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Learning to Tell Coherent Personal Narratives: Linkages to Mother-Child Reminiscing Over Time

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LEARNING TO TELL COHERENT PERSONAL NARRATIVES:
LINKAGES TO MOTHER-CHILD REMINISCING OVER TIME

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To Lauren, for giving meaning to the narrative of my life

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ABSTRACT

Longitudinal and concurrent predictors of children's narrative coherence are identified and used to model pathways to coherence. Narrative coherence in children's independent narratives was measured at 72-months using a multidimensional (context, chronology, and theme) coding system. Fifty-three potential predictors of children's narrative coherence were considered, including children's vocabulary scores, metamemory knowledge, and measures derived from observations of mothers' and children's talk during reminiscing conversations recorded when the children were 54 and 72 months old. Optimal Data Analysis was used to generate three classification tree models to identify variables associated with whether children were low or high on three dimensions of narrative coherence. The optimal predictors of each of the three dimensions of children's narrative coherence were unique, and yet all reflected aspects of talk in the mother-child reminiscing task. Results demonstrated support for the role that social factors play in the development of narrative coherence in childhood.

CHAPTER ONE

INTRODUCTION

As soon as children begin to use words, they engage in reminiscing (e.g., Engel, 1986; Nelson, 1988; Ornstein, Haden, & San Souci, 2008). In reminiscing conversations, preschool children co-construct narratives about past events with parents (e.g., Haden, Reese, & Fivush, 1996; Reese & Cox, 1999; Reese, Haden & Fivush 1993). It is thought that among the benefits of these autobiographical narrative interactions for children is that they learn how to tell a coherent personal narrative. Essentially, they learn to tell the Who, What, Where, When, Why and How of the story about their past. Different researchers have conceptualized coherence in different ways (see Reese et al., 2011 for discussion). In this study, I focus on three important dimensions in the development of narrative coherence. First, *context* refers to where and when an event being discussed took place, which is necessary orienting information. Second, *chronology* refers to the temporal ordering of actions and events within the narrative. Finally, *theme* refers to information about the point of the story, such as the inclusion of a high point and a resolution, or the inclusion of affective and evaluative information. I ask how aspects of reminiscing conversations that children engage in with their mothers over the preschool years may influence children's coherence—rated individually on each of these dimensions—when telling their own personal narratives independently.

It is important at the outset to highlight that learning to tell a coherent personal narrative is essential to early autobiographical memory and memory development more generally (Reese et al., 2011; Fivush, Haden, & Reese, 2006). Narratives are certainly important to meaningfully encode, store, and recall personal memories over time (Haden, Haine, & Fivush, 1997). However, personal narrative abilities are also linked to later literacy skills (Fivush et al., 2006; Haden et al., 1996; Reese, 1995) and scholastic achievement (Dickinson & Tabors, 2001; McCabe & Peterson, 1991; Scarborough & Dobrich, 1994). Moreover, as children learn to construct personal narratives, it is argued that they develop autobiographical memory skills that are critical to the development of the self-concept, because it is in relation to memories of past experiences that a child constructs an understanding of self (Howe & Courage, 1997; Nelson, 1993; Perner & Ruffman, 1995; Povinelli, 1995).

This study focuses on how personal narrative skills develop, and specifically on the development of personal narrative coherence. Based on socio-cultural and Vygotskian theory, it is theorized that parents scaffold their children's narrative development in joint reminiscing conversations, and through this socio-cultural exchange children learn what is worth remembering and how it ought to be remembered. Thus, a primary goal of this study is to examine longitudinally which aspects of these reminiscing conversations are associated with the development of narrative coherence in young children. In introducing this work, I begin with a discussion of prior research and a model for the development of narrative coherence.

Characterizing Narrative Coherence

Traditional Approaches

A coherent narrative is one that makes sense to a naïve listener not just in terms of understanding when, where, and what event took place, but also with respect to understanding the meaning of that event to the narrator (Reese et al., 2011). Labov (1972) provided an account of narrative structure by distinguishing the two essential functions of narrative: referential (i.e., what happened) and evaluative (i.e., why it is worth telling). To Labov, the structure of a narrative implies its function, as the information included in the narrative functions in one of these two ways, and is included in a specific order that optimizes coherence. Labov (1972) described a high-point approach to narrative analysis, in which well-structured narratives follow a specific pattern that includes building up to a high point and ending with a resolution, while less-developed narratives fall short of this "classic" pattern (e.g., "ending-at-the-high-point", "leap-frogging" between events). Subsequent developmental studies characterized narrative structure and coherence with this linguistic account in mind. For example, one early attempt to characterize children's narrative skill focused on their provision of referential information, including both details about events, and contextual orienting information concerning who, where, when, and why (Peterson & McCabe, 1992). In addition, narrative structure was classified using a scheme based on Labov's (1972) high-point approach. Results indicated that the two children in the study stressed the same narrative components that their mothers emphasized. Reflecting their respective mothers, one provided more orientation information while the other focused on sequencing events. This trend was evident in the information they provided as well as the overall structure of their narratives.

A second study using researcher-child interviews about past events characterized the structure of children's narratives by analyzing the relative inclusion of certain information within the narratives (Fivush, Haden, & Adam, 1995). These interviews were coded in two ways. The first scheme analyzed narrative structure by coding propositions into categories including orientations (e.g., information about who, where), referentials (e.g., actions, occurrences), and evaluations (e.g., affective comments). The second scheme characterized narrative cohesion by identifying children's use of temporal markers (e.g., then, because) and descriptives (e.g., adjectives, modifiers). Results indicated that children's personal narratives became more complex, coherent, and detailed across the preschool years, yet the overall structure of these accounts were relatively stable over time.

Narratives told in mother-, father-, and experimenter-child interviews about past events in a third study were analyzed for narrative structure in a similar way (Haden, Haine, & Fivush, 1997). Narrative structure was operationally defined as the relative inclusion of four mutually exclusive categories: actions, descriptions, orientations, and evaluation. Results again indicated that children's inclusion of aspects of narrative structure reflect their parents interaction style. There was some evidence that mothers' use of orientations was related to children's later narrative skills. Specifically, mothers who emphasized evaluations when reminiscing with their child at 40 months of age had children who also emphasized evaluations in independent narratives at 70 months of age.

These three studies suggest that the relative provision of different types of information in narratives can represent the structure and coherence of those narratives. However, these analyses are somewhat limited by their reliance on the structure of the event under discussion in determining the global coherence of the narrative (Reese et al., 2011). What is more, they conceive of coherence as unidimensional, which is parsimonious, but ignores recent evidence to the contrary.

A New Developmental Model of Narrative Coherence

A multidimensional model proposes three essential, independent aspects of narrative coherence: context, chronology, and theme (Reese et al., 2011). Context refers to where and when an event being discussed took place, which is necessary information for the listener to make sense of the description that follows. Chronology refers to the temporal ordering of actions and events within the narrative such that the listener can place events in their correct ordering. Finally, theme refers to information about the point of the story, such as the inclusion of a high point and a resolution, or the inclusion of affective and evaluative information. These affective and evaluation markers convey the meaning of the story to the teller and convey this to the listener; they are the why the story is told.

Taking a developmental approach, the model also posits differential linkages between dimensions and developmental outcomes. Reese et al. (2011) suggest that each one of these three dimensions has its own developmental pathway independent of the others. The authors further provide a rating system for coding a narrative along each dimension on a scale from 0-3 based on the competency displayed in communicating relevant information. This study adopts this rating system in scoring children's independently told personal narratives. I turn now to a fuller discussion of the empirical work presented by Reese et al. (2011) to support their developmental narrative coherence model.

There are a number of studies that have tracked the development of narrative coherence in children. For example, using the model developed by Reese et al. (2011) discussed above, the authors found that preschool children show low narrative coherence on all three dimensions, albeit not at floor for any one. Early in development, coherence is an undifferentiated skill that is based on general verbal and perhaps memorial skills, not on specific narrative competencies. While they are able to maintain a topic reasonably well, preschoolers have difficulty placing an event in a specific time and place or retelling an event in chronological order. Means for context and chronology among preschool data sets were at or below 0.5, and means for theme at these ages were close to 1.0. Cognitively, these young children still have much to develop in language, episodic memory and executive functioning before they will become coherent narrators. Early in childhood, narrative skills become differentiated from verbal competencies, such that by late preschool, children are telling on-topic narratives. School-age children report time and place in their narratives, boosting their context scores. Additionally, a spike in chronology scores is observed between 6 and 11 years of age, signifying a general developmental progression as children learn to temporally order the events in their narratives. Lastly, a less dramatic progression was also observed on the theme dimension, with some younger children scoring under 1.5 and adolescents scoring close to 2.5. Important to note, longitudinal correlations between children's narratives at ages 5 and 6 were not found to be significant, perhaps suggesting that variables outside of early narrative skills influence the development of narrative coherence.

Peterson and McCabe (1983) reported age-related developments in narrative structure such that at age 4 children gave temporally disorganized lists of actions, whereas children at age 5 told narratives that followed the temporal sequence of experienced events but that ended prematurely at the high point of the story. By age 6, children oriented their listeners to who, what, where, and when something happened, gave complicating action building to a climactic event that was evaluated in some way, went on to resolve the action, and sometimes provided a coda updating the events in the narrative. In middle childhood, there is a sharp increase in children's ability to tell a chronologically ordered narrative, and yet the ability to place an event in time and space doesn't appear to emerge until adolescence. The former may rely in part on the understanding of conventional time, which develops in middle childhood, while the latter may rely on cultural constructions of time and space and sophisticated perspective taking skills that emerge in adolescence (Friedman, 2003; 2004). In sum, the age points targeted in this study of 54 and 72 months allow for an investigation of the development of narrative coherence beginning at a time of emerging competencies and ending at a point of relative sophistication. Considering what drives the development of these skills at these ages, the following section describes one essential context in which parents scaffold children's development of narrative coherence.

Factors Contributing to the Development of Narrative Coherence

How might children's personal narrative coherence develop as a function of aspects of early conversations they have with their mothers about past events? Three features of reminiscing conversations may be important for the development of children's narrative coherence skills. The first is individual differences in the *reminiscing style* that parents use when talking about past events with their children. It is well documented that parents vary along a continuum of elaborativeness when talking about the past with their children (see Fivush, Haden & Reese, 2006, for a review). Some parents provide many details and ask many open-ended What, Where, Why, and How type questions ask they participate in conversations with their children about events they have experienced together in the past. Moreover, it is clear that parental reminiscing style influences children's developing skills for reporting details of past experiences (Fivush 2007; Reese, Haden, & Fivush, 1993; Haden, Ornstein, Rudek, & Cameron, 2009). It is through verbal interactions like reminiscing with parents that children develop the capacity to recall and report the past as autobiographical narratives. Nonetheless, few studies have considered how parental reminiscing style relates to the development of skills for telling a *coherent* personal narrative. For example, do early differences in parental reminiscing style relate to differences in children's abilities to tell coherent personal stories later in development?

A second feature of interest in relation to narrative coherence is the occurrence of talk about internal states during parent-child reminiscing. Internal state language includes both mental state talk, such as comments about remembering, knowing, thinking, and emotion talk, including feelings (e.g., sad) and emotional states (e.g., crying). In past event conversations, parents who frequently use internal state language provide children with many opportunities to integrate their understanding of mental processes, of past and present, and of self and other into their representation of personal memories (Fivush & Nelson, 2006; Nelson & Fivush, 2004; Reese, 2002; Welch-Ross, 1995). The inclusion of thoughts and feelings in reminiscing conversations may be especially important as children begin to extract personal meaning from their past experiences. In fact, internal state talk is considered by many theorists and researchers to be integral in constructing a coherent self-narrative (Bird & Reese, 2006; Fivush, 2007; Fivush, Sales, & Bohanek, 2008; Laible & Song, 2006). But again, few studies have considered how internal state language that is used in conversations with children early in the development relates to children's later skills in telling coherent personal narratives.

A third feature of reminiscing conversations considered in this study is the occurrence of metamemory talk. As children are engaging in conversations about the past, they are also learning why remembering is important (Reese & Cleveland, 2006; Rudek & Haden, 2005) and this may have implications for the development of metamemory skills, or abilities to reflect on the process of remembering. Although research has demonstrated that metamnemonic behaviors (e.g., sorting to-be-remembered items) and knowledge (e.g., that sorting facilitates recall) are important predictors of deliberate memory (e.g., Schneider, 1986), there is little currently known about the relation between metamemory and autobiographical memory development. Like knowledge about mental states and emotions, awareness of the process of remembering the past involves the consideration of the inner workings of the mind (i.e., an awareness of memory processes), but may uniquely allow children to connect their past self with their present self. One way of examining these patterns is by looking at how metamemory talk in reminiscing conversations is related to children's later skills for narrative coherence. But, it is the case that metamemory talk is infrequent in these conversations (e.g., Rudek & Haden, 2005). Therefore, in this project, we made use of "independent" assessments of the children's metamemory understanding, based on three separate tasks that were administered to the children to tap this knowledge. As such, along with parental reminiscing style, and internal state and metememory talk during reminiscing, metamemory skill more generally is also considered as a factor in the development of children's narrative coherence abilities.

The Current Study

The current project uniquely contributes to the literature by addressing "What develops?" and considering the variables that operate to bring about developmental change in the development of autobiographical memory (see Ornstein & Haden, 2001).

It is well-documented that with age and experience in talking about the past, children's reports of past experiences become richer and more detailed, but further research is needed to explicate the factors that influence this developmental process. Utilizing an existing longitudinal data set, I examined relations among children's developing autobiographical memory and narrative-telling skills and mothers' contributions to those skills. Mother-child interactions during reminiscing conversations were observed when children were 54- and 72-months old. Characterizations of mothers' and children's contributions to these conversations were hypothesized to be related to children's developing ability to independently tell coherent narratives. These characterizations include parental reminiscing style and children's abilities to report details of past events, as well as mothers' and children's provision of internal states language (including both cognitive terms and emotional utterances). Metamemory comments in these conversations as well as independent assessments of the children's memory skills were also considered as predictors of children's narrative coherence.

The selection of these two age points was guided by prior work that suggests that by 54 months, children's skills for talking about the past with their parents are fairly advanced, and that by 72 months, their abilities to tell a coherent story about the past are reaching a point of relative sophistication. As will be discussed below, three-year-old children do not participate much in reminiscing conversations, whereas four-year-olds are beginning to exhibit narrative competencies, such as ordering events chronologically in a report of a past event. For this reason, 54 months was selected as the first time point because it is an age when children are beginning to show competencies with room for development, and parental support for this development. Although narrative skills continue to develop well into the school years, there is evidence that children's narrative skills develop rapidly over the preschool period. Results of a large cross-sectional study of narrative in 3- to 9-year-old children indicated that by 6 years of age, children's narratives followed the most sophisticated pattern of narrative structure (Peterson & McCabe, 1992). Indeed, it is at this age that children begin to provide contextual details, order events chronologically, and include other aspects that provide coherence to the narratives they tell (Reese et al., 2011). As such, 72-months was selected as the time point at which narrative coherence would be analyzed, because children at this age begin to demonstrate early proficiency.

What follows is a backdrop for the rationale for the current project, beginning with a review of theoretical underpinnings supporting the role of social interaction in promoting cognitive development, and concluding with a review of the literature on autobiographical memory, narrative coherence, and metamemory and parent-child reminiscing.

Theoretical Framework

The discussion of the influence of parent-child conversational interactions on children's cognitive development extends from theory that stresses social and cultural factors in development. Vygotsky (1978) posited a sociocultural theory in which social interaction plays a pivotal role in the processes of cognitive development. In contrast to his predecessors that portrayed development as individualistic and endogenous, Vygotsky focused on the social origins of mental processes. He could not conceive of mental functioning in an individual without social and cultural contexts, because mental processes, according to Vygotsky, do not occur within the individual, but rather occur between people (Wertsch & Tulviste, 1992). These contexts provide tools (e.g., language) with which the learner can engage and skilled partners (e.g., parents) to guide the learner in the use of these tools. In interactions with others, children could first perform a cognitive task with a skilled partner, internalize the processes involved in the task, and ultimately perform the task without help. Vygotsky revolutionized how development is viewed, because he recognized that children could perform tasks with help from others that they could otherwise not perform on their own. This distance between a child's "actual developmental level," or what she could perform alone, and her "potential development," or what she could perform with help, he deemed the zone of proximal development (Vygotsky, 1978). Cognitive development occurs in the zone of proximal development through experience in joint activities with skilled partners (Wertsch & Tulviste, 1992).

Skilled partners are said to scaffold children's development when providing developmentally appropriate support that allows the child to perform the task, internalize the involved processes, and work toward mastering the task without support. Rogoff (1990) extended Vygotskian theory by discussing guided participation, similar to the process of scaffolding with the additional element of mutually active participation. In guided participation, the child is actively engaged in the process of learning with social partners, who themselves are active in structuring a socioculturally organized activity embedded with culturally valued skills and perspectives (Rogoff, 1990). Parent-child reminiscing, in which parents and children co-construct narratives about the past, is one social activity in which guided participation can occur, with potentially profound impacts on the development of autobiographical memory and the related ability to tell coherent narratives.

Autobiographical Memory

Autobiographical memory has been the subject of much interest in psychological research (see Fivush, Haden, & Reese, 2006; Nelson & Fivush, 2004; and Reese, 2002, for reviews). A consensus about its meaning is difficult to reach because of the many disciplines interested in autobiographical memory and the myriad perspectives taken within each discipline (Rubin, 1992). At one level, the term simply refers to the recollection of earlier life experiences. However, it is used in multiple ways within the literature: as a specific memory system with a separable neurological base; as a term describing knowledge about the self; and as the study of the processes and mechanisms whereby subjects recall experienced life events (Baddeley, 1992). These different understandings may be inseparable, as, for example, it would be difficult to consider one's memory for their past without a neurological base with which to do so. Additionally, a diversity of interpretations of autobiographical memory may benefit the study thereof, because it allows for evidence to converge in interesting, unforeseeable ways (Rubin, 1992). Nelson and Fivush (2004) define autobiographical memory as "declarative, explicit memory for specific points in the past, recalled from the unique perspective of the self in relation to others" (p. 488). Note that this definition implies many developmental capacities involved in autobiographical memory, including the ability to report memories, an understanding of social conventions of time (e.g., past, present), and an understanding of the self in relation to others.

People re-experience the past, conscious that the remembered event occurred in another time and place (Tulving, 1983). The uniquely human experience of verbally recalling event memories is possible due to an autobiographical memory system that allows humans to "travel back into the past in their own minds" (Tulving, 1983, p. 1). However, humans are born with neither these specific, embedded capabilities nor the encompassing ability to encode and recall the events of their lives. This is evident in that adults cannot recall many memories from their infancy. Very few (1.1%) autobiographical memories reported by adults occurred before age 3, and little is known about the content, vividness, narrative coherence, or detail of those memories (Rubin, 2000). This robust phenomenon wherein adults cannot access event memories from their infancy is known as *childhood amnesia* or *infantile amnesia* (Dudycha & Dudycha, 1941; Freud, 1924/1953; Howe & Courage, 1993; Pillemer & White, 1989). There has been much debate about the causes of this phenomenon, and still there is no consensus. Surely the problem is not as simple as to say that infants cannot encode, store, or recall memories, because infants do remember events from the past (see Bauer, 2006, 2007, for reviews). This point has been demonstrated in research using elicited and deferred imitation paradigms in which infants are shown novel event sequences (see Bauer, San Souci, & Pathman, 2010; Meltzoff, 1995). Infants can successfully imitate the action sequences either immediately after witnessing the sequence (elicited imitation) or even after a delay (deferred imitation). Infants as young as 6-months-old are able to repeat more parts of a 3-step action sequence one day after having seen it performed than control infants who did not see the target actions (Barr, Dowden, & Hayne, 1996). Infants, therefore, must have some ability to encode memories, store them, and later demonstrate their memories, if nonverbally. Additionally, 3- and 4-year-old children can recall details of life events experienced 1 to 2 years earlier (Hamond & Fivush, 1990). It must then be due to other yet-undeveloped capacities beyond memory skills that infants cannot create autobiographical memories to be recalled later in life.

To consider how children overcome infantile amnesia is to consider the ontogeny of autobiographical memory. While Freud's (1924/1953) theory suggests that early childhood memories are repressed because they are painful and unacceptable, contemporary research offers alternative explanations in terms of cognitive development. Piaget (1971) offered an account wherein children's memories are jumbled up because they are unable to sequence events temporally. Other cognitive explanations more broadly conclude that young children are unable to organize memories effectively (Neisser, 1962). Research that specifically examined preschool children found that increases with age in the ability to recall and report event memories derive from developmental increases in organization of personal knowledge in autobiographical memory (Nelson, 1988). Indeed, the autobiographical memory system gradually emerges as children develop capacities in memory, language, narrative, temporal understanding, understanding of internal states, and understanding of self and others (Nelson & Fivush, 2004). Emergence, a term borrowed from genetics and biology, signifies the appearance of structure at a new level of complexity, generated from the interaction of structures existing at simpler levels. That is, once a child begins to think about the self and to organize personal memories in the narrative form, these and other requisite cognitive capacities interact to generate the appearance of an autobiographical memory system. This dynamic developmental system emerges over time and is history dependent, increases in size and complexity with age, and is embedded in a social context.

With this work on infantile amnesia and the emergence of autobiographical memory as a backdrop, reminiscing style, internal states language, and metamemory talk were considered in this study as potential predictors of narrative coherence. Children are thought to develop autobiographical memory skills through guided participation in reminiscing conversations with parents in which they talk about the past. In these conversations, parents and children jointly construct narratives about past events that become coherent as information is provided about when and where the event occurred, the ordering of what happened, and the personal meaning of the event. Reminiscing style captures the extent to which parents elaborate upon details of what happened, internal states language conveys what people thought and felt about the event, and metamemory talk communicates how the event will be remembered. When present in parent-child reminiscing conversations, children can learn to include this critical information in their own reports of past events. As such, it was considered that the extent to which these aspects are included in early joint reminiscing conversations would predict the coherence of children's independent narratives over time.

Narrative Coherence and Autobiographical Memory

Autobiographical memory relies on children learning the canonical narrative form. The nature of the narrative reflects the nature of human memory (Gee, 1991), and in this way, narrative and autobiography are inextricably tied. Labov (1972) defined narrative as "one method of recapitulating past experience by matching a verbal sequence of clauses to the sequence of events which (it is inferred) actually occurred" (pp. 359-360). This definition implies an inherent interconnectedness between human autobiographical memory and the narrative form; narrative is the telling of such memories. This is why studying the way we make life stories coherent also reveals something about the ways in which we create our private universe of meanings (Linde, 1993). Personal narratives help us to make sense of our experiences (Bruner, 1991). We organize our self-concepts – past, present, and future – in accordance with the collection of our personal narratives, or life story. That is, the narrative form helps us create and maintain personal identity. Three major characteristics of self – continuity of the self through time; relation of the self to others, and reflexivity of the self, or treatment of the self as other – are specifically maintained and exchanged through language. One can only conceptualize of the self as continuous if one remembers one's own history and forms a coherent autobiography. Any single narrative is contingent on the narrative context within which it is embedded (i.e., one's history, traditions, socialization, shared narratives). In this way, personal narratives reflect both the self and one's culture (Gee, 1991). For example, the continuity of self is radically different in certain cultures that believe in reincarnation than in those that do not. Moreover, autobiography in this sense may be an exclusively Western concern in that other cultures are less focused on the singularity of the individual and more on the relation of the individual to the community. In such cultures, autobiography and narrative would have very different functions.

In Western culture, we derive knowledge of the self from the stories we tell about ourselves (Fitzgerald, 1992). For decades, we have increasingly relied on stories as a means for explaining ourselves to ourselves and others. Psychological theorists have likewise viewed the narrative form as perhaps the most pervasive of many forms of human thought. Whether told to oneself or to another, autobiographical memories are usually told in the narrative form (Rubin, 1996). The canonical narrative form gives structure to personal memories and allows them to be integrated into a life story (Bruner, 1987; Labov, 1982). Robinson and Hawpe (1986) claim that, "experience does not automatically assume narrative form. Rather, it is in reflecting on experience that we construct stories" (p. 111). As the structure of language and the structure of thought eventually become inseparable, it is difficult to distinguish narrative discourse from the narrative form of thought (Bruner, 1991). Indeed, our personal experiences and our understanding thereof are reflected in the narratives we tell.

Parent-Child Reminiscing

Telling a coherent and meaningful narrative requires both the ability to recall past experiences and the ability to organize these experiences into culturally conventionalized narrative forms (Haden, Haine, & Fivush, 1997). Children learn to construct coherent narratives about their personal past by means of habitual interactions with their parents, namely parent-child reminiscing (Fivush & Reese, 1992; McCabe & Peterson, 1991). Before children are able to report autobiographical memories, parents discuss past events with them. Children engage with their parents in reminiscing conversations as soon as they can talk (Hudson, 1990; Miller & Sperry, 1988). In these conversations, children learn the forms and functions of recalling and reporting past life events from verbal interactions with parents. The way in which parents reminisce with their children impacts their development of memory and aspects of narrative development. For example, elaborative reminiscing by mothers has been linked to strategic memory development, language and literacy skills, and understanding of self, other, and mind (Fivush, Haden, & Reese, 2006). Specifically, "high-eliciting" mothers had children who provided more memory elaborations in reminiscing conversations compared to the "low-eliciting" group (Haden et al., 2009). Further, when mothers emphasize evaluative information in joint narratives during reminiscing, their children are subsequently adapting similar narrative techniques, evidencing the impact of reminiscing on narrative development (Haden, Haine, & Fivush, 1997). Others have found that talking about the past with parents who discuss and explain internal states allows children to construct relations between past and present, and self and other (Fivush & Nelson, 2006). As these relations are critical to narrative coherence, this type of reminiscing may be particularly beneficial for children's development. In the current study, I investigate the developmental effects of parent-child reminiscing by analyzing children's memory contributions in reminiscing conversations, and measure of coherence in narratives told independently by children. The hypothesis that reminiscing interactions influence the development of coherence was directly tested by concurrently and longitudinally analyzing mother-child reminiscing conversations when children are 54 and 72 months of age and the coherence of children's independent narratives at 72 months.

By reminiscing with parents, children learn that it is culturally important to talk about the past. They also learn what narratives about the past include: information about what happened, information that places the event in spatial and temporal context, and information that evaluates the event in terms of what is personally meaningful (Fivush & Haden, 1997). This social communicative interaction between parents and children can focus children's attention on salient features of an event, facilitating the remembering and understanding of the event as well as providing the opportunity for the acquisition of generalized skills for remembering (Ornstein, Haden, & San Souci, 2008). In reminiscing about a shared past event, mothers direct the telling of narratives about an event in a highly decontextualized setting, often removed from the context in which the event occurred (McCabe & Peterson, 1991). This allows parents and children to reflect on an event with emotional and social context in a removed setting, evaluating and reflecting on the experience unencumbered by situational constraints. For these reasons, parent-child reminiscing is an outstanding context in which children can develop competencies for remembering and reporting past events.

Reminiscing not only requires that one can recall their past, but that they can organize their experiences into a coherent narrative. Narratives told in reminiscing accumulate into a collection of life stories, or a life history, which allows individuals to reflect on their past. Embedded within shared narratives about the past are implicit cultural communications about what is important to talk about and how it ought to be discussed. Thus, reminiscing is a cultural activity that allows for the historical transmission of knowledge from one generation to the next, so that each child "grows up in the context of something like the accumulated wisdom of its entire social group, past and present" (Tomasello, 2000, p. 38). Further, reminiscing is an inherently social activity: life events about which people reminisce are often shared, social experiences, and reminiscing itself is a social activity. As stated earlier, Vygotsky (1978) argued that developmental skills first appear on an interpersonal plane between parents and children. Reminiscing is a prime example of such social development, because parents must guide their children's acquisition of narrative and autobiographical memory skills by discussing events from their shared past. For children who are just learning the forms and functions of reminiscing about the past, it is adults who provide most of the content and structure of personal narratives. Not only will children internalize these implicit cultural lessons about what is important to discuss, but they will internalize how to talk about the past.

Parental Reminiscing Style

Parents scaffold their children's developing narrative skills by co-constructing narratives with children about jointly experienced past events in reminiscing conversations. Parents help to organize event memories into coherent narratives by reflecting on the meaning of the event from multiple perspectives. By doing so, parents support their children's development of the ability to construct meaningful, coherent narratives on their own. However, there are individual differences in the stylistic quality of parental contributions to reminiscing conversations with children. Fivush and Fromhoff (1988) recorded 30 minutes of past event conversations from 10 white, middle-class mothers of 2½-year olds. Half of the mothers talked significantly more than the other half. The first group asked more memory and elaborative questions. Mothers in the two groups differed when their children showed a willingness to discuss an event but displayed a lack of memory for the event, in that the more talkative mothers continued questioning their children about the event, but the less talkative parents dropped the topic. The talkative mothers provided more information about the topic and richly described the elements of the topic. The authors reported that relatively talkative mothers were more persistent in demanding that their children remember some event.

The decades of research that followed have revealed that mothers are consistent over time (Fivush, 2007) and across siblings (Haden, 1998) in their level of elaboration, falling into one of two reminiscing styles (Fivush & Fromhoff, 1988; McCabe & Peterson, 1991). The "low elaborative" or "repetitive" style is characterized by few, redundant questions, whereas the "high elaborative" style is characterized by long, detailed discussions of past events, many questions, encouraging discussion about aspects in which the child is interested, and evaluating positively their responses (Fivush, 2007: Haden et al., 2009). High elaborative parents provide and request new information much more than they repeat old information within the narrative, whereas low elaborative parents provided more repetitions than elaborations (Reese & Fivush, 1993). These low elaborative, or repetitive, parents have shorter conversations about each event discussed in reminiscing conversations, frequently repeat their own questions, and provide less narrative structure, whereas high elaborative parents provide a great deal of narrative structure by embellishing events or aspects of events, providing confirmations of children's responses, and having lengthy conversations about the past. However, high elaborative mothers are not simply talking more than low elaborative mothers; they are clearly displaying a unique style of talking about the past. High elaborative mothers seem to be inviting their children to participate in the conversation more than low elaborative mothers (Haden et al., 2009), in line with Rogoff's (1990) theory of guided participation. This difference in style is likely a reflection of the specific goals mothers are trying to achieve with their children in reminiscing conversations (Haden & Fivush, 1996). Reese, Haden, and Fivush (1993) consider the possibility that low elaborative and high elaborative parents interpret the function of reminiscing differently. Perhaps high-elaborative mothers see reminiscing as a social activity for getting closer to their children by collaboratively recreating shared experiences. Low elaborative parents may view the activity as a forum for testing their children's memory, and thusly encourage their children's independent memory performance.

In support of socio-cultural theory, parental reminiscing style is related to children's development of autobiographical memory. Mothers who ask their children more memory questions in everyday conversations have children who display better memory skills on a variety of tasks, including recalling more aspects of a past event in a joint reminiscing context (Fivush, Haden, & Reese, 2006; Ratner, 1984). Maternal level of elaboration is positively associated with preschool children's concurrent memory performance in reminiscing conversations (Reese, Haden, & Fivush, 1993). Children of high elaborative mothers participate to a greater extent in reminiscing conversations both concurrently and over time relative to children of low elaborative mothers (Fivush 2007). Parents' elaborative style is associated with children's participation as indicated by increases in provisions of all types of talk in reminiscing (Reese & Fivush, 1993). On the other hand, the repetitive parental style was associated only with children's tendency not to respond during conversations. Of note, concurrence between maternal elaboration and child memory performance makes it difficult to tease apart the direction of the effect (i.e., elaborative parents may elicit memory skills from their children, and/or skilled children may elicit elaboration from their parents), warranting the implementation of longitudinal studies. Early longitudinal research showed that an elaborative maternal style is associated with the length of children’s independent narratives concurrently and 1 year later (McCabe & Peterson, 1991) as well as with children’s increased participation and elaboration when recounting events with an experimenter (Hudson, 1990). More contemporary work found bidirectional effects between mothers’ reminiscing style and children’s memory performance such that early on, maternal style predicts children’s memory responses, but by 58 and 70 months of age, there is clear bidirectionality (Haden et al., 2009; Reese, Haden, & Fivush, 1993). This suggests that to the extent that children contribute to reminiscing conversations as their competency improves, their mothers respond by becoming even more elaborative conversational partners. Certainly, maternal reminiscing style is an essential factor in children’s development of children's skills to retrieve and report their memories. The current study assessed the impact of maternal contributions on children’s independent narrative-telling with a direct, reliable measure of narrative coherence.

Whereas it is clear from the literature that children are learning skills to tell details of personally experienced events when reporting the past, it has also been suggested that children are learning to tell these stories in a more coherent fashion through engaging in elaborative reminiscing (Peterson & McCabe, 1992). For example, McCabe and Peterson (1991) propose that specific elements of an elaborative reminiscing style contribute to the development of narrative coherence. In particular, parents ask questions of their children that elicit early narrative telling, and can do so in optimal ways as to best scaffold their children’s narrative development. For example, parents might relate follow-up questions to something children have just said in order to further the coherence and fluency of the discourse. Also, parents foster their children's narrative development by modeling narrative-telling, reinforcing positive narration, and providing corrective feedback. Parental topic-extension (i.e., asking follow-up questions, staying on a topic in which the child shows interest) proved predictive of longer child narratives over time, whereas topic-switching was associated with relatively shorter narratives. More than just learning to report memories in an elaborative way, parent-child reminiscing offers a venue for teaching children skills for structuring their memories into coherent narratives. The style with which parents ask their children memory questions may influence the patterns children learn in reporting memories, such as fully developing a topic before switching to a new one, which would have an obvious influence on the coherence of children's narratives. In this way, these differences in how parents vary in the manner in and extent to which they tried to elicit children's narratives are thought to influence children's developing capacity to tell structured, coherent narratives. Now, I turn to internal state language and metamemory, which are components of children's learning to remember their personal past and find meaning in their life story.

Internal States Language in Reminiscing

Parent-child reminiscing is an interaction through which children learn to construct personal meaning from their past experiences (Bird & Reese, 2006). Specifically, by discussing their own and others' emotions, motivations, and goals in reminiscing, children participate in a meaning-making process by reflecting on these experiences (Fivush, 2007; Nelson & Fivush, 2004). The discussion of evaluative and emotional aspects of past experiences help children understand why those experiences are personally meaningful, allowing them to connect these experiences into a coherent autobiography (Bird & Reese, 2006; Fivush, 1993; Nelson, 1993). This coherent narrative about one's past is thought to allow for the construction of a subjective self, as previously discussed. The use of words that convey emotion, cognition, and perspective, or *internal states language* in reminiscing indicates such an attempt to make an experience personally meaningful (Fivush & Baker-Ward, 2005; Fivush et al., 2008). The use of this language implies that the narrator is attempting to integrate what happened in the past with a subjective perspective on one's thoughts and emotional reactions to the event (Fivush & Haden, 2005; Fivush & Nelson, 2006). For young children beginning to develop a self-concept in relation to their autobiographical experiences, parents implicitly and explicitly offer "instruction" in this meaning-making process by using internal states language (Bauer, Stennes, & Haight, 2003). Because internal states cannot be directly observed, may be fleeting, and conflict at times, children require help interpreting and evaluating them in reminiscing in order to make events meaningful.

Children begin to use internal states language (e.g., remember, think, know) as soon as they begin combining spoken words, and by the end of the preschool years, children use this language in conversations with sophistication (Bartsch & Wellman, 1995). In a study of 28-month-olds, most mothers reported that their children used perceptual (e.g., see), physiological (e.g., hungry), and affective (e.g., scared) expressions (Bretherton & Beeghly, 1982), indicating that children of this age are beginning to be aware of their own and others' desires, beliefs, emotions, thoughts, etc. (i.e., are developing a theory of mind) (Perner, 1991). Not surprisingly, there are individual differences in children's understanding of theory of mind, which is dependent on their home and other environments and is reflected in their internal state language (Fivush & Baker-Ward, 2005). Research points to parental style of talk as a significant factor contributing to children's understanding of self and emotion. Children living in homes in which parents and siblings use more internal states language come to express more thoughts and feelings themselves (Dunn et al., 1991). Additionally, mothers who include more information about emotions in conversations during reminiscing have children who understand more about desires, emotions, and beliefs (Ruffman, Slade, & Crowe, 2002). There is also evidence that highly elaborative parents have children who score higher on measures of emotional understanding than those of repetitive parents (Laible & Song, 2006). Also, children under stress tell less coherent narratives than less stressed children, suggesting that other environmental factors may affect children's ability to make sense of their personal experiences (Fivush, Sales, & Bohanek, 2008). With the above discussion of narrative coherence in mind, this negative association between stress and narrative coherence reflects the importance of being able to reflect upon one's past coherently.

This form of coherent reflection upon one's past may be indicated internal states language, both in the discussion of emotion and cognition. Children learn about emotions from their parents (Denham, Zoller, & Couchoud, 1994), including through emotion-related discourse in parent-child reminiscing (Fivush, Sales, & Bohanek, 2008). Emotional content is a common and salient characteristic of autobiographical reports (Bauer, Stennes, & Haight, 2003), and the discussion thereof can aid children's construction of self through autobiographical memory. For example, greater dyadic reference to children's emotional states was found to be related with more organized self-views (Welch-Ross et al., 1999). Further, Bird & Reese (2006) found that parents who explained the causes and consequences of children's negative emotions and evaluated positive events had children with more consistent self-concepts. This self-referential meaning-making process is an especially important one when it comes to negative past events, as research shows that adults who narrate stressful events more coherently show better psychological outcomes (see Pennebaker, 1997, for an overview). Similar to the discussion of emotions in reminiscing, talking about cognitive states can help children think about aspects of the mind, including motivations, beliefs, and desires. By contemplating the mental activity of the self and others, children consider the past from multiple perspectives, deepening their understanding of their experiences. In an investigation of 30- and 42-month-old children participating in a mother-child reminiscing task, parents' and children's use of cognitive terms was concurrently correlated, suggesting that children learn to use internal states language through communicative interactions with parents (Rudek & Haden, 2005). Overall, research attests that reminiscing about the past with children can have a profound impact on their developing understanding of their selves and their world (Fivush, 2007).

Metamemory

Tulving and Madigan (1970) suggested that researchers ought to investigate "one of the truly unique characteristics of human memory: its knowledge of its own knowledge" (p. 477). Flavell (1971) coined the term *metamemory* to refer to potentially verbalizable knowledge pertaining to the storage and retrieval of information (see Flavell & Wellman, 1977). There is a vast literature concerning what children of elementary school age know about remembering (Schneider & Pressley, 1997). However, the study of the development of metamemory and its relations to mnemonic skills has mostly been limited to linking memory knowledge and memory activity (i.e., strategy use and/or metamnemonic knowledge with explicit memory performance, usually of objects or words), and little is known about its relation to autobiographical memory development.

A first glance at early empirical investigations into the existence of a metamemory-memory behavior relationship would seem discouraging (Schneider, 1985). While some denied that developmental changes in children's metamemory are related to their memory performance (e.g., Borkowski, Milstead, & Hale, 1988; Kelly et al., 1976; Salatas & Flavell, 1976), others did find evidence of a link between the two (e.g., Schlagmüller & Schneider, 2002; Schneider, Schlagmüller, & Vise, 1998). This discrepancy in findings is likely due to the type of knowledge and behavior studied. A review of research on children's ability to use deliberate strategies for remembering (e.g., rehearsal, organization) finds that the use of these memory strategies indeed improves retrieval. When trying to remember the location of an item, 18- to 24-month-old infants engage in rudimentary behaviors that bear a striking resemblance to more complex mnemonic behaviors like rehearsal and self-monitoring (Deloache, Cassidy, & Brown, 1985). By looking at the hiding spot or talking about the item's location, these infants are keeping this information about the item's location alive in memory, and these behaviors are related to subsequent recall. In another study (Wellman, Ritter, & Flavell, 1975), an experimenter hid a toy dog and then instructed 3- and 4-year-old children to either "remember the location of the dog" (remember condition) or to simply "wait here with the dog" (wait condition). Relative to children in the wait condition, children in the remember condition engaged in more deliberate mnemonic behaviors, such as rehearsal, which correlated positively with retrieval.

However, the use of these strategies does not necessarily require metamnemonic knowledge. Children may be unaware that their behavior is related to their ability to remember. A recent investigation addressed the specific relationship between metamemory and the use of deliberate strategies for remembering, uncovering a time-lagged relationship between metamnemonic knowledge and sorting behavior in grade school children (Grammer et al., 2011). According to the authors, aspects of children's environment (e.g., school, home) are related to metamemory and strategy use, and metamnemonic knowledge may play a mediating role in this relationship. Their results indicate that an understanding of memory processes is important for the development of beneficial mnemonic strategies. Simply put, these studies suggest that children learn to use strategies to remember, improving their ability to retrieve information from memory, and this process may partially rely on metamnemonic understanding.

Beyond using strategies to boost the retrieval of already-encoded information, metamemory can refer to meaningfully encoding information. Children must develop the capacity to organize information in their memory such as to optimize retrieval. Dramatic changes occur over the course of the elementary school years in how children encode information when confronted with tasks that involve remembering (Grammer et al., 2011). There is evidence that a qualitative shift occurs over the grade school years from relatively inactive organization based on the associative structure of the task materials to more active organization based on taxonomic criteria (Ornstein, Haden, & Elischberger, 2006). By around the fourth grade, children are beginning to explicitly control the organization of their memories in this way, replacing their earlier tendency to allow the environment to control their organization. Using a sort-recall task in which second-, third-, and fourth-graders were given a list of words that they could remember in any order, older children tended to use more strategies than younger children (Coyle & Bjorklund, 1997). Interestingly, the relation between strategy use (e.g., sorting, categorization) and recall changed with age such that fourth-graders showed a clear and consistent propensity to use, and benefit from, multiple strategies beginning with the first trial of the experiment, but second- and third-graders only showed this relation in later trials. It appears that children at these ages are developing metacognitive awareness, facilitating marked improvements in the effective encoding of information and subsequent recall performance.

Nonetheless, little is known about how metamemory relates to autobiographical memory development. Are developments in metamemory positively related to children's ability to recall and report events from their past? In this study, the relations between metamemory and autobiographical memory are considered in two ways. First, mother-child reminiscing may be quite important in its role as a precursor to mnemonic understanding, as these conversations include explicit references to aspects of memory processes (Rudek & Haden, 2005). For example, reminiscing conversations can include metamemory comments, or references to the process of remembering (e.g., "It was hard to remember that because it happened so long ago"), which can aid in children's learning about the general conditions that affect autobiographical memory. Frequently including metamemory comments in reminiscing conversations may provide children with practice in searching and reporting these memories. In this way, metamemory talk should function much like talk about emotional and cognitive states in reminiscing, in that it allows insight into mental activity as to allow for meaning-making. Children begin to understand how their past self is connected to their current self, and how their past memories are related, and they can construct a coherent self around these connections.

Second, metamnemonic understanding among children may facilitate their ability to organize autobiographical information in memory. In line with the theory that organizing words or items meaningfully in memory during a remembering task assists in their subsequent recall, organizing event memories meaningfully in memory could assist in recalling and reporting autobiographical memories. In this case, encoding past events in a coherent narrative form would be analogous to remembering a list of words based on taxonomic criteria, in that both optimize the memories' personal meaning in order to be most effectively evoked. If individual differences in metamemory could predict the ability of children to strategically remember lists of words, could they not also predict the coherence children's narrative reports of the past? Multiple assessments of children's metamemory knowledge in addition to the provision of metamemory comments in dyadic reminiscing conversations has been included in the current project in order to test for relations between these variables and children's developing capacity to report autobiographical memories in the narrative form.

Approach and Hypotheses

Socio-cultural theory suggests that parents scaffold children's development of the skills necessary to remember and report autobiographical memories about their personal past in reminiscing conversations. Mothers, in the case of this study, can be expected to scaffold their children's developing narrative skills in reminiscing conversations in many ways. For example, during such reminiscing conversations children may implicitly pick up on the mention of one's own and others' internal states (i.e., internal states language) and of the process of remembering one's past (i.e., metamemory talk). In addition, children may attend to the narrative form in co-constructed recapitulations of the past, in turn learning how to construct coherent narratives independently. If children's narrative skills are implicitly learned through socialization during reminiscing conversations, one would expect children's independent narratives to reflect the style and structure of their reminiscing partners. The differential use of internal states language and talk about metamemory in joint reminiscing conversations with mothers should then be related to the overall coherence of children's independent narratives.

In order to examine factors that contribute to children's narrative skills, an analytic strategy was adopted that aims to optimally classify children into one of two groups: those that tell relatively coherent narratives, and those that tell relatively incoherent narratives. As detailed in the statistical treatment section below, I used Optimal Data Analysis (ODA) to conduct nonlinear, hierarchically optimal classification tree analyses (CTA) to predict children's narrative coherence on three dimensions: context, chronology, and theme (Yarnold, 1996; Yarnold et al., 1997). Because these three dimensions develop independent of one another, it was hypothesized that the factors that contribute to the development of each are different. For example, talk about emotions in reminiscing may have played a role in children developing coherence on the theme dimension, but not on the chronology dimension. To my knowledge, no study has used this type of analysis to investigate the developmental predictors of narrative coherence, and the coding system described below used to measure narrative coherence has only recently been developed (Reese et al., 2011). Therefore, due to the novelty of this project, it was difficult to make specific predictions. Nevertheless, the following hypotheses are offered based on the research described in the literature review as general trends that can be expected between the predictors drawn from the reminiscing and metamemory assessments and the narrative coherence outcomes.

First, it was hypothesized that children's language ability, measured by the PPVT and EVT at 54 and 72 months, would most strongly predict all three dimensions of children's narrative coherence at 72 months. While sociocultural theory suggests that parents influence children's development through reminiscing and other interactions, vocabulary scores are directly indicative of children's intelligence and verbal ability. Children simply need a proficient vocabulary to tell stories well. Moreover, parents' previous interactions with children should impact their vocabulary and narrative coherence abilities alike. That is, generally speaking, if highly elaborative parents are more likely to have children who are coherent narrators, then those children may also have more refined vocabularies. Because language scores across the two measures and two age points were thought to be highly correlated, it was unknown which would provide the best predictor of narrative coherence.

While vocabulary scores were hypothesized to be the best predictor of coherence, they were not considered the end-all. Rather, it was hypothesized that the CTA models for the three dimensions of coherence would likely reflect a pattern suggesting that children from both the low and high ranges of vocabulary scores would only produce highly coherent narratives if their mothers exhibited certain elements of an elaborative conversational style, as well. That is, the tree models would indicate an interaction between vocabulary and mothers' conversational style predicting narrative coherence. It was also considered that the variables that entered the models might describe children's verbal productions during reminiscing in combination with mothers', such that children who uttered more memory information during reminiscing conversations would also produce more coherent narratives. Lastly, in line with the suggestion that coherent narration requires the awareness of memory processes, children's metamnemonic knowledge as assessed by the metamemory tasks were hypothesized to potentially enter the models.

The variables hypothesized to predict coherence were specific to the three unique dimensions of coherence. For context, it was hypothesized that mothers who asked many elaborative open-ended questions about past events would have children who produced highly coherent narratives, because this kind of questioning elicits children's production of narrative elements. For example, if while reminiscing mothers frequently ask children when and where an event took place with open-ended questions, children may be more likely to include that kind of information in an independently-told narrative. For chronology, it was hypothesized that children's metamemory talk may positively predict coherence. In order to provide a temporally-ordered narrative, children require abilities in causal reasoning, linking future and past events, and understanding the interrelation between multiple actions within an event (Reese et al., 2011). Because children's metamemory talk may imply an understanding of the process of remembering, it was hypothesized to provide some predictive utility on this dimension. Similarly, scores on the metamemory tasks were posited to potentially predict chronology scores. Finally, for theme, it was hypothesized that children's cognitive words and emotional content would best predict coherence. Children's discussion of what they thought, believed, and felt about a past event during a reminiscing conversation may reflect their self-understanding, suggesting that they may be likely to include such information in an independent narrative, giving it thematic coherence.

CHAPTER TWO

METHODS

Participants

Data from part of a larger longitudinal study of developmental pathways to skilled remembering was used. The sample was drawn from one of two cohorts of families of participants in the larger study. Beginning when the children were 36 months old, families in Cohort 2 completed a number of measures at multiple time points. This project focused on a sample of mothers and children from Cohort 2 that participated in a mother-child reminiscing task at 54 months (n=58) and 72 months (n=53), and an examiner-child talk about the past task at 54 months (n=58) and 72 months (n=53). Families were recruited from county birth records in the Chapel Hill, North Carolina and Chicago, Illinois areas. Children are 93% Caucasian and all come from middle class families. Five families were dropped for missing data. Children's mean age during the 54 month measure was 54.21 (.50), and during the 72 month measures was 72.35 (.55).

Procedure

All families were visited in their homes. At the 54-month time point, families participated in three sessions on three different days. The first two sessions took place 24 hours apart and the final session occurred after a 3 week delay. At the 72-month time point, families participated in only two sessions that took place 24 hours apart. Over these sessions, children's memory, language, and literacy capabilities were assessed by standardized measures of language, background questionnaires, metamemory tasks, parent-child reminiscing, examiner-child talk about the past, story reading, and joint play interactions. The following tasks were included: a joint reminiscing task in which mothers and children talk about previously experienced events, an unscaffolded examiner interview task in which children remember previously experienced events without help from mothers, three different tasks tapping different aspects metamemory, and two standard language measures (see Table 1 for the order of administration of tasks). All interactions were transcribed and coded.

Table 1. Order of Administration of Tasks by Time Point and Visit

	54-months	72-months
Visit 1 (Day 1)	MRM, METS, PPVT	MRM, PPVT
Visit 2 (Day 2)	EVT	ECP, EVT
Visit 3 (Day 22)	ECP, METC, METF	(N/A)

Mother-Child Reminiscing Conversations (MRM)

On the first visit of the 54 and 72 month time point, mothers and children reminisced about several past, shared events. Modeled after Haden (1998) and Reese et al., (1993), mothers first nominated a set of four target events for discussion with their children in an “Event Selection” phase. The researcher encouraged mothers to think of several past events that met three criteria: 1) a novel event, 2) shared between mothers and children, 3) which occurred in the past month. Routine events, such as holidays, were excluded because children have trouble recalling one specific instance of routine events (see Hudson, Fivush, & Kuebli, 1992). Activities with story lines, such as movies, were excluded, because the goal is for reminiscing conversations was to focus on events from the lives of the participants, not the events from a story line. Out of earshot of the child, mothers chose four novel events at each the 54 and 72 month time points. Mothers were then instructed to discuss one old event (reminisced about during the MRM task at an earlier time point) and two new events that were randomly selected from the nominated set of four. The conversations were to last for however long felt comfortable to mothers, and they were audio and video recorded.

Examiner-Child Talk about the Past (ECP)

On the second visit of the 72 month time point, an examiner talked to children about three past events. The two events discussed first were two that were selected by mothers for the MRM task, but were not used for that task. The third event to be discussed in this task was randomly selected from the two events about which mothers and children previously reminisced during the MRM task during the first session, and this event was always discussed last. Mothers were instructed not to assist their children with the interview. In talking about the past with the children, the examiner only gave general prompts (e.g., "I heard that you (name of event)."; "Can you tell me all about the time that you (name of event)?"; "I want to hear all about it."), asked open-ended questions (e.g., "What else can you tell me about (name of event)?"), and supplied comments indicating interest in children's responses (e.g., "Okay, good."). The conversations were audio and video recorded.

Metamemory: Strategy Awareness (METS)

On the first visit of the 54-month time point, children's metamemory was assessed using a strategy awareness task. This task was a variation of the strategic demonstration and judgment task developed by Justice (1986) in which preschoolers and kindergartners made paired comparison judgments of the benefits of several strategic behaviors in a free-recall task. In this task, children were shown short video clips using PowerPoint of a 10-year-old model child demonstrating three actions – looking, naming, and looking away – in an effort to remember 10 unrelated objects. These demonstrations were followed by six strategic pairings, each of two of these three strategies, and children had to make judgments about which of the two behaviors would "help Sarah remember best." The trials were counterbalanced between participants. This task produced a score ranging from 0 to 6 (M = 3.9), took about 10 minutes to complete, and was audio and video recorded.

Metamemory: Talk (METC)

On the third visit of the 54-month time point, children's metamemory was assessed using a task that focused on talk during and after an event. Like the metamemory – strategy awareness task, this task was a variation of the strategic demonstration and judgment task developed by Justice (1986). In this task, children were shown twelve short video clips using PowerPoint and were subsequently asked to judge if conversation during and after the events (e.g., picnic, circus, beach, etc.) about the things they saw and did during the event benefitted memory for those events. That is, participants compared two different children in the video clips who did or did not have conversations during or after the event. They were asked to evaluate which of the two children would remember the event better and why (e.g., "Which boy will remember his trip to the farm the best: Peter, who talked with his mom about the things they were doing and seeing at the farm, or Sam, who did not talk with his mom about the things they were doing and seeing at the farm? Why?"). The trials were counterbalanced, and this task took about 10 minutes to complete and was audio recorded. Possible scores ranged from 0 to 6 based on the number of correct comparisons the child made.

Metamemory: Free Recall (METF)

On the third visit of the 54-month time point and the second visit of the 72-month time point, children's metamemory was assessed using a free recall task. This task was designed to measure children's metamnemonic understanding of specific memory variables and their interactive effects that influence free recall. Wellman (1978) proposed that knowledge about memory falls under two categories: sensitivity (i.e., knowing when to use strategies) and variables (i.e., characteristics of components that affect memory performance). This task focused on evaluating children's understanding of three types of memory variables (i.e., item, task, and strategy) individually (i.e., simple) and in combination with other variables (i.e., complex). First, participants were trained to arrange cards with pictures of an individual performing a task (e.g., jumping over a wall) from easy to hard, based on the task pictured on the card. Next, children completed a memory analog section with the examiner in order to provide the child with a concrete example of remembering for reference during the later judgment section. After children attempted to remember four cards, the examiner explained, "Sometimes it can be hard or easy to remember things, just as it can be hard or easy to jump over a wall." Finally, the child's metacognitive understanding about variables that influence remembering was measured in the judgment portion of the task. The children were shown cards with images of children, and the examiner explained key differences between them (e.g., Number of Items: child A had to remember 18 pictures; child B had to remember 9 pictures; and child C had to remember 3 pictures). The children were then prompted to arrange the cards in the corresponding order from easiest to hardest. Finally, they are asked why they rated them in that order. If they referenced the key difference in response to the why question, they scored higher. Key differences included the number of items, retention time, and type of strategy used by the hypothetical children, and combinations of those variables (e.g., Item X Strategy: child A had to remember 18 pictures and looked at them to help him remember; child B had 18 pictures and wrote down their names to help him remember; and child C had 3 pictures and wrote down their names to help him remember). The sets of cards and the corresponding key differences were counterbalanced, and the task took about 15 minutes to complete and was audio and video recorded.

The Peabody Picture Vocabulary Test (PPVT)

The PPVT-III is a standardized language measure used to assess children aged 2 years 1-month to adults (Dunn & Dunn 1997). This measure is used as an achievement test of receptive vocabulary and a verbal abilities screening test for English speaking children. Children's performance was scored in the standard fashion, and standardized scores were used in the analyses.

The Expressive Vocabulary Test (EVT)

This test is a standardized measure of language abilities designed to assess children aged 2 years, 6-months through adults (Williams, 1997). It is used as a measure of expressive vocabulary and word retrieval for English speaking children. The EVT measures expressive vocabulary through tests of labeling and synonym. Direct comparisons of receptive and expressive vocabulary can be made with PPVT-III, as each was standardized on the same sample population. The children's performance was scored in the standard fashion, and standardizes scores were used in the analyses.

Coding

Four separate coding systems were used to assess 1) mother-child talk in reminiscing conversations; 2) metamemory comments; 3) mother-child internal states language use; and 4) coherence of examiner-child talk about the past. All verbal comments made during the mother-child reminiscing and examiner-child tasks from the

54- and 72-month time points were transcribed verbatim from audiotapes using the CLAN module in the CHILDES program. Then, any nonverbal communicative behaviors (e.g., head nods) were added to the transcripts, and the beginning and end of the discussion of each event were also marked.

Talk in MRM

Transcribed memory conversations from the MRM task recorded during the 54-month point were coded using a comprehensive coding scheme adapted from Haden et al. (2009). The coding categories for mother-child conversations are mutually exclusive and exhaustive. As in previous research (e.g., Reese et al., 1993; Reese & Fivush, 1993), mean frequencies per event for each code for each participant were calculated for use in the analyses. This was done in order to account for situations in which fewer than three events were discussed. Frequencies were preferred to proportions, because the amount of a particular type of talk is relevant to the social learning process in reminiscing and other conversations. The coding scheme is presented below with definitions and illustrative examples. Mothers' talk was classified using the following codes:

- *Elaborations*: Comments or questions that introduce new information about a past event.
    - *Wh-question elaborations*: Open-ended questions that request the child provides new memory information (e.g., "Who did you see at the park?" "What did we do at the zoo?" "Why did we have to do that?").

  - *Yes–no question elaborations*: Questions asking the child to confirm or deny a piece of memory information provided by the mother (e.g., “Did you eat some watermelon?” “Was it hot or cold outside?”).
  - *Statement elaborations*: Declarative comments that provide new information about the event, but do not call for the child to respond (e.g., “We saw lots of dinosaurs at the museum.” “It was about a month ago that we went.”).
- *Repetitions*: Comments that provide or request the content or gist of a previous statement or question. Repetitions can be in the form of *Wh*-questions, yes–no questions, or statements.
- *Evaluations*: Comments that confirm or deny information the child has provided.
  - *Confirmations*: Affirmations of the child’s previous utterance, including a repetition of what he or she had said (e.g., “Yep.” “Uh huh.” “Yes, we did ride on the teetertotter.”).
  - *Negations*: Refutations of the child’s previous utterance (e.g., “Nope.” “Uh uh.”)
- *Associations*: Comments that make reference to another event as to relate that outside information to the event or activity under discussion. This category includes talk about another past event or episode that is related to the information in the current conversation (e.g., “He was walking on his hands like that boy was doing yesterday.”), about general knowledge or facts about the world related to the event under discussion (e.g., “Ponies are baby horses.” “Those berries looked like grapes.”),

about fictional or fantastical representations of the event under discussion (e.g., "The bunny rode on the cow's back."), and about a future occurrence of the event in question (e.g., "We might eat peanuts again when we go to the baseball game next week.").

- *Metamemory*: Talk about the process of remembering, including comments about current memory performance in the past event conversation (e.g., "I remember that too." "It's hard to remember." "Think back to that day to remember.").
- *Placeholders*: The mother takes a conversational turn, but offers no new memory information (e.g., "I don't know.").

Additionally, mothers' talk was categorized using the following codes: *remember prompts*, *fill-in-the-blanks*, *clarifications*, *off-topic talk*, and *unclassifiable talk*. However, these codes were either irrelevant to the hypotheses or their occurrence was rare, so they were not included in analyses. Children's talk was classified using the following codes:

- *Memory elaborations*: Comments containing new information about the past event under discussion (e.g., "We ate cookies!" "Jerry and Tony were there.").
- *Memory repetitions*: Comments repeating previously mentioned information.
- *Evaluations*: Comments that confirm or deny information the mother has provided.
    - *Confirmations*
    - *Negations*
- *Associations*

- *Metamemory*
- *Placeholders*: The child takes a conversational turn, but offers no new memory information (e.g., "I don't know.").

Children's talk was also categorized using the following additional codes: *memory questions*, *clarifications*, *off-topic talk*, *no responses*, and *unclassifiable talk*. Because of their irrelevance to the hypotheses or their dearth in children's talk, these codes were not included in analyses.

Internal States Language

The narratives from the 54- and 72-month MRMs were coded for internal states language, including both cognitive terms and emotional content. *Cognitive terms* include terminology describing the internal states of the self or others, including thoughts and beliefs. Cognitive terms were identified and scored using the following list adapted from Rudek and Haden (2005): know, think, remember, mean, forget, guess, pretend, want, hope, wonder, wish, bet, might, figure, believe, understand, suppose, mind, including any variation of these terms (e.g., knew, thinking). All utterances of words were identified and scored for mothers and children separately.

Emotional content includes utterances describing the affective states of the self or others. Such utterances were identified and scored using a scheme adapted from Bretherton and Beeghly (1982) and Fivush, Sales, and Bohanek (2008). First, mothers' and children's utterances were identified as having emotional content. That is, coders identified and scored any utterance that reflected an affective state experienced by the speaker or another. Then, coded utterances will be sub-coded as expressing either a positive (e.g., happy, have fun, funny, proud) or negative (e.g., sad, angry, scared) emotion/emotional state.

Narrative Coherence

The narratives produced by children with minimal help from an examiner during the experimenter-child talk about the past task from the 72-month time point were coded using the Narrative Coherence Coding Scheme (NaCCS) developed by Reese et al. (2011). This system aims to assess the coherence of personal narratives across development and involves rating three separate dimensions of narrative coherence: context, chronology, and theme. Each narrative received three ratings, one for each dimension, on a scale from 0 to 3 (see Table 2). Given that 72-month-old children rarely produced narratives in the higher ends of the scales, the data was positively skewed. Consequently, median splits were utilized to distinguish children as either “low” or “high on each dimension. Of note, scores on the theme dimension are much higher than scores on the other two dimensions, in line with evidence that coherence on this dimension is higher than scores on the other two dimensions at this age (Reese et al., 2011). To distinguish low and high levels of coherence, a score of 0 or 1 on theme was considered low, and a 2 or 3 on theme was considered high. For the other two dimensions, a score of 0 was considered low, and a score of 1, 2, or 3 was considered high. As a result, those rated high on context provided some information about when or where the event occurred. Those rated high in chronology provided sequencing information that placed at least some events according to the order they happened. Finally, those high in theme had a well-developed topic, included a resolution, and/or related the narrative to other autobiographical experiences or a self-concept.

Table 2. Scoring Criteria for the Three Dimensions of the Narrative Coherence Coding Scheme (NaCCS)

Score	Context	Chronology	Theme
0	No mention of time or location provided	List of actions with minimal or no information about temporal order	The narrative is substantially off topic and is characterized by multiple digressions that make the topic difficult to identify.
1	Mention of time or place at any level of specificity	Fewer than half of the temporally relevant actions can be ordered on a timeline	A topic is identifiable and most of the statement relate to the topic in a consistent manner. However, there is no substantial development.
2	Both time and place are mentioned but no more than one dimension is specific	Can place between 50-75% of the relevant actions on a timeline	The narrative substantially develops the topic. However, there is no resolution, links to other autobiographical experiences, or self-concept; only a wrap-up statement.

3	Both time and place are mentioned and both are specific	Can place more than 75% of the relevant actions on a timeline	The narrative substantially develops the topic. In addition, there is a link to other autobiographical experiences and self-concept.

The children told as many as three independent narratives in the examiner-child talk about the past (ECP) task at the 72-month time point, and the highest score for each dimension at each time point was selected, as these highest scores indicate the child's capacity for telling a coherent narrative. Furthermore, the highest score was chosen because there are many reasons why a child may not fully elaborate upon a past event narrative told to an examiner, including shyness and lack of interest in the past event (see Haden & Hoffman, in press). However, if a child exhibited a relatively high level of coherence on one dimension during the narration of even one past event, it can be inferred that the child is capable of producing narratives at that level of coherence.

Reliability

For all of the above coding, pairs of raters independently coded 25% of the transcripts. Raters established initial agreement averaging greater than 85% with no single reliability estimate less than 80% percent agreement. The primary coder checked for coder drift for the transcripts scored independently by the second coder.

CHAPTER THREE

RESULTS

To begin, an analytic strategy using Optimal Data Analysis (ODA) is outlined. Then, descriptive statistics are provided for narrative coherence scores and predictor variables. Next, univariate associations between each predictor and each dimension of narrative coherence tested using Optimal Data Analysis are given. Finally, the results of the Classification Tree Analyses predicting the three dimensions of children's narrative coherence at 72-months from the set of 54- and 72-month predictor variables are presented.

Statistical Treatment

To test the hypotheses, the data analytic strategy involved generating a model that optimally classifies children as low or high on each of the three dimensions of narrative coherence. Two analytic methods were utilized: univariate Optimal Data Analysis (UniODA) and classification tree analysis (CTA). First, UniODA was used to test univariate associations between each predictor and each of the three dimensions of coherence. This analytic method identifies a cut point on each predictor variable at which all participants who fall at or below that point are classified as either high or low on a given dimension of coherence, and those that fall above that point are classified into the remaining classification (high or low). It creates this cut point and classification model for each variable to maximize classification accuracy; that is, to maximize the number of participants correctly predicted as low or high on coherence. For each dimension of coherence, this procedure is repeatedly separately for each variable.

Second, nonlinear, hierarchically optimal CTA was used to construct three multiattribute "tree" models (Yarnold, 1996; Yarnold et al., 1997). CTA consists of several different univariate steps on the way to constructing a hierarchical decision tree (Ostrander et al., 1998; Smart et al., 2008; Yarnold, 1996). To maximize classification accuracy at each step of the analyses, ODA first finds classification rules by identifying optimal cut points for each predictor (e.g., if METS score ≤ 3, then predict incoherent narratives; if METS score >3, then predict coherent narratives). The individual variables are then evaluated for the size of their effect. The variable with the greatest effect strength will be selected first, and individuals will be classified as low or high on coherence based on whether they are at or below, or above, the cut point for that attribute. It is expected that one predictor will be insufficient at correctly classifying every participant in the sample, so this procedure is repeated in an iterative manner using as many attributes as is necessary. All predictors serve successively to maximally classify a gradually decreasing proportion of the total sample of 54 participants (Donenberg et al., 2003). When no attribute would improve classification accuracy (as determined by *p*, effect strength, or number of correct classifications), that branch of the tree is terminated. This continues until all branches are terminated, and the conceptual diagram of the tree can then be constructed (Yarnold, 1996).

ODA was chosen over a regression model for more than one reason. First, due to the relatively low competency of children at this age (e.g., only 22 out of 54 children scored 1 or higher on context, and only 4 out of 54 children scored 2 or higher on chronology), the distribution of coherence scores along the three dimensions are greatly skewed. As such, regression may have proven inappropriate and ineffective at predicting these coherence scores. Second, as narrative coherence emerges in line with autobiographical memory at the offset of infantile amnesia, it is theoretically interesting to investigate the onset of a minimal level of narrative coherence. It is expected that it will be more meaningful to simply analyze whether children's independent narratives are or are not coherent along each of the three dimensions than to fuss over the degree to which their narratives are coherent along these dimensions.

It is important to note at the outset how CTA will simultaneously handle concurrent and longitudinal data. As many of the predictors were measured from assessments across two age points, children's scores at these two age points will be allowed to independently predict narrative coherence. In the UniODA analyses, each predictor is considered separately for its ability to classify participants. However, in the CTA models, all predictors will be considered simultaneously. Of course, children's scores at multiple time points may be highly correlated, but fortunately multicollinearity does not impede CTA analyses. CTA allows for highly correlated predictors to simultaneously predict a dependent variable, because a) the analyses are not truly multivariate; rather, they are conducted in a stepwise, univariate fashion, such that interactions between predictors occur iteratively, not simultaneously and b) the analysis does not attempt to explain variance, but rather attempts to classify participants. Further, the classification abilities of highly correlated variables are likely to overlap, so it is unlikely that more than one would enter into any given tree.

Similarly, CTA does not require limitations on the number of predictor variables. While traditional multivariate techniques only allow for a certain ratio of predictors to sample size, CTA never considers multiple variables simultaneously. All variables were selected for inclusion in the model because of their theoretical implication on the development of narrative coherence. Moreover, CTA inputs variables into tree models with respect to effect size, not *p* values, so the method does not simply capitalize on chance. Further, the only variables that need to be evaluated using a Bonferroni procedure are those that enter the tree, and in doing so, if any variable drops to a significance level above .05, it is pruned from the tree (see Yarnold & Soltysik, 2010). Lastly, a leave-one-out (LOO) procedure was used that evaluates the obtained model by iteratively holding out individual observations from the sample and creating alternative models to ensure that the model does not capitalize on chance (see Yarnold & Soltysik, 2005). With these considerations in mind, I turn now to the results.

Descriptive Statistics

Narrative Coherence

Children reported up to three personal narratives during the examiner-child talk about the past task at 72-months. Each narrative was coded for the three dimensions of coherence – context, chronology, and theme – using the NaCCS. Means and standard deviations for children's highest scores across the three dimensions of narrative coherence and the number of children classified as low and high on each dimension are displayed in Table 3.

Table 3. Narrative Coherence at 72-months across the Three Dimensions

Dimension	*n*	*M* (*SD*)	High Cutoff	*n* High	*n* Low
Chronology	54	.69 (.99)	1	22	32
Theme	54	1.67 (.55)	2	38	16
Context	54	.43 (.79)	1	16	38

Predictor Variables

Means and standard deviations for the predictor variables can be found in Tables 4 - 9. Children's scores on the PPVT and EVT at 54- and 72-months are displayed in Table 4. Children's scores on the three metamemory assessments (i.e., METF, METS, METC) are displayed in Table 5. Counts of codes categorizing talk in the 54-month MRM averaged across events are displayed in Tables 6 and 7 for mothers' and children's talk, respectively. Finally, counts of mothers' and children's utterances containing mental state language and emotional content are displayed in Tables 8 and 9, respectively.

Table 4. Children's Scores on the PPVT and EVT at 54- and 72-months

Vocabulary Assessment	*n*	*M* (*SD*)
	54-months	
PPVT	57	115.56 (11.77)
EVT	57	113.09 (11.94)
	72-months	
PPVT	56	115.61 (12.06)
EVT	56	113.75 (9.49)

Table 5. Children's Scores on Metamemory Assessments at 54-months

Metamemory Assessment	*n*	*M* (*SD*)
METF Simple	56	2.21 (0.62)
METF Complex	56	1.91 (0.59)
METS	56	4.68 (1.24)
METC	56	4.95 (1.10)

Table 6. Mothers' Talk in the MRM at 54-months

Conversation Code	*n*	*M* (*SD*)	
Elaborations	58	26.64	(10.79)
Wh-Questions	58	11.88	(5.88)
Yes-No Questions	58	8.78	(4.67)
Statements	58	5.98	(4.80)
Repetitions	58	4.91	(4.60)
Wh-Questions	58	1.72	(1.97)
Yes-No Questions	58	1.72	(1.91)
Statements	58	1.46	(2.01)
Evaluations	58	9.75	(4.95)
Confirmations	58	9.21	(4.75)
Negations	58	.54	(.76)
Associations	58	2.22	(2.29)
Metamemory	58	.82	(.87)
Placeholders	58	.54	(.62)

Table 7. Children's Talk in the MRM at 54-months

Conversation Code	*n*	*M* (*SD*)
Memory elaborations	58	11.09 (6.09)
Memory repetitions	58	2.50 (2.57)
Evaluations	58	7.23 (4.70)
Confirmations	58	5.50 (3.75)
Negations	58	1.73 (1.51)
Associations	58	1.45 (1.57)
Metamemory	58	.29 (.48)
Placeholders	58	3.78 (2.74)

Table 8. Mothers' and Children's Cognitive Words in the MRM at 54- and 72-months

		Mothers	Children
Time	*n*	*M* (*SD*)	*M* (*SD*)
54-months	58	17.59 (9.31)	5.21 (6.56)
72-months	58	8.84 (11.52)	4.05 (9.85)

N = 58

Table 9. Mothers' and Children's Emotional Content in the MRM at 54- and 72-months

	n	Mothers *M* (*SD*)	Children *M* (*SD*)
		54-months	
Positive	58	1.12 (1.35)	.45 (.71)
Negative	58	.38 (.89)	.35 (.83)
Total	58	1.50 (1.54)	.79 (1.09)
		72-months	
Positive	58	1.75 (1.87)	.44 (.72)
Negative	58	.41 (.84)	.22 (.66)
Total	58	2.16 (1.76)	.66 (.87)

Univariate Analyses

The above discussion of descriptive information is helpful in painting a picture of the sample, but does not speak to the variables' ability to predict narrative coherence. The individual differences on each measure may reflect underlying discrepancies in children's knowledge and ability that may be related to the task of constructing a narrative. Fifty-three predictors representing children's gender, vocabulary scores, metamemory task scores, and mothers' and children's talk in the 54-month MRM were entered in UniODA analyses. The results of these analyses are given for each dimension in Tables 10-12, which include several pieces of information for each predictor: the cut point and decision rule for predicting low (0) and high (1) coherence, the number of participants predicted to be low and high; the percent of those participants who were actually high on coherence, the overall classification accuracy (PAC) for the model constructed for that variable, and a Monte Carlo probability (*p*) illustrating if the model classifies participants significantly better than chance.

Table 10. Univariate Associations of Predictors With Low (0) Versus High (1) Narrative Coherence on Context

Predictor	ODA Model	*n*	% High Coherence	Overall PAC (%)	*p* <
Child Gender	Male, predict 0;	24	16.7	59.3	0.060
	Female, predict 1	30	40.0		
Expressive Vocabulary Test 54	≤109.5, predict 0;	24	12.5	63.0	0.055
	>109.5, predict 1	30	43.3		
Expressive Vocabulary Test 72	≤107.0, predict 0;	14	7.1	51.9	0.245
	>107.0, predict 1	40	37.5		
Peabody Picture Vocabulary Test 54	≤123.5, predict 0;	39	23.1	69.8	0.338
	≤123.5, predict 1	14	50.0		
Peabody Picture Vocabulary Test 72	≤108.5, predict 0;	20	20.0	51.9	0.755
	>108.5, predict 1	34	35.3		
Metamemory - Free Recall (Simple)	>1.835, predict 0;	40	25.0	66.7	0.539
	≤1.835, predict 1	14	42.9		
Metamemory - Free Recall (Complex)	>1.5, predict 0;	42	23.8	70.4	0.312
	≤1.5, predict 1	12	50.0		
Metamemory - Strategy Awareness	≤5.5, predict 0;	35	25.7	61.1	0.731
	>5.5, predict 1	19	36.8		
Metamemory - Talk	>4.5, predict 0;	38	23.7	66.7	0.289
	≤4.5, predict 1	16	43.8		
Mothers' Elaborative Open-Ended Questions (MRM54)	>15.75, predict 0;	11	0.0	50.0	0.206
	≤15.75, predict 1	43	37.2		
Mothers' Repetitive Open-Ended Questions (MRM54)	>1.75, predict 0;	18	5.6	59.3	0.021
	≤1.75, predict 1	36	41.7		
Mothers' Elaborative Yes-No Questions (MRM54)	>4.25, predict 0;	43	25.6	68.5	0.818
	≤4.25, predict 1	11	45.5		
Mothers' Repetitive Yes-No Questions (MRM54)	>1.75, predict 0;	21	23.8	50.0	0.940
	≤1.75, predict 1	33	33.3		
Mothers' Remember Prompts (MRM54)	>0.25, predict 0;	6	16.7	37.0	0.661
	≤0.25, predict 1	48	31.3		
Mothers' Elaborative Statements (MRM54)	>6.25, predict 0;	20	20.0	51.9	0.771
	≤6.25, predict 1	34	35.3		

Predictor	ODA Model	*n*	% High Coherence	Overall PAC (%)	*p* <
Mothers' Repetitive Statements (MRM54)	>.25, predict 0;	35	22.9	64.8	0.395
	≤.25, predict 1	19	42.1		
Mothers' Evaluation Confirmations (MRM54)	>8.75, predict 0;	23	17.4	57.4	0.326
	≤8.75, predict 1	31	38.7		
Mothers' Evaluation Negations (MRM54)	>1.25, predict 0;	6	0.0	40.7	0.451
	≤1.25, predict 1	48	33.3		
Mothers' Placeholders (MRM54)	≤.25, predict 0;	22	22.7	51.9	0.640
	>.25, predict 1	32	34.4		
Mothers' Associations (MRM54)	≤3.25, predict 0;	37	18.9	72.2	0.066
	>3.25, predict 1	17	52.9		
Mothers' Total Elaborations (MRM54)	>25.75, predict 0;	27	18.5	61.1	0.303
	≤25.75, predict 1	27	40.7		
Mothers' Total Repetitions (MRM54)	>4.25, predict 0;	24	16.7	59.3	0.229
	≤4.25, predict 1	30	40.0		
Mothers' Total Evaluations (MRM54)	>9.25, predict 0;	24	16.7	59.3	0.233
	≤9.25, predict 1	30	40.0		
Children's Memory Elaborations (MRM54)	≤12.75, predict 0;	19	15.8	53.7	0.414
	>12.75, predict 1	35	37.1		
Children's Memory Repetitions (MRM54)	>2.75, predict 0;	16	12.5	51.9	0.267
	≤2.75, predict 1	38	36.8		
Children's Evaluation Confirmations (MRM54)	>2.75, predict 0;	39	25.6	64.8	0.877
	≤2.75, predict 1	15	40.0		
Children's Evaluation Negations (MRM54)	>2.5, predict 0;	15	13.3	50.0	0.358
	≤2.5, predict 1	39	35.9		
Children's Memory Questions (MRM54)	≤0.75, predict 0;	42	26.2	66.7	0.709
	>0.75, predict 1	12	41.7		
Children's Placeholders (MRM54)	>4.75, predict 0;	15	13.3	50.0	0.437
	≤4.75, predict 1	39	35.9		
Children's Associations (MRM54)	≤1.25, predict 0;	30	13.3	70.4	0.009
	>1.25, predict 1	24	50.0		
Children's Total Evaluations (MRM54)	>3.75, predict 0;	39	25.6	64.8	0.922
	≤3.75, predict 1	15	40.0		
Mothers' Cognitive Words (MRM54)	≤17.5, predict 0;	23	8.7	64.8	0.016
	>17.5, predict 1	31	45.2		
Children's Cognitive Words (MRM54)	>4.5, predict 0;	21	19.0	53.7	0.536
	≤4.5, predict 1	33	36.4		

Predictor	ODA Model	*n*	% High Coherence	Overall PAC (%)	*p* <
Mothers' Cognitive Words (MRM72)	≤7.5, predict 0;	30	16.7	66.7	0.066
	>7.5, predict 1	24	45.8		
Children's Cognitive Words (MRM72)	≤3.5, predict 0;	34	17.6	70.4	0.028
	>3.5, predict 1	20	50.0		
Mother's Metamemory Talk (MRM54)	≤.5, predict 0;	31	22.6	61.1	0.243
	>.5, predict 1	23	39.1		
Children's Metamemory Talk	≤.5, predict 0;	43	27.9	64.8	0.732
(MRM54)	>.5, predict 1	11	36.4		
Mother's Metamemory Talk (MRM72)	≤.5, predict 0;	20	30.0	62.5	0.576
	>.5, predict 1	12	50.0		
Children's Metamemory Talk	≤1.5, predict 0;	30	36.7	62.5	0.844
(MRM72)	>1.5, predict 1	2	50.0		
Mothers' Positive Emotion Talk	>1.5, predict 0;	17	17.6	50.0	0.399
(MRM54)	≤1.5, predict 1	37	35.1		
Mothers' Negative Emotion Talk	>.5, predict 0;	13	15.4	46.3	0.301
(MRM54)	≤.5, predict 1	41	34.1		
Mothers' Total Emotion Talk	>1.5, predict 0;	23	17.4	57.4	0.202
(MRM54)	≤1.5, predict 1	31	38.7		
Children's Positive Emotion Talk	≤.5, predict 0;	37	24.3	64.8	0.371
(MRM54)	>.5, predict 1	17	41.2		
Children's Negative Emotion Talk	≤2.5, predict 0;	52	28.8	70.4	0.966
(MRM54)	>2.5, predict 1	2	50.0		
Children's Total Emotion Talk	≤.5, predict 0;	31	25.8	57.4	0.803
(MRM54)	>.5, predict 1	23	34.8		
Mothers' Positive Emotion Talk	≤1.5, predict 0;	16	31.3	58.1	0.695
(MRM72)	>1.5, predict 1	15	46.7		
Mothers' Negative Emotion Talk	≤2.5, predict 0;	29	37.9	61.3	1.000
(MRM72)	>2.5, predict 1	2	50.0		
Mothers' Total Emotion Talk	≤1.5, predict 0;	13	30.8	54.8	0.877
(MRM72)	>1.5, predict 1	18	44.4		
Children's Positive Emotion Talk	≤.5, predict 0;	20	30.0	64.5	0.257
(MRM72)	>.5, predict 1	11	54.5		
Children's Negative Emotion Talk	≤1.5, predict 0;	29	34.5	67.7	0.326
(MRM72)	>1.5, predict 1	2	100.0		
Children's Total Emotion Talk	≤1.5, predict 0;	27	29.6	74.2	0.080
(MRM72)	>1.5, predict 1	4	100.0		

Table 11. Univariate Associations of Predictors With Low (0) Versus High (1) Narrative Coherence on Chronology

Predictor	ODA Model	*n*	% High Coherence	Overall PAC (%)	*p* <
Child Gender	Male, predict 0;	24	37.5	51.9	0.779
	Female, predict 1	30	43.3		
Expressive Vocabulary Test 54	≤106.5, predict 0;	18	27.8	55.6	0.664
	>106.5, predict 1	36	47.2		
Expressive Vocabulary Test 72	≤118.5, predict 0;	36	36.1	59.3	0.907
	>118.5, predict 1	18	50.0		
Peabody Picture Vocabulary Test 54	>114.5, predict 0;	26	26.9	64.2	0.129
	≤114.5, predict 1	27	55.6		
Peabody Picture Vocabulary Test 72	>134.5, predict 0;	5	0.0	50.0	0.774
	≤134.5, predict 1	49	44.9		
Metamemory - Free Recall (Simple)	>2.165, predict 0;	28	32.1	59.3	0.411
	≤2.165, predict 1	26	50.0		
Metamemory - Free Recall (Complex)	>1.5, predict 0;	42	35.7	63.0	0.520
	≤1.5, predict 1	12	58.3		
Metamemory - Strategy Awareness	>3.5, predict 0;	45	37.8	61.1	0.858
	≤3.5, predict 1	9	55.6		
Metamemory - Talk	≤5.5, predict 0;	33	33.3	61.1	0.399
	>5.5, predict 1	21	52.4		
Mothers' Elaborative Open-Ended Questions (MRM54)	>9.25, predict 0;	35	34.3	61.1	0.719
	≤9.25, predict 1	19	52.6		
Mothers' Repetitive Open-Ended Questions (MRM54)	≤0.75, predict 0;	20	30.0	55.6	0.614
	>0.75, predict 1	34	47.1		
Mothers' Elaborative Yes-No Questions (MRM54)	≤7.25, predict 0;	22	27.3	59.3	0.356
	>7.25, predict 1	32	50.0		
Mothers' Repetitive Yes-No Questions (MRM54)	≤3.75, predict 0;	48	35.4	66.7	0.396
	>3.75, predict 1	6	83.3		
Mothers' Remember Prompts (MRM54)	>0.25, predict 0;	6	16.7	48.2	0.384
	≤0.25, predict 1	48	43.8		
Mothers' Elaborative Statements (MRM54)	≤6.75, predict 0;	35	31.4	64.8	0.248
	>6.75, predict 1	19	57.9		
Mothers' Repetitive Statements (MRM54)	≤0.25, predict 0;	19	26.3	57.4	0.324
	>0.25, predict 1	35	48.6		
Mothers' Evaluation Confirmations (MRM54)	≤7.75, predict 0;	23	26.1	61.1	0.249
	>7.75, predict 1	31	51.6		
Mothers' Evaluation Negations (MRM54)	≤0.75, predict 0;	38	31.6	66.7	0.106
	>0.75, predict 1	16	62.5		

Predictor	ODA Model	*n*	% High Coherence	Overall PAC (%)	*p* <
Mothers' Placeholders (MRM54)	≤0.25, predict 0;	22	31.8	55.6	0.554
	>0.25, predict 1	32	46.9		
Mothers' Associations (MRM54)	≤3.75, predict 0;	42	38.1	59.3	0.975
	>3.75, predict 1	12	50.0		
Mothers' Total Elaborations (MRM54)	≤15.5, predict 0;	10	10.0	55.6	0.361
	>15.5, predict 1	44	47.7		
Mothers' Total Repetitions (MRM54)	≤5.25, predict 0;	36	33.3	63.0	0.414
	>5.25, predict 1	18	55.6		
Mothers' Total Evaluations (MRM54)	≤8.75, predict 0;	25	28.0	61.1	0.266
	>8.75, predict 1	29	51.7		
Children's Memory Elaborations	≤8.75, predict 0;	22	27.3	59.3	0.370
(MRM54)	>8.75, predict 1	32	50.0		
Children's Memory Repetitions	≤1.25, predict 0;	15	20.0	57.4	0.210
(MRM54)	>1.25, predict 1	39	48.7		
Children's Evaluation Confirmations	≤4.75, predict 0;	25	28.0	61.1	0.263
(MRM54)	>4.75, predict 1	29	51.7		
Children's Evaluation Negations	>0.75, predict 0;	36	36.1	59.3	0.790
(MRM54)	≤0.75, predict 1	18	50.0		
Children's Memory Questions	≤0.25, predict 0;	31	32.3	61.1	0.237
(MRM54)	>0.25, predict 1	23	52.2		
Children's Placeholders (MRM54)	≤2.25, predict 0;	19	26.3	57.4	0.365
	>2.25, predict 1	35	48.6		
Children's Associations (MRM54)	>0.75, predict 0;	28	35.7	55.6	0.900
	≤0.75, predict 1	26	46.2		
Children's Total Evaluations	≤4.75, predict 0;	21	23.8	61.1	0.192
(MRM54)	>4.75, predict 1	33	51.5		
Mothers' Cognitive Words (MRM54)	>11.5, predict 0;	39	35.9	61.1	0.846
	≤11.5, predict 1	15	33.3		
Children's Cognitive Words (MRM54)	>6.5, predict 0;	17	29.4	53.7	0.709
	≤6.5, predict 1	37	45.9		
Mothers' Cognitive Words (MRM72)	≤1.0, predict 0;	24	16.7	70.4	0.004
	>1.0, predict 1	30	60.0		
Children's Cognitive Words (MRM72)	≤0.5, predict 0;	27	18.5	72.2	0.003
	>0.5, predict 1	27	63.0		
Mother's Metamemory Talk (MRM54)	>1.5, predict 0;	7	28.6	46.3	0.849
	≤1.5, predict 1	47	42.6		

Predictor	ODA Model	*n*	% High Coherence	Overall PAC (%)	*p* <
Children's Metamemory Talk	≤2.0, predict 0;	52	38.5	63.0	0.562
(MRM54)	>2.0, predict 1	2	100.0		
Mother's Metamemory Talk (MRM72)	>0.5, predict 0;	12	50.0	56.3	0.882
	≤0.5, predict 1	20	60.0		
Children's Metamemory Talk	>0.5, predict 0;	8	37.5	62.5	0.420
(MRM72)	≤0.5, predict 1	24	62.5		
Mothers' Positive Emotion Talk	>0.5, predict 0;	29	31.0	61.1	0.255
(MRM54)	≤0.5, predict 1	25	52.0		
Mothers' Negative Emotion Talk	>0.5, predict 0;	13	30.8	50.0	0.565
(MRM54)	≤0.5, predict 1	41	43.9		
Mothers' Total Emotion Talk	>0.5, predict 0;	36	36.1	59.3	0.648
(MRM54)	≤0.5, predict 1	18	50.0		
Children's Positive Emotion Talk	≤1.5, predict 0;	47	36.2	64.8	0.212
(MRM54)	>1.5, predict 1	7	71.4		
Children's Negative Emotion Talk	≤1.5, predict 0;	48	37.5	63.0	0.300
(MRM54)	>1.5, predict 1	6	66.7		
Children's Total Emotion Talk	≤1.5, predict 0;	39	35.9	61.1	0.459
(MRM54)	>1.5, predict 1	15	53.3		
Mothers' Positive Emotion Talk	≤1.5, predict 0;	16	43.8	64.5	0.187
(MRM72)	>1.5, predict 1	15	73.3		
Mothers' Negative Emotion Talk	≤0.5, predict 0;	23	52.2	54.8	0.431
(MRM72)	>0.5, predict 1	8	75.0		
Mothers' Total Emotion Talk	≤2.5, predict 0;	19	42.1	67.7	0.051
(MRM72)	>2.5, predict 1	12	83.3		
Children's Positive Emotion Talk	>2.5, predict 0;	1	0.0	61.3	0.874
(MRM72)	≤2.5, predict 1	30	60.0		
Children's Negative Emotion Talk	≤1.5, predict 0;	29	55.2	48.4	0.491
(MRM72)	>1.5, predict 1	2	100.0		
Children's Total Emotion Talk	≤1.5, predict 0;	27	55.6	48.4	0.925
(MRM72)	>1.5, predict 1	4	75.0		

Table 12. Univariate Associations of Predictors With Low (0) Versus High (1) Narrative Coherence on Theme

Predictor	ODA Model	*n*	% High Coherence	Overall PAC (%)	*p* <
Child Gender	Female, predict 0;	30	70.0	48.2	1.000
	Male, predict 1	24	70.8		
Expressive Vocabulary Test 54	≤124.5, predict 0;	44	65.9	44.4	0.761
	>124.5, predict 1	10	90.0		
Expressive Vocabulary Test 72	>105.5, predict 0;	43	65.1	46.3	0.608
	≤105.5, predict 1	11	90.9		
Peabody Picture Vocabulary Test 54	≤124.5, predict 0;	41	63.4	49.1	0.410
	>124.5, predict 1	12	91.7		
Peabody Picture Vocabulary Test 72	≤116.0, predict 0;	34	61.8	55.6	0.309
	>116.0, predict 1	20	85.0		
Metamemory - Free Recall (Simple)	>2.5, predict 0;	23	60.9	61.1	0.437
	≤2.5, predict 1	31	77.4		
Metamemory - Free Recall (Complex)	>1.5, predict 0;	42	66.7	44.4	0.715
	≤1.5, predict 1	12	83.3		
Metamemory - Strategy Awareness	≤2.5, predict 0;	4	0.0	77.8	0.177
	>2.5, predict 1	50	76.0		
Metamemory - Talk	>5.5, predict 0;	21	66.7	57.4	0.905
	≤5.5, predict 1	33	72.7		
Mothers' Elaborative Open-Ended Questions (MRM54)	≤10.75, predict 0;	26	53.8	66.7	0.044
	>10.75, predict 1	28	85.7		
Mothers' Repetitive Open-Ended Questions (MRM54)	≤0.75, predict 0;	20	65.0	59.3	0.973
	>0.75, predict 1	34	73.5		
Mothers' Elaborative Yes-No Questions (MRM54)	≤7.75, predict 0;	23	47.8	72.2	0.007
	>7.75, predict 1	31	87.1		
Mothers' Repetitive Yes-No Questions (MRM54)	>1.25, predict 0;	25	60.0	61.1	0.320
	≤1.25, predict 1	29	79.3		
Mothers' Remember Prompts (MRM54)	>0.25, predict 0;	6	33.3	74.1	0.052
	≤0.25, predict 1	48	75.0		
Mothers' Elaborative Statements (MRM54)	≤3.25, predict 0;	18	44.4	74.1	0.020
	>3.25, predict 1	36	83.3		
Mothers' Repetitive Statements (MRM54)	≤0.25, predict 0;	19	57.9	64.8	0.405
	>0.25, predict 1	35	77.1		
Mothers' Evaluation Confirmations (MRM54)	≤7.75, predict 0;	23	60.9	61.1	0.627
	>7.75, predict 1	31	77.4		
Mothers' Evaluation Negations (MRM54)	≤1.25, predict 0;	48	68.8	37.0	0.946
	>1.25, predict 1	6	83.3		

Predictor	ODA Model	n	% High Coherence	Overall PAC (%)	$p <$
Mothers' Placeholders (MRM54)	≤0.25, predict 0;	22	59.1	63.0	0.309
	>0.25, predict 1	32	78.1		
Mothers' Associations (MRM54)	≤0.25, predict 0;	13	53.8	68.5	0.523
	>0.25, predict 1	41	75.6		
Mothers' Total Elaborations (MRM54)	≤24.25, predict 0;	21	42.9	75.9	0.002
	>24.25, predict 1	33	87.9		
Mothers' Total Repetitions (MRM54)	≤8.0, predict 0;	45	66.7	42.6	0.837
	>8.0, predict 1	9	88.9		
Mothers' Total Evaluations (MRM54)	≤6.75, predict 0;	16	56.3	66.7	0.582
	>6.75, predict 1	38	76.3		
Children's Memory Elaborations (MRM54)	≤8.75, predict 0;	22	50.0	70.4	0.035
	>8.75, predict 1	32	84.4		
Children's Memory Repetitions (MRM54)	≤1.75, predict 0;	24	54.2	66.7	0.050
	>1.75, predict 1	30	83.3		
Children's Evaluation Confirmations (MRM54)	≤2.75, predict 0;	15	53.3	68.5	0.423
	>2.75, predict 1	39	76.9		
Children's Evaluation Negations (MRM54)	≤1.75, predict 0;	30	56.7	63.0	0.035
	>1.75, predict 1	24	87.5		
Children's Memory Questions (MRM54)	≤0.25, predict 0;	31	58.1	61.1	0.038
	>0.25, predict 1	23	87.0		
Children's Placeholders (MRM54)	≤1.25, predict 0;	11	36.4	75.9	0.069
	>1.25, predict 1	43	79.1		
Children's Associations (MRM54)	≤0.25, predict 0;	15	53.3	68.5	0.336
	>0.25, predict 1	39	76.9		
Children's Total Evaluations (MRM54)	≤6.25, predict 0;	25	56.0	64.8	0.123
	>6.25, predict 1	29	82.8		
Mothers' Cognitive Words (MRM54)	≤17.5, predict 0;	31	61.3	57.4	0.316
	>17.5, predict 1	23	82.6		
Children's Cognitive Words (MRM54)	≤2.5, predict 0;	24	58.3	63.0	0.246
	>2.5, predict 1	30	80.0		
Mothers' Cognitive Words (MRM72)	>15.0, predict 0;	17	58.8	64.8	0.627
	≤15.0, predict 1	37	75.7		
Children's Cognitive Words (MRM72)	≤2.5, predict 0;	33	66.7	50.0	0.873
	>2.5, predict 1	21	76.2		
Mother's Metamemory Talk (MRM54)	>1.5, predict 0;	7	57.1	68.5	0.837
	≤1.5, predict 1	47	72.3		

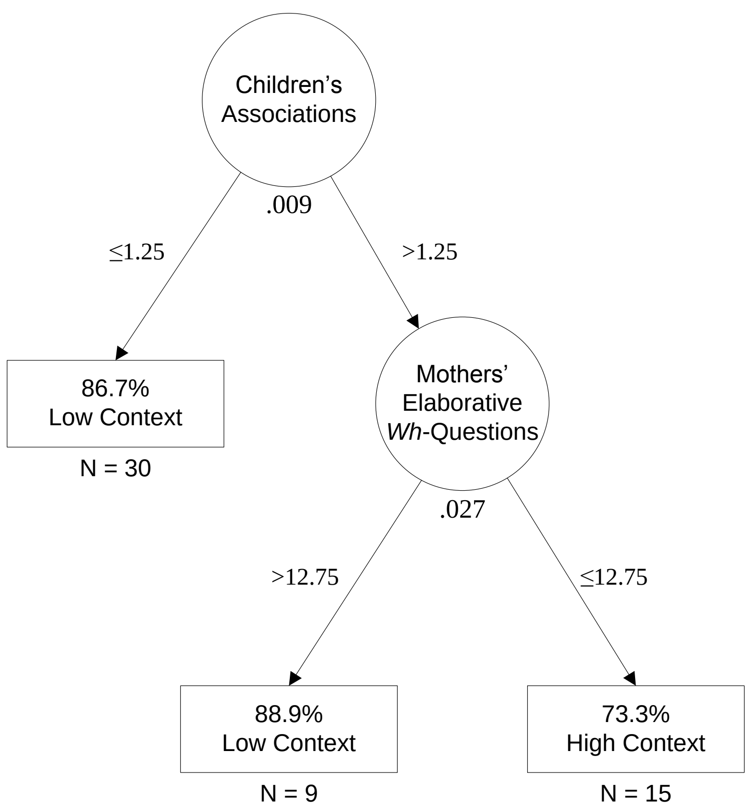
Predictor	ODA Model	*n*	% High Coherence	Overall PAC (%)	*p* <
Children's Metamemory Talk	>0.5, predict 0;	11	63.6	64.8	0.732
(MRM54)	≤0.5, predict 1	43	72.1		
Mother's Metamemory Talk	>0.5, predict 0;	12	50.0	71.9	0.050
(MRM72)	≤0.5, predict 1	20	85.0		
Children's Metamemory Talk	≤0.5, predict 0;	24	62.5	53.1	0.069
(MRM72)	>0.5, predict 1	8	100.0		
Mothers' Positive Emotion Talk	≤0.5, predict 0;	25	64.0	57.4	0.631
(MRM54)	>0.5, predict 1	29	75.9		
Mothers' Negative Emotion Talk	≤1.5, predict 0;	49	69.4	35.2	1.000
(MRM54)	>1.5, predict 1	5	80.0		
Mothers' Total Emotion Talk	>4.5, predict 0;	4	50.0	70.4	0.980
(MRM54)	≤4.5, predict 1	50	72.0		
Children's Positive Emotion Talk	≤0.5, predict 0;	37	64.9	50.0	0.267
(MRM54)	>0.5, predict 1	17	82.4		
Children's Negative Emotion Talk	≤0.5, predict 0;	43	65.1	46.3	0.144
(MRM54)	>0.5, predict 1	11	90.9		
Children's Total Emotion Talk	≤0.5, predict 0;	31	61.3	57.4	0.153
(MRM54)	>0.5, predict 1	23	82.6		
Mothers' Positive Emotion Talk	≤1.5, predict 0;	16	62.5	58.1	0.623
(MRM72)	>1.5, predict 1	15	80.0		
Mothers' Negative Emotion Talk	>2.5, predict 0;	2	0.0	77.4	0.225
(MRM72)	≤2.5, predict 1	29	75.9		
Mothers' Total Emotion Talk	≤0.5, predict 0;	5	60.0	67.7	0.985
(MRM72)	>0.5, predict 1	26	73.1		
Children's Positive Emotion Talk	≤0.5, predict 0;	20	60.0	58.1	0.112
(MRM72)	>0.5, predict 1	11	90.9		
Children's Negative Emotion Talk	>2.5, predict 0;	1	0.0	74.2	0.679
(MRM72)	≤2.5, predict 1	30	73.3		
Children's Total Emotion Talk	≤0.5, predict 0;	16	56.3	64.5	0.112
(MRM72)	>0.5, predict 1	15	86.7		

Classification Tree Analyses

Figure 1 presents the classification tree model predicting low versus high coherence on the context dimension, Figure 2 presents the model predicting low versus high coherence on the chronology dimension, and Figure 3 presents the model predicting low versus high coherence on the theme dimension. Decision points are represented by circles, with a generalized *p* value given below each. Cutoff values for optimal classification of observations are given beside the arrows, which themselves represent predictive pathways. Rectangles indicate final classifications, or the percentage of accurately identified children, and the number of children predicted for each pathway is given below the rectangles. Below are descriptions of the three obtained tree models classifying children as low or high on each of the dimensions of narrative coherence.

Context

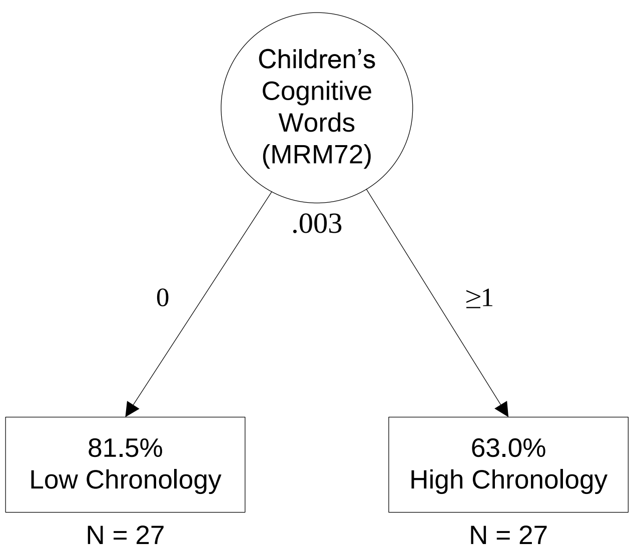
Figure 1. Optimal Data Analysis Classification Tree Model for Predicting Low (0) versus High (1) Narrative Coherence on Context



The single strongest predictor of coherence on the *context* dimension was children's associations. For children who provided 1.25 associations or fewer on average in the MRM at 54-months (n = 30), the model predicted low context scores with 86.6% accuracy. Among children who provided more than 1.25 associations on average (n = 24), mothers' elaborative *Wh*-questions were the next most important predictor of coherence on the context dimension. Those whose mothers provided more than 12.75 elaborative *Wh*-questions (n = 9) were predicted to be low on the context dimension with 88.9% accuracy. On the other hand, those whose mothers provided relatively few (average counts ≤12.75) elaborative *Wh*-questions (n = 15) were predicted to be high on the context dimension with 73.3% accuracy.

Chronology

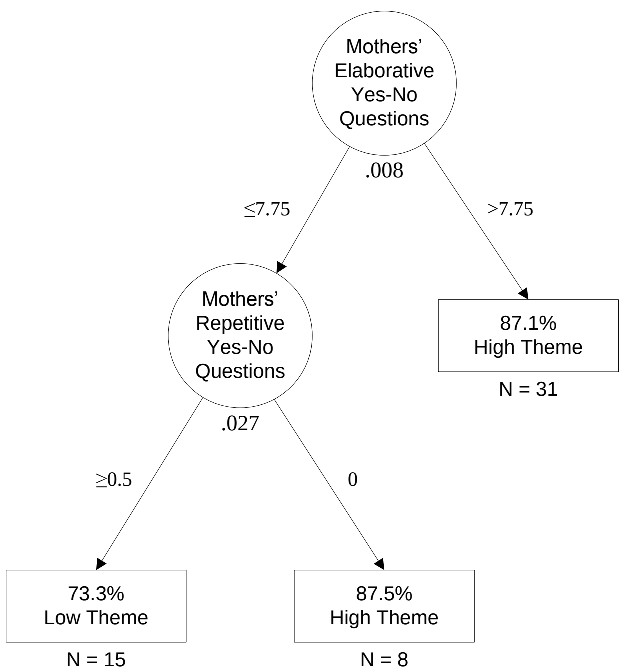
Figure 2. Optimal Data Analysis Classification Tree Model for Predicting Low (0) versus High (1) Narrative Coherence on Chronology



Only one variable entered into the classification tree model for *chronology*: children's cognitive words during the 72-month MRM. Children who provided at least one cognitive word while reminiscing with their mothers (*n* = 27) were predicted to be high on the chronology dimension of coherence with 63.0% accuracy. Children who did not provide any cognitive words while reminiscing with their mothers (*n* = 27) were predicted to be low on chronology with 81.5% accuracy.

Theme

Figure 3. Optimal Data Analysis Classification Tree Model for Predicting Low (0) versus High (1) Narrative Coherence on Theme



The strongest predictor of coherence on the *theme* dimension was mothers' elaborative yes-no questions in the 54-month MRM. Children whose mothers averaged more than 7.75 such questions (*n* = 31) were predicted to be high on the theme dimension with 87.1% accuracy. For children whose mothers averaged less 7.75 elaborative yes-no questions (*n* = 23), mothers' repetitive yes-no questions were the most important predictor of coherence on the theme dimension. Children whose mothers asked fewer than 7.75 elaborative yes-no questions and did not ask any repetitive yes-no questions (*n* = 8) were also predicted to be high on theme, this time with 87.5% accuracy. When mothers did ask at least one repetitive yes-no question (i.e., averaged 0.5 or higher) in combination with averaging fewer than 7.75 elaborative yes-no questions (*n* = 15), children were predicted to be low on theme with 73.3% accuracy.

Classification Performance

Statistics summarizing the classification performance of each model are given in Table 13. Overall classification accuracy represents the percentage of the 54 total children in the model who were correctly classified. Sensitivity is an index of the *descriptive utility* of a classification model, indicating the percentage of membership (i.e., low vs. high coherence) correctly identified by the model (Yarnold & Soltysik, 2005). On the other hand, predictive value is an index of *prognostic utility* of a model, reflecting the percentage of correct classifications. Effect strength for sensitivity is a standardized index of effect strength that can be used in the direct comparison of multiple CTA models. Similarly, effect strength for predictive value is calculated to standardize that measure, and the two effect strengths are averaged to give an overall effect strength of the model. For these three measures of effect strength, values < 25% are considered *weak*, between 25% and 50% are considered *moderate*, between 50% and 75% are considered *relatively strong*, and > 75% are considered *very strong*. Finally, cross-classification tables for each model summarizing the number of children who were correctly and incorrectly predicted low or high on each dimension of coherence are provided (Tables 14-16).

Table 13. Classification Performance Statistics for CTA Models

	Context		Chronology		Theme	
Overall classification accuracy	45/54	83.3%	39/54	72.2%	45/54	83.3%
Sensitivity (High coherence)	34/38	89.5%	22/32	68.8%	11/16	68.8%
Sensitivity (Low coherence)	11/16	68.8%	17/22	77.3%	34/38	89.5%
Effect strength for sensitivity		58.2%		46.0%		58.2%
Predictive value (High coherence)	34/39	87.2%	22/27	81.5%	11/15	73.3%
Predictive value (Low coherence)	11/15	73.3%	17/27	63.0%	34/39	87.2%
Effect strength for predictive value		60.5%		44.4%		60.5%
Effect strength overall		59.4%		45.2%		59.4%

Table 14. Cross-Classification Table Summarizing Classification Performance of Tree Model for Context

	Children's Predicted Coherence	
Children's Actual Coherence	Low	High
Low	34	4
High	5	11

Table 15. Cross-Classification Table Summarizing Classification Performance of Tree Model for Chronology

	Children's Predicted Coherence	
Children's Actual Coherence	Low	High
Low	22	10
High	5	17

Table 16. Cross-Classification Table Summarizing Classification Performance of Tree Model for Theme

	Children's Predicted Coherence	
Children's Actual Coherence	Low	High
Low	11	5
High	4	34

CHAPTER FOUR

DISCUSSION

This study aimed to identify developmental factors that optimally predict children's narrative coherence on three dimensions: context, chronology, and theme. Although prior work has suggested that parent-child conversational interactions about a range of past experiences can foster the development of children's narrative skills, work illustrating predictive factors of different aspects of narrative competence has been limited. The results of the study contribute to the literature in three ways. First, they provide descriptive information about the knowledge, ability, and performance of children at 54 and 72 months of age across various measures of language, memory, and narrative. Second, they quantify the predictive capability of every measured variable at predicting children's scores on each of the three dimensions of narrative coherence. Third, the study involves the application of a new statistical approach to archival data. Using Optimal Data Analysis, three multi-attribute classification tree models were constructed that optimally classify children as low or high on coherence for each of these three dimensions. These three trees identify not only which variables are used in optimal classification, but cut points at which scores on these variables discriminate children as high or low on the respective coherence dimension. In doing so, these results are the first of their kind used in the study of narrative development.

The Current Sample

The current sample was included in Reese et al.'s (2011) study establishing the NaCCS as a valid measure of narrative coherence. However, this study takes this work a step further to explore concurrent and longitudinal associations among the dimensions of children's narrative coherence and other measures of these same children on a range of skills that, based on prior literature, might be expected to predict narrative coherence. To begin, I will describe the sample in terms of the measured variables.

The children in this sample had slightly above-average vocabularies. On both the PPVT and EVT, children's scores averaged about one standard deviation above the population mean (*M* = 100, *SD* = 15), and were consistent from 54-months to 72-months. Scores from the metamemory assessments at 54-months indicate that the children in the sample knew quite a bit about the process of remembering. An average score of 4.1 out of a possible 6 on the METF, including 1.9 of the possible 3 complex questions, suggests that these children had at least a basic understanding that certain factors influence memory, including the number of items to be remembered, the duration of retention, and whether or not one writes down the information to be remembered. Further, an average score of 4.7 out of a possible 6 on the METS suggests that the children also understand that looking at and naming objects can influence memory performance. Finally, an average score of 5.0 out of a possible 6 on the METC suggests that the children have a rather advanced understanding that talking about an experience during or after the event can help in subsequent memory thereof.

Mothers provided a substantial amount of total elaborative talk per event discussed (*M* = 26.6) in reminiscing conversations at 54-months – far more than total repetitive talk (*M* = 4.9) – especially in the form of elaborative *Wh*-questions (*M* = 11.9) relative to repetitive *Wh*-questions (*M* = 1.7). However, there was great variability in the provision of elaborative and repetitive talk. Mothers also evaluated their children frequently (*M* = 9.8), and those evaluations were overwhelmingly confirmations (*M* = 9.2). Mothers also made associations (*M* = 2.2) between the past events under discussion in the reminiscing conversations and other events or general knowledge previously known by children, but this type of talk was relatively infrequent.

Children were also making substantial contributions to the conversations. Their provision of memory elaborations (*M* = 11.1) and confirmations (*M* = 5.5) in the conversations indicates that they were active participants in co-constructing these past event narratives with their mothers. Children also provided associations (*M* = 1.5), suggesting that they were also making connections between the event under discussion and their previous experiences and knowledge base. Like mothers, children also varied in their provision of different types of talk in the memory conversations.

The counts of mothers' and children's total cognitive words used in the MRM at 54- and 72-months indicate that these words are often used in reminiscing conversations, but that there is great variability in their use by both mothers and children. Although Rudek and Haden (2005) concluded that mothers' use of these words was stable from 30- (*M* = 20.8) to 42-months (*M* = 18.95), mothers' use of these words decreased from 54-

(*M* = 17.6) to 72-months (*M* = 8.8). Children's provision of cognitive words increased relative to the means reported by Rudek and Haden at 30- (*M* = .95) and 42-months (*M* = 2.95), and yet were relatively stable from 54- (*M* = 5.2) to 72-months (*M* = 4.1). This developmental pattern is interesting, given that the use of these words is considered reflective of meaning-making in the context of narrating past events. Beyond simply talking about what happened in the past event, mothers and children are also talking about their thoughts, beliefs, wishes, hopes, intentions, and suppositions. This type of talk goes beyond relating the facts of what happened to conveying the personal significance of the past event.

The inclusion of emotional content in the MRM at 54- and 72-months indicates that these utterances were relatively rare for both mothers and children. Mothers' utterance contained very little emotional content at 54- (*M* = 1.5) and 72-months (*M* = 2.2), as did children's (*M*s = 1.1, .9 respectively). Whereas the inclusion of cognitive words implies that mothers and children commonly mentioned their thoughts, beliefs, etc. related to the past events, the lack of emotional content implies that they are not talking much about how they felt in relation to the event. While the process of discussing cognitive states in reference to past events allows for self-referential meaning-making, so does discussing emotional states in this context. These two different mental states may play different roles, not only in meaning-making, but in facilitating the development of narrative coherence. Investigating past event narratives in a sample and context with more variability in the provision of emotional content (e.g., in discussing a traumatic past event) to test the longitudinal association between this content and narrative coherence may prove to be a fruitful avenue for future research.

Main Findings

Before discussing the results of the CTA analyses with regard to each dimension of narrative coherence, first I will provide two overarching conclusions. First, the hypothesis that children's vocabulary scores would be the most predictive of their narrative coherence was not supported. Other than the marginally significant model that classified children with relatively high scores on the Expressive Vocabulary Test (>109.5) at 54-months as high on the context dimension and children with relatively low scores (≤109.5) as low on context, none of the EVT or PPVT scores were related to any dimension of coherence, and no vocabulary score entered any classification tree model. Rather, every predictor that entered the tree models was a measure of mothers' and children's talk during the reminiscing conversations. This is taken to mean that above children's verbal competency and metamnemonic knowledge, the development of narrative coherence is driven by verbal interactions with parents. Even considering that the majority of variables considered here were measures of talk in these reminiscing conversations, this finding is nonetheless an indication that social interaction may drive this development.

Second, the three models produced for the respective dimensions of coherence are not the same. Reese et al. (2011) predicted that the factors that would contribute to each dimension would not be the same, given that they have divergent developmental progressions due to their dependence on different developmental competencies. Indeed, the univariate results indicate dissimilar patterns of factors related to each dimension, and the tree models for the three dimensions do not share a single predictor. These results confirm that each dimension is a unique construct and should be considered separately in analyses of narrative coherence.

Context

The tree model predicting low versus high coherence on context revealed that two variables interact to predict coherence on this dimension. Of the 15 children who provided greater than 1.25 associations on average in a past event narrative while reminiscing with mothers at 54-months *and* had mothers who provided 12.75 or fewer elaborative *Wh*-questions on average, 11 were high on coherence for context. Among the 39 children for which both of these conditions were not met, 24 were low. This model classified participants with 83.3% overall accuracy with a moderately strong overall effect strength of 59.4%. That children's associations were positively associated with coherence on this dimension is not surprising, because associative talk inherently contextualizes an aspect of a past event conversation. That is, an association is a comparison between a particular referent in a past event conversation and another context in which the child has come across that referent. Even if not explicitly discussed, in making this association, the child is communicating an understanding that this one referent existed in two different places and times.

On the other hand, it is counter to the hypothesis that mothers who asked more elaborative *Wh*-questions were *less* likely to have children high on the context dimension relative to mothers who asked fewer *Wh*-questions. Because these open-ended questions invite children to fill in the details of the past event on their own, as opposed to mothers providing the information in statements, the opposite trend was expected. However, that fewer maternal elaborative *Wh*-questions predict high coherence does not necessarily imply that these questions somehow hinder the development of coherence. Rather, it may be that the only pathway to a high level of coherence on the context dimension at this age is when children provide several associations *despite* having mothers who ask relatively few *Wh*-questions. These children's relatively high provision of associations in conversations in which mothers ask relatively few *Wh*-questions may indicate a level of narrative sophistication uncommon among 72-month-old children. Consider that the number of children who had reached a relatively high level of coherence on the context dimension was quite low (16 of 54). Indeed, previous research has indicated that this dimension is the latest to develop (Fivush, 1991; McCabe & Peterson, 1991; Reese et al., 2011). Furthermore, it may be that mothers of such exceptional children do not need to provide as many of these questions, because the function they serve is more appropriate for less sophisticated children. In any case, future research ought to consider these findings and further probe the relationship between associative talk, mothers' *Wh*-questions, and the development of context coherence.

Chronology

The tree model predicting low versus high coherence on chronology is straightforward: of the 27 children who used at least one cognitive word while reminiscing with their mothers at 72-months, 17 were high on the chronology dimension of coherence. Of the 27 children who did not use any cognitive words, 22 were low. That the model had an overall classification accuracy of 72% and moderate overall effect strength of 45.2% using only one predictor speaks to the strong interrelation between cognitive words and chronology coherence. The link between cognitive words, a form of meaning-making by discussing thoughts and beliefs, and chronology, or temporally ordering the events of a narrative, was not a hypothesized relationship. However, it was hypothesized that metamemory knowledge would be related to coherence on this dimension, and these two variables (cognitive words and metamemory knowledge) have a common bond: they both imply an understanding of cognitive processes. It may be that chronology coherence, a relatively late-developing capacity, requires not only an understanding of temporal relationships, but necessitates an understanding of cognitive processing. Certainly, this result of an association between cognitive words and chronology coherence warrants further consideration from researchers interested in the development of narrative coherence.

Theme

Finally, the tree model predicting low versus high coherence on theme reveals an interaction between two maternal contributions to reminiscing conversations at 54-

months predicting coherence on this dimension. Of the 15 children whose mothers provided fewer than 7.75 elaborative yes-no questions in the 54-month MRM *and* more than 0 repetitive yes-no questions, 11 were low on theme. Of the 31 children whose mothers provided more than 7.75 elaborative yes-no questions, 27 were high on theme. Among the 8 children whose mothers provided fewer than 7.75 elaborative *and* 0 repetitive yes-no questions, 7 were high on theme. This model classified participants with 83.3% overall accuracy with a moderately strong overall effect strength of 59.4%.

Two important conclusions can be drawn from this tree model. First, yes-no questions, which probe or test children for confirmations of what they know, seem to be important for the development of coherence on the theme dimension. It was hypothesized that cognitive words and emotional content uttered in the reminiscing conversations would be related to coherence on the theme dimension, for the reason that in past event conversations, this kind of language can provide children with the opportunity to integrate their understanding of mental and emotional processes into their representation of personal memories (Fivush & Nelson, 2006; Reese, 2002; Welch-Ross, 1995). Additionally, Reese et al (2011) reported that coherence on the theme dimension relies upon certain metacognitive abilities, including creating temporal links between the past and present and the ability to self-reflect, which also could have been reflected in the discussion of mental processes. However, these factors did not enter into the tree. The interplay of elaborative and repetitive yes-no questions that optimally predicts children's coherence on the theme dimensions calls for future research to explicate the importance of these types of questions on children's development of narrative coherence.

Second, it is clear that not all yes-no questions are created equally. There is a contrast between the use of elaborative and repetitive yes-no questions in the theme tree model. Mothers who asked more than 7.75 elaborative yes-no questions had children high on the theme dimension 87.1% of the time, regardless of the number of repetitive yes-no questions they asked. On the other hand, when mothers asked elaborative yes-no questions less frequently, the model then considered repetitive yes-no questions, and in this case, if mothers repeated even just one yes-no question, the likelihood that their child was high on theme coherence decreased significantly. These results may indicate that elaborative questions, unlike repetitive ones, function to promote children's full elaboration upon topics (McCabe and Peterson, 1991). In line with this suggestion, previous work has posited that an elaborative style of talk in reminiscing with children may promote the development of narrative coherence (Haden, Haine, & Fivush, 1997; Peterson & McCabe, 1992).

Limitations and Future Directions

The results of this study using Optimal Data Analysis for the first time in this field of study offer new insights into the development of narrative coherence. However, this study has one important limitation: the sample size was quite small for use with ODA. With only 54 participants, the possible size of the classification tree models was limited from the outset to a maximum of only four or five variables. Indeed, the largest obtained tree model had only two variables as decision points. In a study with a much larger sample, the trees would be allowed to grow to include many more variables, facilitating findings of multiple interactions between these more numerous variables that could better explain the pathways to narrative coherence. However, longitudinal data is difficult to collect, and most such studies are limited to samples of this size or smaller. To remedy this issue, researchers should consider sharing their data to compile large enough datasets that could maximize the efficacy of this type of analysis. Considering the future directions mentioned in the discussion of each tree model above, this could be one avenue for further exploration of these associations.

Contributions to the Literature

Coherent narration requires a combination of skills that are in the early stages of development when children are 72-months-old, and continue to develop across the life-span (Reese et al., 2011). It requires both the ability to recall past experiences and the ability to organize these experiences into narrative forms (Haden, Haine, & Fivush, 1997). The results of this study underscore that narration is not simply a reflection of verbal ability, because children's vocabulary scores were not significantly associated with narrative coherence on any of the three dimensions, longitudinally or concurrently. Rather, elements of parent-child reminiscing conversations proved optimal at predicting whether children could coherently narrate a past event. In these verbal interactions with their parents, children learn the specific skills required to remember and recapitulate a past experience (Fivush & Reese, 1992). Specifically, in the context and theme tree models, McCabe & Peterson's (1991) prediction that parents' questioning of children in reminiscing may play a role in eliciting early narrative coherence was supported. This suggests that the differences in how parents tried to elicit children's narratives influenced children's developing capacity to tell structured, coherent narratives.

This study is the first of its kind, in that Optimal Data Analysis was used to identify the predictors that classify children as coherent narrators. For each dimension, UniODA results describe the unique predictive capability of each predictor considered in the model, and the classification tree models determine which predictors optimally classify participants as low or high on coherence. Not only were the types of talk during reminiscing that predict coherence ascertained, but cut points were pinpointed demonstrating the minimum or maximum number of utterances for each predictor in order for children to be classified as coherent. Although future studies with larger sample sizes may be able to extrapolate on the models obtained in this study, these results go a long way in establishing the patterns of talk related to the development of narrative coherence.

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VITA

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