order hierarchical structures) may relate to cognitive preferences of children in different ages. According to Piaget and Inhelder (1972), 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 inferring logical links between things. Such a 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; nine-year-olds are comparatively more likely to infer underlying relations between events, so they constructed narratives with more causal connections, hence their narrations were more coherent. Put another way, the tendency to value details may presumably render five-year-olds' narratives less coherent.

To sum up, the present study unveils Mandarin-speaking children's

development in maintaining coherence in narratives through establishment of causal relations. In addition, the discourse tendency with the preponderance of non-overtly marked causal statements manifests itself in the narratives of participants across all ages. The study also demonstrates that the system of causal network provides an alternative to quantitatively assess narrative coherence by covering all possible causal relations, which encompass overtly and non-overtly marked causal connectivity between adjacent or non-adjacent propositions. Compared with causal connectives, the causal network appears to be a more sensitive tool to reveal children's development in maintaining coherence.

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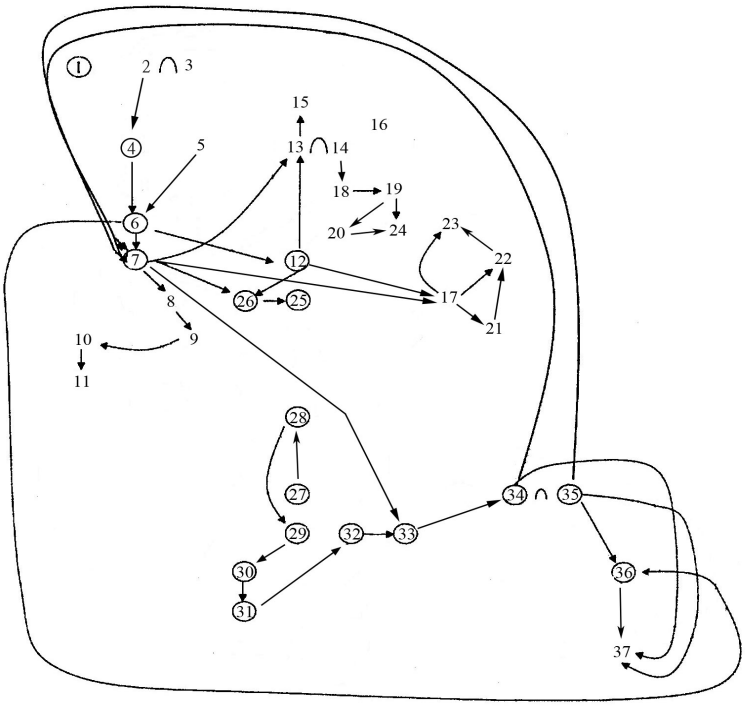
APPENDIX

Causal map and story events of the frog story by one child



Note: Each number in the map stands for one story event. Circled numbers are the causal-chain events; 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 lighter,'
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. xiaogou pa shang chuanghu
'The dog climbs up the window.'
10. xiaogou buxiaoxin diao xiaqu le
'The dog accidentally falls down.'
11. ba qingwa de quanzi shuaihuai le
'(It) breaks the frog's jar.'
12. ranhou tamen dao senlin fujin zhao
'Then they search around in a forest.'
13. xiao nanhai zai dongkou li zhao
'The little boy searches inside a 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 a tree.'
18. xiaogou buxiaoxin yao shu
'The dog inadvertantly shakes the tree.'
19. ba fengwo nong diao le
'(It) knocks down the beehive'
20. suoyi mifeng dou pao chulai le

'so all the bees run out.'

21. xiao nanhai dao shu shang de dong li zhao
'The little boy searches for (the frog) in the hole in the tree.'
22. yi zhi maotouying jiu fei chulai
'An 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 tamen 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 wood.'
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 the other frogs.'

從因果關係看漢語兒童敘事連貫能力的發展

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本研究藉由因果關係檢視漢語兒童敘事連貫能力的發展。研究對象包括: 五歲、九歲兒童及成人各三十位。我們以繪本 *Frog, where are you?*為據，收集敘事語料；以 Trabasso 及 Sperry (1985) 的因果網路架構分析經轉寫編碼後的語料。研究結果顯示：隨其年齡增長，兒童會在敘事中建構更多因果連結，從而愈能掌握敘事連貫性。而因果網路架構不啻為量化敘事連貫性的另一選項。針對上述發現，研究者藉由工作記憶、溝通能力、認知偏好等面向進行探討，並提出後續研究的建議。

關鍵字：敘事發展、連貫性、因果關係、漢語兒童