Personal narrative as a 'breeding ground' for higher-order thinking talk in early parent-child interactions

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Abstract

Personal narrative is decontextualized talk where individuals recount stories of personal experiences about past or future events. As an everyday discursive speech type, narrative potentially invites parents and children to explicitly link together, generalize from, and make inferences about representations—i.e., to engage in higher-order thinking talk (HOTT). Here we ask whether narratives in early parent-child interactions include proportionally more HOTT than other forms of everyday home language. Sixty-four children (31 girls; 36 White, 14 Black, 8 Hispanic, 6 mixed/other race) and their primary caregiver(s) (M_{income} = \$61,000) were recorded in 90-minute spontaneous home interactions every 4 months from 14–58 months. Speech was transcribed and coded for narrative and HOTT. We found that parents at all visits and children after 38 months used more HOTT in narrative than non-narrative, and more HOTT than expected by chance. At 38- and 50-months, we examined HOTT in a related but distinct form of decontextualized talk—pretend, or talk during imaginary episodes of interaction—as a control to test whether other forms of decontextualized talk also relate to HOTT. While pretend contained more HOTT than other (non-narrative/non-pretend) talk, it generally contained less HOTT than narrative. Additionally, unlike HOTT during narrative, the amount of HOTT during pretend did not exceed the amount expected by chance, suggesting narrative serves as a particularly rich 'breeding ground' for HOTT in parent-child interactions. These findings provide insight into the nature of narrative discourse, and suggest narrative potentially may be used as a lever to increase children's higher-order thinking.

Keywords: personal narrative, higher-order thinking, reasoning development, pretend, language socialization, naturalistic observation

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A wide body of research implicates the language interactions children have in the early home environment as a source of individual variation in their later academic outcomes. Much of the previous research on children's early language environments has focused on support for vocabulary and other linguistic skills (e.g., Hart & Risley, 1995; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991; Rowe & Goldin-Meadow, 2009). However, in order to succeed in school, children also need to know how to use language to link ideas together and support complex thought. In other words, they must be able to use their language for *higher-order thinking*.

Higher-order thinking is the cognitive capacity to make inferences and generalizations, use classifications and taxonomies, and broadly go beyond the information given (Bruner, 1973; Resnick, 1987). Higher-order thinking has been increasingly recognized as crucial for academic and employment success in the 21st century (Koenig, 2015; National Research Council, 2012). Previous research suggests that early participation in talk about and with relations—*higher-order thinking talk,* or HOTT—can help prepare children for the kinds of higher-order thinking skills they are expected to use in school (Frausel, et al., 2020). Understanding the contexts in which HOTT is routinely used by parents and children may help us understand how to support the development of higher-order thinking skills, and how to decrease disparities in these skills and academic outcomes.

In this paper, we ask whether parents and children are particularly likely to use HOTT in their personal narratives. For comparison, we also examine HOTT in a similar but distinct form of talk, *pretend*, to clarify the aspects of everyday talk that encourage parents and children to use

HOTT, and to determine whether other forms of decontextualized discourse are equally likely to support HOTT. Personal narrative and pretend share many theoretical similarities in that both require speakers to use their imagination and memory to think about ideas outside the present context. However, narrative and pretend potentially differ in their affordances for higher-order thinking, particularly regarding their relation to the speaker's environment. In this study, we examine rates of HOTT use in narrative and non-narrative contexts in spontaneous parent-child interactions, recorded every 4 months between 14- and 58-months. At 38- and 50-months, we also examined HOTT use in pretend. These analyses offer an in-depth understanding of the conditions under which HOTT is used by parents and children in everyday home environments.

Importance of Decontextualized Talk in Early Parent-Child Interactions

To clarify our definitions, we focus specifically on *personal* narrative, operationalized as talk in which individuals recount stories of personal experience about past, future, or recurring events. Our control, pretend, is operationalized as talk during imaginary episodes of interaction (e.g., Demir, Rowe, Heller, Goldin-Meadow, & Levine, 2015; Rowe, 2012). Narrative and pretend are often both positioned in the literature as types of *decontextualized talk*, or talk that is not grounded in the present or immediate context (Rowe, 2013; Snow & Ninio, 1986; Tabors, Snow, & Dickinson, 2001). Personal narrative is decontextualized because it involves describing internal representations of events—memories of past events, plans for the future, or generalized routines—rather than the current or present context, and has been implicated in the development of children's memories (Valentino, Nuttall, Comas, McDonnell, Piper, Thomas, & Fanuele, 2014). Pretend is decontextualized because it treats the current environment in a non-literal way (e.g., by pretending a banana is a phone).

Our focus here is on narrative. We use pretend as an important comparative context, and we acknowledge that other types of decontextualized talk (including book-reading; see Demir-Lira, Applebaum, Goldin-Meadow, & Levine, 2018) are also argued to be vital for children's later language abilities and academic achievement.

Prior research has demonstrated that early exposure to and participation in decontextualized talk matters for children's later cognitive and linguistic outcomes (Demir, et al., 2015; Dickinson & Tabors, 2001; Rowe, 2012). Importantly, children's use of decontextualized talk is fostered by their communicative experiences with caregivers (e.g., Haden, Haine, & Fivush, 1997; Haight & Miller, 1993; Reese, Leyva, Sparks, & Grolnick, 2010), although early in development, most of the talk that children hear and produce is *contextualized*; that is, focused on persons, objects, or events in the present environment (Rowe, 2012). However, decontextualized talk—as when speakers discuss personal experiences in the past or future, or treat the environment in a non-literal way through pretend play—requires speakers to create meaning through language itself, rather than rely on nonverbal cues and the present environment to convey meaning.

There are at least two hypotheses to explain why decontextualized talk matters for children's later academic skills. First, decontextualized talk could serve as a precursor to *academic language* (Uccelli, Demir-Lira, Rowe, Levine, & Goldin-Meadow, 2019). Academic language is the language of instruction used in formal education settings (Cummins, 1983; Snow, 2010; Snow & Uccelli, 2009); understanding and producing the more formal register of academic language can be challenging if children have little or no exposure to talking and thinking about ideas removed from the present context.

Second, decontextualized talk might promote *emergent literacy*, the development of literacy-related skills before formal reading instruction (e.g., Curenton, Craig, & Flanigan, 2008; Dickinson & Snow, 1987; Snow & Ninio, 1986). Certain features of decontextualized language make it ideal for facilitating emergent literacy skills, including its lexical and syntactic complexity relative to more contextualized talk (Demir, et al., 2015), and much research supports the idea that decontextualized language skills relate to later literacy (Cummins, 1983; Snow, 1983, 1991; Snow, Cancino, De Temple, & Schley, 1991).

We suggest a third possibility—that early decontextualized talk might also matter for children's later academic outcomes because it naturally affords the opportunity to engage in generalizable and relational higher-order thinking skills, such as inference and comparison. Personal narrative may be a particularly strong context for HOTT, and it may differ not only from non-narrative talk, but also other forms of decontextualized talk, such as pretend. In the following sections, we compare narrative and pretend by highlighting four affordances of these decontextualized types of talk to explain why they might encourage families to invoke HOTT—their story-like structure, their relative salience, their very status as decontextualized, and their ability to promote metacognition. We clarify why these affordances might encourage HOTT use, and note differences between the ways the affordances are known to manifest in narrative versus pretend, leading us to predict different likelihoods of HOTT.

Affordances of Narrative for Encouraging Higher-Order Thinking Talk

Story-Like Structure

Both narrative and pretend are structured into story-like forms, and are examples of extended discourse (Tabors, Roach, & Snow, 2001). In spontaneous talk, narrative and pretend both generally occur in long strings of interconnected utterances, and both involve, to some

extent, the use of story. 'Good' stories, whether about a person's personal experiences or make-believe, require the storyteller to coherently link story elements to a cause-and-effect framework (Stein & Albro, 1997). In effect, they require the storyteller to use higher-order thinking to describe relationships between representations.

But young children do not yet produce reliably good, coherent stories and, as a result, their narrative and pretend utterances do not necessarily contain HOTT. Importantly, narratives tend to be more organized and structured than pretend play at ages 4-5, simply because 'plotted' narratives take place more frequently in storytelling contexts than in play contexts (Benson, 1993). We theorize that the push toward grounding narratives in stories may encourage children to produce more instances of HOTT in narrative than in pretend.

Relative Salience

Personal narrative and pretend are also both relatively salient and relevant to the self, compared to other kinds of talk, although personal narrative is, by definition, even more personally salient than pretend. For example, parents in informal conversation with their children at museums have been shown to enhance their children's comprehension of scientific concepts by drawing comparisons between their children's past experiences and the concepts they are discussing (Valle & Callanan, 2006), comparable to effects shown in the cognitive self-referencing literature (Burnkrant & Unnava, 1995).

However, make-believe pretend is also salient. Empirical research demonstrating that embedding abstract concepts into fictional storytelling contexts can facilitate learning these concepts (Casey, Erkut, Ceder, & Young, 2008; Leech, Haber, Jalkh, & Corriveau, 2020). Similarly, providing children with mathematics problems that are more story-driven and relevant can increase performance (Gerofsky, 1996). When logical syllogisms are embedded into fantasy

contexts (e.g., "Dogs live in trees. Rex is a dog. Does Rex live in a tree?"), as opposed to realistic settings, children generally perform better (Dias & Harris, 1988, 1990; Hawkins, Pea, Glick, & Scribner, 1984; Kuczaj, 1981; Richards & Sanderson, 1999). Fantasy is thought to encourage children to more carefully consider the premises (Harris & Leevers, 2000).

People may be more motivated to do more complex thinking when the topic is more relevant, interesting, or salient to them. Consequently, parents and children may be motivated to incorporate HOTT into both narrative and pretend talk, because both types of talk are particularly salient in early childhood. However, because personal narrative concerns the self, we posit that narrative may be *more* salient or self-relevant than pretend, potentially resulting in more HOTT use in narrative relative to pretend.

Removed From 'Here-and-Now'

Both narrative and pretend are decontextualized, meaning they frequently refer to times and places removed from the present communicative context, sometimes described as the '*there-and-then*' rather than the '*here-and-now*' (Demir, et al., 2015). Using decontextualized talk to communicate means that speakers cannot rely as much on present environmental cues to scaffold their language, and relationships between representations may be less explicit in decontextualized talk than in contextualized talk. To compensate, speakers may be forced to use more precise syntactic markings, or more specific language, to indicate the exact nature of events (Curenton & Justice, 2004).

At the same time, narrative and pretend differ in the extent to which they are divorced from the communicative context. Narrative refers to displaced actions or events that either happened in the past or will happen at some point in the future. In contrast, pretend draws upon familiar features of the surrounding context, but treats the current environment in a non-literal

way; in other words, pretend is decontextualized by creating a *new* contextualization. Participants may use objects in the environment in new ways (e.g., using a leaf as a boat), but they are still interacting with objects in their present space. As a result, pretend may rely on the *here-and-now* linguistically more than narrative does (although it is a non-literal here-and-now). Because narrative relies on the *there-and-then* more than pretend does, we theorize that narrative may contain more HOTT.

Promote Metacognition

Finally, both narrative and pretend make use of metacognitive skills. Metacognition, the act of thinking about one's cognition (Kitchner, 1983), lies at the heart of problem-solving and higher-order thinking skills (Brown & Campione, 1978), and programs seeking to enhance students' higher-order thinking skills often include metacognition as a significant component (e.g., Nickerson, Perkins, & Smith, 1985; Zohar & Dori, 2003). When children engage in narrative talk about the past or future, they are encouraged to make explicit their cognition as they reflect, predict, question, hypothesize, build awareness, identify goals, and anticipate consequences and reactions—all of which involve higher-level thinking and problem-solving skills (National Research Council, 2012). Furthermore, metacognitive reflection on these processes consolidates knowledge, enabling thinkers to generalize to other situations (Epstein, 2003).

Pretend also relates to metacognition (Whitebread, 2010). When individuals engage in pretend, they often take on another role or persona, and use perspective-taking skills to imagine another's thoughts and feelings, skills central to both metacognition and theory of mind (Bergen, 2002; Leslie, 1987; Whitebread & O'Sullivan, 2012). In this way, children engaging in pretend

are practicing the metacognitive skills that are crucial for higher-order thinking, much as narrative promotes these same skills.

The reliance of narrative and pretend on metacognition could invite parents and children to use HOTT. However, narrative supports story-like structure, salience, and decontextualization more than pretend does. We therefore predict that narrative is likely to contain more HOTT than pretend. At the same time, pretend may contain more HOTT than other talk (i.e., non-narrative and non-pretend talk), because other talk is more likely to be less story-driven, less salient, less reliant on metacognition, and more contextualized.

The Current Study

Previous research has found that the rate at which children use, grow, and change in HOTT across development predicts academic achievement for children, including text-based inferencing and analogical reasoning (Frausel, et al., 2020). In this paper, we expand on these prior findings and examine the particular talk contexts in which parents and children invoke HOTT. We ask whether decontextualized talk such as personal narrative and pretend contain proportionally more HOTT than baseline, and whether these proportions change across development. Our specific research questions are: (1) How frequently do parents and children incorporate HOTT into personal narrative, compared to non-narrative talk, and does this frequency change over development? (2) How frequently do parents and children incorporate HOTT into pretend at 38- and 50-months, and does this pattern differ from personal narrative or other non-narrative and non-pretend talk?

Methods

Participants

This study was approved by the Institutional Review Board (IRB) at the University of Chicago (Environmental Variation and Language Growth, Protocol Number 02-942). All parents provided written consent for their and their child's participation.

Participants were 64 typically-developing, monolingual English-acquiring children and their primary caregiver(s), who were taking part in a longitudinal study of language development (Goldin-Meadow, Levine, Hedges, Huttenlocher, Raudebush, & Small, 2014). Families were recruited to represent the demographic and racial/ethnic diversity characteristic of the Chicago area, as reported on the 2000 U.S. Census. The sample includes 31 girls and 33 boys (36 first-born or only children). The participants are racially and ethnically diverse, including 36 White Non-Hispanic, 8 White Hispanic or Latino/a, 14 Black/African American, and 6 children of mixed/other race. At the beginning of the study period, 5 families reported incomes of less than $15,000; 13 had incomes between $15,000 and $34,999; 8 had incomes between $35,000 and $49,999; 13 had incomes between $50,000 and $74,999; 11 had incomes between $75,000 and $99,999, and 14 reported incomes greater than $100,000. Using the midpoint of each income category as an estimate for each family's income, the sample had a mean income of $61,000 (*SD* = $32,000).

Procedure

Children were videotaped by an experimenter (using a video camera with mini-DV tapes) interacting spontaneously with their primary caregiver(s) during 90-minute home visits recorded every 4 months from 14 months to 58 months. Recording took place between 2002–2007. During these home visits, experimenters were instructed not to interact with the families, and no

guidance was given to families about what activities to engage in. Parents and children were instructed to behave as they normally would, so the videos capture typical, every day, spontaneous parent-child interactions, such as playing with toys, preparing and having meals, putting together puzzles, playing board games, and watching television, as well as moments of non-interaction when children play by themselves.

Not all families completed every visit; on average, families completed 11.3 sessions (SD = 1.8 sessions, range 4–12 sessions). Out of a possible 768 session visits (64 subjects x 12 visits), a total of 726 visits were completed, i.e., only 5.5% of visits were missing. Of the 64 participants, all have at least 4 visits, and 50 have all 12 visits. Using binomial logistic regression, we tested whether any demographic covariates (child gender, child first-born status, child race/ethnicity, family income, and parent education) predicted likelihood of missing at least one visit. We found that, after controlling for other covariates, Black families were more likely than White Non-Hispanic families to have at least one missing visit (β = 1.82, SE_β = 0.83, p = .04, odds ratio = 6.19), which limits our ability to draw conclusions about ethnic/racial differences, although that is not a focus of this paper.

Transcribing and Coding Spontaneous Interactions

After digitizing mini-DV tapes, all talk from the focal child was transcribed into an Excel template. All child-directed talk from the primary caregiver(s) was transcribed, including all talk directed to the focal child, as well as talk directed to siblings or other children living in the home under age 13. Talk was divided into *utterances*, defined as any sequence of words preceded and followed by a pause, change in conversational turn, or change in intonational pattern; a total of 1,015,569 utterances were transcribed (n = 646,685 for primary caregivers and n = 368,884 for children). Reliability was established by having a second coder transcribe 20% of videos.

Reliability was assessed at the utterance level and was achieved when the coders agreed on 95% of transcription decisions.

Although reading verbatim text from picture and chapter books was initially transcribed and included in the transcripts of spontaneous interactions, these utterances (n = 11,370 for primary caregivers and n = 375 for children) were removed from analyses so that we could focus on parents' and children's use of spontaneous language. Utterances that were elicited in book-reading interactions, but were not verbatim reading of text (for example, labeling or describing pictures; see Demir-Lira, Applebaum, Goldin-Meadow, & Levine, 2018), were retained in analyses. Some of these utterances were coded as personal narrative (what Demir-Lira, et al., 2018, called *extending the topic*, e.g., "Do you remember the last time we went to the zoo?"). Other utterances elicited by book reading activities were coded as non-narrative (e.g., "What color is that?" "What do you think will happen next?"). In the present analyses, we make no distinction between utterances that took place during book-reading interactions and those that did not.

The unit of analysis for all coding was the utterance. Each utterance was coded along two independent and orthogonal dimensions: the context of the talk in which the utterance appeared (narrative or pretend), and whether the utterance contained higher-order thinking talk. Each is defined in more detail below.

Context of Talk

Each utterance produced by parents and children at all 12 age points was coded as being part of a *narrative* or not. This code was designed to allow us to answer our primary research question—does narrative facilitate HOTT? We compare the proportion of utterances that displayed HOTT in narrative vs. non-narrative talk. Our second research question was—does

narrative facilitate HOTT over and above other types of decontextualized talk? To address this question, we coded all utterances produced at two visits for *pretend.* The two visits selected for this secondary analysis were 38- and 50-months; this choice was informed by the results of the first analyses (to be described in more detail below) and due to the prominence of pretend at these ages (Haight & Miller, 1993). At these two visits, we compared rates of HOTT in three types of talk: narrative, pretend, and (as a baseline) *other* (i.e., anything not coded as either narrative or pretend).

Personal Narrative Coding. Personal narrative was operationalized as language used to recount stories of personal experience about the past, future, or habitual recurring events. In order to count as a personal narrative, the utterance had to contain an action or event that was associated with orienting information, either a spatial location (e.g., "at school") or time (e.g., "last Christmas"). In order to capture descriptions of events that were removed from the *here-and-now*, we considered an event to be in the past or future if it was at least a few hours away from the time of the utterance (e.g., Shin, Leech, & Rowe, 2020). Narratives could be about the child, members of the child's family, other people in the child's life (e.g., neighbors/friends), or other people known to the teller of the narrative. See Table 1 for example personal narrative utterances.

We coded all parent and child utterances between 14- and 58-months for personal narrative using the written transcripts. One hundred and three transcripts (which represents 14.2% of the 726 transcripts in the corpus) were coded by two or more people for reliability. Pooling together each pair of coder's reliability transcripts, average interrater percent agreement for identification of utterances as narrative or not was 97.6% (range: 95.6–99.2%) (average

Cohen's kappa = 0.73; range 0.63–0.83). Disagreements were resolved through discussion or by the more experienced coders.

Pretend Coding. Pretend was operationalized as language during imaginary, non-literal, or imitative episodes of interaction. We took a behavioral approach to symbolic pretend play, and included talk where parents or children used one object to represent or substitute for another; took on the role or persona of another; attributed actions, thoughts, or feelings to inanimate objects; told stories about fictional or made-up characters; and negotiated or communicated about any of the above. Some aspects of construction pretend play were also included if additional details in talk or action were deemed sufficient to 'dramatize' the play (e.g., discussing what 'the people' in the tower are doing). Games with rules (such as hide-and-seek) were not coded as pretend play. See Table 1 for example pretend utterances.

Pretend was coded only at the 38- and 50-month visits. Because aspects of our coding manual relied on paralinguistic cues such as voicing, as well as other aspects of how parents and children were interacting with their surrounding environment (e.g., holding and moving toys), coding of pretend was done on the written transcripts in conjunction with the video. Twenty-two transcripts (18% of transcripts at these two age points) were coded by two or more coders for reliability. Average interrater percent agreement for identification of utterances as pretend was 94.0% (range 93.4–95.3%) (average Cohen's kappa = 0.79, range 0.76–0.83). Disagreements were resolved through discussion or by the more experienced coders. A small number of utterances ($n = 190$ for parents and $n = 146$ for children) were coded as both narrative and pretend[1], and were removed from analyses so that narrative and pretend were mutually exclusive.

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[1] In these instances, the child's talk met the criteria for narrative, although the events they described were more fantastical and had elements of pretend; for example, "Do witches come in your room at night?"

Table 1

Definitions and Examples of Narrative and Pretend Utterances

Talk context	Definition	Example Utterances
Narrative	Language used to recount stories of personal experience about the past, future, or recurring events	Remember when we got those cars on our vacation? Did you have fun yesterday at Ben's house? We're going to take the choo-choo next summer when we go to California. Mom is going to go to the foot doctor tomorrow.
Pretend	Language during imaginary episodes of interaction including making an object represent another; attributing actions, thoughts, or feelings to inanimate objects; and assuming a role or persona	Do I have to pay you money now for cutting my hair? Can you roar really loud? You're going to be the evil witch. This pillow is a magic carpet!

Higher-Order Thinking Talk Coding

HOTT was broadly operationalized as talk that links ideas and concepts into a more complex framework. Based on literature reviews, as well as data-driven pilot analyses, talk was categorized as HOTT if it explicitly invoked one of four types of higher order thinking:

inferences, *comparisons*, *hierarchies*, and *abstractions* (see Holyoak & Morrison, 2012; Markman & Gentner, 2001). These four related skills are relevant to educational application (Halford, Wilson, & Phillips, 2010; Speed, 2010), where HOTT is integral to both formal and informal teaching and learning. Children and parents very likely engaged in other higher-order thinking that was not represented in their language, and they also used language in complex ways that required sophisticated thinking not involving higher-order thinking talk (e.g., using a double negative construction). However, our goal was to explore HOTT expressed in talk, be it in simple or complex constructions. For this reason, our results can be understood as exploring the linguistic context for higher-order thinking *talk*, not higher-order thinking cognition more broadly.

HOTT was coded when parents and children made statements using HOTT (e.g., "They're laughing because he fell down"), when parents and children asked others to reason using HOTT (e.g., "Why were they laughing?"), and when parents and children responded to HOTT-eliciting questions (e.g., "Because he fell down"). In Table 2, we provide definitions of the four types of HOTT, and present examples of each type occurring in narrative, pretend, and other talk (see Frausel, et al., 2020, for additional coding criteria and examples). As noted above, because HOTT was relatively infrequent in the overall sample, we collapse across the four HOTT types in all our analyses.

Table 2

Definitions and Examples of HOTT Utterances in Narrative, Pretend, and Other Talk

HOT Type	Definition	Example Utterances
Inference	Deriving a conclusion not otherwise given by using known or logical premises.	*Narrative*
		He put the birds in the bucket so no cats could get to them.
		Why didn't you take a nap at school today?
		Pretend
		I have no power until I find my magic wand.
		Daddy, get the barbies, or else Swiper will swipe them.
		Other
		How come you're getting upset?
		If you're not going to do it now, then we'll put it away.

Comparison	Demonstrating similarities or differences between entities by analogy or by example.	*Narrative*
		When the bee stung me, Grandma said I looked like a monster.
		One day, you'll go to the same school as your brother.
		Pretend
		You're both looking for dinosaurs.
		Read your book to your baby like Mommy read to you.
		Other
		Are you dancing like the teddy bear?
		These are both pink.

Hierarchy	Using hierarchical taxonomies (pointing to an arrangement of categories with a superordinate/ subordinate framework) or partonomies (pointing out the relation between parts and wholes).	*Narrative*
		What kind of bird did we have on Thanksgiving?
		That's part of your Halloween costume from last year.
		Pretend
		What kind of icing should we have on our cake?
		The town got all sorts of disasters.
		Other
		Persian is a type of cat.
		This is the only sort of cookies we have right now.

| Abstraction | Pointing out mental frameworks or models that could facilitate thinking; making definitions that attempt to describe the meaning of a word or concept, beyond giving a label. | *Narrative*
We're going to the arboretum, which is where there's trees and plants and flowers.
Didn't we discuss yesterday that it's impolite to talk during movies?
Pretend
A spell is where you put fire everywhere.
Regular people can't see invisible people, only invisible people can see other invisible people.
Other
People go to sleep when the sun goes down.
Cows say 'moo.' |

NOTE. *Other* and *Pretend* together constitute non-narrative utterances.

All parent and child utterances from each visit between 14- and 58-months were coded for HOTT using the written transcripts. Ninety-seven transcripts (approximately 8 from each age point), constituting 13.4% of the 726 transcripts, were coded by two or more people for reliability. Average interrater percent agreement for identification of utterances as HOTT was 98.1% (range: 96.0–99.3%) (average Cohen's kappa = 0.81, range 0.73–0.87). Disagreements were resolved through discussion or by the more experienced coders.

Measures

For every parent and child at each of the twelve age points, we calculated the following for each transcript: total number of utterances; total number of narrative and non-narrative utterances; total number of HOTT and non-HOTT utterances; and total number of HOTT utterances occurring in narrative and non-narrative contexts. Using these measures, we calculated the proportion of total utterances, as well as the proportion of narrative and non-narrative utterances that contained HOTT. At 38- and 50-months, we also calculated total number of pretend utterances; total number of HOTT utterances occurring in pretend and *other* (i.e., non-narrative and non-pretend) talk contexts; as well as the proportion of pretend and other utterances containing HOTT. Because session lengths varied slightly ($M = 88.6$ minutes long, $SD = 4.8$ minutes, range 44–97 minutes), for some descriptive analyses we transformed raw numbers of utterances to number of utterances per hour.

Results

Findings are presented in two major sections corresponding to our research questions. To answer our first research question, we compared rates of HOTT in narrative and non-narrative talk from 14–58 months, and to answer our second research question, we compared rates of HOTT in narrative, pretend, and all other non-narrative and non-pretend talk at 38- and 50-

months. Prior to each section, we present descriptive statistics summarizing frequency of HOTT, narrative, pretend, and their intersection in parents' and children's everyday talk.

Use of HOTT and Narrative Across Development

We first present descriptive statistics summarizing the number of HOTT and personal narrative utterances used by parents and children across development, as well as the intersection of HOTT and personal narrative (i.e., HOTT utterances occurring in narrative). As a baseline, we also report total number of utterances.

Table 3 presents means and standard deviations for each speaker at each session. Not surprisingly, as children developed, they produced an increasing number of utterances per hour; at the same time, the number of utterances produced by parents decreased. Both personal narrative and HOTT were relatively infrequent, but both increased across development. Children used fewer than five HOTT utterances per hour between 14- and 30-months, but by 58-months, they were producing almost 20 HOTT utterances per hour on average. Parents speaking to 14-month-old children used fewer than 15 HOTT utterances per hour, but increased to more than 30 HOTT utterances per hour when addressing children at 58 months. When extrapolated over the course of a child's typical home discourse experiences, these numbers become substantial.

Personal narrative was similar to HOTT in frequency per hour. Parents and children produced fewer than 10 personal narrative utterances per hour at 14- and 18-months. At 58-months, however, parents produced almost 35 personal narrative utterances per hour, and children produced close to 25. As hypothesized, there was some overlap of these utterances, though the numbers are low due to the relative rarity of both HOTT and narrative. By the end of the study period, close to five of parents' HOTT utterances occurred in narrative contexts, and for children, close to three HOTT utterances occurred in narrative contexts.

Table 3

Frequency of Different Types of Utterances Produced by Parents and Children Per Hour

Child Age (months)		Parents					Children			
		Total	Narrative	HOTT	HOTT in Narrative		Total	Narrative	HOTT	HOTT in Narrative
	N	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*N*	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
14	64	681.3	6.8	12.8	0.8	64	33.9	0.3	0.3	0.0
		(290.3)	(8.1)	(8.7)	(1.4)		(42.4)	(0.9)	(1.2)	(0.0)
18	63	685.7	9.1	13.6	1.1	63	120.2	0.6	0.6	0.0
		(298.2)	(10.1)	(7.8)	(1.5)		(103.0)	(1.9)	(1.4)	(0.0)
22	62	657.3	17.6	16.4	1.7	62	240.5	3.8	1.0	0.1
		(314.8)	(22.2)	(11.6)	(2.5)		(161.8)	(7.6)	(1.9)	(0.3)
26	61	643.1	24.5	21.7	2.6	61	356.7	9.7	2.2	0.2
		(299.7)	(34.0)	(16.3)	(3.4)		(187.2)	(19.5)	(5.7)	(0.6)
30	61	630.2	28.8	26.2	2.6	61	390.1	12.9	4.4	0.2
		(278.0)	(22.4)	(17.7)	(2.5)		(166.8)	(16.8)	(6.3)	(0.7)
34	62	573.6	27.6	28.1	2.9	62	439.4	13.4	9.9	0.8
		(290.9)	(31.2)	(18.4)	(4.0)		(176.9)	(16.5)	(12.6)	(2.5)
38	61	650.7	28.8	32.7	3.4	61	462.3	16.1	13.9	1.2
		(322.0)	(22.4)	(20.1)	(3.2)		(141.1)	(13.0)	(11.1)	(1.7)
42	60	591.7	29.8	31.4	3.5	60	439.2	17.0	15.7	1.6
		(317.2)	(36.5)	(20.8)	(4.6)		(167.8)	(23.0)	(13.0)	(3.2)
46	58	545.1	35.3	37.9	5.4	59	446.7	19.3	19.5	2.3
		(358.3)	(42.8)	(25.8)	(6.9)		(199.9)	(19.7)	(13.4)	(3.6)

50	58	540.9	33.3	38.3	5.1	59	424.8	22.6	18.8	2.2
		(307.7)	(28.3)	(28.9)	(5.3)		(163.1)	(20.0)	(14.1)	(2.3)
54	54	487.9	28.5	36.0	4.6	56	397.7	17.4	20.7	1.7
		(309.4)	(23.9)	(27.0)	(5.2)		(170.8)	(17.0)	(14.7)	(2.2)
58	58	452.3	34.0	33.2	4.5	58	403.8	25.3	19.7	2.8
		(334.0)	(31.7)	(29.9)	(4.4)		(154.5)	(21.3)	(11.0)	(3.2)

NOTE. On four occasions (once each at the 46- and 50-month visits and twice at the 54-month visit), the parent did not talk during the 90-minute taping. On these occasions, we analyze only children's talk and record the parent as missing; variability in parent talk to children may therefore be underrepresented. Number of non-narrative utterances may be calculated by subtracting narrative from total utterances, and non-narrative HOTT utterances may be calculated by subtracting HOTT in narrative utterances from HOTT utterances.

Onset of HOTT and Narrative Talk

We also calculated the age when children began to regularly engage in narrative talk, their *narrative onset*. Narrative onset was calculated as the first session in which children used narrative utterances in two sessions back-to-back—although for most children, once they started using narrative, they used it in the majority of subsequent sessions. Sixty-one children had a measurable narrative onset (two children dropped out of the study before their narrative onset was established, and one child did not have a narrative onset because he only used narrative in one session). Using the session in which onset occurs as an estimate for children's 'true' age of onset, mean age of narrative onset was 26.9 months (*SD* = 8.2 months, range 14–50 months). Given the four-month gap between observation sessions, we cannot be more precise. However,

our data suggest that personal narrative talk emerges sometime between 23–27 months. This is in

line with and extends a previous longitudinal analysis of five children's language development

(although coded differently, Miller & Sperry, 1988), as well as theoretical and empirical studies

of autobiographical memory produced in early discourse narratives about the past (Haden, Haine,

& Fivush, 1997; Nelson, & Ross, 1980; Peterson & McCabe, 1992).

As reported in other studies (Frausel, et al., 2020), children's HOTT onset using these

same criteria is 27.0 months. Importantly, this co-occurrence reveals that narrative and HOTT

begin to emerge around the same point in development. However, when we examined the age at

which children began to regularly incorporate HOTT *into* their narrative talk—calculated when

children used at least one HOTT utterance in a narrative context in two sessions back-to-back—

we found that regular use of HOTT in narrative occurred later in development. Forty-eight

children had a measurable HOTT-in-narrative onset using these criteria, and the mean age of

onset was 40.6 months ($SD = 7.4$ months, range 22–54 months), approximately a year after they

first began using narrative and HOTT talk independently. This finding suggests that these uses

were not simply artifacts of parent talk or linguistic constructions of either narrative or HOTT,

but rather, that co-occurrence of these language practices was meaningful as an indicator of

cognitively rich narratives.

Proportion of Narrative and Non-Narrative Talk Containing HOTT

To answer our first research question, we calculated the frequency with which HOTT was

used in narrative and non-narrative contexts. Because parents and children differed in total

number of utterances, as well as number of narrative and HOTT utterances, we report the

proportion of narrative and non-narrative utterances that contained HOTT. Since the majority of

utterances are non-narrative, the proportion of non-narrative utterances containing HOTT is very similar to baseline HOTT rates in talk overall.

HOTT use in narrative and non-narrative contexts is reported in Figure 1, in panel (a) for parents and panel (b) for children. For parents, a greater proportion of narrative utterances contained HOTT than non-narrative utterances, and this pattern held from 14- to 58-months. At 38 months, for example, 12.0% of parents' narrative utterances contained HOTT, compared to 4.8% of parents' non-narrative utterances. Furthermore, parents' rates of HOTT use in narrative utterances was fairly stable across development (around 10–15%, with more noise earlier in development due to infrequent HOTT and narrative use), whereas rates of HOTT in non-narrative utterances gradually increased. For children, this same pattern—narrative utterances containing proportionally more HOTT than non-narrative utterances—emerged starting at 38 months. Thus, HOTT appears to be a relatively stable feature of adults' narrative talk with children during this period, with children becoming increasingly active after 38 months.
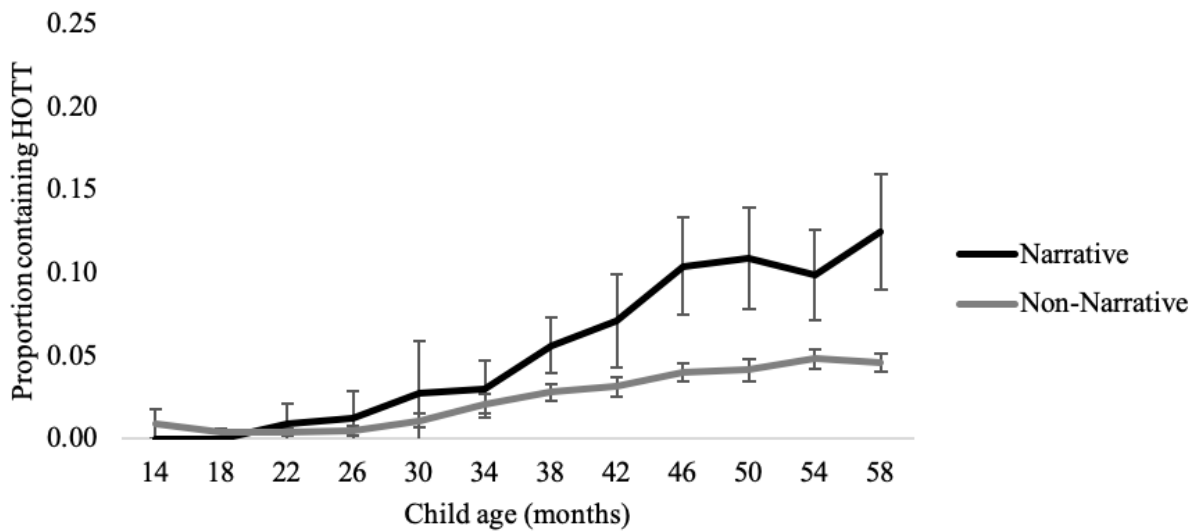
Figure 1

Mean Proportion of (a) Parents' and (b) Children's Narrative and Non-Narrative Utterances

Containing HOTT

(a) Parents
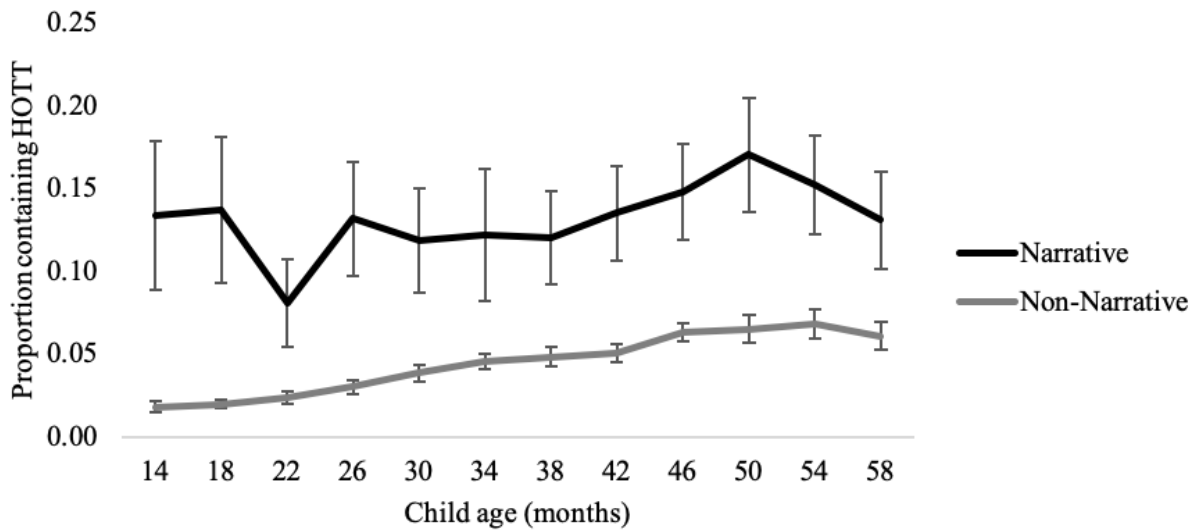
(b) Children

NOTE. Error bars ±2 SE. On eight occasions (1 parent of a 14-month-old; 1 parent of an 18-month-old; 2 parents of 26-month-olds; 1 parent of a 42-month-old; 1 parent of a 50-month-old;

and 2 26-month-old children), speakers produced only a single narrative utterance, and that utterance contained HOTT; their proportion of narrative utterances containing HOTT was therefore 100%. These occasions were removed from the figures.

To test these effects statistically, we used a two-level hierarchical linear model (HLM; Raudenbush & Bryk, 2002), with age points at level 1 nested in individual dyad at level 2. HLM flexibly allows for missing data at level 1, and incorporates all participants who have been observed at least once (Raudenbush & Bryk, 2002, pg. 199). The outcome ($HOTT_{ti}$) is number of HOTT utterances produced for dyad i at time t, using a *Poisson* distribution (i.e., log-link function, appropriate for low-probability events), and we use total number of utterances ($Utterances_{ti}$) as the exposure variable. At level 1, we include an *intercept* term (π_{0i}), as well as age in months centered at 38 months (π_{1i}, referred to as *growth*; 38 months was selected because it is the point in development at which children appear to use more HOTT in narrative than non-narrative, see Figure 1). We also included a quadratic term for age (π_{2i}, or *acceleration*) to better fit the empirical data, and because the inclusion of this term improved model fit ($\chi^2(6) = 984.37$, $p < 0.001$). At level 1, we also include fixed effects of speaker (π_{3i}, with children as the reference category) and narrative[2] (π_{4i}, with non-narrative as the reference category). The residual e_{ti} is the portion of dyad i's HOTT utterances at age point t not predicted by age, speaker, or narrative status. At level 2, we include random effects for the intercept (r_{0i}), growth (r_{1i}), acceleration (r_{2i}), speaker (r_{3i}), and narrative (r_{4i}).

---

[2] We tested several interactions we theorized to be of interest, including parent by narrative and parent by growth, but found there was too much collinearity among the fixed effect predictors for the model to be estimated.

In the mixed model, a dyad's number of HOTT utterances relative to total utterances produced is thus predicted by an intercept term (β_{00}, interpreted as children's rate of HOTT in non-narrative talk at 38-months, or when all other predictors are set to 0), differences by linear age (β_{10}), differences by quadratic age (β_{20}), the effect of the parent compared to children (β_{30}), and the effect of narrative compared to non-narrative (β_{40}), as well as random effects (r_{0i} through r_{4i}), which allow these to vary by each dyad.

Level 1 Model

$E(\text{HOTT}_{ti}|\pi_i) = \lambda_{ti} * \text{Utterances}_{ti}$

$\log[\lambda_{ti}] = \eta_{ti}$

$\eta_{ti} = \pi_{0i} + \pi_{1i}*(\text{Age}_{ti} - 38) + \pi_{2i}*(\text{Age}_{ti} - 38)^2 + \pi_{3i}*(\text{Parent}_{ti}) + \pi_{4i}*(\text{Narrative}_{ti}) + e_{ti}, e_{ti} \sim N(0, \sigma_t^2)$

Level 2 Model

$\pi_{0i} = \beta_{00} + r_{0i}$

$\pi_{1i} = \beta_{10} + r_{1i}$

$\pi_{2i} = \beta_{20} + r_{2i}$

$\pi_{3i} = \beta_{30} + r_{3i}$

$\pi_{4i} = \beta_{40} + r_{4i}$

Mixed Model

$\eta_{ti} = \beta_{00} + \beta_{10}*(\text{Age}_{ti} - 38) + \beta_{20}*(\text{Age}_{ti} - 38)^2 + \beta_{30}*\text{Parent}_{ti} + \beta_{40}*\text{Narrative}_{ti} + r_{0i} + r_{1i}*(\text{Age}_{ti} - 38) + r_{2i}*(\text{Age}_{ti} - 38)^2 + r_{3i}*\text{Parent}_{ti} + r_{4i}*\text{Narrative}_{ti} + e_{ti}, e_{ti} \sim N(0, \sigma_t^2)$

Results for the fixed and random effects of the model are reported in Table 4, and critically, suggest that narrative contains proportionally more HOTT than does non-narrative (see estimate for B_{40}). At 38 months, the model predicts parents use HOTT in 11.19% of narrative

utterances ($e^{-3.76 + 0.66 + 0.91}$) and 4.50% of non-narrative utterances ($e^{-3.76 + 0.66}$), and children use

HOTT in 5.78% of narrative utterances ($e^{-3.76 + 0.91}$) and 2.33% of non-narrative utterances ($e^{-3.76}$).

Table 4

Hierarchical Linear Model to Predict HOTT Utterances Relative to All Utterances

		Coefficient	Standard Error	*t*-ratio	*df*
Fixed Effects	β_{00} (intercept)	-3.76***	0.07	-57.06	63
	β_{10} (slope)	0.04***	0.002	22.99	63
	β_{20} (acceleration)	-0.0006***	0.0001	-4.84	63
	β_{30} (parent)	0.66***	0.04	14.80	63
	B_{40} (narrative)	0.91***	0.04	21.00	63
		Standard deviation	Variance component	χ^2	df^a
Random effects	r_0 (intercept)	0.41***	0.26	1741.66	49
	r_1 (slope)	0.01***	0.0001	572.55	49
	r_2 (acceleration)	0.0009***	0.000001	578.86	49
	r_3 (parent)	0.34***	0.11	653.10	49
	r_4 (narrative)	0.30***	0.09	305.47	49

Goodness of fit -2 log likelihood

38,890.91 (20)

NOTE. We report fixed effects from the unit-specific model with robust standard errors.

[a] The chi-square statistics are based on only 50 of 64 dyads who had sufficient data for computation. Fixed effects and variance components are based on all the data.

*** $p < 0.001$.

Use of HOTT in Narrative, Pretend, and Other Talk at 38- and 50-months

We have found that personal narrative contained proportionally more HOTT than non-narrative, for parents from child age 14- to 58-months and for children from 38 months on. However, non-narrative talk is a fairly broad category. To unpack these findings further and to understand whether all decontextualized talk contexts similarly with regard to HOTT, we examined rates of HOTT use in utterances coded as pretend. To answer our second research question, we examined HOTT use in pretend at 38 months (the first session at which children use more HOTT in narrative than in non-narrative), as well as a year later at 50 months, and compared these rates to HOTT use in narrative. As a baseline, we continue to report HOTT use in all other (non-narrative and non-pretend) utterances.

In Table 5 below, we report the frequency of pretend and HOTT in pretend utterances produced by parents and children at the two age points; to facilitate comparison, we also include narrative (from Table 3) and other utterances. Interestingly, pretend is more common than narrative in both parents' and children's talk, but it becomes slightly *less* frequent at 50-months, compared to 38-months. This developmental pattern is in contrast to narrative, which becomes *more* frequent at 50-months, compared to 38-months. As in HOTT in narrative, HOTT in pretend utterances are relatively infrequent, although when extrapolated over the course of a child's everyday talk and input, they become more meaningful.

Table 5

Frequency of Different Types of Utterances Produced by Parents and Children at 38- and 50-Months

Utterance Type	Parents		Children	
	38 months	50 months	38 months	50 months
	Mean (*SD*)	*Mean* (*SD*)	*Mean* (*SD*)	*Mean* (*SD*)
	N = 61	*N* = 58	*N* = 61	*N* = 59
Pretend	53.2 (64.8)	36.7 (63.3)	62.8 (64.2)	52.9 (66.0)
HOTT in Pretend	2.9 (3.9)	2.8 (4.6)	1.8 (2.9)	2.9 (4.3)
Narrative[a]	28.8 (22.4)	33.3 (28.3)	16.1 (13.0)	22.6 (20.0)
HOTT in Narrative[a]	3.4 (3.3)	5.1 (5.3)	1.2 (1.7)	2.2 (2.3)
Other	568.8 (297.0)	471.0 (275.2)	383.4 (120.4)	349.3 (142.5)
HOTT in Other	26.5 (18.4)	30.5 (23.5)	11.0 (8.7)	13.7 (10.8)

[a] Replicated from Table 3.

NOTE. Pretend, Narrative, and Other sum to Total Utterances in Table 3; HOTT in Pretend, HOTT in Narrative, and HOTT in Other sum to HOTT utterances in Table 3.

Proportion of Narrative, Pretend, and Other Talk Containing HOTT

Next, we examined rates of HOTT use in pretend at 38- and 50-months, and compared it to rates of HOTT use in narrative (using the same data reported in the previous section) and all other non-narrative and non-pretend talk. Figure 2 below displays the mean proportion of personal narrative, pretend, and other utterances that contain HOTT for parents and children at 38- and 50-months.

Figure 2

Mean Proportion of Parents' and Children's Other, Pretend, and Narrative Utterances

Containing HOTT
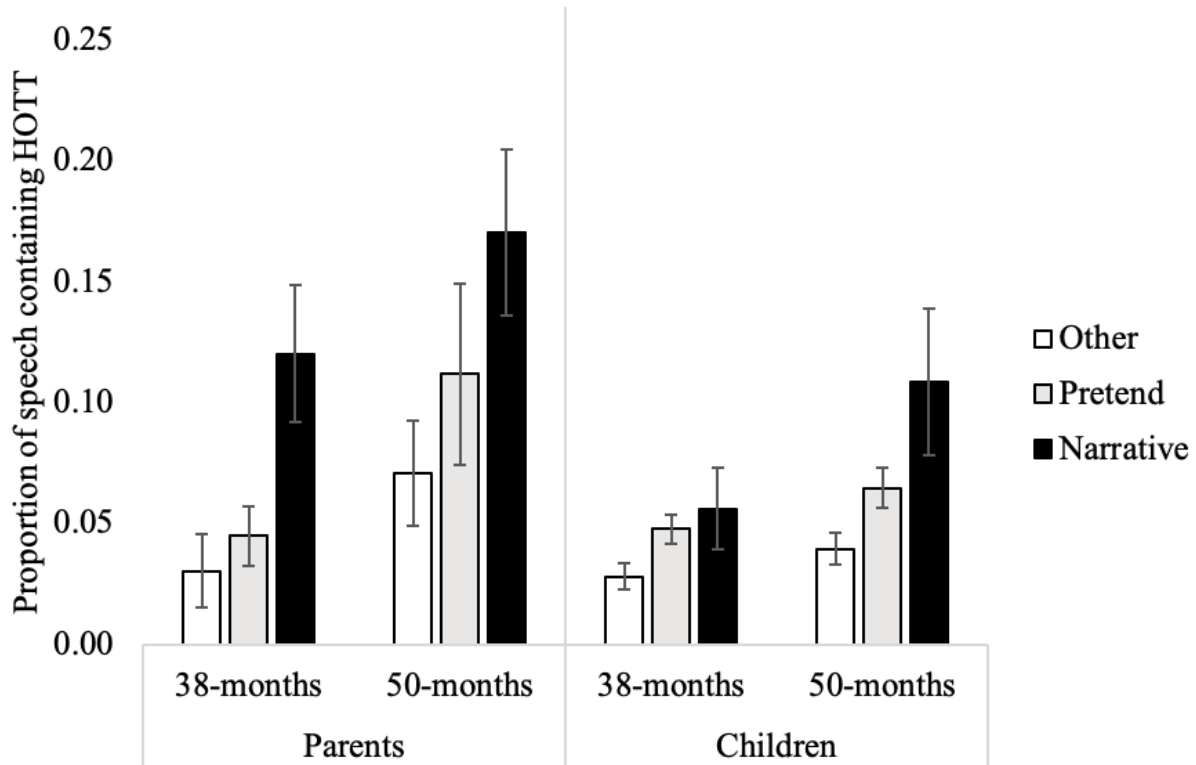
NOTE. Error bars ±2 SE. One parent at 50 months who produced only a single pretend utterance

that contained HOTT has been removed from the figure.

We conducted a generalized linear mixed-effects rate model with a binomial distribution

to test whether rates of HOTT use differed for parents and children at each visit in each of the

three talk contexts (narrative, pretend, other). We included fixed effects of session (using 38-

months as the reference category), speaker (using parents as the reference category), talk context

(using pretend as the reference category), and their interactions (two-way: session x speaker,

session x narrative, session x other, speaker x narrative, speaker x other; three-way: speaker x

session x other, and speaker x session x narrative), with a random effect for each dyad. We found

an interaction between speaker, session, and other (β = -0.38, SE$_\beta$ = 0.15, p = 0.01), such that

children's rates of HOTT use differed between other and pretend between the 38- and 50-month

sessions. There was also a marginal speaker by other interaction (β = 0.20, SE$_\beta$ = 0.10, p = 0.07),

such that parents and children differed in HOTT use in other talk. The interaction between

speaker and session was also significant (β = 0.41, SE$_\beta$ = 0.14, p = 0.003), suggesting that rates

of HOTT use overall differed between parents and children at the two visits. There were also

main effects of speaker (β = -0.67, SE$_\beta$ = 0.10, p < 0.001), session (β = 0.32, SE$_\beta$ = 0.09, p <

0.001), and narrative (β = 0.78, SE$_\beta$ = 0.09, p < 0.001), as well as a marginal main effect of other

(β = -0.13, SE$_\beta$ = 0.07, p = 0.06).

Because speaker interacted with so many variables, we conducted two follow up

analyses, one for parents and one for children, to more precisely test whether rates of HOTT use

in narrative, pretend, and other talk differed at the two sessions for each speaker. In each model,

we included fixed effects for session, talk context (using pretend as the critical reference

category), and their interaction, with a random effect for each participant. Results for each model

are reported in Table 6.

Table 6

Results from Generalized Linear Mixed-Effects Rate Models with a Binomial Distribution to

Predict Rates of HOTT Use

	Parents β (SE$_\beta$)	Children β (SE$_\beta$)
Fixed effects		
Intercept	-2.987***	-3.737***
	(0.080)	(0.108)
Session	0.333***	0.689***
	(0.094)	(0.105)
Other	-0.135*	0.038
	(0.068)	(0.088)
Narrative	0.772***	0.857***
	(0.089)	(0.131)
Session x Other	-0.039	-0.379***
	(0.099)	(0.114)
Session x Narrative	-0.074	-0.343*
	(0.124)	(0.165)
Random effects		
Participant	0.126	0.291
	(0.355)	(0.540)
Deviance	2,076.1 (328)	1,874.9 (344)

NOTE. ^$p < 0.10$, *$p < 0.05$, **$p < 0.01$, **$p < 0.001$.

For both parents and children, there was a main effect of session, suggesting overall HOTT use increased between 38- and 50-months. For parents, there was no interaction between session and talk context, indicating similar patterns across the two visits. Parents differed in rates of HOTT use in pretend vs. other, as well as in pretend vs. narrative—narrative contained more HOTT than pretend, which contained more HOTT than other talk. For children, in addition to main effects of session and narrative, there were interactions between session and both other talk and narrative talk, indicating that patterns for children differed at 38- and 50-months.

To determine exactly how children's patterns of HOTT in narrative and pretend differed between 38- and 50-months, we conducted two additional follow-up generalized linear mixed-effects rate models for children at 38- and 50-months, with fixed effects for talk context (using pretend talk as the critical reference category), with a random effect for each participant. Results are reported in Table 7.

Table 7

Results from Follow-up Analyses of Children's Talk Using Generalized Linear Mixed-Effects

Rate Models with a Binomial Distribution

	Children at 38 months β (SE$_\beta$)	Children at 50 months β (SE$_\beta$)
Fixed effects		
Intercept	-3.795***	-3.090***
	(0.123)	(0.100)
Other	-0.042	-0.281***
	(0.090)	(0.076)
Narrative	0.759***	0.577***
	(0.133)	(0.106)
Random effects		
Participant	0.592 (0.769)	0.284 (0.533)
Deviance	818.2 (179)	893.2 (173)

NOTE. ^$p < 0.10$, *$p < 0.05$, **$p < 0.01$, **$p < 0.001$.

For children at 38 months, there were no differences in rates of HOTT use in pretend vs. other, but there were differences in pretend vs. narrative—narrative contained more HOTT than pretend. At 50 months, children's patterns looked similar to parents—narrative contained more HOTT than pretend, which contained more HOTT than other talk.

Expected and Observed Occurrence of HOTT in Narrative and Pretend

We employed a second analytical approach to consider the robustness of the relationship

between HOTT and narrative vs. pretend, this time by comparing each individual's 'expected' occurrence of HOTT in narrative vs. pretend (based on their average rate across all talk), to their 'observed' occurrence. We calculated the 'expected,' or chance, values by multiplying, for each individual, their base rate for narrative by their base rate for HOTT. For example, at 38 months, one parent used narrative in 9.7% of her talk and pretend in 12.3% of her talk (so 78% of her talk is other). This parent used HOTT in 8.9% of her talk (so 91.1% of her talk is non-HOTT). If HOTT is unrelated to talk context, and only appears in narrative and pretend by chance, as a result of her natural rate of HOTT use, we would expect that HOTT in narrative utterances would comprise 0.86% of her total utterances (9.7% * 8.9%), and HOTT in pretend utterances would comprise 1.09% of her total utterances (12.3% * 8.9%). This parent spoke 546 utterances per hour; we therefore would expect about 5 of her utterances per hour to display HOTT in a narrative context, and about 6 of her utterances per hour to display HOTT in a pretend context.

Next, we calculated the 'observed' occurrence rate of HOTT in narrative and in pretend, by dividing the *actual* number of HOTT in narrative and HOTT in pretend utterances by the total number of utterances used by the parent. This example parent actually used 15 HOTT in narrative utterances per hour, which accounted for 2.74% of her total talk—almost three times the value expected by chance. In contrast, she used only 7 HOTT in pretend utterances, representing 1.28% of her total utterances—almost the same value expected by chance. We performed these same calculations on all parents and children at 38- and 50-months; means for expected and observed (a) proportion of all utterances and (b) total number of utterances are reported in Figure 3.

Because pretend makes up a greater proportion of parent's and children's everyday talk than narrative (see Table 5), frequency of HOTT in pretend utterances was sometimes greater

than HOTT in narrative utterances, particularly for children. Nevertheless, these figures

demonstrate that parents and children incorporate HOTT into their narrative talk at higher rates

than predicted by chance, whereas HOTT occurs in pretend about as often as predicted by
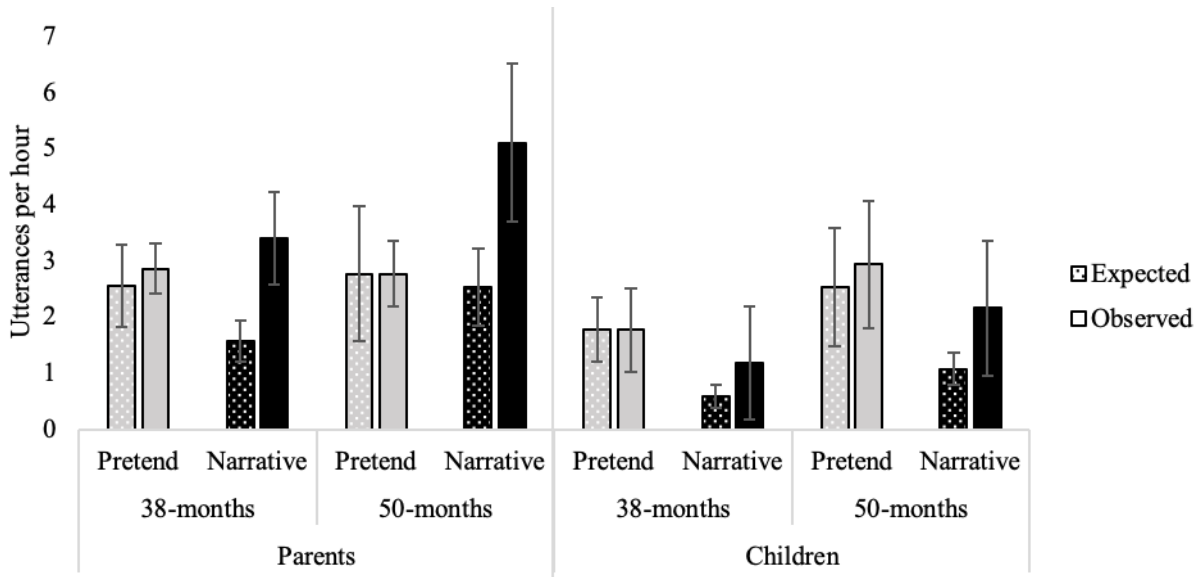
chance.

Figure 3

Mean Expected (patterned bars) and Observed (solid bars) (a) Proportion and (b) Number of

HOTT in Narrative (black bars) and HOTT in Pretend (gray bars) Utterances

(a) Proportion of Utterances
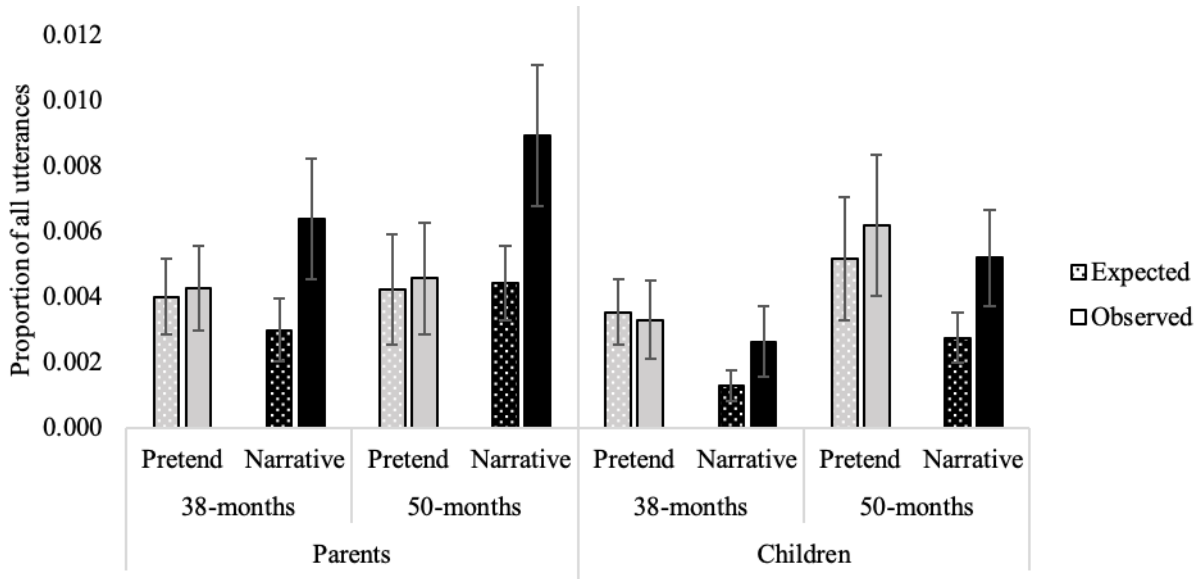
(b) Number of Utterances

NOTE. Error bars ±2 SE.

As is evident from Figure 3, for HOTT in narrative, the observed values are *greater* than the expected values, whereas for HOTT in pretend, the observed and expected values are not reliably different. Both parents and children were more likely to incorporate HOTT into their narrative talk than into their pretend talk. The statistics to support these observations are available in the Supplementary Materials.

Discussion

In this paper, we examined whether different talk contexts provide different opportunities for parents and children to use HOTT. We highlighted *personal narrative* as a potentially rich context for higher-order thinking in parents' and children's spontaneous talk between 14- and 58-months, and compared rates of HOTT in narrative to non-narrative. We found that, for parents between child ages 14- and 58-months and for children beginning at 38-months, narrative contained proportionally more HOTT than non-narrative. Narrative also contained more HOTT than expected by chance, based on speakers' base rates of HOTT and narrative talk. This finding points to narrative as a rich communicative context in which parents and children naturally invoke higher-order thinking.

At 38- and 50-months, we compared use of HOTT in narrative to HOTT use in a theoretically-similar form of talk, *pretend*. At 38-months, children used more HOTT in narrative than either pretend or other talk, whereas pretend and other talk contained similar amounts of HOTT. For less mature speakers, pretend may rely more on the present environment, potentially resulting in more contextualized pretend play that makes less use of HOTT. By contrast, in children's talk at 50-months, and for parents at both 38- and 50-months, the proportion of pretend containing HOTT lay *between* the proportion of other and narrative containing HOTT. Parents' pretend play may be more complex and decontextualized than children's at both ages,

whereas children's pretend at 50 months may have matured, and come to rely more on language

or theory of mind, rather than the surrounding environment. This more mature pretend talk may

occupy a liminal space on the continuum between the 'here-and-now' (as reflected in other talk),

and the 'there-and-then' (as reflected in narrative talk).

However, unlike HOTT incorporated into narrative, the expected occurrence of HOTT

incorporated into pretend is *not* different from the observed value. Although pretend may be a

talk context where parents and children invoke HOTT more frequently than in baseline 'other'

talk, they are not doing so at rates greater than expected by chance. These findings point to a

particularly privileged relationship between HOTT and narrative.

Implications

Some qualities of language may make it easier for parents and children to use higher-

order thinking, particularly when children are very young. These qualities include being story-

driven, being salient or relevant to the self, relying on metacognition, and being

decontextualized. Narrative is one kind of talk that displays all of these qualities, to a stronger

extent than non-narrative talk, and arguably to a stronger extent than pretend. Theoretically, this

fact enhances our understanding of the nature of higher-order thinking by suggesting that it

frequently appears in decontextualized talk, particularly when that talk serves a narrative

function. These findings offer another potential mechanism—in addition to exposure to academic

language, and the promotion of emergent literacy skills—to explain why narrative talk is

beneficial for children's later academic outcomes. The study also enhances our understanding of

the nature of narrative by suggesting higher-order thinking makes up a vital (and potentially

requisite) part of it.

Practically, our findings can be leveraged in interventions with parents and families that seek to enhance the quality of children's early language environments to boost their school-readiness skills. Although much research has focused on variations in the early home environment as providing support for children's linguistic outcomes, a growing body of research suggests parents may also socialize children into educationally relevant thinking skills, such as higher-order thinking. In support of this hypothesis, our previous work (Frausel, et al., 2020) demonstrates that children's early use of HOTT between 14- and 58-months predicts their performance on standardized assessments of higher-order thinking administered years later in grade school, including text-based inferencing and analogical reasoning. Thus, HOTT during the preschool years serves as an early index of, and potential training opportunity for, later higher-order thinking outcomes.

Despite the importance of HOTT, little empirical work has examined how to support its use in early home environments (as opposed to classroom contexts, where more is known; e.g., Miri, David, & Uri, 2007). Early interventions targeting parents' use of HOTT is one strategy to support school readiness and build on parents and children's already-occurring discourse. To have an impact, though, interventions must be clearly understood by their audience, and although 'higher-order thinking' is a concept familiar to many educators and researchers, lay individuals may not have as many intuitions as to how to support the development of these important skills. In contrast, families may more readily grasp that telling personal stories can build children's academic skills. Encouraging personal storytelling may be flexibly adapted to families' unique cultural contexts, a possibility that is important to explore in future work. Moreover, even though the results of this study suggest that pretend at 50-months has some promise for encouraging HOTT, pretend use tends to decline across the lifespan (Smith & Lillard, 2012), whereas

narrative use increases and continues into adulthood (Singer, 2004). An intervention targeting

narrative could serve as an important leverage point through which HOTT can be encouraged

and stimulated in children.

Indeed, prior work has established that it is possible to intervene with respect to parent's

use of decontextualized talk with children from diverse backgrounds (Morgan & Goldstein,

2004; Reese, Leyva, Spark, & Grolnick, 2010; van Bergen, Salmon, & Dadds, 2018; Valentino,

Cummings, Borkowski, Hibel, Lefever, & Lawson, 2019). For example, Leech, Wei, Harring,

and Rowe (2018) conducted a randomized control trial with 36 children and their parents, with

parents randomly assigned to either a training condition (in which parents were told about the

importance of decontextualized talk) or a control condition. Trained parents increased the

amount of decontextualized talk they gave their children, compared to baseline—particularly talk

about past personal events—and parents maintained these gains for the duration of the study.

Decontextualized input is malleable, and thus encouraging families to share stories of personal

experience might serve as a way to influence children's later higher-order thinking skills and

outcomes.

Limitations

Although rich in theoretical and practical significance, this study has a number of

limitations. First, it is unclear the extent to which the findings, which came from families

recorded in the first decade of the 21st century, would generalize to more contemporary

populations who have ready access to technology. The advent of smart phones, smart speakers,

and other technological advances in the past two decades means parenting and child-rearing may

have changed significantly since this study was initiated, which may change the ways in which

parents and children interact (e.g., Kelly, Ocular, Alvarado, Austin, Brunton, Millan, & Drexler,

2019). For example, in our corpus, parents and children sometimes looked at old family photos in albums, and discussion of events in the photos were included as narrative talk. The fact that parents now have constant access to the camera and photos on their phones might mean parents and children engage in *more* of this kind of talk now, compared to the early 2000's. Alternatively, parents and children might engage in this kind of talk *less* frequently because access to these photos is now ubiquitous and looking at photos is no longer a novel event. Nonetheless, this study still presents an intensive examination of parent-child talk during a fairly recent time period.

Another more general limitation to observational studies such as ours is that parents could be changing their behavior because they know they are being filmed. Parents might have been responding to demand characteristics based on the presence of the experimenter. Even if this were the case, however, parents would likely be purposefully emphasizing aspects of their talk and behavior they felt were important for the child's development, providing us insight into the linguistic practices they wanted to be using regularly in their home talk. In addition, it is very difficult to maintain unnatural behavior for an extended period of time (Gardner, 2000; Jewitt, 2012). With the repeated, long testing observations (90 minutes sessions over a 4-year period), and the high variability we observed among families, we have confidence that we are capturing a realistic range in children's home language contexts.

Finally, an unexpected by-product of the experimenter's presence might have been to provide a new 'audience' for personal narrative talk. Occasionally in the corpus, parents and children appear to engage in narrative talk for the benefit of the experimenter. This practice, in part, explains the approach taken by Burger and Miller (1999), who examined spontaneous personal narrative talk in naturalistic situations at home for twelve families, recorded when

children were 2½ and 3 years old. The experimenter in this study was instructed to act as a

'family friend who had stopped by for a visit,' rather than to adopt a 'silent stance' or to act

invisible, as was done in this study. Ultimately, it is unknown the extent to which the presence of

the camera influenced people's behavior, or whether children's 'true' early experiences are

accurately being captured on the videotapes.

Future Research

The findings from this study inspire many avenues for future research. One important

area of future research includes examining relations between parent and child talk. Do parents

who frequently tell rich narratives, with many examples of HOTT, inspire their children to do the

same? How stable across development is speakers' use of HOTT, narrative, and HOTT in

narrative? Now that narrative has been highlighted as a rich context for HOTT, future research

can also examine whether there are any effects of different levels of exposure to higher-order

thinking in narrative and non-narrative talk on children's later educational outcomes.

Additionally, pretend was only coded at 38- and 50-months; future work can examine

whether the relationship between HOTT and pretend is different at different age points. Related

to this point, pretend has been treated in these analyses as a singular form of talk, but there are

many different ways in which parents and children pretend: play while using one object to

represent or stand for another; play while using object replicas; and telling or re-telling stories

about fictional characters. There are also differences in children's play partners: collaborative vs.

solo pretend play; play with parents vs. play with siblings; and play with objects vs. play that

relies more on language. Each of these different ways or types of pretending may differentially

affect use of HOTT. Pretend that is more story-driven (such as telling or retelling stories about

fictional or made-up characters without enactment), or that is particularly salient, or that relies

less on the here-and-now, or that makes use of metacognition, may (like narrative) increase

HOTT. These types of pretend play may be more common in later developmental stages.

Future research can also examine differences in HOTT use in different kinds of personal

narratives by examining the salience of the events discussed and the ecological context in which

the narratives are situated. Children tend to produce more complex and coherent stories when

telling stories about negative, rather than positive, events (Fivush, Sales, & Bohanek, 2008).

Narratives concerning more emotional events may encourage parents and children to use even

more instances of HOTT. In line with ecological theory, narrative talk could be coded for

whether speakers are describing shared or unshared experiences (Fivush & Merrill, 2016).

Talking about a shared experience potentially gives parents more opportunities for scaffolding.

But when telling stories about unshared experiences, children are challenged to more clearly

articulate the order and nature of events, which may provide more opportunities for children to

use HOTT. Additional analyses of different types of narrative and pretend could lead to greater

insights into what makes these kinds of talk so relevant for children's later educational outcomes.

Finally, although this paper focuses on narrative (and uses pretend as a close

comparison), other forms of decontextualized talk are prevalent in early parent-child interactions,

including non-immediate talk during book-reading. A well-replicated finding in the

developmental psychology literature is the relationship between shared parent-child book-

reading and children's later cognitive and linguistic outcomes (for a meta-analysis, see Bus, Van

IJzendoorn and Pellegrini, 1995). Although some work focuses on frequency of book-reading

(Payne, Whitehurst, & Angell, 1994; Sénéchal & Lefevre, 2002), other work focuses on

qualitative differences, finding, for example, that talk extending the topic of the book (including

story predictions, evaluations, or inferences, as well as comparing the content of the book to the

child's own experiences) predicts children's receptive vocabulary at 2nd grade, reading

comprehension at 3rd grade, and internal motivation to read at 4th grade (Demir-Lira, et al.,

2018). In future research, book-reading talk (most of which was included in this study as non-

narrative/non-pretend "other" talk), as well as the verbatim text of children's picture books

(Montag, Jones, & Smith, 2015), can be explored as another rich context that naturally invites

parents and children to use higher-order thinking talk. Moreover, picture books have the

potential to serve as a prompt for eliciting personal narratives (Hindman, Skibbe, & Foster,

2013).

Conclusion

In sum, in this paper, we have examined parents' and children's use of spontaneous

higher-order thinking talk in narrative and pretend early in development. We interpret these data

to show that narrative serves as a rich linguistic context where parents and children frequently

invoke higher-order thinking in talk, proportionally more than in the related talk context of

pretend play, and proportionally more than in non-narrative, non-pretend everyday talk. By

heightening personal narrative talk in childhood, teachers, educators, parents, and researchers

might potentially foster the development of the higher-order thinking skills that are so crucial for

later academic success, making the language they will need for later expression and

interpretation of academic content taught in school available to them early, from those who care

for and about them.

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Supplementary Materials

As reported in the primary manuscript, we conducted analyses to examine the

relationship between the expected observed occurrence of HOTT in narrative and pretend. In the

following section, we again describe the observed differences reported in the main manuscript to

provide context, but follow-up on these observations to report a set of general linear mixed

effects rate models to test these relationships and the role of speaker (parent versus child), time

(38 versus 50 months), speech type (narrative versus pretend), and speech status (expected

versus observed). Overall, the findings replicate the results presented in the manuscript to show

that HOTT was produced in greater than expected frequency within narrative but not pretend, but

with a different analytical strategy.

Expected versus Observed Occurrence of HOTT in Narrative and Pretend.

We employed a second analytical approach to consider the robustness of the relationship

between HOTT and narrative and pretend, this time by comparing each individual's 'expected'

occurrence of HOTT in narrative and pretend (based on their average rate across all talk), to their

'observed' occurrence. We calculated the 'expected,' or chance, values by multiplying, for each

individual, their base rate for narrative by their base rate for HOTT. For example, at 38 months,

one parent used narrative in 9.7% of her talk and pretend in 12.3% of her talk (so 78% of her talk

is other). This parent used HOTT in 8.9% of her talk (so 91.1% of her talk is non-HOTT). If

HOTT is unrelated to talk context, and only appears in narrative and pretend by chance, as a

result of her natural rate of HOTT use, we would expect that HOTT in narrative utterances

would comprise 0.86% of her total utterances (9.7% * 8.9%), and HOTT in pretend utterances

would comprise 1.09% of her total utterances (12.3% * 8.9%). This parent spoke 546 utterances

per hour; we therefore would expect about 5 of her utterances per hour to display a HOTT

relationship in a narrative context, and about 6 of her utterances per hour to display a HOTT

relationship in a pretend context.

Next, we calculated the 'observed' occurrence rate of HOTT into narrative and pretend,

by dividing the actual number of HOTT in narrative and HOTT in pretend utterances used by the

parent by total number of utterances used by the parent. This sample parent actually used 15

HOTT in narrative utterances per hour, which accounted for 2.74% of her total talk—almost

three times the value expected by chance. In contrast, she used only 7 HOTT in pretend

utterances, representing 1.28% of her total utterances—almost the same value expected by

chance. We performed these same calculations on all parents and children 38- and 50-months;

means for expected and observed (a) proportion of all utterances and (b) total number of

utterances are reported in the main manuscript in Figure 3. Because pretend makes up a greater

proportion of parent's and children's language than narrative (see Table 5 in the main

manuscript), frequency of HOTT in pretend utterances was sometimes greater than HOTT in

narrative utterances, particularly for children. Nevertheless, Figure 3 demonstrate that parents

and children incorporate HOTT into their narrative talk at higher rates than predicted by chance,

whereas HOTT occurs in pretend about as often as predicted by chance.

Statistical Support for Expected vs. Observed Analyses

We next conducted a generalized linear mixed-effects rate model with a binomial

distribution, with fixed effects for speaker (parent vs. child, with children as the reference

category), session (38- vs. 50-months, with 38-months as the reference category), speech context

(narrative vs. pretend, with narrative as the reference category), and speech status (expected vs.

observed, with expected as the reference category). We also included two-way interactions

between status and context, status and session, status and speaker, context and session, context

and speaker, and session and speaker; three-way interactions between status, context and session; status, context, and speaker; status, session, and speaker; and context, session, and speaker; and a four-way interaction between status, context, session, and speaker. We also included a random effect for each family. Our primary aim was to determine whether there is an interaction between speech context and speech status—that is, whether we observe *greater* use of HOTT than expected by chance for narrative, but not for pretend.

In this model, we found significant main effects of speaker ($\beta = 0.81$, $SE_{\beta} = 0.21$, $p < 0.001$), which suggests parents use more HOTT than children; session ($\beta = 0.81$, $SE_{\beta} = 0.21$, $p < 0.001$), which suggests HOTT use increased between 38- and 50-months; and status ($\beta = 1.31$, $SE_{\beta} = 0.21$, $p < 0.001$), which suggests greater HOTT use in observed than expected. Critically, the interaction between context and status *was* significant ($\beta = -1.17$, $SE_{\beta} = 0.24$, $p < 0.001$), and was the only significant interaction. For HOTT in narrative, the observed values are *greater* than the expected values, while for HOTT in pretend, the observed and expected values are not reliably different. Both parents and children were more likely to incorporate HOTT into their narrative speech than their pretend speech.