Journal of Child Language (2021), **48**, 88–109
doi:10.1017/S0305000920000197

CAMBRIDGE
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ARTICLE

Clause-initial AND usage in a cross-sectional and longitudinal corpus of school-age children's narratives

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(Received 23 September 2018; revised 23 May 2019; accepted 5 March 2020;
first published online 23 April 2020)

Abstract

Young children adopt an event-chaining strategy when storytelling, frequently linking clauses with *and*. The current study tested whether age-related changes in clause-initial *and* usage might index narrative structure development in the Eugene Children's Story Corpus (ECSC), which includes 180 structured spontaneous narratives elicited yearly for three years from 60 children, aged five to seven at study onset. The narratives were segmented into clauses to quantify clause-initial *and* usage. Adult judgments of narrative coherence and cohesiveness were elicited as measures of narrative structure. Mean length of utterance (MLU) and clause (MLC) were used as measures of language complexity. Results indicated developmental increases in all measures, but only *and*-connected dependent clause usage increased with cross-sectional and longitudinal age. Only MLC predicted the relative frequency of clause-initial *and* regardless of children's age. These results suggest children's frequent use of *and* to connect events reflects immature language; its association with flat narrative structure is likely epiphenomenal.

Keywords: Eugene Children's Story Corpus; conceptual development; language development; coordinative conjunctions

Introduction

Adult narratives have a hierarchical structure. Locally-related events are embedded within higher-level discourse segments that code themes or goals (Chafe, 2008; van Dijk, 1977; Gee & Grosjean, 1984; Kintsch & van Dijk, 1978). In comparison to adults' narratives, children's narratives have a flatter structure wherein events are related sequentially rather than being organized according to higher-level thematic units (Berman & Slobin, 1994; Botvin & Sutton-Smith, 1977; McCabe & Peterson, 1991). Berman and Slobin (1994, p. 179) illustrate this flat structure with the following excerpt from a narrative produced by a three-year-old child (3;9):

And, um this dog is looking into the bowl. And then the frog is still in there. And now look what happened! And now he got away. And then, look what happened! He tried to go in … And then he licked the boy and he was mad! And then some bees came out of the tree. And then he tried to get the bees, but he couldn't.

The most salient feature of this excerpt is the high frequency use of the word *and*, often in collocation with *then*. More specifically, the child uses *and* to connect nearly all the independent clauses in the excerpt, which is to say that the child uses *and* as a discourse marker rather than as a coordinating conjunction (see Fraser, 1999). This is something that has often been observed in young school-aged children's narratives (Peterson & McCabe, 1988; Berman & Slobin, 1994, pp. 177–179). The aim of the current study was to determine whether this type of *and* usage tracks the development of narrative structure. The extent to which it does has practical value since it would mean that corpus-based methods could be applied to study narrative development. These methods would facilitate investigation of individual differences as a function of subject variables such as working memory capacity or familial socioeconomic status, which would further theories of language acquisition relevant for understanding both typical and atypical narrative development.

A corpus-based approach

The development of hierarchical narrative structure is typically studied using discourse analytic methods. Similar to traditional linguistic analyses, these methods require the analyst to hand-code grammatical or conceptual relations manifest in the language at various hierarchical levels. For example, story grammar analysis requires hand-coding for the presence or absence of episodic components such as settings, initiating events, plans, and so on (see, e.g., Fiestas & Pena, 2004; Merritt & Liles, 1987; Paul, Hernandez, Taylor & Johnson, 1997; Weiss & Johnson, 1993); information structure analysis requires hand-coding features that relate to the accessibility and status of themes and rhemes, which themselves reference immediate, intermediate and long-distance discourse contexts (see, e.g., Crawley & Stevenson, 1990; Hickmann & Hendriks, 1999; Hickmann, Hendriks, Roland & Liang, 1996; McGann & Schwartz, 1988; Wigglesworth, 1990). These coding schemes allow for detailed investigation of discourse phenomena, but they also require either strong experimental constraints on story elicitation (e.g., Hickmann & Hendriks, 1999) or the elicitation of a limited number of stories from a small sample of study participants (e.g., Fiestas & Pena, 2004; Weiss & Johnson, 1993). Such constraints limit the ecological validity and generalizability of the findings.

In contrast to traditional linguistic analyses, a corpus-based approach to language study focuses on the frequency and distribution of linguistic variables in large samples of natural language. When these samples are spontaneous speech, the approach allows for strong inferences about how different populations of speakers use language under normal speaking conditions (see Biber, 1993; Gries, 2009). The potential for ecologically valid and generalizable conclusions regarding language use is a clear strength of the approach. Yet, the descriptive data acquired are only as informative as the hypotheses that motivate the choice of the variables under study (see McEnery & Gabrielatos, 2006; Tognini-Bonelli, 2001). Thus, before a corpus-based approach can be applied to the study of narrative development in large corpora of children's stories, it is important to identify linguistic variables that can

https://doi.org/10.1017/S0305000920000197 Published online by Cambridge University Press

be reasonably assumed to track narrative structure. Here, we investigate whether *and* might be one such variable based on the observation that children rely more heavily than adults on *and* to sequence events in a linear manner (see, e.g., Berman & Slobin, 1994; Peterson & McCabe, 1988).

AND as a potential marker of narrative structure

The connective *and* marks narrative structure at both the global and local level, depending on whether it is used as a discourse marker or as a coordinating conjunction. The former usage connects events or ideas in a linear fashion; the latter connects closely related propositions. It is possible to extract the different usages on independent syntactic grounds. Discourse markers occur in utterance-initial position (Schiffrin, 1987; Zwicky, 1985) and are syntactically detachable from what follows in that they can be dropped without affecting the syntactic structure of the clause (Fraser, 1999). For example, the utterances [*Mary was tired*] [*and she went home*] could just as easily be rendered [*Mary was tired*] [*she went home*], indicating that *and* is a discourse marker. When *and* is used as a coordinating conjunction to combine local events, the result is a syntactically complex sentence because speakers drop the shared subject (e.g., [*Mary was tired* [*and went home*]$_{\text{dependent}}$]$_{\text{main}}$). We discuss this type of *and* usage below with respect to zero anaphora. Of course, as a coordinating conjunction, *and* can also be used to connect any two syntactic phrases within a clause. This usage is not addressed in the present study since it does not relate to our interest in the development of narrative structure. Here, we focus exclusively on clause-initial *and*.

Our working hypothesis is that the high frequency use of clause-initial *and* in children's narratives indexes what Berman and Slobin (1994) have referred to as an event-chaining narrative strategy; that is, the strategy of organizing events in sequence without regard to thematic cohesion. Specifically, Berman and Slobin observed that five-year-old children deploy *and* or *and then* to transition from "one utterance to the next" and from "one event to another" in a sequence that is locally determined (p. 174), most likely by the events depicted on the pages of the wordless picture books used to elicit the narratives they analyzed. This discourse marking use of *and* has also been described as the simple conjunctive use to express additive and temporal relations (Sanders, Spooren & Noordman, 1992, 1993). Additive *and* connects clauses such that their combined meaning does not differ from the meanings of each independently, while temporal *and* simply signals the sequential relations between clauses (Bloom, Lahey, Hood, Lifter & Feiss, 1980).

Sanders and colleagues contrast the simple conjunctive use of *and* with its conceptually more sophisticated use for expressing implicational relations, including contrastive and causal relations. Moreover, they have shown that the more sophisticated uses of *and* develop later in school-aged children's elicited speech (see also Bloom *et al*., 1980; Peterson & McCabe, 1988). In addition to using *and* to join clauses in implicational relations, older children also presumably behave more like adults in relying on spatial and temporal adverbs (e.g., *there, when, here, next*) to locate events in space and time when storytelling (Diessel, 2004; Hudson & Shapiro, 1991); a presumption not directly assessed in the current study. These observations predict that clause-initial *and* is less frequently used in older children's narratives relative to younger children's narratives. This prediction also follows from the

https://doi.org/10.1017/S0305000920000197 Published online by Cambridge University Press

working hypothesis that high frequency use of clause-initial *and* indexes an event-chaining narrative strategy rather than one of hierarchical organization.

Note that our working hypothesis critically relies on Fraser's (1999) definition of a discourse marker as a syntactically detachable element that has a procedural (i.e., pragmatic) function. But the focus on clause-initial position opens up an alternative explanation for young children's apparent event-chaining use of *and* in narratives; namely, that it is a consequence of their slow acquisition of anaphora in expressive language. Specifically, the slow acquisition of zero anaphora may result in the overuse of *and* to combine independent clauses (Serratrice, 2007). The use of zero anaphora may depend on conceptual development in so far as young preschool and school-aged children (three to five years old) are still developing the ability to properly select between alternative character reference forms to indicate new versus refocused versus still-in-focus subjects in narrative speech (Berman, 1997; Connor, 2012; MacWhinney & Bates, 1978; Warden, 1976, 1981). It could also depend on syntactic development. Even though very young children comprehend anaphoric reference (Deutsch, Koster & Koster, 1986; Song & Fisher, 2007), the production of anaphoric forms requires the emergence of linguistic devices necessary to convey narrative structure (Karmiloff-Smith, 1985). Zero anaphora, in particular, requires complex syntax since its use results in a clause that lacks an overt subject and so is dependent on a main clause for referent resolution. Such complex constructions have been shown to emerge gradually over the course of development (Berman, 1997; Bowerman, 1979; Diessel, 2004; Frizelle, Thompson, McDonald & Bishop, 2018).

Current study

The current study tested the working hypothesis that children's use of clause-initial *and* indexes an event-chaining narrative strategy against the alternative hypothesis that the distribution and frequency of clause-initial *and* indexes the complexity of syntactic structures used in storytelling. The working hypothesis predicts a developmental decrease in the frequency of clause-initial *and* as well as a relationship between clause-initial *and* usage and narrative structure that is independent of language complexity and children's age. By contrast, the alternative hypothesis predicts a developmental increase in the number of *and*-initial dependent clauses as well as a relationship between clause-initial *and* usage and measures of language complexity that is independent of narrative structure and children's age. These predictions were tested in the Eugene Children's Story Corpus (ECSC), which includes cross-sectional and longitudinal audio recorded stories elicited from school-age children. This structure allows for strong inferences about development: if age-related effects are observed both cross-sectionally and longitudinally they are developmental; if they are observed only cross-sectionally or longitudinally, then alternative explanations for age-related effects are possible (e.g., cohort effects or task learning). Here, we tested for developmental effects on the frequency and distribution of *and* usage in narratives produced by children who ranged in age from five to seven years old at the start of the study period and between seven and nine years old by the end – an age range during which significant changes in narrative structure are reported (e.g., Botvin & Sutton-Smith, 1977; Shapiro & Hudson, 1991). The narratives were elicited using Mercer Mayer's wordless picture books that depict different adventures of a frog. Thus, the results from the present study of *and* usage can be directly related to

and usage in other well-known Frog Story corpora, including the corpus that Berman and Slobin (1994) used in their classic study on narrative development.

Methods

Participants

Children

The ECSC was collected as part of a larger cross-sectional and 3-year longitudinal study on the acquisition of prosody. Storytelling was only one of several tasks children completed. Children were recruited via word-of-mouth and from local elementary schools in Eugene, Oregon and the surrounding areas. Recruitment in Year one began in October 2009 and continued through January 2010. Children who participated for all three years of the study returned every year within two weeks of the date when they had last participated. This means that children were on average exactly 12 months older in Year two of the study than in Year one, and were again on average exactly 12 months older in Year three of the study than in Year two.

The 60 children who provided stories for the present study were in kindergarten through second grade in Year one. Sixteen of the 60 children (12 male) were five years old ($M = 5;6$, $SD =$ three months), 19 of the children (six male) were six years old ($M = 6;6$, $SD =$ three months), and 25 of the children (10 male) were seven years olds ($M = 7;5$, $SD =$ three months). The majority came from households where the primary caregiver had at least a bachelor's degree ($N = 53$). The majority were also identified by caregivers as white only ($N = 44$), consistent with the demographics of the area. Sixteen of the children were identified as from one of several ethnic and/or racial minority groups ($N =$ eight) or as multi-racial ($N =$ eight). Most of the children were exposed only to English since birth ($N = 57$). All of the children were identified as typically developing native English speakers by their caregivers. Typical language development was confirmed using the Peabody Picture Vocabulary Test (PPVT-4; Dunn & Dunn, 2007) and two subtests from the Clinical Evaluation of Language Fundamentals (CELF-4; Semel, Wiig & Secord, 2003): recalling sentences (language production) and sentence structures (language comprehension). The children's mean age-standardized scores on these tests in the first year of study were 118.97 ($SD =$ 11.51) on the PPVT, 11.93 ($SD = 2.73$) on recalling sentences, and 11.80 ($SD = 2.23$) on sentence structure. These scores indicate that the children in the present study had above-average language skills: the standardized 50th percentile score is 100 on the PPVT and 10 on the CELF subtests.

Adults

Since traditional discourse analytic methods are time consuming, we crowd-sourced two different narrative judgment tasks to derive independent measures of narrative structure in the 180 stories that were the focus of the present study. Adult participants were part of the Amazon's Mechanical Turk (MTurk) community of "workers" who participate in "Human Intelligence Tasks" (HITs) for very minimal compensation. The minimal compensation makes it likely that these "workers" engage in the on-line tasks more as a hobby than as work per se. Participation in the current study was limited to "workers" from the USA or Canada who had completed at least 5000 previous HITs with an approval rate of at least 98%. Participants were paid a total of $0.85 at task completion. A total of 180 participants

https://doi.org/10.1017/S0305000920000197 Published online by Cambridge University Press

completed a narrative coherence judgment task, and 210 participants completed a narrative cohesiveness judgment task.

Materials

Spontaneous narratives were elicited using Mercer Mayer's frog story picture books: *A Boy, a Dog, and a Frog* (Mayer, 1967); *Frog, Where are You?* (Mayer, 1969); *Frog on His Own* (Mayer, 1973); *One Frog Too Many* (Mayer & Mayer, 1975). Each of these picture books depict the adventures of a frog in relation to other characters, including a boy who also appears in all four of the books used. To elicit natural storytelling, children told their story to an accompanying caregiver; caregivers told their story to the child in turn. The tellings were digitally audio-recorded for later transcription and coding using a wireless microphone attached to a hat or headband that the child and caregiver each wore.

Elicitations were structured as follows. First, the child and adult caregiver each chose a book on which to base their story. The choice tended to differ across years in the study: only 9% (N = six) of the children chose the same book across all three study years; 34% (N = 24) chose a different book every year; and, 57% (N = 40) chose the same book in two of the three study years. Once participants had chosen their books, the experimenter helped the child look through their choice, drawing the child's attention to particular events at predetermined locations in the book by asking several predetermined questions about events depicted on the pages. The goal was to help the child conceptualize a narrative. Following familiarization, either the child or caregiver told their story to the other, while paging through their book. The choice of who went first was left up to the participants. This resulted in storytelling sessions where 49% of the time the child told their story first. After a first round of storytelling was complete, another round of storytelling was initiated. The goal of story repetition was to minimize language planning and word-finding effects on the production of narrative prosody in the second elicitation (see Redford, 2013). In sum, each child (and caregiver) told the same story twice in a single study session, and children always had the example of an adult story (based on a different picture book) prior to the second telling of their own story. The focus of the current study is on narratives produced during the child's second telling only.

Procedures

Narrative coding

Each of the 180 child narratives elicited were first segmented into pause-delimited utterances by trained research assistants who followed the acoustic and temporal guidelines established in Redford (2013, pp. 573–74). After segmentation, utterances were orthographically transcribed and disfluencies identified. Disfluencies included filled pauses (e.g., "um"), word interruptions, repetition-restarts, and prolongations (Levelt, 1983). Unintelligible portions and sound effects were also marked. A senior research assistant reviewed all segmented and transcribed files for accuracy and consistency and made any adjustments necessary directly to the files.

Once transcribed, the text was extracted and segmented into individual clauses. Clauses were defined as "any unit containing a unified predication, whether in the form of a verb or adjective" (Berman & Slobin, 1994, p. 26). Note that pauses are not relevant to this definition and so the number of utterances, defined by pauses,

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was almost always different from the number of clauses. Consider, for example, the following text based on 30 seconds of a five-year-old boy's narrative, which has 12 utterances (pauses are indicated with forward slashes), six complete clauses (clause boundaries are indicated with square brackets), and one partial clause:

> … / [*his dog fell out*] / [*and they were calling*] / [*and then / they found a little / tree / with a bee thing*] / [*and then / his dog was barking at it*] [*then it went kersplat*] / [*and then / the little boy climbed a tree*] / [*and there was a / um / a* /…

In most cases, clausal segmentation was straightforward; however, additional criteria were required for utterances containing infinitives or quotations. Infinitives were treated as a predicate and the utterance segmented into two clauses when a noun phrase intervened between the conjugated verb and the infinitive (e.g., [*the little boy told the dog*] [*to go the opposite way*]). Otherwise, utterances with infinitives were treated as a single clause (e.g., [*and they're both trying to catch it*]). Quotations were treated as a stand-alone clause if the unit within the quote could be used as such (e.g., [*and the others just said*] [*"don't do that frog"*]). Otherwise, the quotation was considered to be the object of the preceding verb (e.g., [*and he says "shh" to the dog*]).

Unintelligible utterances and sound effects were treated as separate clausal units when they were not clearly a constituent of another clause (e.g., [*and then he was standing on a rock*] [*(unintelligible)*] [*and then under that rock was a deer*] versus [*and then he just (unintelligible) holded on*]).

Narrative structure judgment tasks

The texts were stripped of all boundary marking (i.e., pause or clause boundaries) and presented to a restricted subset of adult participants from the MTurk worker community via the MTurk user interface. The participants completed one of two judgment tasks: a coherence judgment task and a cohesiveness judgment task. These tasks were used to establish independent measures of narrative coherence and cohesiveness, respectively.

In the NARRATIVE COHERENCE JUDGMENT task, each adult participant rated 10 randomly-selected narratives for goodness, organization, and inventiveness in random order (see Appendix A). The assumption was that coherent narratives are good narratives because they are inventive while also being conceptually clear and organized according to larger themes. Goodness was anchored from Poor (= 1) to Very Good (= 5), inventiveness from Boring (= 1) to Very Inventive (= 5), and organization from Incoherent (= 1) to Well-Structured (= 5). Higher scores thus represented better narratives. Note that the three rating dimensions we adopted correspond well with the dimensions used to evaluate narrative coherence of picture-elicited stories in the Test of Narrative Language (Gillam & Pearson, 2004), which was designed for clinical purposes but also "to measure narrative language in research studies" (pp. 8–9).

In the COHESIVENESS JUDGMENT TASK, adults made judgments based on adjacent clauses (see Appendix B). Task length was limited to approximately 200 clause pairs (M = 203.8), which means that each participant judged a random selection of either three or four narratives. Clause pairs were presented in the order in which they occurred within the narrative, such that clauses one and two of a narrative appeared on the screen, followed by clauses two and three, and then clauses three and four, and so

https://doi.org/10.1017/S0305000920000197 Published online by Cambridge University Press

on. After reading each clause pair, the participant judged whether the pair represented separate events or went together as part of a single event. The assumption was that lay readers can reliably assess the conceptual relatedness of events relayed in text. Judgments were not recorded for clause pairs where one side of the pair was something other than a clause (e.g., a sound effect). Five participants judged all clause pairs in every narrative. A technical error resulted in the loss of judgments for three narratives produced by three different children in two different study years (one from Year one; and two from Year three), so the measure of narrative cohesion was calculated for 177 narratives.

Measures

Clause-initial AND usage

Raw counts of clause-initial *and*, all *and*s, and clauses were extracted from each of the narrative texts. These counts allowed us to compute two normalized measures of *and* usage: the proportion of clause-initial *and* to all *and*s (= PAA); and the proportion of clause-initial *and* to all clauses in a narrative (= proportion of all clauses or PAC). The PAA measure characterized the overall use of *and* in a narrative; specifically, the degree to which *and* was used to connect clauses (for clause-chaining or coordination) versus the degree to which it was used to connect other units (e.g., two nouns or two verbs). The PAC measure characterized the pervasiveness of event-chaining as a narrative strategy.

In addition, the number of dependent *and*-connected clauses was counted in each narrative text, where dependent *and*-connected clauses were defined as *and*-initial clauses with no overt subject. The goal was to further characterize the function of clause-initial *and*. When *and* connects two independent clauses it serves a discourse marking function; when it connects an independent and dependent clause, it serves a coordinating function. The number of dependent *and*-connected clauses was divided by the total number of clause-initial *and*s (= DAC) to provide a third normalized measure of clause-initial *and* usage.

Language complexity

The mean length of utterance (MLU) and mean length of clause (MLC) in a narrative were also computed to characterize language complexity independently of narrative structure. MLU is a familiar measure of language complexity, first introduced by Brown (1973). It was calculated here as the number of words in a narrative divided by the number of pause-delimited utterances in that narrative. Disfluent word productions were excluded from the calculation. Note that although MLU is more typically based on morpheme counts rather than word counts, we used word counts because English has minimal inflectional morphology and the most frequent verbal forms are irregular and so monomorphemes (e.g., *was*, *had*, *said*, *ran*). Also, comparative studies in English have found very high correlations between morpheme-based and word-based MLUs (e.g., Parker & Brorson, 2005).

Although MLU indexes grammatical development in young children, its usefulness in characterizing older children's language has been questioned (Klee & Fitzgerald, 1985; Frizelle *et al.*, 2018). For this reason, we also calculated the MLC for each narrative by dividing the total number of words in a narrative by the number of clauses in that narrative. Again, disfluent word productions were excluded from the calculation. Although the MLC measure is new to studies of first language

https://doi.org/10.1017/S0305000920000197 Published online by Cambridge University Press

acquisition, its use has been validated elsewhere (e.g., Frizelle *et al.*, 2018). It also clearly captures information about language development that is different from the MLU given the different definitions of utterances and clauses in the present study. This assertion can be checked with reference to the example text under *Procedures* above.

Narrative structure judgments

The COHERENCE MEASURE of narrative goodness, organization, and inventiveness was calculated as the average rating obtained per narrative.The COHESIVENESS MEASURE was calculated as the average judgment per clause pair, where a judgment of "separate" was given a value of 0 and a judgment of "together" was given a value of 1. To estimate measurement validity, the mean crowd-sourced coherence and cohesiveness measures were evaluated for a subset of narratives against categorical scores obtained using the standardized coherence and cohesiveness criteria set out in the Test of Narrative Language (TNL; Gillam & Pearson, 2004) for oral narration.

First, narratives were rank ordered according to their mean coherence or cohesiveness scores to identify the 10 highest and 10 lowest scoring narratives. Then, for COHERENCE MEASURE validation, audio versions of the 20 lowest and highest coherence scoring narratives were identified, collated, and presented in random order to a clinically certified speech-language pathologist (CCC-SLP) who was naïve to the aims of the study. The SLP scored the stories with reference to the general (as opposed to picture-specific) criteria for overall story coherence in the TNL (Gillam & Pearson, 2004: 19–20); specifically, criterion 23 (= "the story makes sense…each statement relates to the story as a whole") and criterion 24 (= "the story is complete, creative, and well-organized"). TNL scoring is categorical with specific examples provided for the SLP to distinguish between a low (0), medium (1), or high (2) score for a given criteria. Non-parameteric chi-square tests indicated that the SLP easily distinguished the 10 highest from the 10 lowest ranked narratives according to the TNL narrative coherence criteria: #23, $\chi 2(1) = 12.93$, $p < .001$; #24, $\chi 2(2) = 17.33$, $p < .001$.

COHESIVENESS SCORES were similarly evaluated using the standardized TNL criteria to estimate event cohesion (Gillam & Pearson, 2004: 18–19); specifically, criterion 19 (= "temporal relationships between events") and criterion 20 (="uses causal terms (*because*, *since*, *so*, *therefore*, etc.) to indicate that one action caused something to happen"). Since the categorical scoring for these criteria is based on specific language use (e.g., use of adverbial phrases to indicate a temporal relationship = 2), we simply analyzed the text of the 20 narratives for the required language. Not surprisingly, almost all children were found to use "and" or "then" in their stories (= 1). A number of children also used the adverbial "when" (= 2). Thus, the TNL scores based on criterion 19 were not highly differentiating: stories ranked low in cohesiveness received a mean TNL score of 1.2; stories ranked high in cohesiveness received a mean TNL score of 1.6. The use of causal terms (criterion 20) was more differentiating: stories ranked low in cohesiveness received a mean TNL score of 0.6; stories ranked high in cohesiveness received a mean TNL score of 1.5. Despite the group difference, the chi-square test was not significant [$\chi^2(2) = 2.43$, $p = .297$]. This is because the specific terms referenced in the TNL instructions were used relatively rarely overall. The cohesiveness scores used in the present analyses should therefore be interpreted strictly as the dominant response to the instructions given in Appendix B, which are not necessarily in line with the notion of event cohesiveness as standardized in the TNL.

https://doi.org/10.1017/S0305000920000197 Published online by Cambridge University Press

Statistical analyses

Hierarchical linear regression modeling in R software (R Core Team, 2017) was used to test for effects of (1) children's age-in-months at study outset (i.e., cross-sectional age), (2) study year (i.e., chronological time), and (3) the interaction between age-in-months and study year on the dependent variables. Multiple linear regression was used to investigate whether separate measures of language complexity and narrative structure predicted clause-initial *and* usage within narratives in models that controlled for cross-sectional and longitudinal age.

In the hierarchical linear regression analyses, the effects of study year and its interaction with age-in-months was assessed through model comparison. More specifically, the base model for each dependent variable included age-in-months at study outset as the sole predictor. The full model added study year as an additional hierarchical predictor. An interaction model was then constructed by adding the interaction between age-in-months and study year to the full model. The *F*-statistic of the base model provided the effect of age-in-months. The effects of study year and its interaction with age-in-months were assessed by comparing the full model to the base model and the interaction model to the full model, respectively, using one-way ANOVA analyses. The interaction term was not found to be a significant predictor in any of the analyses. The results reported below therefore refer only to the contributions of the main effects of cross-sectional age and study year. Cohen's f^2 is reported as a measure of effect size for all statistically significant effects.

Although cross-sectional age was treated as a continuous variable in all analyses, we simplify discussion and depiction of this effect by grouping narratives across study year based on children's age in the first year of study: narratives produced by the 20 youngest children (13 male), who ranged in age from 5;2 and 6;3 years old ($M = 5;8$, $SD = 4$ months); narratives produced by the 20 oldest children (seven male), who ranged in age from 7;3 and 7;10 years old ($M = 7;7$, $SD = 2$ months); and, narratives from the remaining 20 children (eight male), who ranged from 6;3 and 7;2 years old ($M = 6;9$, $SD = 3$ months)[1]. Narratives are referred to in the figures below as produced by children in the Y, O, and B age groups, respectively.

Results

Recall that the overall study goal was to test the working hypothesis that children's use of clause-initial *and* indexes an event-chaining narrative strategy. The specific aims were to test predictions that arise from the working hypothesis against the alternative hypothesis that children's use of clause-initial *and* tracks the development of language complexity. The results detailed below provide more support for the alternative hypothesis than the working hypothesis.

Clause-initial AND use

The first set of analyses tested for developmental effects on the proportion of clause-initial *and*s to all *and*s in a narrative (PAA), the proportion of clause-initial *and*s to all clauses in a narrative (PAC), and the proportion of clause-initial *and*s that conjoined an independent and dependent clause (DAC). The hierarchical linear

[1]Narratives produced by one of the two children who were aged 6;3 in Year 1 were assigned to to the Y group; the others were assigned to the B group.

https://doi.org/10.1017/S0305000920000197 Published online by Cambridge University Press

Table 1. The mean and standard deviation (in parentheses) of clause-initial *and* measures (PAA = clause-initial *and* as a proportion of all *and*s; PAC = clause-initial *and* as a proportion of all clauses; DAC = dependent *and*-initial clauses) are given as a function of children's cross-sectional age (Y = youngest, B = in-between, O = oldest) and study year.

	Year 1			Year 2			Year 3		
AND usage	Y	B	O	Y	B	O	Y	B	O
PAA	.76 (.25)	.79 (.12)	.75 (.12)	.81 (.13)	.70 (.13)	.76 (.13)	.77 (.15)	.72 (.12)	.73 (.14)
PAC	.46 (.28)	.43 (.15)	.36 (.24)	.40 (.20)	.32 (.18)	.39 (.20)	.38 (.20)	.29 (.12)	.43 (.18)
DAC	.07 (.06)	.15 (.14)	.17 (.12)	.18 (.25)	.25 (.20)	.26 (.23)	.22 (.15)	.23 (.18)	.24 (.15)

regression analyses indicated that the overall use of *and* in clause-initial position (PAA) and the relative frequency of clause-initial *and*s (PAC) did not vary systematically with cross-sectional or longitudinal age. Table 1 shows the mean PAA, PAC, and DAC by children's age group within study year. Interestingly, the PAA data suggest that school-age children mainly use *and* to connect clauses: only about 25% of all *and*s in the narratives ($N = 1004$) coordinated constituents below the level of the clause. The descriptive data also suggest a year-on-year decrease in PAC, limited to narratives produced by younger children. And, in fact, when the analyses were rerun on PAC values associated with narratives produced by the youngest 40 children in the sample ($N = 120$ narratives), the finding was a significant effect of study year on PAC, $F(1,117) = 5.90$, $p = .02$, Cohen's $f^2 = .22$, though not of cross-sectional age.

In contrast to the analyses on PAA and PAC, the analyses on DAC indicated effects of both cross-sectional and longitudinal age [age-in-months, $F(1,173) = 4.98$, $p = .03$, Cohen's $f^2 = .17$; study year, $F(1,172) = 9.62$, $p < .01$, Cohen's $f^2 = .24$]. The effect of cross-sectional age can be seen in Figure 1. Narratives produced by the youngest 20 children (Y) had the lowest proportion of dependent *and*-connected clauses, followed by narratives produced by oldest 20 children (O). This effect is most evident in the Year one data, when children were between five and seven years old. The figure suggests that longitudinal increases in the production of dependent *and*-connected clauses was especially marked between Year one and Year two of the study.

In sum, the PAA data show that school-age children mainly use *and* in clause-initial position to combine events; the PAC results provide some support for the predicted developmental decrease in the relative frequency of clause-initial *and;* and the reliable developmental increase in DAC suggests that the function of clause-initial *and* changes over time.

Language and narrative development

The next set of analyses tested for the developmental effects on the measures of language complexity and narrative structure that are suggested by the descriptive data presented in Table 2.

Hierarchical linear regression analyses on MLU indicated effects of cross-sectional age, $F(1,178) = 10.59$, $p < .01$, Cohen's $f^2 = .06$, and study year, $F(1, 177) = 10.50$,

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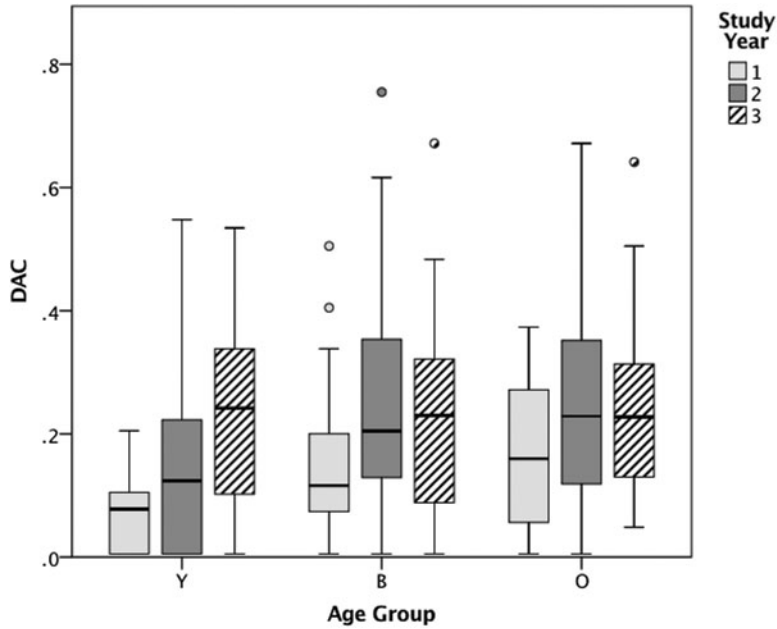

Figure 1. The relative frequency of dependent *and*-connected clauses (DAC) is shown as a function of children's cross-sectional age (Y = youngest, B = in-between, O = oldest) and study year. The measure is the number of dependent clauses with initial *and* in a narrative divided by the total number of clauses with initial *and* in that narrative.

Table 2. The mean and standard deviation (in parentheses) of narrative duration and number of words, utterances, and clauses per narrative are shown as a function of cross-sectional age (Y = youngest, B = in-between, O = oldest) and study year.

	Year 1			Year 2			Year 3		
Narrative	Y	B	O	Y	B	O	Y	B	O
Duration (sec.)	150.16 (64.32)	156.99 (67.07)	168.03 (78.49)	140.85 (43.92)	183 (63.48)	227.71 (126.8)	154.2 (48.12)	173.01 (68.31)	166.93 (71.53)
Words (*N*)	220.5 (131)	250.55 (91.8)	273.85 (141)	233.95 (87)	341.45 (112.5)	385.80 (205.8)	258.90 (92.2)	338.30 (151.1)	318.45 (106.8)
Utterances (*N*)	67.4 (28.93)	68.75 (32.81)	71.8 (48.79)	61.55 (21.9)	83.4 (35.01)	101.45 (70.5)	69.1 (26.46)	77.9 (34.09)	75.25 (38.82)
Clauses (*N*)	36.55 (17.85)	41 (12.51)	45.95 (22.74)	42.65 (13.8)	57.45 (18.36)	63.4 (32.46)	43.2 (13.45)	56.45 (24.12)	48.95 (13.75)

$p < .01$, Cohen's $f^2 = .06$ (see Figure 2). The effect of cross-sectional age on MLC was also significant, $F(1,178) = 9.37$, $p < .01$, Cohen's $f^2 = .05$ (see Figure 3). A longitudinal effect on MLC was only significant in analyses split by age group, and then only for narratives produced by the oldest group of children, $F(1,58) = 7.41$, $p < .01$, Cohen's $f^2 = .12$.

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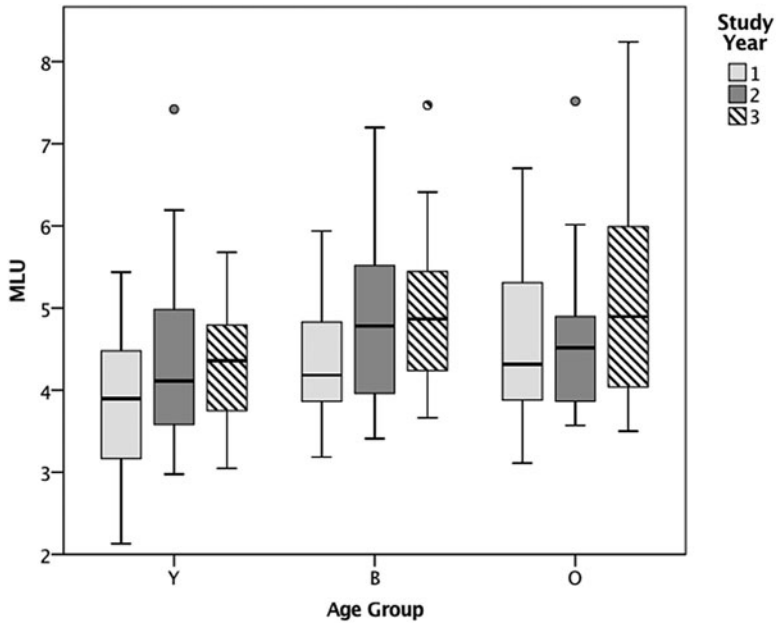

Figure 2. The mean length of utterances (MLU) in a narrative is shown as a function of children's cross-sectional age (Y = youngest, B = in-between, O = oldest) and study year.

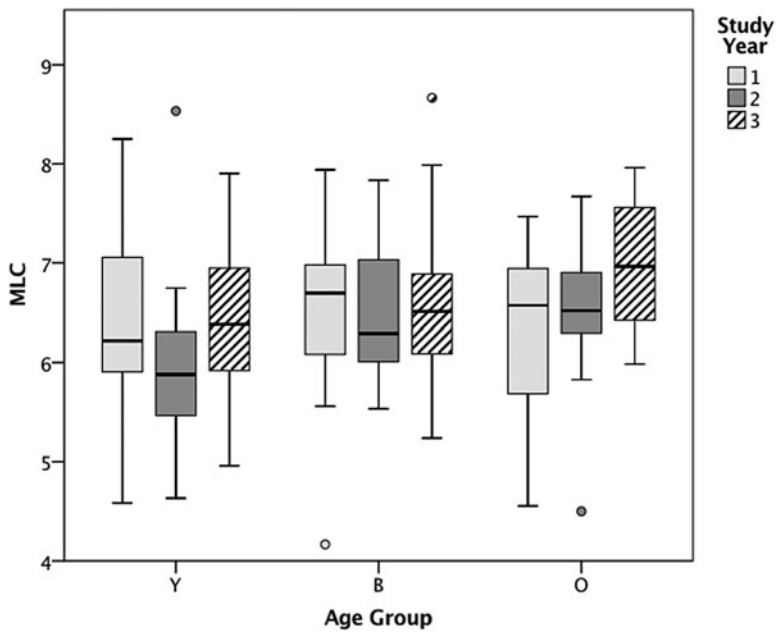

Figure 3. The mean length of clauses (MLC) in a narrative is shown as a function of children's cross-sectional age (Y = youngest, B = in-between, O = oldest) and study year.

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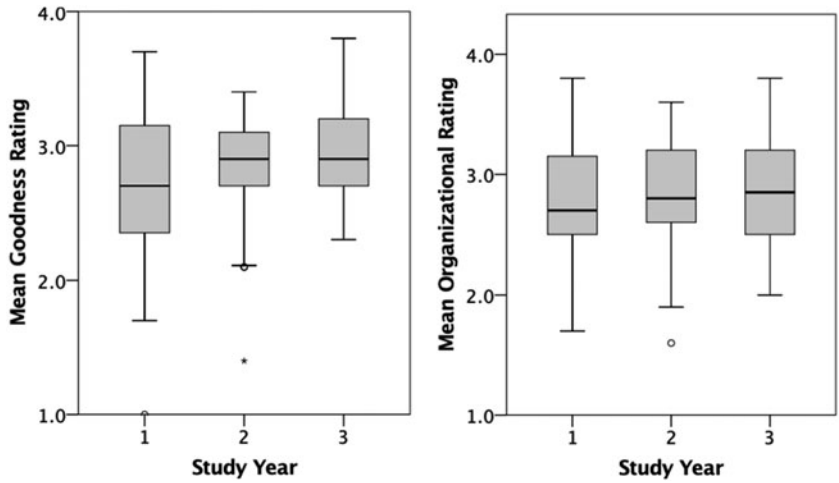

Figure 4. Goodness, organization, and inventiveness ratings on children's narratives were averaged across adult judges. The mean ratings, an index of narrative coherence, increase by study year.

As for narrative structure, results from the analyses indicated a significant effect of study year on goodness and inventiveness ratings (see Figure 4): goodness, $F(1, 177) = 11.15$, $p < .01$, Cohen's $f^2 = .25$; inventiveness, $F(1, 177) = 10.60$, $p < .01$, Cohen's $f^2 = .24$; but not of cross-sectional age. Neither the effect of study year nor cross-sectional age reached significance on ratings of overall narrative organization, but the trend by study year was there, $F(1, 177) = 2.79$, $p = .10$, Cohen's $f^2 = .12$, and in the same positive direction as the goodness and inventiveness ratings.

Hierarchical linear regression analyses on cohesiveness provided stronger evidence of narrative development. The proportion of clause pairs in a narrative that were judged as conveying separate thoughts or concepts varied significantly with cross-sectional age, $F(1, 175) = 31.11$, $p < .01$, Cohen's $f^2 = .18$, and with study year $F(1, 174) = 5.81$, $p = .02$, Cohen's $f^2 = .03$. These results are shown in Figure 5.

Overall, the results on our measures of language complexity and narrative structure showed the expected increases as a function of children's age. Next, we test whether these measures independently predict clause-initial *and* usage in children's narratives.

Predicting clause-initial AND usage

The working hypothesis predicts an inverse relationship between narrative structure and clause-initial *and* usage. The alternative hypothesis predicts an inverse relationship between language complexity and clause-initial *and* usage. These predictions, which assume that either narrative structure or language complexity will explain a greater degree of variance in clause-initial *and* usage than age alone, were tested using multiple linear regression.

Mean goodness, inventiveness, and organization ratings were averaged to provide a single measure of narrative coherence. This measure was entered with the cohesiveness measure into the model alongside the two measures of language complexity (MLU and MLC). The narrator's absolute age (age-in-months at the time of storytelling) was

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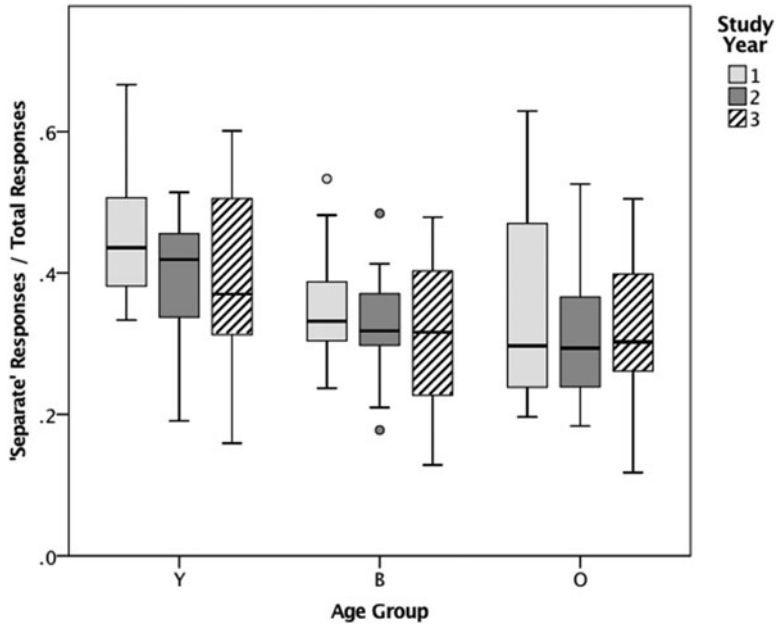

Figure 5. The proportion of 'separate' judgments for each narrative was divided by the total number of judgments for that narrative. This measure, an index of (in)cohesiveness, declines as a function of children's cross-sectional age (Y = youngest, B = in-between, O = oldest) and study year.

entered to control for developmental effects unrelated to the narrative structure and language complexity effects of interest.

Results from the full model were that the multiple predictor variables together accounted for only 3% of PAA variance, which was not significantly different from the null model. In contrast, the full model explained 18% of PAC variance and 13% of DAC variance. These models were significantly different from the null model (PAC: $F(5,171) = 7.43$, $p < .001$; DAC: $F(5,166) = 4.92$, $p < .001$). The coefficient values are shown for the PAA, PAC, and DAC models in Tables 3, 4, and 5, respectively.

Tables 4 and 5 indicate that a narrator's absolute age was a significant predictor of PAC and DAC. The sign of the coefficient values provides further evidence for a developmental decrease in the overall use of clause-initial *and* together with a developmental increase in its use to conjoin main and dependent clauses.

Tables 4 and 5 also show a significant relationship between MLC and *and* usage, but the direction of the relationship was unexpected: clause length was positively correlated with PAC (Table 4) and negatively correlated with DAC (Table 5). The straight bivariate correlations between MLC and PAC were also significantly and positively correlated, $r(180) = .361$, $p < .001$. The direction of these relationships are opposite of what might be expected under the assumption that clause length reflects syntactic complexity. We return to this point in the general discussion.

Overall, the multiple regression results suggest that clause-initial *and* usage varies directly with language complexity, but not with narrative structure. MLC is a significant predictor of *and* usage even after the variance due to a narrator's

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Table 3. Full model results for the proportion of clause-initial *and*s to the total number of *and*s (PAA) in a narrative.

	Estimate	Std. Error	*t* value	*p*
Absolute Age	−0.001585	0.000841	−1.885	.06
Coherence	−0.002068	0.029060	−0.071	.94
Cohesiveness	0.006232	0.109499	0.057	.95
MLU	0.011689	0.010762	1.086	.28
MLC	−0.028327	0.014470	−1.958	.05

Table 4. Full model results for the proportion of clauses with initial *and*s to total clauses (PAC) in a narrative.

	Estimate	Std. Error	*t* value	*p*
Absolute Age	−0.003379	0.001180	−2.862	<.01**
Coherence	0.021096	0.040782	0.517	.60
Cohesiveness	−0.030664	0.153664	−0.200	.84
MLU	0.009313	0.015103	0.617	.54
MLC	0.079138	0.020307	3.897	<.001***

Table 5. Full model results for the proportion of dependent *and*-connected clauses to total *and*-initial clauses (DAC) in a narrative.

	Estimate	Std. Error	*t* value	*p*
Absolute Age	0.003780	0.001075	3.515	<.001***
Coherence	0.067039	0.037148	1.805	.07
Cohesiveness	−0.046166	0.013757	−0.330	.74
MLU	0.003101	0.013757	0.225	.82
MLC	−0.045194	0.018497	−2.443	.01*

age is accounted for. The unexpected direction of the effect of MLC on *and* usage invites further consideration of how clause-initial *and* may function in children's narratives.

General discussion

The present study was designed to assess whether clause-initial *and* usage tracks the development of narrative structure in a corpus of children's narratives. The working hypothesis was that children's high frequency use of *and* during storytelling indexes an event-chaining narrative strategy. The results undermined this hypothesis and so discredit the idea of using clause-initial *and* to study the development of narrative

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structure in large corpora. Instead, the results suggest that developmentally-related changes in the use of clause-initial *and* track developmental increases in language complexity. The relationship between clause-initial *and* usage and language complexity may in turn imply that an event-chaining narrative strategy is as much an emergent feature of linguistic development as it is a feature of conceptual development.

AND usage and language development

The descriptive data from the present study confirms that school-aged children very often use *and* to connect clauses. In fact, a third of all clauses in a narrative were introduced with *and*. Also, only 25% of all *and*s produced were used to conjoin phrases below the level of the clause. It is exactly this high frequency use of *and* to connect clauses that led us to investigate *and* usage as a possible marker of narrative development. But, even though the frequency of clause-initial *and* usage in narratives varied systematically with the narrator's age, and even though narrative coherence/cohesiveness also increased with age, only mean clause length was systematically related to clause-initial *and* usage. Thus, we conclude that age-related variability in *and* usage depends mainly on the development of language abilities. The significant effect of age and study year on the proportion of dependent *and*-initial clauses (DAC) is also consistent with this conclusion: the youngest group of speakers produced narratives with the fewest dependent *and*-connected clauses, followed by the in-between group and then the oldest group.

Although we computed DAC to capture changes in anaphoric reference related to conceptual development (Karmiloff-Smith, 1985), the emergence of zero anaphora is also tied to complex sentence structure that emerges relatively late in acquisition (Bowerman, 1979; Diessel & Tomasello, 2000). As with the relative frequency of clause-initial *and*, only MLC predicted variance in DAC; our measures of narrative structure did not. In this way, the results on the coordinating conjunctive use of *and* combine with the results on the relative frequency of clause-initial *and* to suggest that age-related differences in the use of *and* as a connecting device correspond more strongly with the development of language than with the development of narrative structure.

On the other hand, the direction of the correlation between MLC and the measures of *and* usage was unexpected. As noted, the relative frequency of clause-initial *and* (PAC) generally decreased with age while the use of *and* to connect a dependent and independent clause (DAC) generally increased with age. MLC also increased with age. Despite this, the multiple regression analyses indicated that MLC was positively correlated with PAC and negatively correlated with DAC. Whereas an inverse correlation between MLC and DAC may simply signal that multi-clausal sentences are comprised of shorter clauses on average than monoclausal sentences, the positive correlation between MLC and PAC is more difficult to interpret. Our best speculation is that children who frequently use *and* to introduce clauses also use *and* in more sophisticated ways than children who less frequently use *and* to introduce clauses. This speculation follows from work by Sanders and colleagues (see Sanders *et al*., 1992, 1993; Spooren & Sanders, 2008) who describe a broad range of conceptual uses of *and* in narratives (but see Peterson & McCabe, 1987). In particular, Sanders and colleagues note that, in the earliest stages of discourse development, children rely most heavily on conceptually simple additive and

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temporal connectives yielding event chains. Such use is illustrated in an excerpt taken from a narrative produced by a child in our youngest age group:

> [*and he looked behind a tree*] [*and he found a lilypad with a frog on it*] [*and he sees a frog*] [*and he runs to get it*] [*and he falls in the water upside-down*] [*and the doggie does*] [*and he comes back up with a bucket on his head*][*and he catches it*]

More conceptually and syntactically complex uses of *and* emerge later in development. Consider the following excerpt taken from a narrative produced by a child in our oldest age group:

> [*then the frog got out of the pond*] [*and looked at a woman with a baby stroller and a cat*] [*then he sprang into the stroller*] [*and the baby saw him*]

Here, the child uses *and* to connect two of four clauses in the excerpt, but, in the first clause pair, sequential actions by a single actor are syntactically combined. In the second clause pair, *and* is used to express an implicational relationship between the clauses: the preceding event clearly causes the subsequent one. The excerpt also demonstrates the use of *then* rather than *and* to express temporal relations. Thus, a more qualitative, theory-driven analysis of *and* usage in the ECSC would likely reveal developmental changes that are not apparent in the quantitative analysis we have provided herein.

In addition to highlighting the inherent limitation of a corpus-base approach for studying language use, the likely evolution of *and* usage over developmental time also suggests that language development is tightly intertwined with the development of narrative coherence and cohesion, which is often taken to signal conceptual development. This means that the implicit assumption of the present study, that *and* usage is driven EITHER by conceptual development (i.e., working hypothesis) OR by language abilities (i.e., alternative hypothesis), is itself limited and limiting. For example, it could be that the acquisition of complex syntax, which helps drive the emergence of hierarchical narrative structure through cohesion, could also help drive conceptual development. This possibility extends an idea from the work on word learning where it has been suggested that vocabulary acquisition is as likely to increase a child's conceptual space as it is to result from gains in conceptual development (Gopnik, 2001).

Of course, age-related changes in narrative structure and language may also reflect processing changes, further complicating efforts to understand the factors that shape children's use of a particular linguistic variable like *and*. For example, working memory has been implicated in the development of complex syntax (see e.g., Acheson & MacDonald, 2009; Adams & Gathercole, 1995, 2000; Ellis & Sinclair, 1996). It is also clearly important for tracking multiple referents across protracted stretches of discourse, which is relevant to the emergence of hierarchical narrative structure. Thus, it could be that working memory limitations account for why young children prefer conceptually simple uses of *and* in narratives even though they are reported to use *and* to express more conceptually complex relations during spontaneous speech (Spooren & Sanders, 2008).

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Cross-sectional versus longitudinal study

Though limited in some ways, the present study clearly demonstrates the strength of an approach that combines cross-sectional and longitudinal data for analysis of developmental patterns and thus the importance of corpora like the ECSC for developmental research. In particular, the results reported herein show that cross-sectional effects can emerge absent longitudinal ones and vice versa. Whereas it is common knowledge that cross-sectional effects can emerge from uncontrolled (i.e., non-developmental) differences in population samples, this knowledge is rarely demonstrated in the interpretation of study findings based on cross-sectional data. Instead, such findings are interpreted within a developmental framework. The validity of this interpretation is then left up to the field to determine through replication. A combined approach does not have this weakness. When a cross-sectional effect is also evident in the longitudinal data, a developmental interpretation of the effect is validated within a single study.

Longitudinal studies are, of course, more difficult to complete than cross-sectional ones. It is perhaps for this reason that longitudinal studies have a privileged status in the developmental literature. But absent cross-sectional information, it is also not certain that longitudinal data are the same as developmental data. Children may simply get better at certain assessment tasks, or, in the case of the present study, a specific storytelling task, with repeated exposure to the task itself. This type of learning is interesting and important, but it does not necessarily provide the kind of general developmental insights we seek.

In sum, even though most of what we know of language development is drawn from studies that use either cross-sectional or (much less frequently) longitudinal data, results from the present study remind us of the limitations of this approach. Given the difficulty of collecting a substantial amount of cross-sectional and longitudinal data for study, it is our hope that other researchers might benefit from the cross-sectional and longitudinal corpus of narratives we have analyzed in the present study. Accordingly, the audio recordings and transcripts of the 180 stories studied herein have been made available to the larger research community through CHILDES (MacWhinney, 2000).

Conclusion

Children's extensive use of clause-initial *and*s to advance narratives is likely tied to language abilities. Children may rely heavily on clause-initial *and* in narrative language simply because they have a limited productive vocabulary and so cannot easily access adverbials that convey more specific relations between events. At the same time, children's preferential use of clause-initial *and* to combine independent clauses rather than main and dependent clauses, even in circumstances where the subject is the topic of two predicates, may signal limited syntactic abilities. Of course, language abilities are correlated with narrative structure in that both change over developmental time. At this juncture, though, it is unclear how the two are related. Overall, the current study results may caution against casual inferences about children's conceptual development based on their narrative language. Of course, this is not to imply that a corpus-based approach to the study of narrative language development is entirely without merit. Such analyses could still prove useful in at least identifying the points at which narrative language development occurs, which in turn would lend itself to more detailed analyses of what actually changes and why.

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Acknowledgements. This research was supported by the Eunice Kennedy Shriver National Institute of Child Health & Human Development (NICHD) under grants R01HD061458 (PI: Redford) and R01HD087452 (PI: Redford). The content is solely the authors' responsibility and does not necessarily reflect the views of NICHD.

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Appendix A: Instructions for Narrative Coherence Task

Below you will be shown transcripts from people telling a short story. Your task will be to read each story and then rate them according to 3 different criteria: Goodness, Creativity, and Structure. We will ask you to rate 10 of these stories in total. The stories are transcripts of real speech. Only words were transcribed. There is no punctuation. The transcripts will also sometimes include special symbols such as % and $. You should try your best to ignore these symbols and just focus on the meanings of the words.

For each of the 3 rating criteria, you will be asked to judge the stories on a 5-point scale. The first criterion is Goodness, and you will choose a 1 for "Poor" story quality, a 5 for "Very Good" story quality, or any number in between on the scale. The second criterion is Creativity, with 1 meaning the story was "Boring" and 5 meaning it was "Very Inventive". The third criterion is Structure, with 1 meaning the story was "Incoherent" and 5 meaning it was "Well-Structured".

Appendix B: Instructions for Clausal Cohesiveness Task

Below you will be shown approximately 200 pairs of word strings taken from transcriptions of people telling a story. You will be asked to classify them as either belonging Together or as being Separate. If it seems to you that these strings could go together in the order presented as part of a single thought or concept, then you should select the "Together" option. Otherwise, if it seems to you that these strings belong to separate thoughts or concepts, then you should select the "Separate" option.

It is important to note that the 2 strings together do NOT necessarily need to form a complete sentence in order to be classified as "Together".

The strings were taken from transcriptions of natural speech, and you will occasionally also see some non-word symbols such as %. Ignore these as best you can, and just try to focus on the meaning of the words that are present.

Cite this article: Kallay JE, Redford MA (2021). Clause-initial AND usage in a cross-sectional and longitudinal corpus of school-age children's narratives. *Journal of Child Language* **48**, 88–109. https://doi.org/10.1017/S0305000920000197