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UNIVERSITY OF CALIFORNIA, MERCED



The Process of Scaffolding in Conversation: Who Does it Best and Why?

A dissertation submitted in satisfaction of the requirements for the degree Doctor of
Philosophy

in

Psychological Sciences

by

Kristi Ann Imberi-Olivares

Committee in charge:
Professor Jan Wallander, Chair
Professor Jeff Gilger
Professor Will Shadish
Professor Jack Vevea

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(Chair)

University of California, Merced

2012

DEDICATION

To my son, the love and light of my life, who is the source of inspiration for my pursuit in this area of research. His presence has encouraged me to reach as high as possible, it is my hope he does the same.

You are my greatest accomplishment.

This dissertation is for you.

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Studies in Hierarchical Linear Modeling
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ABSTRACT OF THE DISSERTATION

The Process of Scaffolding in Conversation: Who Does it Best and Why?

by

Kristi Ann Imberi-Olivares

Doctor of Philosophy in Psychological Sciences

Professor Jan Wallander, Chair

Research demonstrates the importance of social interaction for children. Two important aspects of social interaction are conversation and scaffolding. Previous work has shown that children benefit from conversation with parents. However, no research has examined if children learn from conversation equally when interacting with different partners, so it is unclear how that learning may be different or similar to how children learn from parents. Even though it is clear that conversation is important for how children learn, no one has looked at conversation using the framework of scaffolding. Scaffolding is an ongoing interaction between a child and some other speaker where the other speaker provides support contingent on the child's progress (Bruner, 1975). Because conversation is an essential part of scaffolding, it is important to understand

what potential differences exist between different conversation partners to illuminate differences that may exist in scaffolding.

Previous scaffolding research has found that peers scaffold differently than parents; in most cases, they are not as effective as mothers and they exhibit fewer scaffolding-like behaviors. Much less work examines how siblings scaffold; siblings are similar to peers but may be more familiar with the target child. However, there are several methodological problems with these studies, such as the mother being present or comparing children in different settings using different stimulus items. Further, no research has examined what is responsible for the fact that some people can scaffold better than others. In order to understand how children learn differently from different people, we need to know what is responsible for the difference in scaffolding.

This research explores whether children can benefit equally from conversation with people other than their parents and seeks to explain why differences in scaffolding exist between partners. Study participants included ethnically diverse 3- and 4-year-old children recruited in local Merced County preschools.

In Study 1, 144 participants engaged in a free play interaction with either their parent, older sibling, or other adult. Examining their conversations, results indicate that children seem to vary in how they benefit from conversation depending on their partner. In particular, children asked more questions of parents and other adults than siblings, but siblings provided more informative answers than parents and equally to other adults. Further, parents and other adults turned the question back to children more often than siblings did.

In Study 2, the erroneous utterances and how partners responded to these were investigated in the same 144 children who participated in a free play task with either their parent, older sibling, or other adult. Results indicate that parents and other adults provided more reformulations than siblings did. This confirms that children do not equally benefit from conversation with different partners. In both Study 1 and Study 2, sibling age spacing does not seem to affect their interaction with children during conversation.

In Study 3, 92 participants engaged in a building task with either their parent, older sibling, or older peer (age-matched to siblings). Scaffolding and orienting behaviors, as well as appropriate shifts in instruction, were investigated. Parents used more scaffolding and orienting behaviors than both siblings and peers. They also made more appropriate shifts during the course of interaction. Siblings and peers did not differ in the amount of scaffolding and orienting behaviors. They also did not differ in the amount of appropriate shifts made. In addition, children performed equally at independent post test regardless of who their teaching partner was, with 4-year-olds outperforming 3-year-olds.

Because Study 2 confounded motivation with familiarity within siblings and parents, Study 3 introduced a control for motivation. In Study 3, 63 participants engaged in a building task with either their parent or older sibling. However, unlike Study 2, siblings were told that they would receive a reward if the child performed well during post test. Scaffolding and orienting behaviors, as well as appropriate shifts in instruction, were investigated. Despite introducing a reward, no effects were found between siblings' scaffolding and orienting behaviors in this study and Study 3. Confirming the findings

from Study 2, parents used more scaffolding and orienting behaviors, and made more appropriate shifts than siblings did. No effect of teaching partner was found with respect to children's independent post test performance. Consistent with previous studies, sibling age spacing did not have an effect on scaffolding behaviors in both Study 2 and Study 3.

Overall, the results of this research suggest that children learn differently from different people, and the benefits of parent-child interaction may not be as beneficial with other types of partners. Knowledgeability, familiarity, and motivation all seem to play a role in why people scaffold differently. This research adds importantly to both the conversation and scaffolding literatures, and these findings have implications for current theories of how children learn, parenting practices, and classroom application.

CHAPTER I: INTRODUCTION AND BACKGROUND

From an early age, children are active learners, and an important way that they learn about the world is through social interaction (Bruner, 1973; Evans, Wells, & Moch, 2003; Lloyd & Duveen, 1990; Rogoff, 1990). Vygotsky (1962) argued that social interactions are crucial for cognitive growth to occur. On their own, children can only operate within specific limits, which are fixed according to their development and “intellectual possibilities” (Vygostky, 1934a, pg. 219). In order for children to experience cognitive growth, they need to go past their own sphere of learning and the only way they can achieve this is by collaboration with others. According to Vygotsky, this process of collaboration and extending beyond children’s own fixed limits is only possible within the scope of social interaction. These social interactions serve as a medium for social activities to be transformed and used by children according to their understanding and involvement, something they could not gain on their own. Social interaction enables adults to act as the experts in introducing children to social activities and tools, above and beyond what they are capable of possessing on their own, that can be later acquired and utilized by the child (Rogoff & Gardner, 1984).

Such social interaction affects children’s knowledge in two ways. First, it can expand knowledge directly (Nelson-Le Gall, 1985). Second, it can influence the children’s skill repertoire indirectly (Dunn, 1988). Direct influence is associated with an adult’s personal intervention or guidance of a young child's social attitudes, reactions and behaviors. For instance, showing a child how to solve a problem, while controlling the

learning environment so that the child can take things step by step, directly expands the base of their knowledge. Indirect influence is associated with an adult's example and the environment she creates for the child to understand and observe social interactions. For example, an adult may demonstrate a particular activity, such as baking cookies, and have her child observe. This indirectly affects the child's skill repertoire since the adult is not directly guiding the child through the activity. Social interaction affords children opportunities to participate in a more advanced skill, either through active observation or through joint involvement in problem-solving (Tudge & Rogoff, 1989). In these situations, an adult (or more skilled partner) is able to guide the child's cognitive growth by structuring and modeling the appropriate solution to the problem, the activity being observed, and the child's involvement in the task. For example, because adults have greater skill and understanding than children, they can more easily find effective ways to achieve shared thinking that broadens their children's own understanding. When children receive help through this process, they also gain the opportunity to acquire knowledge and skills which may be utilized in future tasks and problems.

Researchers have suggested that both of these benefits of social interactions (knowledge expansion and skill repertoire) involve the transfer of knowledge in two phases: external and internal. Vygotsky (1962) argued that any higher mental function necessarily goes through an external stage in its development because it is initially a social function. Once a function or concept has been socially co-constructed, it becomes available to be internalized. Wertsch (1985) suggested that initially, social interaction enables learning to occur externally between individuals, and later, the product

(knowledge) of social interaction becomes internalized within the individual. As a result, knowledge gained from the social interaction is transferred to the child as part of his own understanding (Tudge, 1992). In other words, as children internalize the use of the tools (signs, symbols, language) gained from the interaction, they are better able to utilize these tools on their own in future situations. For example, language is initially used in interaction between adult and child as a means of communication. Not only is language important as a means of communication, but it is also valuable for planning of actions. Gradually, it is internalized into a means of the child's own thinking and control of his own activity. According to Vygotsky (1978), children use a sort of inner speech to guide themselves through the implementation of complex processes for accomplishing tasks or for figuring out ways to combine old procedures to produce new ones. In this sense, social interaction not only leads to increased knowledge, but it actually changes a child's thoughts and behaviors.

In order for successful transfer of knowledge or skill repertoire to occur and begin this process, children must engage with others who are more knowledgeable or capable than they are (Kaye, 1970). Both adult guidance and child participation have been found to have significant effects on children's learning (Beizer & Howes, 1992; Goncu & Rogoff, 1998; Rogoff, 1982; Rogoff & Guavain, 1986). Adults are able to structure and model the correct solution to the problem and their guidance of children's participation in social activities facilitates children's cognitive development (Rogoff, 1990). In particular, this assistance enables children to perform and engage in activities that might normally be out of their mental capabilities. It is the adult's ability to structure the

situation, in relation to the child's own skill level, that fosters children's cognitive growth during a given interaction (Vygotsky, 1978). In developing children's abilities, adults can guide them towards performing actions or tasks which are just beyond their current capacity. With such guidance, children can perform beyond their own ability. Vygotsky defined these limits as the zone of proximal development (ZPD), which is the difference between what children can already do on their own and their "potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978; pg 34). In particular, Vygotsky suggested that those interactions which occur within the child's ZPD result in the most salient transfer of knowledge. The ZPD allows the adult to initially take on most of the responsibility for guiding the interaction, but then, the adult can gradually transfer that responsibility to the child.

According to Vygotsky, children benefit from interacting with more knowledgeable others, but this does not necessarily have to be through structured teaching situations, it may simply be embedded in their participation in everyday, social activities (Tharp & Gallimore, 1988). Although cultural variations exist in whom children participate in social activities with, from an early age, children typically become involved to some extent in the on-going social activities around them (Rogoff, 1981). For example, Vandermaas-Peeler, Way, and Umpleby (2002) found that adults in the Western culture often engaged children in household activities such as baking. Similarly, Childs and Greenfield (1980) observed Zinacanteco mothers engaging their daughters in learning how to weave in south-central Mexico. As children participate in such social

activities, they appropriate these patterns, and they acquire the means to be competent members of their culture via social interaction (Volk, 1999). It is not just that the child learns from others during social interactions, but instead that the actual means of social interaction (e.g. gestures, language) are internalized and transformed by the child to then use as tools for future social activities and problems (Wertsch, 1985).

In addition to serving as a short cut for children and facilitating the process of knowledge acquisition in a much more useful way than if children were to learn in isolation, another strength of social interaction is that it affords parents important teaching opportunities and, in particular, opportunities to scaffold their children's learning. Scaffolding is an ongoing interaction between a child and some other speaker (here referred to as 'teaching partner'), where the teaching partner provides support contingent on the child's progress (Bruner, 1975; Bruner & Sherwood, 1976; Neitzel & Stright, 2003; Ratner & Bruner, 1978). The hallmarks of scaffolding are its interactive nature and that it embodies the notion of reciprocal interaction, where the adults adjust their teaching behaviors in relation to their children's needs (Valsiner, 1984). There is an ongoing interplay between the teaching partner and child in the joint completion of the task (Palinscar, 1984). In order to establish whether a particular kind of help counts as scaffolding, it needs to be established whether the teaching partner is aiming to develop a specific skill, concept, or level of understanding. In other words, although scaffolding does not necessarily need to apply to a well-defined problem-solving activity (such as building a wooden pyramid made up of blocks), it does need to refer to the kind of help which is given in the attempt to carry out a specific learning activity which has clearly

defined learning goals. Among other behaviors, this involves orienting and maintaining the child's attention, breaking down the overall task into sub-goals so that it is more manageable for the child, and pointing out key things parts of the task, while offering the child support dependent on the child's needs (Wood & Middleton, 1975; Wood, Bruner, & Ross, 1976). For example, Pratt and colleagues (1988) examined parental scaffolding and added 'verbal hinting' (teaching partner provides implicit suggestions for child to do the next step – e.g. "look at my red piece," "do you see one with a hole?") to Wood and colleagues (1976) initial list of key behaviors for effective scaffolding. Verbal hinting builds on some particular information that the child already knows. Pratt and colleagues (1988) believed that it further facilitated learning by reactivating the importance of this preexisting information, telling the child that he should pay more attention to a particular fact, or that he should begin his work with this information, while still challenging the child.

In addition to specific behaviors, scaffolding must also include adjusting assistance through both the quality and quantity of help so that, over time, scaffolding increases the child's competency in a given task (Diaz, Neal, & Vachio, 1991; Evans et al., 2003; Greenfield, 1984; Griffin & Cole, 1984). In order to do this effectively, teaching partners need to adhere to two underlying principles during instruction: sensitivity and contingency (Wood & Middleton, 1975; Wood, Wood, & Middleton, 1978). The *region of sensitivity* involves the teaching partner providing support just above the child's current knowledge and adjusting up or down according to their child's success or failure on task. For example, Wood and Middleton (1975) observed mothers

tutoring their children on a block-building task. They found that the more parental assistance provided within the region of sensitivity to instruction, the more the child gained from the tutoring session. The *contingent shift rule* consists of teaching partners providing less support following a child's success and more support following a child's failure. Similar to Vygotsky's zone of proximal development (ZPD), this region shifts according to the context and skills of the people interacting. In this instance, adult assistance is contingent on the child's response (i.e. failure or success). Research demonstrates that children who receive contingent and sensitive scaffolding dependent on their efforts perform better independently on subsequent tasks (Wood & Middleton, 1975; Vygotsky, 1978).

This work examines conversation and different conversational partners during the process of scaffolding. Within this area, two key questions are of interest: 1) if children benefit equally from conversation with people other than their parents, and 2) why different partners scaffold differently. Very few people have looked at the transmission of knowledge and recruitment of knowledge by children under these situations independently. Below is a review of the important contributions in the fields of conversation and scaffolding, reconciliation of the two literatures, and the relationship between them and the current research questions.

The Importance of Conversation

Another key component of the scaffolding process is conversation. This is because all of scaffolding necessarily involves conversation. This can occur in two ways. First, conversation can occur as a part of a larger scaffolding interaction. Second,

conversation by itself can occur as its own form of scaffolding without any accompanying activity. For example, two people can be completing a task and talking, or two people can be doing nothing else but talking, and in both of these situations, scaffolding can occur.

Conversation on its own serves as an important avenue for learning. Although children can learn about certain aspects of the world through direct observation, conversation may serve as a short-cut for children and facilitate knowledge acquisition in a more rapid way than direct observation (Ochs, 1987; Ratner, 1984; Rogoff, 1993; Tharp & Gallimore, 1988). Instead of having children experience everything first-hand, which may involve a lengthy process of trial and error, adults are able to by-pass this process by providing knowledge via conversation. Conversation is especially useful for transmitting knowledge when direct observation is unavailable. In fact, some knowledge can be transmitted only through conversation. For example, conversation is useful with regards to religious and metaphysical domains that children cannot explore themselves (Harris, 2000; Harris & Koenig, 2006; Issacs, 1930). Generally, children do not have direct experience with God and therefore, any understanding of God is gained through social interaction with others.

Instead, children gain knowledge about religious concepts, such as God and heaven, by engaging in interaction with others, directly or indirectly. For instance, Issacs (1930) notes how a 6-year-old child asked, “Why do angels never fall down to earth when there is no floor to heaven?” Since no perceptual observation can be made regarding what heaven looks like or how angels exist in heaven, drawing on his current

repertoire of knowledge, the child concludes that angels, like other animals and human beings, should fall to earth without solid ground to stand on in heaven, and is puzzled as to why this assumption does not hold. Social interactions provide an opportunity for the parent to take the next step and explain why the child's current way of thinking about these metaphysical concepts is not exactly right. It also affords parents the opportunity to give additional information to direct the child into a more correct way of thinking about these sorts of issues. In addition, Evans (2001) compared children's concepts of origin of species between those who grew up in Christian fundamentalist communities to those children who grew up in non-fundamentalist communities. Results indicated that, like adults from the same communities, children from Christian fundamentalist communities offered more creationist explanations than children from the non-fundamentalist communities. On the other hand, children from the non-fundamentalist community embraced evolutionary explanations instead of creationist ones. This suggests that children do not invent these notions about an extraordinary God and species origins, but these differences are due to a difference between the two communities with respect to whether or not they positively endorse God as creator (Harris & Koenig, 2006).

Conversation is also beneficial for learning about a variety of more concrete domains such as psychology, cosmology, history, geography, and biology (Carey, 1985; Flavell, Astington, Harris, & Olson, 1988; Gelman & Kremer, 1991; Keil, 1989; Spelke, 1988). Children do not have direct access to mental processes such as these; they cannot make any real observations about how the brain works. Nevertheless, Johnson (1990) found that by 5 years of age, children understand the difference between the impact of a

brain transplant and a heart transplant. They also understand that thinking and remembering would stop if the brain were removed (Gottfried, Gelman, & Schultz, 1999). By 7 years of age, children understand that a person's identity is connected to their brain and that, if a child's brain were transplanted into a pig's brain, the pig would claim to be a child and not a pig (Johnson, 1990). Children are unable to observe directly brain processes such as thinking and remembering, yet they seem to have some understanding of how the brain works from an early age. Children's understanding about the existence and functioning of the brain is gained via interaction with other people, in particular, adults, which fosters their understanding about the brain.

Another example of children receiving information rather than having to sort things out on their own is category membership. For example, Callanan (1991) argues that social interactions foster children's word learning through the ways in which parents label objects. The majority of children's first words are nouns, and mothers tend to focus on object labels when talking with their young children (Goldfield, 1998). From an early age, children are able to label objects at the basic level (e.g. chair, dog), but they do not yet understand more general superordinate terms (e.g. furniture, animal) until 4 to 5 years of age (Callanan, 1982; Markman, 1989; Perez-Granados & Callanan, 1997a). In addition to labeling objects at the basic level during conversation, parents introduce superordinate labels to their children by relating them to the basic level labels within the category hierarchy (Perez-Granados & Callanan, 1997a). For example, Callanan (1985) found that mothers point and label objects at the basic label (e.g. "This is a dog") and mention relations (e.g. "This dog is an animal") when introducing superordinate labels.

This way of labeling possibly helps children understand names of objects and the meanings of words (Perez-Granados, 2002).

Some researchers argue that this kind of object labeling during social interactions actually facilitates children's understanding of category membership (Masur, 1997; Stevens, Blake, Vitale, & MacDonald, 1998). In particular, several studies suggest that social interaction fosters children's category knowledge in a sense that children incorporate their parents' descriptions of objects into their own representations of different objects (Adams & Bullock, 1986; Callanan, 1985, 1991; Mervis, 1987). For example, Adams and Bullock (1986, p. 187) found that parents of 3-year-olds provide categorical statements such as, "They [penguins] live at the South Pole and they swim and they catch fish," when they introduced new labels. Beyond teaching children, 'this is called a penguin,' parents also provided children with categorical information. Similarly, Gelman and colleagues (1998) also found that parents did not only label objects for their 2- and 3-year-olds, but they also provided varying information with respect to category membership (e.g. "these are special snakes that swim under water, *they* are called eels," "there's a chipmunk and *they* eat acorns"). This information helps incorporate these distinctions into their own representations of category membership. For example, when parents describe chipmunks as eating acorns, the child may not only learn that acorn-eating is typical behavior of chipmunks, but that chipmunks, as a class, have common properties and behaviors (Callanan, 1990). In these and other ways, input that parents provide during social interaction with their children is potentially important to children's learning.

One of the most helpful conversational paths for children seeking information is the ability to ask questions and receive information when they need it (Balandin & Iacono, 1993b; Callanan & Oakes, 1992; Chouinard, 2007). Chouinard (2007) found that children ask, on average, 76-95 questions per hour when engaged in conversation with their parents (or as many as 3 questions every 2 minutes) and their parents answer these questions informatively approximately 85% of the time. This results in a huge amount of information being requested by children over the course of their development. Asking questions is not something that children do now and then; it is something that is absolutely central to their daily interactions with other people (Chouinard, 2007). The ability to ask questions and receive answers is an effective tool that allows children to gather information and reorganize their conceptual knowledge as they work toward an adult-like understanding of the world. Children's questions allow them to get answers exactly when they can use them most, when they are open to the information, and when they are trying to resolve a state of disequilibrium (Chouinard, 2007). As children encounter new information, they must revise their previous knowledge either by assimilating new information into what they already know or abandoning their previous knowledge altogether. Children who rely solely on firsthand observation might try to resolve an inconsistency on their own through active experimentation and possibly reach an inaccurate solution. Questions can fill in gaps in the child's knowledge, help resolve cognitive uncertainty, and guide the direction of the child's thought (Callanan, Shrager, & Moore, 1995; Callanan & Jipson, 2001; Kemler Nelson, Egan & Holt, 2004; Kelemen, Callanan, Casler, & Perez Granados, 2005). For example, Vosniadou (1994) investigated how school-aged children come to understand that the shape of the earth is spherical.

When children are told that the earth is a sphere, they may experience cognitive uncertainty in lieu of the fact that they may be unable to reject their perceptual understanding that the world is flat. Being able to ask questions may be one way of making sense of this new information that the world is spherical, guiding their thoughts and reconciling their uncertainty. Through the responses received, children are able to accept a claim that they cannot verify for themselves firsthand.

Children's questions also assist them in learning about the metaphysical domain such as heaven and God (Harris, 2000; Harris & Koenig, 2006; Issacs, 1930). Harris (2000) observed a young boy and his father watching a burial, which prompted the 4-year-old boy to ask, "It's only the naughty people who are buried, isn't it, because auntie said all the good people went to heaven?" Again, the child cannot make a direct, firsthand observation in regards to how that person being buried is going to get up to heaven. Relying on his current assumption that people are buried in the ground and his aunt's claim that good people go to heaven, the child concludes that the person must be naughty. Conversation, and in particular, questions, provide parents with the opportunity to take the next step and explain why the child's current way of thinking is not exactly right.

Questions also afford parents the chance to give additional information to guide the child into a more correct way of thinking about these sorts of issues. For example, O'Halloran and Altmaier (1996) suggest that when teaching abstract concepts, such as death, it is important for parents to understand their child's prior knowledge and experience with the topic because this will allow parents to frame explanations in ways

that are more accessible and easily understood by children. Cotton and Range (1990) suggest that if children cannot developmentally understand a challenging topic, parents do their best to avoid discussing the topic completely and redirect their child's attention to something else.

Further, when children do not receive the answer they need, they persist and ask follow-up questions (Chouinard, 2007; Fraizer et al. 2005; Tizard & Hughes, 1984). For example, Tizard and Hughes (1984) observed 4-year-old children's conversation at home with their mothers. They found that when children were puzzled by something they did not understand, they would ask a sequence of persistent questions, consider the adult's answers, and relate those answers to their own knowledge; this, in turn, might prompt still further questions. They also found that children often provided evidence of assimilating an answer received to an earlier question by reintroducing that information in the form of a following question. For instance, after learning that flat roofs typically have drains to let rainwater run away from the house, one 4-year-old child persisted to ask if snow on a flat roof also required a drain (Tizard & Hughes, 1984). Similarly, Fraizer, Gelman, and Dumas (2005) found that children aged 2- to 4-years-old persisted in trying to elicit an explanation when not given one to their initial "why" or "how" question. In particular, when children did not receive an explanation, they persisted in trying to obtain one by adding more details or by reiterating or rephrasing the original question. If they were given an explanation, they were more likely to ask a follow-up question. Fraizer and colleagues (2005) found that children asked such follow-up questions after almost one fifth of the explanations they received.

In addition, Chouinard (2007) analyzed a variety of question types asked by children from the CHILDES database. In particular, she investigated children's persistence in asking additional questions when they did not receive the answer they were looking for. Chouinard (2007) found that when children received a response from the parent that did not contain the target information; they were significantly more likely to repeat their question than when they received a response that did contain the information they were asking for. This strongly suggests that children's primary purpose for asking questions is to get the information. Therefore, it appears that even through question-asking, children maintain active participation and persevere if they do not receive relevant answers.

Another strength of conversation is that it allows parents to anticipate what the child's needs are and what information is going to be most salient to them. In other words, depending on the child's needs, parents modify their responses according to what information will be most useful for the child (Furrow, Nelson, & Benedict, 1979). For example, Kemler Nelson and O'Neil (2005) found that parents tailor their response to their children's questions depending on the specific artifact that children ask about. For unfamiliar objects (e.g. binoculars, kaleidoscope), parents responded with functional information the majority of the time, alone or in addition to names. For atypical members (e.g. magnifying glass) of familiar categories, parents responded with only the category name. For familiar objects (e.g. book, pen), parents tended to turn the question back to the child. Because parents are more sensitive to what their children know, they can tell when a question is seriously recruiting information versus when the child already

knows the answer. Turning the question back to the child (e.g. what do you think it is?) is a way of showing parental sensitivity to what information children need most (e.g. they need the information more for the novel objects than for the familiar objects). Furthermore, in a study exploring parent-child interactions in a children's museum, Crowley and colleagues (2001) found that parents helped children select and encode relevant evidence as well as how to generate new kinds of evidence or make direct comparisons between distinct types of evidence. Parents also drew on the child's prior knowledge as a source for causal explanation.

Previous research has also found that parents are more likely to reflect, or turn, a child's question back following questions that they believe their child already knows the answer to (Kemler Nelson & O'Neil, 2005). For example, a child might ask 'What's this?' about a tiger. If the parent knows that the child knows what a tiger looks like, they may be aware that the child is just being silly or trying to keep their attention. In this case, they might respond with something like 'You're being silly' or 'What do you think it's called?' (referred to as a turning it back response in this dissertation). This explanation would be in line with scaffolding work that suggests a crucial factor in effective scaffolding involves sensitivity to what children already know.

Similarly, several studies have found that parents will adjust their speech to their youngest children by reducing sentence length and complexity, providing repetition, and using longer pauses between utterances as compared to their speech with older children and adults (Golinkoff & Ames, 1979; Shatz & Gelman, 1973; Snow, 1972). For example, Callanan and Sabbagh (2004) investigated parent-child conversations while

playing with sets of toys in free-play, storytelling, and categorization contexts. They found that mothers of children with lower productive vocabularies provided fewer labels compared to mothers of children with higher productive vocabularies. Children with higher productive vocabularies received more multiple labels and more discussion of how labels related to each other from their mothers.

The Role of Scaffolding

Even though it is clear that conversation is important for how children learn, no one has looked at conversation under the umbrella of scaffolding. Although successful scaffolding encompasses a set of specific behaviors ranging from recruiting the child's initial interest to breaking the overall goal into more manageable sub-parts, conversation is the main vehicle by which these behaviors are transmitted to the child. Therefore, in order to have effective scaffolding, conversation must exist during the interaction. For example, if a mother simply demonstrates how to open a jar without monitoring if her child is paying attention, explaining her actions, or asking the child if he understands, her actions may go unnoticed by the child. Although some learning may be present during the use of solely one behavior (e.g. pure demonstration), in order for scaffolding to be effective, the presence of conversation is crucial.

One example of the overlap between conversation and scaffolding are reformulations, a process by which conversation can scaffold language itself. For example, parent reformulations have been investigated in the conversation literature, but they are a good example of how scaffolding and conversation overlap. Reformulations create a contrast between two forms that have been used to express the same intention,

and so contain useful information about which forms are acceptable and which are not (Chouinard & Clark, 2003). For example, if the child says “Grandma *goed* to the park”, the parent might respond “Yeah, grandma *went* to the park.” Research has found that parents provide corrective information for as many as two-thirds of children’s erroneous utterances and children make use of such information (Chouinard & Clark, 2003). Parents adjust their own responses during conversation to be just challenging enough for the child, neither so simplistic that the child learns nothing from the parent’s model, nor so sophisticated that the child is confused. In other words, parents appropriately modify their responses by providing reformulations to clarify the child’s intention in order to facilitate the conversation and its goals.

Scaffolding necessarily relies on conversation, and it is difficult to imagine scaffolding that is not in a context of conversation¹. In fact, conversation is the only part of scaffolding that can exist on its own. Even though these are two separate literatures, if we want to really understand scaffolding, then we need to look at it in the context of how children have conversations with people. Therefore, this work takes a closer look at how conversation works in a scaffolding situation.

In addition to the interaction between conversation and scaffolding being understudied, we also know very little about how children learn from individuals other than parents. Children spend a lot of time interacting with siblings, peers, and other adults, such as teachers. Can they learn anything at all from these individuals? If so, does

¹ However, not all conversation is necessarily scaffolding. For example, two individuals can have a conversation about their day or a trip to the grocery store, but this does not scaffold children’s learning in any way.

that learning take a different form than learning from parents? Research on children's willingness to trust the testimony of different individuals has found that children do not treat all potential sources of information as equal (Corriveau & Harris, 2009a; Corriveau and Harris, 2009b; Koenig, Clement & Harris, 2004; Jaswal & Neely, 2006). Children are sensitive to a range of variables when deciding who they should trust to give them information. Children are more likely to seek information from a familiar individual than an unfamiliar one, and they are more likely to trust an informant that has been right in the past than one that has been wrong or uncertain in the past.

However, in all of these studies, children are given more than one choice regarding whom to turn to in order to get the information they need. Children do not always have the same advantage in everyday life. It is unclear what would happen if children only had one possible source of information, and that source was not a familiar parent. Previous work by Tizard and Hughes (1984) suggests that children ask fewer questions of teachers than they do of parents, suggesting that children might show a differential pattern in question-asking behavior toward different partners.

Therefore, it is possible that the benefits of conversation and scaffolding we see with parents are not present with other individuals. Conversation is necessary in order for scaffolding to be effective, so knowing how conversation works with different people may give us additional insight to differences in scaffolding. I plan to investigate whether conversation and scaffolding works differently with different people. In other words, are teaching partners, other than parents, effective conversation partners and scaffolders, and

if not, why? Below is a review of the existing literature on how children interact with various teaching partners.

Parents as Teaching Partners

Previous literature has suggested that parents, peers, and siblings scaffold differently. The majority of research investigating the influence of scaffolding on children's cognitive development has emphasized the role of parents and other adults as expert guides for children's problem-solving (Haden, Haine, & Fivush, 1997; Landry, Smith, Swank, Zucker, Crawford, & Solari, 2011; Rogoff & Gardner, 1984; Rogoff, Malkin, & Gilbride, 1984; Wertsch, McNamee, McLane, & Budwig, 1980; Wood & Middleton, 1975). Parents create a 'scaffold' that structures their interactions with their children in a way that facilitates children's cognitive growth (Rogoff & Wertsch, 1984; Robinson, Burns, & Davis, 2009). Parental scaffolding has been found to improve children's categorization (Rogoff & Gauvain, 1986; Steward & Steward, 1974; Vandermaas-Peeler et al., 2003), problem-solving abilities (Gauvain, Fagot, Leve, & Kavanagh, 2002), nonverbal skills (Richter, Grieve, & Austin, 1988; Rogoff et al., 1984), reading abilities (Dieterich, Assel, Swank, Smith, & Landry, 2006; Neumann, Hood, & Neumann, 2009; Robins, Treiman, Rosales, & Otake, 2011), and comprehension skills (Bjorklund et al., 2004; Fluck, 1995; Linnel & Fluck, 2002; Pratt, Green, MacVicar, & Boutrogianni, 1992). These behaviors not only increase their child's immediate performance, but they also help facilitate future efforts (Gonzalez, 1996; Landry, Smith, & Miller-Loncar, 1997; Tomasello & Farrar, 1986; Vandermaas-Peeler, Way, & Umpleby, 2003; Wood et al., 1978). For example, Dieterich and colleagues (2006)

examined maternal verbal scaffolding on children's reading decoding and comprehension. They found that early maternal scaffolding at 3 years of age predicted better language skills at 4 years of age, and this further resulted in a trend for better reading comprehension at 10 years of age. Similarly, Tomasello and Farrar (1986) investigated parents' interactions with their 15-month-old children during a free play session. They measured children's initial vocabulary at 15 months, and again, at 21 months. Children whose mothers provided greater scaffolding (e.g. appropriately adjusting their speech dependent on their child's needs) during the initial session had larger gains in their vocabulary at 21 months than children whose mothers provided little scaffolding. In addition, Rogoff and Gauvain (1986) investigated the role of parent-child interaction during a categorization task where parents and children organized photographs of familiar objects into categories. They reported significant correlations between the child's individual posttest performance, one week later, and their parents' scaffolding behaviors.

There are several aspects of parent's scaffolding behavior that are beneficial to children. Specifically, parents are very good at sensitively tailoring their instruction to their children's needs and guiding at a level that is near the limits of their children's performance (Baumwell, Tamis-LeMonda, & Bornstein, 1997; Henderson, 1984b; Hoff-Ginsberg, 1987; Mistry & Rogoff, 1987; O'Connell & Bretherton, 1984). Parental scaffolding is very beneficial to children because they are good at tailoring their contribution to a task to fit within the child's ZPD, which maximizes what children can learn (Rogoff & Wertsch, 1984; Fiese, 1989). For example, parents scaffold their young

children's emerging pretend play by arranging play situations within their child's grasp, providing suggestions, and coordinating their interactions (Farver, 1993; Haight & Miller, 1993). Similarly, Hoddapp and colleagues (1984) found that during ball-rolling and peek-a-boo game tasks with infants, parents performed contextual behaviors (e.g. holding out their hands, leaning forward, requesting that the child do "peek-a-boo" in the peek-a-boo game, etc.) more frequently when they saw it was needed most by the infant. Parents changed their behavior in a way that seemed to support the infant's performance of a skill (ball rolling or peek-a-boo). Similarly, Slade (1987) investigated the effect of different amounts and styles of parental involvement on toddlers' play and found that the child's play level was the highest in an active maternal involvement condition when the mother initiated, suggested, and joined in play with the child dependent on the child's current needs. This suggests that parents provide a scaffolding effect in a sense that children are able to play more cognitively advanced games with the parent's guidance and adjustment. The tailored support provided by parents allows children to perform beyond their existing level of capability, something they would be unable to achieve on their own (Fiese, 1989).

Parents excel at shifting their reactions contingently, as is required for effective scaffolding (McNaughton & Leyland, 1990; Neumann, Hood, & Neumann, 2009; Neumann & Neumann, 2010; Rogoff et al., 1984; Wood et al., 1978). For example, Wood and Middleton (1975) had parents assist their 3- to 4-year-old children in assembling a three-dimensional pyramid puzzle and found that parents responded contingently, adjusting according to whether the child succeeded or failed at a given step

in the task. In particular, their findings suggest that those mothers who scaffolded effectively, as measured by the child's independent performance, were those who had systematically changed their instructions on the basis of the child's response to earlier interventions and were able to estimate the child's current ability or readiness for different types of instructions. These parents tended to be responsive to their children, altered their behaviors contingent upon their children's abilities, and tailored their assistance so that it was within the grasp of their children.

Two specific ways that parents adjust their responses are by ratcheting up the cognitive demand of their questions when interacting with children and shifting contingently and progressively depending on their child's response. One way parents do this is by modifying the cognitive demand or level of their questions and comments in response to children's input (Danis, Bernard, & Leproux, 2000; Ninio, 1983). Blewitt and colleagues (2009) have begun to measure these sorts of parental contingent responsiveness in regards to children's reading abilities. They found that when an item is new to a child, the child must first gain some familiarity with the phonological form and associate it with a referent, attaining a general sense of where it applies before the child can benefit from the elaboration provided by high demand questions. For example, suppose a child encounters an unfamiliar toy; low demand questions (e.g. what is it?) might help a child associate the label with its referent although the question does not provide opportunities for further understanding. It is not until the child understands the association that he can benefit from higher demand questions which require thinking about the object's actions, functions, or to contrast it with other items (e.g. what does that

do?). Results indicate that parents are very good at making the necessary shifts in reading for children. In addition, Justice (2002), who introduced children to completely unfamiliar labels during story reading, found demand questions to be effective for children's word learning because her participants needed to learn to associate the new labels with their referents and this kind of question afforded this opportunity. According to Justice (2002), children did not learn more from high demand questions because they were not ready to benefit from the additional information that high demand questions help children to access. Parents not only adjust their instruction according to their children's responses, but they also shift their contingency either progressively or regressively as a function of their children's immediate successes or failures (Wood et al, 1976; 1978; Pacifici & Bearison, 1991; Conner, Knight, & Cross, 1997; Pratt, Kerig, Cowan, & Cowan, 1998). For example, Evans and colleagues (2003) investigated parental scaffolding during a shared book-reading task with first-grade children and found that parents adhered to the principles of scaffolding. In particular, they provided more feedback clues when their children misread words and less support when their children succeeded. In fact, results suggested that the level of support parents provided shifted up, or increased, when their child was unsuccessful in rereading a word after feedback.

Parents are also very skilled at tailoring their scaffolding interactions based on the child's current cognitive abilities (or age) (Beningo & Ellis, 2004; Broen, 1971), perceived task difficulty (or task demands) (Fraser & Roberts, 1975; Hoover-Dempsey, Bassler, & Burrow, 1995; Mulvaney, McCartney, Bub, & Marshall, 2006), and task

content (Sonnenschein et al., 1993). Research has suggested that parents modify their teaching strategies to adjust to the task demand, content, and their child's level of knowledge and age (Kermani & Brenner, 2000).

The effects of the child's current cognitive abilities/age on parental scaffolding.

One example of how parents appropriately tailor their scaffolding interactions to their child's ability is the fact that both the amount and type of scaffolding offered by parents varies as a function of their child's age. As a whole, younger children receive more directives, additional parental guidance, and more specific information from their parents than older children do (Kontos, 1983; Rogoff et al., 1984). For example, Wertsch and colleagues (1980) found that children's age influenced how both mothers and their children approached a problem-solving puzzle task. Over time, adults decrease the amount of scaffolding they provide to their children as their children become older and more knowledgeable (Conner & Cross, 2003). In a study investigating parental scaffolding behaviors during a board game task, Benigno and Ellis (2004) found that parents offered scaffolding more often to their younger children than to their older children. In particular, parents assisted their younger children an average of 16.31 times over the course of the game, on the other hand, they helped the older children only 2.75 times (four times less).

Research also suggests that parents of preschoolers with lower ability levels used more explicit kinds of sensitive scaffolding behaviors than did mothers of preschoolers at

higher ability levels and, that for all children, the explicitness of scaffolding increased as task difficulty and children's response errors increased (Saxe et al., 1987). For example, Wood and colleagues (1976) had adults teach 3-, 4-, and 5-year-olds how to build a pyramid. They found that with the youngest children, the teaching partner was mainly concerned with orienting them to the task either by demonstrating it or providing tempting material. Further, the teaching partner intervened directly twice as often with the 3-year-olds than with the 4-year-olds and four times more often than with the eldest group (5-year-olds). In other words, the adult worked to highlight the solutions for the youngest children by recruiting and maintaining the 3-year-olds interest and highlight the goal of the task for them. With the 4-year-olds, the adult's task was more to help them recognize the nature of the discrepancy that existed between their attempted constructions and what was required by the task. The adults' scaffolding approach tended to shift from showing to telling when working with 3- to 4-year-olds (Wood et al., 1976). Finally, the adults only intervened with the 5-year-olds when their children experienced difficulty with the task.

Similarly, Wertsch and colleagues (1980) investigated the way that parents and their preschool children divided strategic responsibilities for carrying out a problem-solving task which involves re-creating a puzzle of a dump truck to match a model. Results indicate that parents were more likely to provide assistance to younger children than older ones. In particular, when working with younger children, parents often took on the responsibility of making certain that information from the model was being used appropriately to re-construct their own puzzle by intervening more directly. On the other

hand, while working with older children, parents provided less direct intervention and assistance, placing more of the task responsibility on the child. Vandermaas-Peeler and colleagues (2003) investigated the amount of direct intervention and overall guidance that mothers provided to their 3- to 6-year-old children during a cooking task. They found that mothers utilized high levels of intervention with greater use of verbal hints, with 3-year-old children than with 6-year-old children, especially for steps with higher difficulty (e.g. reading instructions). In particular, mothers held their young child's hand as they cracked the egg and together they dumped it into the bowl, or took over the task altogether, telling the child to observe. On the other hand, they were more likely to provide lower levels of assistance to their older children, such as giving the child a strategy (e.g., telling the child to hit the egg hard against the side of the bowl) rather than actually helping them do the step (Vandermaas-Peeler, 2003).

During an origami (paper-folding) task where parents and their 3- and 5-year-old children created an airplane and boat, Pellegrini, Brody, and Sigel (1985) found that parents were more directive and less demanding in the kinds of questions they asked to younger children than they were with older children. Similarly, Evans and colleagues (1998) found that parents provided broader, context cues (e.g. context for misread word) to poor readers in kindergarten and specific feedback (e.g. pointing to a letter in the misread word) to better readers. Further, Plumert and Nichols-Whitehead (1996) found that mothers provided more scaffolding, and, in particular, directive prompting, to 3-year-olds than to 4-year-olds when assisting them on the same task.

The effects of task difficulty/demands on parental scaffolding.

In addition to parental scaffolding varying with respect to the child's ability and age, some studies have found that task difficulty also has an impact on the type and quantity of assistance that parents provide to their young children (Greenfield, 1984; Renshaw & Gardner, 1990; Rogoff, Gauvain, & Gardner, 1987). Parent's initial assessments of the level of difficulty of a task may influence their scaffolding behaviors (Goodsitt, Raitan, & Perlmutter, 1988; McNaughton & Leyland, 1990). In particular, several researchers suggest that higher levels of task difficulty have been associated with increased parental control of the task, directive instruction, and support of their children (Damast, Tamis-LeMonda, & Bornstein, 1996; Pratt et al., 1992). For example, in a study investigating the effects of parent-child interaction on their children's performance on a matching task, Freund (1990) found that mothers' awareness of task concepts, task difficulty, task context, and their child's task-related abilities had strong effects on their teaching (e.g. focusing on different concepts) and, subsequently, on their child's successful task completion. In particular, results indicate that mothers took on more task responsibility and regulation when task difficulty increased of both age groups of children, on the other hand, parents' verbal content became less specific when task difficulty decreased. Similarly, Sonnenschein, Baker, and Freund (1992) asked mothers to provide instruction to their 3-year-old children for either an easy or difficult version of a matching task and to share their own perceptions of the task's difficulty. They found that mothers' assessments of task difficulty had as strong an influence on their instruction as the actual level of task difficulty. Further, Behrend and colleagues (1999) investigated

maternal teaching behaviors with their preschool-aged children while constructing a puzzle with varying difficulty (easy, medium, and hard). They found that parents used more verbal utterances and provided additional support when children worked on the most difficulty puzzle than when they completed the easiest puzzle.

Research suggests that parental scaffolding varies dependent on the difficulty of the task because parents define difficulty based on their children's performance. For example, one parent may view a task as too difficult for their children to comprehend and another parent may view the exact same task as easier because they believe their child is knowledgeable enough to complete it. The parents' opinion of their children's current abilities and cognitive competence will influence how they define how difficult the task is. This results in parents assuming more responsibility for directing and organizing problem-solving interactions for their children (Rogoff, 1990). For example, Goodnow (1990) found that a parent's view about the task, their child, and their own role affects how they interact with their child on a particular task. In addition, Nietzel and Stright (2003, 2004) investigated parental assistance during four problem-solving tasks (2 puzzles and 2 errand-planning tasks) while interacting with their 5-year-old children. Their results indicate that parents' initial assessment of the problem-solving task was a powerful predictor of teaching behaviors in that when parents viewed the task negatively (too hard and/or unfamiliar), they were less likely to provide metacognitive information, regulate task difficulty, and encourage the child's active role.

Alternatively, some research suggests that parents define task difficulty according to the perceived cognitive demands it places on the child, regardless of the child's actual

performance (Bruner, 1983; McNaughton & Leyland, 1990). Although little attention has been paid to this area, there is evidence showing that some parents evaluate task difficulty beyond just its cognitive requirements (e.g. child's temperament, parent personality, parent education, etc.) (Henderson, 1984a; Rogoff et al., 1984). For example, during several problem-solving tasks, Neitzel and Stright (2003) found that highly conscientious mothers with children who were perceived to have more difficult temperaments were particularly likely to respond negatively, such as getting frustrated easily and providing little help, to their children during the problem-solving tasks. For less conscientious mothers, there was no relation between child temperament and their scaffolding behaviors. Similarly, Gauvain and Fagot (1995) found that mothers who viewed their preschool children as having difficult personalities were more likely to express disapproval of their children's problem-solving efforts and provide less scaffolding to their young children.

The effects of task content on parental scaffolding.

The literature suggests that parents also focus on different concepts depending on the specific task context. Typically, when the task content is presented as educational or school-related, parents provide more scaffolding, such as providing the child with more explicit feedback on their progress. On the other hand, when the task content is presented as a game, parents are likely to provide less support, such as giving very general feedback. For example, Sonnenschein and colleagues (1993) investigated the effects of task content on parent interactions with their preschool-aged children. Parents assisted their children on a matching task in the context of either a game or a school-readiness

test. Parents in the ‘game’ condition received the instructions, “We are trying to assess the appropriateness of a game for play with children...we would like you to play the game with your child...” (Sonnenschein et al., 1993; pg. 35). On the other hand, parents in the ‘school-readiness’ condition received the instructions, “We are interested in when certain concepts are mastered by preschoolers, the concepts we are interested in are considered necessary prerequisites for academic work in first grade....” (Sonnenschein, Baker, & Freund, 1993; pg. 36). They found that when the task was viewed as a school-readiness test, parents provided task-specific concepts (e.g. “Find a picture with a bone”) and more explicit feedback. On the other hand, when the task was viewed as a game, mothers provided general matching strategies (e.g. “Look at all the cards before you choose one”).

Similarly, Rogoff and colleagues (1984) had preschool children and parents participate in a classification task that was either a ‘home task’ or ‘school task.’ The home task involved putting grocery items (i.e. condiments (ketchup, pickles, olives), snacks (crackers, cookies); sandwich spreads (margarine, honey, peanut butter), fruits (pineapples, peaches, applesauce); baking goods (cake mix, muffin mix, flour); and dry goods (macaroni mix, rice)) on shelves in a mock kitchen. The school task involved sorting photographs of common objects (i.e. machines (popcorn popper, hair dryer); cutting tools (scissors, paring knife); table settings (bowl, cup); hygiene utensils (toothbrush, curlers), baking utensils (mixer, measuring cup); and cleaning tools (broom, bucket) into a divided tray. Rogoff and colleagues (1984) reported that differences in the quality of teaching varied between home and school tasks and across ages. In particular,

parents took a much more formal stance when classifying objects in the ‘school task,’ with parents being likely to rehearse items and their locations. This was very different from the parents’ assistance in the ‘home task,’ in which parents provided significantly less help. Rogoff and colleagues (1984) suggest that these differences in teaching behaviors reflect differences in parents’ interpretation of the task content and goals. Overall, these studies illustrate that the perception of task content influences what scaffolding strategies parents use. Depending on the content of the task, parents may be more or less likely to let their children take over the responsibility and regulate the activity (Sonnenschein et al., 1993).

In general, parents are very good at scaffolding their children’s learning, sensitively monitoring their children’s success or failure, and contingently adjusting their behaviors accordingly. Parents use differential scaffolding strategies and seem to focus on providing information that will be most profitable to their child dependent on the child’s current cognitive abilities, task difficulty, and task content. For example, the amount and type of scaffolding support parents give their children varies as a function of the child’s age. Parents tend to provide more assistance to younger children whose cognitive abilities are not as developed. In particular, parents use more directives and give more specific information to their younger children than to older children. Parents tend to decrease the amount of scaffolding they provide to their children as their children become older and more knowledgeable.

In addition to child factors influencing parental scaffolding, when parents view a task as being difficult, more structured, and out of their child’s grasp, they intervene more

directly and provide the child with less responsibility. On the other hand, when the task is perceived as easy and less structured, parents are more likely to allow their children to take on additional independence and responsibility for the task. Lastly, parents may be more or less likely to let their children take over the responsibility and regulate the activity depending on the content of the task. When the task content is presented as educational or school-related, parents provide more support to their children, than when the task content is presented as game-like.

Peers as Teaching Partners

We know less about peer scaffolding behaviors. The work that has been done suggests that, compared to parents, peers exhibit consistently poorer scaffolding behaviors. Peers show less sensitivity (Shute, Foot, & Morgan, 1992), less demonstration (McLane, 1987; Wertsch, 1978), less modeling of sophisticated strategies (Ellis & Rogoff, 1982; Webb, 1985; Radziszewska & Rogoff, 1988), and almost no preparation for children to perform future problem-solving tasks on their own (Herber, 1981; Bakeman & Adamson, 1984; McLane, 1987; Rogoff, 1990). For example, in a series of tasks by Radziszewska & Rogoff (1988) and Ellis and Rogoff (1982; 1986) involving learning a classification system to organize sets of common objects, 6-year-olds performed better after working with their parents than 8-year-old peers. In particular, parents explained the overall goal and provided category rationales for the groups of items to make it more easily understandable for the child. Parents were also more likely to orient the child to task and make connections between current knowledge and the present task. On the other hand, peers tended to focus on immediate actions, using a

step-by-step approach, poorly communicated their problem-solving strategies, and unlike parents, peers were more likely to provide too much assistance by carrying out the task themselves. Similarly, Shute and colleagues (1992) also investigated the differences in scaffolding behaviors between parents and peers as they tutored young children on an animal classification task. On all the verbal and nonverbal scaffolding indices, parents showed greater sensitivity than peer teachers did and they were more likely to display behaviors which promoted efficient learning in their children. In particular, parents looked at their children more, asked more sensitive questions, elicited more involvement from them and gave them more of the decision-making as the task progressed. Further, children taught by parents performed significantly better on the posttest than those who were taught by peers (Shute, Foot, & Morgan, 1992).

Research has also found that parents actively involve their children more than peers do, and children who work with their parents perform better than when they worked with peers (Ellis & Rogoff, 1982; Radziszewska & Rogoff, 1988). For example, Ellis and Rogoff (1986) found that peer tutors appear to exercise continuing control over the materials of the task which, in turn, suppresses the target child's own active involvement in the task. In contrast, parents appear to allow increasing amounts of participation by the young child as learning progressed, acknowledging their sensitivity to the learner's need for involvement and their awareness that learning involves relinquishing control of the task to the learner (Shute et al., 1992). Gauvain and Rogoff (1989) examined 5-year-olds' planning skills while working with either their parent or a peer. They found that while peers and mothers both allowed children to share in the decision-making, children

planned more efficient routes when working with their mothers, than when they worked with peers. In particular, Radziszewska and Rogoff (1988) found that when children experience difficulty, peers do not know when to appropriately adjust their instruction so that the child can gain more competence.

In addition to structured tasks, literature suggests that parental scaffolding is also more effective than peer support during free-play situations. For example, in an observational free-play setting and a structured dominoes task, parent's interactions with their 7-year-old children were compared with peer-child interactions (Gerrits et al., 2005). The results indicated that more mutual responsiveness and more total control were displayed during the parent-child interaction than when children interacted with their peers. Wilkinson and colleagues (1981) observed eighteen 2-year-olds interacting with their parents and peers. They found that in comparison to peers' speech, parents' speech was longer and more complex and involved asking more questions and giving answers to their children more often. In other words, parent-child interactions seem to be characterized by the teaching partners doing most of the initiating, guiding, and directing. On the other hand, peer-child interactions typically did not entail this kind of dynamic, but instead, left more of the responsibility on the part of the child (Wilkinson et al., 1981). Research also suggests that children tend to seek help much more frequently from the parent than a peer (Verba & Marcos, 1995). Therefore, compared to parents, peer teachers are more likely to be insensitive to the child's needs, providing little guidance, little adjustment, and almost no preparation for children to perform future problem-

solving tasks on their own (Bakeman & Adamson, 1984; Ellis & Rogoff, 1986; Rogoff, 1990).

However, several methodological issues exist in this peer literature, which leaves this work unsatisfying. For example, in most of these studies, the mother or additional children (beyond the peer and target child) are present during these peer interactions (e.g. Vandell & Wilson, 1987). This has the potential to influence how the peer behaves towards the target child, and vice versa. For instance, some research suggests that the quality of social interactions with children, as well as the amount of contingent support, decreases as the number of people involved in the activity grows (Benigno & Ellis, 2004). Thus, comparing parent-child interaction to peer-child-third person interaction has important consequences and is an inadequate evaluation. It is unclear if the results are due to actual mother-peer differences, or a difference between how a child may interact when in a dyadic versus a triadic situation. In addition to triadic peer situations, these studies are inconsistent in that most of them compare the interactions of children with completely unfamiliar peers to children's interactions with well-acquainted peers (e.g. Vandell, 1977). Lastly, some of these studies do not assess a subsequent independent performance task following the teaching trial (e.g. Crowley, Callanan, Jipson, Galco, Topping, & Shrager, 2001). Although parents and peers may scaffold differently during interaction, without measuring children's independent performance, it is difficult to see how these differences influence learning and future efforts. While literature suggests peers are ineffective at scaffolding, this may be due to the nature of the tasks rather than the peer's skill level.

Siblings as Teaching Partners

In general, the literature demonstrates that peers consistently exhibit less effective scaffolding behaviors than parents do, but children do not only interact with peers and parents. Children also interact with siblings. Thus, another important question is how different siblings are from parents at scaffolding. Very little research has looked at how siblings scaffold, particularly in comparison to parents. However, the work that has been done suggests that they, like peers, scaffold differently than parents and are generally not as effective at it, showing less sensitivity and providing less contingent adjustment (Cicirelli, 1975; 1976a; Brody, Stoneman, & MacKinnon, 1982; Dunn & Kendrick, 1982a; Tomasello, Conti-Ramsden, & Ewert, 1990; Tudge & Winterhoff, 1993; 1997; 2002). For example, Cicirelli (1975) investigated the effects of receiving help from a mother or older sibling on first grade children's' problem-solving behavior. Children who received help from mothers showed more advanced problem-solving skills at a bulb-pressing task than those who worked with older siblings. Hoff-Ginsberg and Krueger (1991) compared mother-child and sibling-child conversations, and found that mothers were more skilled at tailoring their speech to younger children than older siblings were. Similarly, Tomasello & Mannle (1985) found that, compared to mothers, preschool-aged older siblings provided less non-linguistic scaffolding, such as fewer object references and joint attention exchanges. Further, older siblings did not appropriately adjust the length or complexity of their utterances. This suggests that, unlike mothers, older siblings fail to make the necessary kinds of pragmatic adjustments to scaffold younger children.

Similarly, Cicirelli (1976a) compared mother-child and sibling-sibling interactions on a problem-solving task. He found that mothers gave more feedback and explanation to their children than older siblings did, and children responded to their mothers with more help-seeking and accepting behaviors and than they did to the older siblings. Brody and colleagues (1982) compared older siblings and peers, who were age-matched to the target child, interactions with young children during a board game. They found that older siblings assumed the teacher role more often than peers did when interacting with the children.

In addition to differences in how siblings and parents scaffold children's learning during structured problem solving tasks, research has also looked at sibling and parental scaffolding differences during free-play interactions. This work suggests that, compared to parents, siblings exhibit consistently poorer scaffolding behaviors during free play sessions as well. For example, Mannle and colleagues (1992) observed mother-child and sibling-child interactions during a 15-minute free play session. Compared to older siblings, mothers expected and encouraged their children to be equal partners in conversations and were much more skilled at tuning in to their children's less comprehensible conversational abilities (Mannle, Barton, & Tomasello, 1992). Mothers used more clarification and confirmation requests when interacting with their children than siblings did. Siblings and children talked less and had shorter conversations than when children interacted with their mothers. Compared to mothers, siblings also asked fewer questions of the children and provided more directives to them. In particular, these siblings failed to acknowledge their younger siblings' utterances 83% of the time,

compared to 21% for mothers. Lastly, mothers repaired disruptions in conversations with their children twice as often as siblings did.

While it appears that older siblings are less effective than parents at scaffolding young children's learning, several methodological issues exist in current sibling literature. For example, several studies that compare siblings and parents achieved their results through comparisons across home settings where the stimulus items were different, which may result in an inaccurate comparison of behavioral differences (e.g. Tomasello & Mannle, 1985; Vandell & Wilson, 1987). Important differences in sibling-child interactions may occur when the stimulus items change across settings. In addition, some of these studies do not assess a subsequent independent performance task following the teaching trial (e.g. Steward & Steward, 1974). Further, in most of these studies, the mother is present so the interaction becomes of triadic nature. This has potential influences for how the sibling and child respond to each other. In particular, research suggests that siblings tend to direct fewer teaching behaviors to children when a third person is present and sibling-child conversations tend to be less individualized when the mother is present (Brody et al., 1982; Barton & Tomasello, 1991). In order to draw that conclusion effectively, studies would need to be done using the same dyadic situations, comparing mother-child and sibling-child.

If siblings scaffold less effectively than parents do, as literature suggests, then the question becomes why is this the case? A number of researchers have speculated that this results from sibling age-spacing effects. For example, research suggests that sibling age-spacing influences behaviors during a teaching interaction with closer spaced siblings

scaffolding similarly to peers, while further spaced siblings use scaffolding behaviors similar to that of their parents (Koester & Johnson, 1984; Perez-Granados & Callanan, 1997a; Poris & Volling, 2001; Klein, Feldman, & Zarur, 2002; Maynard, 2002; Howe, Brody, & Recchia, 2006). For instance, Minnett and colleagues (1983) observed interactions with seventy-three 7- to 8-year-old children and their older siblings. She found that more closely spaced siblings engaged in more aggressive and negative behaviors. On the other hand, further spaced (3-4 years older) siblings showed more positive behaviors (e.g. praise, affection) and were more likely to teach the younger child. Further, Perez-Granados and Callanan (1997b) found that farther age-spaced older siblings provided more hints than did closer age-spaced older siblings. Similarly, Cicirelli (1974, 1975) investigated the interactions of 160 sibling pairs at two age-spacings (2 and 4 years) during an object-sorting task. Results indicate that children were more willing to accept and benefit from help received from a sibling who was 4 years older than a sibling who was closer in age (2 years apart). In addition, sibling teachers who were 4 years older facilitated the learner's performance better than sibling teachers who were 2 years older.

However, the research for sibling age-spacing effects is mixed. Contrary to the previously mentioned studies, several studies have found no significant age-spacing effects within sibling teaching interactions (Abramovitch, Corter, & Pepler, 1980; Dunn & Kendrick, 1981b; and Pepler, Abramovitch, & Corter, 1981). For example, Abramovitch and colleagues (1986) compared interactions of siblings who were 1 to 2 years apart versus siblings who were 2.5 to 4 years apart. They found that age-spacing

did not influence sibling interaction. Further, some research has found that close age-spacing is beneficial for girls, but detrimental for boys (Koch, 1954; Rosenberg & Sutton-Smith, 1969; Sutton-Smith & Rosenberg, 1970).

This smaller literature on sibling age-spacing also suffers from some of the same methodological issues that we have seen already. For example, several studies achieved these results through comparisons across different home settings where the stimulus items are different (e.g. Abramovitch, Corter, & Lando, 1979; Dunn & Kendrick, 1981b). Some of these studies also fail to assess a subsequent independent performance task following the teaching trial (e.g. Pepler et al., 1981). Although closer and further spaced siblings may scaffold differently during interaction, without measuring children's independent performance, it is difficult to see how these differences influence learning and future efforts. It is unclear if, and how, these age-spacing differences even influence how children perform at posttest. In order to draw that conclusion effectively, studies would need to be conducted assessing independent performance and investigating how children who worked with their spaced siblings perform at posttest compare to those children who worked with father spaced siblings. In addition, many of these studies that find no age-spacing effects examine social behavior, specifically prosocial and agnostic, instead of investigating specific teaching behaviors. Aspects of social behavior may be more closely linked to other aspects of the sibling relationship (e.g. quality) than to age-spacing between siblings. It is therefore possible that while age-spacing effects may not strongly affect agnostic and prosocial behaviors, they may nevertheless play an important role in teaching behaviors. It may be that children are already learning social skills from

their siblings and people around them, so those are more relevant to their current level anyway, but problem solving may require the interaction of a more knowledgeable partner.

Another interesting question is how different or similar peers and siblings are in their scaffolding. Would we expect to see similar scaffolding behavior between siblings and peers? Although siblings and peers are both considered to be less effective scaffolders than parents, important differences also exist between peers and sibling scaffolding behaviors. For example, some research suggests that siblings used more frequent spontaneous guidance, provide more positive feedback, and the target child is more actively engaged (e.g. asking more questions) when being taught by their sibling than by a peer (Azmitia & Hesser, 1993). Similarly, during a trapezoid teaching task, Cicirelli (1972) found that older siblings were more effective scaffolders, providing more explanation, descriptions, and definition of concepts, than older peers were when interacting with first-grade children. However, most of the research comparing sibling-child and peer-child interactions does not age-match the peer to that of the older sibling, but instead age-match the peer to the target child. Thus, knowledgeability is not equal between the peer and older sibling which may result in inaccurate comparisons because children of varying ages will have variations in skill level. For example, if we compare a young children's interaction with their 8-year-old siblings and 5-year-old peers and we find a difference, it could be that siblings are just better at scaffolding or it may be that because these siblings are much older than the peers are, so that they have greater task knowledge and a higher skill level. Children may also interact differently with siblings

and peers dependent on how close or far apart in age they are. The results may be a consequence of a different age interval and not of differences between siblings and peers. In order to draw that conclusion effectively, studies would need to be done age-matching the peer to that of the sibling.

Therefore, based on the current scaffolding literature, it appears that not all teaching partners are created equal. However, work in this area is forty years old and methodological issues exist with current research. Additional work on this would be useful in gaining a better understanding. While the literature suggests that important differences exist between parents, peers, and siblings, very few researchers have looked at why these exist. Siblings seem to be better at scaffolding children's efforts than peers are, and less effective than parents are, but why is this?

Rationale for Present Studies

After reviewing the conversation and scaffolding literature, there appear to be two largely unexplored questions. First, *do* children benefit from conversation equally with people other than their parents? Second, *why* do we see differences in scaffolding behaviors between parents, siblings, and peers? Here three factors are identified that could possibly account for differences in teaching partners (knowledgeability, familiarity, and motivation). To date, these factors have not been systematically studied in the literature.

Research Questions

Based on these proposals, this research is designed to answer the following questions:

Conversation:

1. Do children benefit with conversation equally from people other than their parents?
 - a. Are children just as likely to ask questions from their parents vs. siblings vs. other adults?
 - b. Do siblings and other adults provide children with information to the same degree as parents?
 - c. Do siblings and other adults have sensitivity, similar to the parent, when children know the answer themselves?
 - d. Does sibling age-spacing influence their interaction with children?

Teaching Partner Differences:

2. Who is better at scaffolding among parents, siblings, and peers?
 - a. Do parents use more effective scaffolding behaviors than siblings?
 - b. Do siblings and peers appropriately shift their scaffolding behaviors based on the child's failure or success?
 - c. Do parents orient the child to the task more during a building interaction?
3. Why are certain teaching partners better than others with respect to scaffolding, what role is played by,
 - a. Knowledgeability?

- b. Familiarity?
 - c. Motivation?
- 4. What role does sibling age-spacing play?
 - a. Do further spaced siblings use more scaffolding behaviors than closer spaced siblings?

Knowledgeability

One proposed reason we might see differences in conversation and the effectiveness of scaffolding between parents, siblings, and peers may be due to a difference in knowledge state. It is apparent that the amount of knowledge a particular teaching partner has varies between partners and it is unclear what role this plays in conversation and scaffolding. Perhaps siblings and peers are less adept at knowing how to accommodate children during conversation and effectively scaffold children's learning because they are less knowledgeable and are therefore unable to attend to and help the children as appropriately as parents do. Children may also be sensitive to the knowledge states of other individuals, knowing that other children (e.g. siblings and peers) have less knowledge than adults do, and because of this, are less likely to elicit information from a sibling or peer than an adult.

Vygotsky (1978) suggested that in order for cognitive growth to occur, children need to work with more knowledgeable partners. In particular, he explains that the more experienced partner provides help in the way of an intellectual scaffold, which allows the less experienced learner to accomplish more complex tasks than may be possible alone.

Piaget (1928; 1932), on the other hand, takes a very different approach. He considers the most critical factor in a child's cognitive development to be interaction with peers. This type of interaction gives opportunities for the child to have cognitive conflict, which results in constructive discussion with peers. He claimed that children are most challenged in their thinking when they are with peers, because they all are on an equal footing and are more easily able to confront and discuss ideas than when interacting with adults (Light, 1983; Piaget, 1945/1995).

Although research has begun to address the issue of knowledgeability, I have found that little work has followed up on this discrepancy. Some studies find that children are more likely to progress during a problem-solving activity when they work with a more skilled partner, supporting Vygotsky's argument (Goldin & Hayes-Roth, 1980; Perret-Clermont & Sherrard, 1980; Wertsch, 1979). Azmitia (1988) investigated the influence of a teaching partner's expertise on their scaffolding behaviors with a 5-year-old during a Lego building task where they re-created a Lego house following a model. She found that when children worked with expert teaching partners, they were able to construct the Lego replicas more accurately and quickly than when they worked with less competent teaching partners. This evidence suggests that the relative knowledge of teaching partners influences the extent to which children learn from the interaction (Azmitia, 1988). Ellis and Rogoff (1986) took this further, suggesting that effective scaffolding depends on *both* teaching partners' task-specific knowledge and their general skill. They suggest this is why parents are more effective teachers than peers. In addition, some research indicates that this has important consequences for less

knowledgeable teaching partners, in that, the teaching partner must improve his own knowledge at the same time he is assisting the child to acquire it (Verba, 1998; Verba & Winnykamen, 1992). More knowledgeable teaching partners, on the other hand, already have general skills that compensate for children's potential inabilities, and therefore, they do not have to combine two activities of learning and teaching as siblings and peers do. Therefore, parents, being more knowledgeable than siblings and peers, may have a better understanding of how to structure a teaching task and how to convey that information to their children. Further investigation into the relative roles of knowledgeability would be valuable in understanding whether children learn differently from conversational partners other than their parents and why differences exist in scaffolding behaviors.

Familiarity

In addition to knowledgeability varying between teaching partners, the amount of familiarity also varies between teaching partners and this may impact how effective a teaching partner is at scaffolding. Children may, due to familiarity, treat other adults and peers differently than they treat parents and siblings. Several studies suggest that children are more likely to engage in interaction with and take direction from a familiar individual than an unfamiliar one, at least in some situations (Corriveau & Harris, 2009a; 2009b; Hay & Murray, 1982). For example, Zaratany and Lamb (1985) placed 12-month-olds in a room with either their mother or a stranger. Infants then saw a novel stimulus and received positive or fearful facial cues from the adult. Only infants in the mother condition regulated their behavior towards the stimulus according to their mother's facial cues. This suggests that infants observe the informant's identity and only

modify their behavior in response to cues from the familiar and trusted informant and not from an unfamiliar one. Similarly, Corriveau and Harris (2009a, 2009b) gave children aged 3, 4 and 5 years of age conflicting information about the names and functions of novel objects by two informants, one a familiar teacher, the other an unfamiliar teacher. They found that three age groups invested more trust in the familiar teacher. In particular, they preferred to ask for information and to accept the information that the more familiar teacher supplied compared to the unfamiliar teacher.

In addition, Corriveau, Harris, and Meins (2009) presented 4- and 5-year-old children with a variety of novel objects (e.g. an unfamiliar tool from the hardware store), and asked their mother and a stranger to give conflicting names. Children were then asked to say which name they thought the object was called. They found that children typically showed a preference for the names supplied by their mother, choosing the name that she had provided 65% of the time. In a follow-up study, Corriveau and colleagues (2009) showed preschool children novel objects, and children received conflicting input from a familiar teacher working in their preschool and an unfamiliar teacher working in a different, comparable preschool. The study was run in each preschool so that, for half the children, teacher A was familiar and teacher B was unfamiliar whereas for the other half teacher A was unfamiliar and teacher B was familiar. Again, they found children preferred to accept the information given by the familiar informant. This preference emerged in both preschools and across all three age groups tested, with 3-, 4- and 5-year-olds preferring the information provided by the familiar informant 68%, 64% and 78% of the time. These studies lead us to believe that the more familiar a teaching partner is, the

more responsive the child might be to their teaching efforts. Therefore, familiarity might account for existing differences between peers and siblings.

Familiarity might also affect the behaviors displayed by the teaching partner. For example, it could be that the greater familiarity between siblings not only facilitates the older sibling's teaching behaviors but also promotes the younger child's skill in obtaining concrete instructions from the experienced sibling, resulting in a more efficient process of scaffolding (Klein et al., 2002). In particular, older siblings may be more familiar with their younger siblings' cognitive abilities and, therefore, they may be better at appropriately regulating their learning process than peers (Cooper & St. John, 1990; Weisner, 1989).

Based on cross-cultural work, there is additional reason to believe that familiarity may be responsible for the differences between parents and older siblings scaffolding behaviors. In the United States, compared to older siblings, parents may be better at providing sensitive and tailored instruction to their young children given greater familiarity and experience in the caregiver role. However, in some non-Western cultures, older siblings serve as surrogate caregivers from a very young age, taking on sole responsibility for supervising the activities of their younger siblings (Weisner & Gallimore, 1977). For example, Leiderman and Leiderman (1977) found that in the Kikuyu tribe of Kenya, Kikuyu children begin taking care of their younger siblings usually around ages 7 to 12 years. This responsibility begins around the infant's fourth month and gradually expands until the sibling is in charge for the majority of the day by the time the younger child is 7 or 8 months old (Leiderman & Leiderman, 1977). This

caregiving responsibility may afford non-Western older siblings more opportunities to gain increased familiarity with the child and additional experience in scaffolding.

Therefore, older siblings, in our culture, may not be adept at providing sensitive and tailored instruction to children because they do not have as much familiarity in that role, as parents and their non-Western counterparts do. Therefore, it appears that the more familiar a teaching partner is, the better they may be at tailoring their scaffolding techniques. Gaining additional insight into what role familiarity plays with respect to scaffolding would also help our understanding of why differences between teaching partners exist.

Motivation

Lastly, that the amount of motivation to help a child succeed a given teaching partner has may vary between parents, siblings, and peers, and this could serve as an underlying reason why different people scaffold differently. Although some researchers have suggested that parents are more motivated to help their children than peers and siblings are, no one has controlled for it (Farran, 1982; Ninio, 1983; Benigno & Ellis, 2004; Westerlund & Lagerberg, 2007). For example, during an interview with middle-class parents, Haight and colleagues (1997) reported that parents identified their own roles as teaching and encouraging development and preparing their children for school (Haight, Parke, & Black, 1997). Parents may be particularly motivated to provide information to children, to help them through a situation and to help them learn. These particular motives may not be shared by others, however; other partners may have other

intentions, and peers and siblings especially may not care about teaching children as much as simply finishing the task.

Studies have found that, at least in the United States, older siblings' and peers' behaviors support the possibility that they may have different goals, compared to parents. Older siblings and peers tend to demonstrate how to perform the task correctly, focusing on completing the task as successfully as possible, even at the expense of allowing the child to take an active role in the interaction (Ellis & Rogoff, 1982; 1986; Perez-Granados and Callanan, 1997b). In contrast, mothers help their children participate in the completion of the task, focusing more on guiding children's understanding of the task (McLane & Werstch, 1986; Musatti, Verba, & Mayer, 1994; Verba & Marcos, 1995). For example, Perez-Granados and Callanan (1997b) found that older siblings focused more on making the correct choices and giving directions to the younger child than mothers did. Older siblings were also more likely to point to the correct choice, tell the child which was the correct choice, or simply place the correct card in the basket themselves. On the other hand, mothers focused more on guiding children's understanding of the categories and provided more information and hints than older siblings did, using indirect or implicit teaching methods. These results indicate that siblings were more focused on completing the task as successfully as possible, even at the expense of allowing the child to take an active role in the interaction, instead of helping the child to independently succeed at the task. In contrast, mothers seem to place more emphasis on purposefully teaching their children general skills, such as category knowledge, which could be extended to future activities. They also actively involved

their children more in the completion of the task, giving their children opportunities to gradually take on responsibility throughout the interaction.

Similarly, Ellis and Rogoff (1982; 1986) found that while working with young children on a series of classification and matching tasks, peers tended to assist children by carrying out the task themselves with parents being more likely to give extensive direction and provide verbal instructions. Peers seemed to view the task as a means to an end, instead of teaching opportunity and focused more on completing the task as quickly and as correctly as possible. On the other hand, parents viewed the tasks as opportunities to teach their young children in a way which could extend to future tasks or problems (Ellis & Rogoff, 1982; 1986). In addition, McLane (1987) observed peer-child interactions during a jigsaw puzzle task and compared this to parent-child interactions on the same puzzle. The results indicated that mothers were better than 5-year-old peers were at helping 3-year-old children assemble a puzzle. Unlike the mothers, the 5-year-old peers did most of the pick-up and placement of the pieces and did not address to the model puzzle. McLane (1987) suggests that peer teachers had a different definition of the goal of the task from the mothers, in that mothers viewed teaching their children how to complete the task as the goal while the peers viewed the goal as completing the task as correctly and quickly as possible. Older siblings and peers may view their role in the interaction as a model, merely showing the child how to complete the task. On the other hand, parents may view their role as facilitators, encouraging their children to take an active role in completing the task. Therefore, it seems that, at least in the United States,

parents are significantly more effective at scaffolding young children than both older siblings and peers.

In other countries, however, siblings and peers do better. One aspect the literature fails to account for, other than age spacing, is that different people may have different motivations. In some non-Western cultures, where older siblings, and, sometimes, older peers, are considered surrogate caregivers, older siblings are often expected to supervise the activities of young children (Bryant & Litman, 1987; Farver, 1993; Koentjaraningrat, 1985). For example, in Idakho tribe, a sub-tribe of Abaluyia in Western Kenya, Lijembe (1967) found that child caretaking is one of the numerous domestic tasks shared among parents and older siblings. In addition to increased experience in the caregiving role, older siblings in these non-Western cultures have many opportunities to observe and imitate their parents and more competent caregivers than U.S. siblings and peers as they interact with younger children in the family. Parents guide these older siblings as they learn to tend to fussy, hungry, angry, and sleepy younger siblings. This guidance provides older siblings with a rich repertoire of responses to their younger siblings which can be later utilized in other social contexts, such as during a teaching interaction (Gaskins, 1996; Weisner et al., 1988; Zukow-Goldring, 1995). Further, from an early age, non-Western older siblings understand their primary responsibility is to care for their younger siblings.

This increased responsibility and expectation may result in greater motivation for these older siblings to help their younger siblings succeed, compared to U.S. older siblings who are not necessarily expected to take on the primary role of caring for their

younger siblings. For example, in a study investigating child-directed speech of Kipsigis mothers and older siblings, results indicate that both mothers and children adjusted the amount and complexity of their speech to fit with the younger child's level (Harkness, 1977). Rabain-Jamin (2001) found that in Wolof (West Atlantic group of Niger-Congo families) children, older siblings exhibited similar amounts of scaffolding-like behavior (e.g. prompting questions from the child, orienting the child to the task), to United States parents. Therefore, it may not be the case that peers and siblings do not have enough knowledgeability to be effective teaching partners, the differences between parents, siblings, and peers could reflect a variation in motivation.

Predictions

Table 1 summarizes the reasons that other people might be better partners, or might respond differently to different children. Because of differences in familiarity, knowledgeability, and motivation between people, it is expected that there will be differences in how children benefit from conversation with different partners as well as differences in why some teaching partners are better at scaffolding than others. In particular, with respect to peers and other adults, children will not be as familiar with them as they will be with their parent or sibling. Similarly, peers and other adults will not be as familiar with the children or the children's knowledge state as a parent or sibling will be. In lieu of these differences in familiarity, it is proposed that children will benefit less from conversation and receive less scaffolding when interacting with these unfamiliar individuals compared to more familiar partners such as parents and siblings if familiarity is playing a role in why we see differences in partners. In regards to siblings

versus parents, siblings are somewhat familiar with the target child, and the target child with them, although not as familiar as a parent would be. Thus, it is proposed that parents will be more beneficial conversational and teaching partners for children than siblings will be. With respect to knowledgeability, parents are more knowledgeable than children and other adults may be seen as having the same knowledgeability as parents, but siblings and peers will not. Therefore, if knowledgeability is driving the difference between partners, then siblings and peers will not be as beneficial conversational partners and will be less effective at scaffolding children compared to other adults and parents. In regards to motivations, parents are highly motivated to help their children and other adults may have a similar level of motivation to the parent, but siblings and peers will not be as motivated to help the child as will the parent (their focus may be more likely to be on the task than on the target child, for example). If motivation is driving this difference between partners, then it is proposed that parents and other adults will be better conversational and teaching partners than both siblings and peers. These proposed differences between social interaction partners are summarized in Table 1.

Table 1: Potential differences between social interaction partners

	Knowledgeability	Familiarity	Motivation
Parents	High	High	High
Peers	Low	Low	Low
Siblings	Low	High	Low
Other adult	High	Low	Low

CHAPTER II: METHODS AND RESULTS

General Design

The goal was to understand why we see differences in scaffolding between parents, siblings, and peers, and to gain insight into the relative roles of familiarity, knowledgeability, and motivation. To examine these issues, three studies were conducted to compare interactions with parents to interactions with other individuals. In all three studies, participants were recruited in one of three ways: (1) recruitment flyers, (2) speaking with parents on-site at local preschools, and (3) managing a booth at local community events. Recruitment flyers advertising this research were posted at U.C. Merced and public sites in Merced. In addition, approval was granted to speak with parents of children in the Merced County School District preschools during drop off and pick up times on-site at local preschools. These parents received a letter asking them to give me permission to contact them for future studies. They returned their permission for such contact to their child's preschool, and a list of willing participants was compiled and contacted based on eligibility (e.g. age of target child). Lastly, recruitment booths were hosted at local community events such as "Week of the Young Child – A Day in the Park Event," "A Salute to Mother's Event," "A Celebration of Fathers Event," to advertise this research. Here, parents received a letter asking them to give permission to be contacted for future studies. If they were willing to participate, they signed their permission for such contact during the event, and a list of willing participants was compiled and contacted based on eligibility (e.g. age of target child). The methods and results for each study are presented in turn. All procedures were approved by the UC Merced IRB.

Subjects received no monetary payment for participation, instead, children, siblings, and peers received a coloring book and customized UC Merced research t-shirt.

General Analyses

A general analysis approach was adopted that recognized the multiple levels within these data and the nested structure of repeated measures within children, which violates the independence assumption because clusters of observations (e.g., within children) are not independent of each other. With traditional statistical approaches, such as multiple regression and logistic regression, an underlying assumption is that the observations are independent. When the assumption of independence is violated, the regression coefficients can be biased, and the estimates of standard errors are smaller than they should be. Accordingly, there is a risk of concluding that a relationship is statistically significant when it may have occurred by chance alone. Therefore, hierarchical linear analysis (HLM) was used in all three studies (Bryk & Raudenbush, 1992).

HLM is a random-intercept logistic regression model used to analyze a data structure where repeated outcome variables (level 1) are nested within individual. HLM extends multiple regression to nested, or repeated-measures, data. Because there are several observations for each person, waves of data are nested within person. The basic idea underlying HLM is that separate analyses can be conducted for each child and the results of these analyses (regression coefficients) become the dependent variables for analyses between individuals. HLM examines variance within and between persons, in a manner similar to repeated measures ANOVA. However, it does this by applying what

amounts to a small regression equation for each person at level-1 and allowing the parameters of the regression equation to vary by group membership. For example, a two-level HLM model is defined by two types of regression equations. The first is the level-1 that expresses the outcome variable in relation to predictor variables for each individual. The level-1 equation models outcome variables within individuals:

$$Y_{ij} = \beta_{0j} + \beta_{1j}X_{ij} + r_{ij}$$

where β_{0j} represents the intercept (regression constant), β_{1j} is the slope, r_{ij} is a unique effect for each person (residual error), i subscript represents level-1 units and j subscript represents level-2 units. It then uses group-level variables (level-2) to explain variation in the individual-level parameters. The predictor variables for level-2 include variables that do not change over time, either because they are inherently stable characteristics or because they were measured on only one occasion. The level-2 equation models group-level variables (e.g. gender):

$$\beta_{0j} = \gamma_{00} + \gamma_{01}Z_j + \gamma_{02}Z_j + \gamma_{03}Z_j + \gamma_{04}Z_j + u_{0j}$$

where γ are the level-2 regression coefficients, Z is a level-2 independent variable (e.g. male, age, parent, peer, sibling), γ_{01} is the effect of Z on the intercept. HLM tests for main effects and interactions within and between levels while preserving the independence assumption.

For Studies 1 and 2, a 2-level HLM model analogous to an ANOVA-like logistic analysis was conducted on the binary outcome (whether a behavior occurred or did not occur) of differences in behavior (e.g. information-seeking questions, scaffolding, etc.)

dependent on condition, target child age, and target child gender. Study 3 will use a 2-level HLM model to investigate differences in behavior dependent on condition, target child age, and target child gender. An example of the binary outcomes is information-seeking questions asked versus information-seeking questions not asked in a particular interaction. Reference categories serve as the reference level when the model is estimated. In other words, the dummy coded parameter estimates specify one of the groups to become the reference category where all of the other groups are compared to that category. Outcome, or criterion, variables, predictor variables and reference categories varied by study.

In all three studies, a 2-level hierarchical linear model (HLM) was conducted to investigate the effects of sibling age spacing. Outcome variables were different dependent on each study. However, sibling age spacing and target child's gender were represented as predictor variables at level 2 of the model across all three studies. In addition, a series of independent samples t-tests across dyadic conditions were conducted to look at children's independent post test performance. Teaching partner and child's age (as a continuous variable) served as an independent variable with total correct connections, total connections, and total attempts serving as dependent variables. In all studies, a second analysis was run where data were split by child's age (younger versus older) to investigate correlations between dependent variables and condition within each age group. Lastly, a series of two-way between-subjects ANOVAs were also conducted to investigate sibling age-spacing (as a continuous variable), child's gender, and child's age (as a categorical variable; 3 or 4 years of age) as independent variables with children's independent post test performance as a dependent variable.

All significant p-values reflect a Bonferroni adjustment in this dissertation. The Bonferroni correction is a statistical adjustment for the multiple comparisons that are made in an exploratory study. It attempts to prevent data from incorrectly appearing statistically significant by lowering, or keeping, the error rate to a specified level ($\alpha = .05$) and divides the α -level by the number of comparisons made. This decreases the chance of making a Type I error rate. Two-level ANOVAs and HLM analyses were completed with the aid of a statistical consultant.

Study 1: Children's Questions: Parents vs. Siblings vs. Other Adults

The goal of Study 1 was to investigate how willing children are to use these different people as sources of information. To do this, a body of naturally occurring conversation between children aged 3;0-4;11 and their parents, other adults, or older siblings (aged 2-6 years older) was compiled. Conversation partners who are more knowledgeable or who are more familiar to the child should lead to greater question-asking and more informative responses. Partners who are less knowledgeable, less familiar with the child's needs, and less motivated to assist the child should provide less information to children. Unlike previous studies looking at naturally occurring parental behaviors in the home, this study allows for a more direct comparison because it employ the same stimuli across conditions.

Specifically, this study is designed to test the following predictions:

Hypothesis 1: Children may be more likely to ask information-seeking questions from their parents and siblings versus other adults.

Hypothesis 2: Siblings may provide more informative answers than other adults, but less so than parents.

Hypothesis 3: Parents may provide more informative and turning it back responses than both siblings and other adults.

Hypothesis 4: Parents and siblings may be more likely to reformulate children's erroneous utterances than other adults.

Hypothesis 6: Farther-spaced older siblings may be more likely to provide informative answers and turn the question back to children than closer-spaced older siblings.

Hypothesis 7: Children in farther-spaced sibling dyads may receive more reformulations than children in closer-spaced sibling dyads.

Participants and Procedure

In this study, 144 3- and 4-year-old children participated. Two different waves of sampling were conducted where children were randomly assigned within each wave. Eighty-eight (88) children were recruited and randomly assigned to participate with either a parent or a blind experimenter they did not know, while a separate group of 56 children were recruited and randomly assigned to participate with either a parent or an older sibling. No significant differences were found between the two parent groups and therefore they were collapsed across them for analyses. They are referred to as one parent group throughout this study. Upon arrival to the research site, participants were told that they were participating in a study to see what sort of things the child finds interesting about different kinds of objects. Both parents and blind experimenters were told that they were going to play with a child while we record the interaction. With respect to the experimenter condition, experimenters were undergraduate research assistants and kept blind to the goals and predictions of the study. A team of blind

research assistants were used in order to preserve the novelty of the toys. These experimenters will be referred to as ‘other adult’ throughout the study. In addition, because we could not leave two children alone together in the experimental room unsupervised, in both conditions of this study a separate undergraduate research assistant, whose only task was to sit in the corner and read, was present in the research room. This research assistant was not an active part of the study and did not interact with the participants, parents, siblings, or other adults. The participants were told that the research assistant was working on another project, and that the research assistant would not interrupt their play, and should not be talked to. Together the target child and the conversational partner were told that we had a set of toys that we would like them to play with together, and that they could play with these toys however they liked. The participants went into a room that contained a box full of toys designed to range from familiar to unfamiliar items, the latter of which would generate more complex explanatory and procedural questions. For example, a toy doctor’s kit was part of the stimuli which included a stethoscope and thermometer as well as other items found in a doctor’s office in order to stimulate children to ask questions about what the objects were and how to use them; we also included a ‘Barrel of Monkeys’ game designed to stimulate children to ask procedural questions. Examples of the toys are shown in Figure 1.

Figure 1. An example of the toys used during the free-play session



Data Analysis

Sessions were videotaped between the targeted child and conversation partner; the sessions lasted 45 minutes on average, and any videos under 30 minutes were excluded from the study (N=11, 8%). Videos were excluded for reasons such as the child interrupting the session to use the restroom, child wanting to discontinue participation, video camera battery dying, etc. Then the sessions were transcribed and coded; each session was transcribed and coded by two independent transcribers and coders to ensure accuracy. For transcriptions, interrater reliability was calculated by taking the number of times two independent transcribers agreed on transcript lines divided by the total number of lines in a given interaction. The percentage agreement between the transcribers was .95 averaged across subjects. For coding, interrater reliability was calculated by taking

the number of times two independent coders agreed on codes divided by the total number of codes in a given interaction. A team of eight coders were used, with two coders paired up for a given number of files. The percentage agreement between the coders was .95 averaged across subjects. Any inconsistencies in initial codes were resolved through discussion.

Each of the transcripts was coded for the following:

The first coding distinction used was designed to separate information-seeking questions that were potentially useful for cognitive development, as opposed to questions that were not information-seeking questions, less clearly useful for cognitive development. All codes used in this research followed the coding system reported in Chouinard (2007). Examples are:

Information-seeking questions:

E.g. “What does that button do?”

E.g. “Why did you put that there?”

Non-information-seeking:

Clarification: “What?”

Permission: “Can I have some ice cream?”

Attention-seeking: “Mommy?”, “Guess what?”

Request for action: “Can you move that?”

Second, it was also of interest whether or not the conversational partner provided the children what they were asking for. Although non-responses can be informative in a more implicit way, children have to infer the information from them. Thus, for the purpose of this research, coding focused on explicit, straightforward informative responses. Codes

reflected whether or not the partner responded to the child at all, if there was a response, codes indicated whether or not it was an informative answer:

Informative response:

Child says: “How do you open it?”

Father says: “You have to open it like this”

Non-informative response:

Mother says: “Let’s not break it”

Child says: “Why?”

Mother says: “There we go”

The third set of coding examined whether or not the conversational partner turned the question back to the child. Codes investigated whether or not the partner responded to the child at all, and if there was a response, codes reflected whether or not it was a turning it back answer:

Turning it back response:

Child says: “What is that?”

Mother says: “What do you think it is?”

A fourth coding was designed to separate out children’s utterances that were erroneous, as opposed to utterances that were grammatically correct.

Erroneous utterances:

E.g. “We’re eating all of *these* stuff?”

E.g. “No she didn’t *fell*, she jumped down”

E.g. “Yeah but I *broked* it”

Lastly, two distinctions were made within conversational partners’ responses:

When the conversational partner used a reformulation in response to the child’s erroneous utterance and when the conversational partner did not reformulating the child’s error.

Reformulations were coded as follows:

Examples of reformulations

Child says: “Now what you want to play with?”

Other adult says: “I don’t know, what *do* you want to play with?”

Child says: “No, I just *wan* sit down”

Father says: “You wanna roll it? You *wanna* sit down?”

In order to investigate whether information-seeking questions, informative responses, turning it back responses, and reformulations varied across teaching partner, target child’s age, and target child’s gender, a 2-level HLM model was conducted. First, information-seeking questions were added as a level-1 outcome variable with teaching partner, target child’s age, and target child’s gender added as level-2 predictor variables, with other adult as a reference category. This analysis was repeated to compare parents to other adult with other adult added as a level-2 predictor variable and sibling removed from level-2, instead, serving as a reference category.

Second, informative responses were added in as a level-1 outcome variable in the model with teaching partner, target child's age, and target child's gender added as level-2 predictor variables. Specifically, parent and sibling were added as level-2 predictor variables with other adult as the reference category. This analysis was repeated with sibling removed from level-2 and other adult added into the model as a level-2 predictor variable, with sibling serving as the reference category. Third, turning it back responses were added as level-1 outcome variable, with teaching partner, child's age, and child's gender added as level-2 predictor variables. Level-2 consisted of parent and sibling as predictor variables and other adult as the reference category. To compare parents to other adult, this analysis was repeated with other adult added in as a level-2 predictor variable and siblings removed from the model, instead serving as a reference category. To investigate reformulations, a fourth analysis was conducted with reformulations as the outcome variable in level-1 and parent, sibling, child's age, and child's gender added in the model as level-2 predictors, and other adult served as the reference category. Then, sibling was removed and other adult added in the model as a level-2 predictor with sibling as the reference category.

Lastly, a two-level HLM was conducted to investigate sibling age-spacing effects on informative responses, turning it back responses, and reformulations. In four separate analyses, informative responses, turning it back responses, and reformulations were added as a level-1 outcome variables with gender of the target child, target child's age, and sibling age-spacing (as a continuous variable) added as predictor variables in level-2.

Results

Number of utterances produced by the target child and responses given by parents, siblings, and peers to the target child in Study 1 appear in Tables 2, 3, 4, and 5.

Utterances are separated by total number of questions, number of information-seeking questions, and non-information-seeking questions. Responses are separated by total number of informative responses, non-informative responses, turning it back responses, and reformulations. Further, percentages in these tables represent the number of occurrences out of total occurrences within conditions based on percentage of likelihood within that specific condition. For example, parents have an 82% chance of receiving an information-seeking question from children, or 2,171 information-seeking questions out of the 2,657 total information-seeking questions children asked to parents.

Descriptive statistics for all measures and outcomes in Study 1 appear in Table 6. These numbers represent probability or likelihood of receiving a particular type of question or providing children with a particular type of response within condition, not within the total occurrence of questions/response. Although children asked a variety of questions and no questions, analyses only focus on the sub-class of information-seeking questions. Even though conversational partners gave a variety of responses and no response at all, analyses only focus on the sub-class of responses (e.g. informative, turning it back, and reformulations).

Table 2

Number of Utterances Produced by the Target Child in Study 1, Separately by Conversational Partner

Conversational partner	Utterances produced by target child		
	Total Questions	Information-seeking questions	Non-information seeking questions
Parent	44,252	1,903 (4%)	42,349 (96%)
Sibling	15,348	1,228 (8%)	14,120 (93%)
Other adult	29,399	882 (3%)	28,517 (97%)

Table 3

Number of Informative Utterances Produced in Response to the Target Child's Information-Seeking Questions in Study 1, Separately by Conversational Partner

Conversational partner	Responses to target child		
	Total responses	Informative responses	Non-informative responses
Parent	36,083	361 (1%)	35,722 (99%)
Sibling	19,660	1,780 (6%)	17,880 (94%)
Other adult	33,256	998 (3%)	32,258 (97%)

Table 4

Number of Turning it Back Utterances Produced in Response to the Target Child's Information-Seeking Questions in Study 1, Separately by Conversational Partner

Conversational partner	Responses to target child		
	Total Questions	Turning it back responses	Non-turning it back responses
Parent	44,252	177 (0.4%)	44,075 (99.6%)
Sibling	15,348	5 (0.03%)	15,343 (99.07%)
Other adult	29,399	59 (0.2%)	29,340 (99.8%)

Table 5

Number of Reformulations Produced in Response to the Target Child's Erroneous Utterances in Study 1, Separately by Conversational Partner

Conversational partner	Responses to target child		
	Total responses	Reformulations	Non-reformulations
Parent	40,011	240 (0.6%)	39,771 (99.4%)
Sibling	21,489	13 (0.06%)	21,476 (99.04%)
Other adult	34,307	274 (0.8%)	34,033 (99.2%)

Information-seeking questions.

To examine the number of information-seeking questions asked of parents, other adults, and siblings, fact, procedural, and explanation questions and were combined to constitute one combined category labeled information-seeking questions. As mentioned above, a 2-level HLM model was conducted with information-seeking questions added in the model as a level-1 outcome variable and parent and sibling added as level-2 predictor variables, with other adult as the reference category at level-2.

The regression coefficient relating the amount of information seeking questions asked of siblings compared to other adults was highly statistically significant ($b=0.992$, $p=0.000$). It appears that children were more likely to ask information-seeking questions of their older siblings (7.3%) than other adults (2.8%). This test was repeated to compare parents to siblings, with parents and other adults added as level-2 predictor variables in the model, and siblings removed from level-2 and added as the reference category. The regression coefficient was statistically significant ($b=-0.813$, $p=.000$). This indicates that siblings had a significant higher likelihood of receiving an information-seeking question (7.3%) than did parents (3.3%). The regression coefficient comparing parents versus other adults was not statistically significant ($b=0.179$, $p=0.239$). It appears that children asked just as many information-seeking questions of parents and other adults.

Second, target child's age (in months) and gender (with female as the reference category) were added as level-2 predictor variables. The regression coefficient relating the target child's age to information-seeking questions asked was not statistically significance ($b=0.073$, $p=0.59$). The regression coefficient relating target child gender to

the amount of information-seeking questions asked was also not statistically significant ($b=0.111$, $p=0.26$).

Information-seeking questions answered informatively.

To examine the number of informative answers provided by parents, other adults, and siblings, all of the information-seeking questions that received no response at all were combined with those that received a non-informative response, and compared to the number of responses that received an informative response. This was done for both questions asked of parents and of other adults. As previously mentioned, a 2-level HLM model was applied to investigate whether informative answers that children received would be the same regardless of conversational partner (parent versus sibling versus other adult). First, informative responses were added in the model at level-1 as the outcome variable and parent and sibling were added as level-2 predictor variables, with other adult as the reference category. The regression coefficient relating parents versus other adults to informative answers was statistically significant ($b=-0.762$, $p=0.004$) which indicates that children had an increased chance of receiving informative answers from other adults (2.7%) than their parents (1.2%). The regression coefficient relating the amount of information seeking questions asked of siblings compared to other adults was statistically significant ($b=0.715$, $p=0.04$). This indicates that children asked more information-seeking questions of siblings (5.3%) than of other adults (2.7%) during conversation.

This test was repeated to compare parents to siblings, with parents and other adults added as level-2 predictor variables in the model, and siblings removed from level-2 and added as the reference category. The regression coefficient relating parents to

siblings was statistically significant ($b=-1.478$, $p=.000$). This indicates that surprisingly siblings had a higher probability of producing an informative response to children's information-seeking questions (5.3%) than did parents (1.2%).

In both analyses, target child's age (in months) and gender (with female as the reference category) were added as level-2 predictor variables. The regression coefficient relating target child gender to the amount of informative responses was statistically significant ($b=-0.578$, $p=.000$), with females having a higher probability of receiving informative responses (31%) than males (20%). However, the regression coefficient relating the target child's age to informative was not statistically significance (age: $b=-0.058$, $p=.780$).

Turning it back responses.

Recall that parents did not answer more questions than other partners; however, this does not necessarily mean they are no more sensitive to their children's learning needs. One possibility is that parents are more familiar with what their children know, and thus can tell when a child's question is seriously recruiting information versus when he/she actually already knows the answer. To examine the number of questions answered with a turning it back response by the parents, other adults, and siblings, all of the information-seeking questions that received no response at all were combined with that received a non-informative response, and compared those to the number of responses that received a turning it back response. This was done for questions asked of parents, other adults, and siblings. As mentioned above, a 2-level HLM model was conducted to examine differences in data dependent on condition (parent, sibling, or other adult), target

child age, and target child gender. In particular, this statistical test was used to investigate whether turning it back answers that children received would be the same regardless of conversational partner (parent versus sibling versus other adult). First, turning it back responses were added as the outcome variable in level-1 and parent and sibling were added as level-2 predictor variables with other adult as the reference category. The regression coefficient relating parents to turning it back responses was statistically significant ($b=0.704$, $p=0.04$). It appears that parents (0.2%) had a significantly higher likelihood of producing turning it back responses than other adults (0.1%). The regression coefficient relating siblings versus other adults to turning it back responses was not statistically significant ($b=-1.523$, $p=0.16$). This test was repeated to compare parents to siblings, with parents and other adults added as level-2 predictor variables in the model, with siblings removed from level-2 and added as the reference category. The regression coefficient relating parents to siblings was not significant ($b=2.227$, $p=.06$).

Second, target child's age (in months) and gender (with female as the reference category) were added as level-2 predictor variables. The regression coefficient relating target child gender to the amount of turning it back responses given was statistically significant ($b=-0.069$, $p=0.004$). This implies a difference in proportions of turning it back responses between males and females, with females having a higher probability of receiving significantly more turning it back responses (3.5%) than males (3.3%). However, the regression coefficient relating the target child's age to turning it back responses was not statistically significance ($b=-0.589$, $p=0.08$).

Reformulations.

As previously stated, 2-level HLM model was conducted to examine differences in reformulations dependent on condition, target child age, and target child gender. In particular, this statistical test was used to investigate whether the number of reformulations that children received would be the same regardless of conversational partner (parent versus sibling versus other adult). First, reformulations were added as a level-1 outcome variable, and parent and sibling were added as level-2 predictor variables, with other adult as the reference category. The regression coefficient comparing reformulations between siblings and other adults was statistically significant ($b=-2.143$, $p=0.000$). This indicates that other adults had an increased probability of producing more reformulations (0.6%) than siblings (0.07%). The regression coefficient comparing reformulations between parents and other adults was not statistically significant ($b=-0.269$, $p=0.221$).

This test was repeated to compare parents to siblings, with parents and other adults added as level-2 predictor variables in the model with siblings as the reference category. The regression coefficient relating parents to siblings was significant ($b=1.874$, $p=.000$) which indicates that parents had a significantly higher probability of producing more reformulations (0.4%) than siblings (0.07%) did. The regression coefficient relating other adults to siblings was also highly statistically significant ($b=2.143$, $p=.000$) which indicates that other adults (0.6%) had a significantly higher likelihood of producing reformulations while interacting with 3- and 4-year-old children, than siblings (0.07%).

Second, target child's age (in months) and gender were added as level-2 predictor variables. The regression coefficient relating the target child's age to reformulations was not statistically significant ($b=-0.006$, $p=0.202$). The regression coefficient relating target child gender to that amount of turning it back responses given was also not statistically significant ($b=-0.005$, $p=0.336$).

Table 6

Percent Chance of Utterances Produced by, and in Response to, the Target Child in Study 1, Separately by Conversational Partner

Conversational partner	Probability of utterances produced by target child	Probability of responses to target child		
	Information-seeking questions	Informative responses	Turning it back responses	Reformulations
Parent	.33 ^a	.12 ^a	.002 ^a	.004 ^a
Sibling	.73 ^b	.53 ^b	.000 ^{a, b}	.000 ^b
Other adult	.28 ^a	.27 ^c	.001 ^b	.006 ^a

Note: Probabilities or likelihoods of receiving a particular utterance from or producing a specific response to the target child

Note: Entries with different superscripts are significantly different from each other, $p \leq .05$

Conclusions of children's question-asking behavior and conversational partners' responses.

Taken together, these results confirmed the hypothesis that parents may provide more turning it back responses than both siblings and other adults. Parents gave significantly more turning it back responses to children than both other adults and siblings. However, siblings and other adults did not significantly differ in the amount of turning it back responses they gave children. With respect to child's gender, results indicate that females

are more likely to receive a turning it back response than males. No significant effects were found for child's age. Although significant differences exist between conversational partners, the results did confirm the hypothesis that children may ask more questions of siblings and parents than other adults. Children were more likely to ask information-seeking questions of their parents and siblings than other adults.

While significant results suggest a difference in the amount of informative responses conversational partners give children, the hypothesis that siblings will provide more informative answers than other adults, but less than parents was not confirmed. Siblings provided more informative answers to children than parents, but there was no difference from other adults. However, other adults were significantly more likely to provide an informative response to children than parents were. Furthermore, females were more likely to receive an informative response than males across condition. Lastly, results did not confirm the hypothesis that parents and siblings will be more likely to reformulate children's errors than other adults. Contrary to the prediction, parents and other adults gave significantly more reformulations than siblings did, but they did not significantly differ in the amount of reformulations they provided children with when compared to each other.

Sibling age-spacing effects.

As described above, sibling age-spacing and target child gender were represented at level 2 of a two-level HLM analysis, with varying outcome variables (information-seeking questions, informative response, turning it back responses, and reformulations) added in the model at level-1 in four separate analyses. Across all outcome variables, in

level-2, age-spacing between siblings was accounted for in one analysis, the gender of the target child in a separate analysis (with age-spacing removed from level-2), and lastly, both age-spacing and target child gender were included in a final analysis.

Information-seeking questions answered informatively.

First, informative responses were added in the model as level-1 outcome variables and sibling age-spacing was added as a level-2 predictor variable. The regression coefficient relating sibling age-spacing to informative responses was not statistically significant ($b=0.011$, $p=0.14$). Second, target child gender was added as a level-2 predictor variable and in place of sibling age-spacing. The regression coefficient relating target child gender to informative responses was negative and not statistically significant ($b=-0.399$, $p=0.19$). There appears to be little evidence of a gender effect.

Lastly, sibling age-spacing was added back into level 2 as a predictor variable, with target child gender remaining to examine if there was an effect of target child gender when controlling for age-spacing. The regression coefficient relating the child's gender ($b=-0.292$, $p=0.35$) was not statistically significant. While controlling for target child gender, the regression coefficient relating the effect of sibling age-spacing ($b=0.089$, $p=0.27$) was also not statistically significant.

Turning it back responses.

First, sibling age-spacing was added as a level-2 predictor variable with turning it back responses as a level-1 outcome variable. The regression coefficient relating sibling

age-spacing to turning it back responses was negative and not statistically significant ($b=-0.020$, $p=0.72$). There appears to be little evidence of a sibling age-spacing effect. Then, target child gender was added as a level-2 predictor variable and sibling age-spacing was removed from level-2. The regression coefficient relating target child gender to turning it back responses was negative and not significant ($b=-0.0005$, $p=0.44$). There appears to be little evidence of a gender effect. Next, sibling age-spacing was added back into level 2 as a predictor variable, with target child gender remaining a predictor in level 2 as well, to see if there was effect of target child gender when controlling for age-spacing. The regression coefficient relating the effect of target child's gender ($b=-21.94$, $p=1.00$) was not statistically significant. The regression coefficient relating the effect of sibling age-spacing ($b=-0.034$, $p=0.56$), while controlling for the target child's gender, was also not statistically significant.

Reformulations.

With reformulations as a level-1 outcome variable and sibling age-spacing only as a level-2 predictor variable in the model, the regression coefficient relating sibling age-spacing to reformulations was not statistically significant ($b=0.025$, $p=0.23$). It appears that there are no significant differences in the amount of reformulations older siblings give at various age-spacing intervals. Next, target child gender only as a level-2 predictor variable yielded a regression coefficient relating target child gender reformulations was not significant ($b=0.550$, $p=.45$). This indicates there is no significant effect of target child gender on the amount of reformulations older siblings use. Lastly, when both sibling age-spacing and target child gender were level-2 predictor variables, the

regression coefficient relating the effect of child's gender ($b=-1.044$, $p=.17$) was not statistically significant. While controlling for child's gender, the regression coefficient relating the effect of sibling age-spacing ($b=0.036$, $p=.11$) was also not statistically significant.

Conclusions of sibling age-spacing effects.

In all cases, sibling age-spacing does not seem to have a significant effect on the amount of informative responses, turning it back responses, and reformulations they provide to children's questions during conversation. There is also no evidence for an effect of child's gender on the amount of informative responses, turning it back responses, and reformulations they receive from their siblings.

General Conclusions of Study 1

These results suggest that for some outcomes, such as providing corrections to children's erroneous utterances, parents are more beneficial conversational partners than siblings and other adults. However, in other situations, siblings and other adults may be more beneficial, providing children with more informative responses than parents do. In the current study, sibling age-spacing does not significantly affect their behavior as conversational partners. Nonetheless, this does not suggest that in other types of situations, sibling age-spacing does not play a role on their behavior during conversation with children.

Study 2: Building Study

This study served as more controlled, problem-solving situations, aimed at investigating the underlying differences of scaffolding behaviors between parents, peers, and siblings. This is also the first study to look at scaffolding through conversational analysis.

Specifically, this study is designed to test the following hypotheses:

Hypothesis 1: With respect to familiarity, peers may use significantly less scaffolding and orienting behaviors than parents and siblings.

Hypothesis 2: With respect to knowledgeability, parents may use significantly scaffolding and orienting behaviors than both siblings and peers.

Hypothesis 3: With respect to contingency and sensitivity, parents may make significantly more appropriate shifts when children fail and succeed than siblings and peers

Hypothesis 4: Siblings in farther-spaced dyads may use more scaffolding behaviors than siblings in closer-spaced dyads.

Hypothesis 5: Children may perform better at post test when they worked with their more familiar parents and siblings than when they worked with unfamiliar peers.

Hypothesis 6: Children who worked with more knowledgeable parents may perform better at post test than those who worked with less knowledgeable peers or siblings.

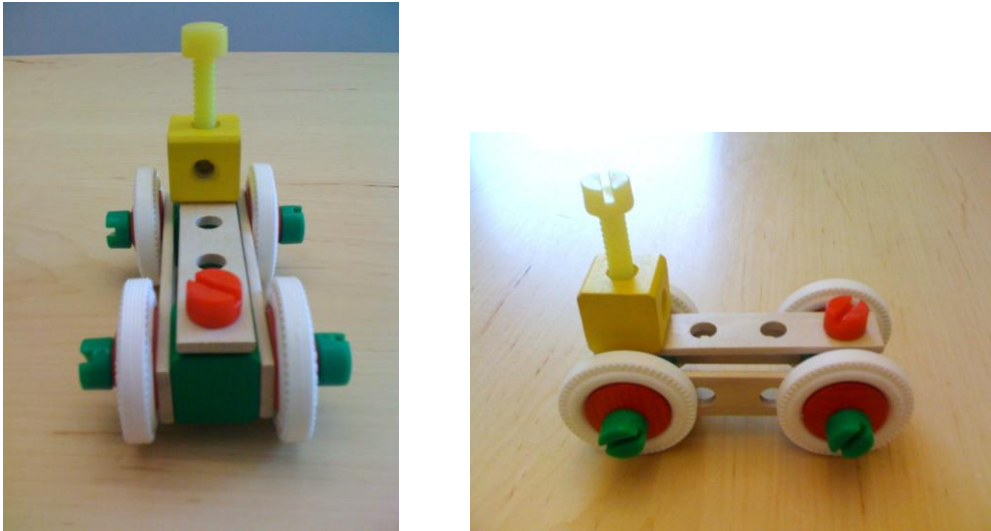
Hypothesis 7: Children in farther-spaced dyads may perform better at post test than those in closer-spaced dyads.

Participants and Procedure

In this study, 92 children between the ages of 3;0 to 4;11 participated in 2 sessions in which they built a replica of a constructor toy model. Peers were age matched to the age of older siblings to control for knowledgeability (between peers and siblings) so that familiarity is only being investigated as an underlying factor of scaffolding differences.

Children came into the lab with either their parent (N=39), older sibling (N=26) or an age-matched peer (whom they have never met before) (N=28) and participate in two sessions: 1) building trial and 2) post test. During the building trial, children were randomly assigned to build a replica of a Constructor toy car (see Figure 2) with either the help of their parent, a sibling who is 2;0 to 6;11 years older or an age matched peer. Teaching partners received no formal training on the paradigm. In post test, children built a replica of the Constructor toy car on their own to determine how well they generalize the skills acquired during interaction dependent on who helped them. In addition, because two children could not be left alone together in the experimental room unsupervised, in all conditions and both trials (building trial and post test) of this study a undergraduate research assistant, whose only task was to sit in the corner and read, was present in the research room. This research assistant was not an active part of the study and did not interact with the participants. The participants were told that the research assistant was working on another project, and that the research assistant would not interrupt their play, and should not be talked to.

Figure 2. An example of the Constructor toy car



Data Analysis

A video recording was made of the conversation between parents, siblings, and children, and these recordings were transcribed for data analysis. Then the sessions were transcribed and coded; each session was transcribed by two independent transcribers to ensure accuracy. For transcriptions, interrater reliability was calculated by taking the number of times two independent transcribers agreed on transcript lines divided by the total number of lines in a given file. The percentage agreement between the transcribers was 95% averaged across subjects. For coding, interrater reliability was calculated by taking the number of time two independent coders agreed on codes divided by the number of codes in a given file. The percentage agreement between the coders was 95% averaged across subjects.

Each of the transcripts was coded for the following:

The first coding distinction used was designed to code for scaffolding behaviors used by teaching partners. Scaffolding behaviors were coded as follows:

Scaffolding behaviors:

Mother says: “Alright C what should we start with first?”

Child says: “Umm, the wheels”

Mother says: “Wheels?”

Child says: “Yeah” [Child pulls out 4 wheels]

Mother says: “What goes in them?”

Mother says: “See look, there’s the wheel and then there’s this. And then what do we put inside of it?”

Then, whether the teaching partner provided orienting behaviors was determined. In particular, the distinction was made between when the teaching partner provided orienting and when the teaching partner did not use an orienting behavior when the child became disengaged with the task. Orienting was coded as follows:

Examples of orienting

Mother says: “Look L, look at what I’m doing”

Sibling says: “M pay attention, we need to build this together”

Father says: “Look, see what I put in there?”

Lastly, for every scaffolding intervention, whether the child succeeds or fails following that intervention was coded. Appropriate shifts were defined by observing his/her rates of failure or success for each intervention. If the child fails, the teaching partner should use additional/more specific techniques (follow-up). If the child partially succeeds during the course of a goal, the teaching partner should reinforce scaffolding (follow-up). If the child succeeds on final completion of a goal, the teaching partner should move on to a new scaffolding intervention (initial).

Examples of appropriate shifts

Mother says: “What else do we need?” (*initial scaffolding intervention*)

Child says: “And we need a..”

Child points to the yellow screw on the top of the car model

Mother says: “Okay”

Child takes yellow screw from crate and sets on table (*final success*)

Mother says: “Yes, what do we need next?” (*new initial scaffolding intervention*)

Father says: “What goes right here?” (*initial scaffolding intervention*)

Father points to the top 4-hole plank on their construction

Child says: “A wheel” (*incorrect answer – failure*)

Father says: “No not a wheel, we need a green block” (*follow-up scaffolding intervention*)

Building trial analyses.

In order to examine the binary outcome of differences in scaffolding behaviors, orienting behaviors, and appropriate shifts dependent on condition, target child’s age (continuous variable), and target child’s gender, a 2-level HLM model was conducted. First, scaffolding was added as a level-1 outcome variable with teaching partner, target child’s age, and target child’s gender added as level-2 predictor variables, with peer as a reference category. This analysis was repeated to compare parents to peers with peer added as a level-2 predictor variable and sibling removed from level-2, instead, serving as a reference category.

Second, orienting was added in as a level-1 outcome variable in the model with teaching partner, target child’s age, and target child’s gender added as level-2 predictor variables. This analysis was repeated with sibling removed from level-2 and peer added into the model as a level-2 predictor variable, with sibling serving as the reference category. Third, appropriate shift was added as level-1 outcome variable, with teaching partner, child’s age, and child’s gender added as level-2 predictor variables. To compare parents to peers, this analysis was repeated with peer added in as a level-2 predictor variable and siblings removed from the model, instead serving as a reference category.

In order to investigate sibling age-spacing effects on scaffolding behaviors, a 2-level HLM model was conducted. Scaffolding was added as a level-1 outcome variable

with gender of the target child, target child's age, and sibling age-spacing (as a continuous variable) added as predictor variables in level-2.

Post test analyses.

In order to examine whether post test performance varied dependent on teaching partner two separate analyses were conducted. First, a series of independent samples t-test were conducted across dyadic conditions, with teaching partner as an independent variable and post test performance (e.g. total correct connections, total connections, total attempts) as dependent variables. Second, a series of between-subjects ANOVAs were also conducted to investigate sibling age-spacing, target child's age, and target child's gender on children's post test performance. In particular, 3 separate ANOVAs were run for each age group with independent performance as the dependent variable and teaching partner (parent, sibling, or peer) as the independent variable.

Results

Building trial.

Raw numbers of teaching partner behaviors while interacting with the target child in Study 2 appear in Tables 7, 8, and 9. Behaviors are separated by total number of scaffolding, non-scaffolding, number of orienting, number of non-orienting, number of appropriate shifts, and number of when no shifts were made. Total behaviors represent all scaffolding and orienting behaviors, appropriate shifts, as well as other behaviors not investigated in this research. 27,219 total behaviors made and of that, parents made 12,452 behaviors, with siblings making 7,552 behaviors and peers making 7,289 behaviors. Further, percentages represent the number of occurrences out of total

occurrences within conditions based on percentage of likelihood within that specific condition. For example, out of 12,452 total behaviors made by parents, 2,281 or 18% of them were labeled as scaffolding behaviors with 10,171 or 82% of them some other behavior not categorized as scaffolding.

Descriptive statistics for all measures and outcomes in Study 2 appear in Tables 10 and 11. Numbers represent probability or likelihood of using a particular type of behavior within condition, not within the total occurrence of behaviors. Although teaching partners displayed a variety of behaviors, analyses only focus on the sub-class of behaviors (e.g. scaffolding, orienting, and appropriate shifts).

Table 7

Number of Scaffolding and Non-Scaffolding Behaviors Produced While Interacting with the Target Child in Study 2, Separately by Teaching Partner

Teaching partner	Behaviors while interacting with target child		
	Total behaviors	Scaffolding behaviors	Non-scaffolding behaviors
Parent	12,452	2281 (18%)	10,171 (82%)
Sibling	7,552	261 (3%)	7,291 (97%)
Peer	7,289	336 (5%)	6,953 (95%)

Table 8

Number of Orienting and Non-Orienting Behaviors Produced While Interacting with the Target Child in Study 2, Separately by Teaching Partner

	Behaviors while interacting with target child		
Teaching partner	Total behaviors	Orienting behaviors	Non-orienting behaviors
Parent	12,452	660 (5%)	11,792 (95%)
Sibling	7,552	221 (3%)	7,331 (97%)
Peer	7,289	89 (1%)	7,200 (99%)

Table 9

Number of Appropriate Shifts and No Shifts Produced While Interacting with the Target Child in Study 2, Separately by Teaching Partner

	Behaviors while interacting with target child		
Teaching partner	Total behaviors	Appropriate Shifts	No shifts
Parent	12,452	1068 (9%)	11,384 (91%)
Sibling	7,552	107 (1%)	7,442 (99%)
Peer	7,289	98 (1%)	7,191 (99%)

Scaffolding behaviors.

First, parents and siblings were added as level-2 predictor variables, while peer served as the reference category. The regression coefficient comparing scaffolding behaviors between parents and siblings was statistically significant ($b=2.540$, $p=0.000$). It appears that parents used significantly more scaffolding behaviors than older siblings did. This implies differences in proportions of scaffolding behaviors between parents and siblings with parents having a higher probability of using scaffolding behaviors (18.3%) than siblings (1.3%). However, the regression coefficient comparing scaffolding behaviors between siblings and peers was not statistically significant ($b=-0.258$, $p=0.577$).

This test was repeated to compare parents to peers, with parents and peers added as level-2 predictor variables in the model, with siblings removed from level-2 and added as the reference category. The regression coefficient relating parents to peers was significant ($b=2.809$, $p=.000$). This indicates that parents used significantly more scaffolding behaviors when interacting with their children than peers did. This implies differences in proportions of scaffolding behaviors between parents and peers with parents having an increased probability of using scaffolding behaviors (18.3%) than peers (2.0%). The regression coefficient relating peers to siblings was not statistically significant ($b=0.164$, $p=.725$).

In both analyses, child's age (in months) and gender were added as level-2 predictor variables. The regression coefficient relating the target child's age to scaffolding from parents and siblings was not statistically significance ($b=0.033$, $p=0.243$). The regression coefficient relating target child gender to scaffolding behaviors

from parents and siblings was also not statistically significant ($b=0.552$, $p=0.125$). The regression coefficient relating the target child's age to scaffolding behaviors from parents and peers was not statistically significant ($b=0.327$, $p=0.257$). The regression coefficient relating target child gender to scaffolding behaviors received from parents and peers was also not statistically significant ($b=0.622$, $p=0.09$).

Orienting the child.

First, parents and siblings were added as level-2 predictor variables while peers served as the reference category. The regression coefficient comparing orienting behaviors between parents and peers was statistically significant ($b=0.702$, $p=0.02$). Parents made significantly more orienting behaviors than peers did. This implies differences in proportions of orienting behaviors used within scaffolding interactions between parents and peers with parents having an increased likelihood of using an orienting behavior (4.5%) than peers (1.0%). Further, the regression coefficient comparing orienting behaviors between siblings and peers was statistically significant ($b=-0.867$, $p=0.02$). This indicates differences in proportions of orienting behaviors with siblings having a higher probability of using orienting behaviors (2.3%) than peers (1.0%).

This analysis was repeated to compare parents to siblings, with parents and peers added as level-2 predictor variables in the model, and siblings removed from level-2 and added as the reference category. The regression coefficient relating parents to siblings was significant ($b=0.702$, $p=0.02$). This indicates that parents used significantly more orienting behaviors when interacting with their children than peers did. This implies differences in proportions of appropriate shifts between parents and siblings with parents

having an increased probability of using orienting behaviors during scaffolding (4.5%) than siblings (2.3%).

In both analyses, target child's age (in months) and gender were added as level-2 predictor variables. The regression coefficients relating target child gender ($b=0.117$, $p=1.24$) and target child's age ($b=0.025$, $p=0.38$) to orienting behaviors provided by parents and peers were not statistically significant.

Appropriate shifts.

First, parents and siblings were added as level-2 predictor variables while peers served as the reference category. The regression coefficient comparing appropriate shifts between parents and peers was statistically significant ($b=3.232$, $p=0.000$). Parents made significantly more appropriate shifts than peers did. This implies differences in proportions of appropriate shifts used within scaffolding between parents and peers with parents having a higher likelihood of making appropriate shifts (7.8%) than peers (0.3%). However, the regression coefficient comparing appropriate shifts between siblings and peers was not statistically significant ($b=0.378$, $p=0.86$).

This analysis was repeated to compare parents to siblings, with parents and peers added as level-2 predictor variables in the model, and siblings removed from level-2 and added as the reference category. The regression coefficient relating parents to siblings was significant ($b=3.232$, $p=.000$). This indicates that parents made significantly more appropriate shifts when interacting with their children than peers did. This implies differences in proportions of appropriate shifts between parents and siblings with parents have a higher probability of using an appropriate shift during scaffolding (7.8%) than siblings (0.5%).

In both analyses, target child's age (in months) and gender were added as level-2 predictor variables. The regression coefficients relating target child gender ($b=0.707$, $p=0.08$) and child's age ($b=0.027$, $p=0.33$) to appropriate shifts given by parents and siblings were not statistically significant.

Table 10

Percent Chance of Behaviors Produced While Interacting with the Target Child in Study 2, Separately by Teaching Partner

Teaching partner	Probability of behaviors while interacting with target child		
	Scaffolding behaviors	Orienting behaviors	Appropriate shifts
Parent	.18 ^a	.04 ^a	.078 ^a
Sibling	.01 ^b	.02 ^b	.005 ^b
Peers	.02 ^b	.01 ^c	.003 ^b

Note: Probabilities or likelihoods of producing a specific behavior while interacting with the target child

Note: Entries with different superscripts are significantly different from each other, $p \leq .05$

Conclusions of building trial results.

Contrary to the first hypothesis that predicted peers will use significantly less scaffolding and orienting behaviors than parents and siblings, results indicate that although peers are significantly worse than parents, they are not significantly worse than siblings. This partially confirms the prediction that familiarity of the teaching partner plays a role in how effective they are at scaffolding. However, results did support the second hypothesis which predicted that parents will use significantly more scaffolding

and orienting behaviors than both siblings and peers. Parents used significantly more scaffolding and orienting behaviors than both siblings and peers. This supports the theory that teaching partner knowledgeability plays an important role in how effective they scaffold children's learning. In addition, with respect to contingency and sensitivity, results confirmed the third hypothesis with parents making significantly more appropriate shifts when children failed and succeeded during a scaffolding intervention than both siblings and peers did. There were no significant differences between siblings and peers in the amount of appropriate shifts made. Lastly, these results indicate no significant effect of the target child's age and gender on the amount of scaffolding they receive from their teaching partners.

Sibling age-spacing effects on building trial.

Of specific interest was the relation between scaffolding behaviors (level-1 outcome variable) and sibling age-spacing, child's age, and child's gender (level-2 predictor variables). In the first level of analysis, whether the child received a scaffolding behavior or not (dependent variable) was examined with sibling age-spacing as the level-2 predictor variable. The regression coefficient relating sibling age-spacing to scaffolding was not statistically significant ($b=0.026$, $p=0.34$). It appears that there are no significant differences in the amount of scaffolding older siblings give at various age-spacing intervals. In a second analysis, child's gender and age of the target child were added as level-2 predictor variables (with age-spacing removed from level 2). The regression coefficient relating target child gender to scaffolding behaviors was not

significant ($b=0.568$, $p=.53$). This indicates there is no significant effect of target child gender on the amount of reformulations older siblings use.

Third, sibling age-spacing, target child's age, and child's gender were included as level-2 predictor variables in a final analysis, to see if there was an effect of child's gender while controlling for sibling age-spacing. The regression coefficient relating the effect of child's gender ($b=0.033$, $p=.26$) was not statistically significant. The regression coefficient relating sibling age-spacing ($b=0.853$, $p=.37$), while controlling for target child's gender, was also not statistically significant.

Conclusions of sibling age-spacing on building trial.

These results did not confirm the third hypothesis that children in farther-spaced sibling dyads will use more scaffolding behaviors than those in closer-spaced sibling dyads, at least within the age range included in this study. Contrary to the proposal, there were no significant differences between the amount of scaffolding behaviors siblings used and their age-spacing. Results also indicate that target child's age and gender do not significantly affect the amount of scaffolding behaviors siblings used when interacting with children during the building trial.

Post Test

Descriptive statistics for all measures and outcomes in Study 2 appear in Tables 11 and 12. Numbers represent means and standard deviations within target child age group.

Total correct connections.

A 3x2 between-subjects ANOVA was conducted with total connections in the final product as the dependent variable and teaching partner (parent, sibling, or peer) and age (younger age group: 36-48 months, older age group: 49-59 months) as the independent variables. There was a significant main effect for age, $F(1,85)=8.867$, $p=.004$, partial $\eta^2=.094$, with children in the older age group connecting significantly more correct pieces in their final product ($M=4.28$, $SD=5.49$) than children in the younger age group ($M=1.57$, $SD=2.14$). No other effects were significant (teaching partner: $F(2, 85)=1.856$, $p=.163$; interaction: $F(2,85)=.400$, $p=.672$). However, the means indicated that there is a trend in the expected direction with children who worked with a parent ($M=4.03$, $SD =4.89$) constructing more total correct connections in their final product than those who worked with an older sibling ($M=2.12$, $SD =3.64$) or an older peer ($M=2.47$, $SD=4.32$), however, this difference is not statistically significant.

Then, data were split by child's age to examine if a correlation between the total pieces connected and condition existed within the two age groups. A one-way ANOVA was conducted with total correct connections during posttest as the dependent variable and teaching partner (parent, sibling, or peer) as the independent variable. Results indicate no significant effect of condition for either group (younger age group: $F(2,41)=1.142$, $p=.33$; older age group: $F(2,44)=1.195$, $p=.31$).

Total connections.

Due to the means above being low, perhaps the task was too hard for children, so total connections (correct and incorrect) during the process of constructing the final

product were investigated. A 3x2 between-subjects ANOVA was conducted with total connections in the final product as the dependent variable and teaching partner (parent, sibling, or peer) and age (younger age group: 36-48 months, older age group: 49-59 months) as the independent variables. There was a significant main effect for age, $F(1,83)=7.72$, $p<.05$, partial $\eta^2=.084$, with children in the older age group including significantly more connections in their final product ($M=5.98$, $SD=.75$) than children in the younger age group ($M=2.97$, $SD=.781$). No other effects were significant (teaching partner: $F(2, 83)=1.232$, $p=.297$; interaction: $F(2,83)=.324$, $p=.724$). However, the means indicated that there is a trend in the expected direction with children who worked with a parent ($M=5.49$, $SD =5.73$) constructing more total connections in their final product than those who worked with an older sibling ($M=3.08$, $SD =4.24$) or an older peer ($M=5.10$, $SD=5.76$), however, this difference is not statistically significant.

Next, data were split by child's age to examine if a correlation between the total pieces connected and condition existed within the two age groups. A one-way ANOVA was conducted with total connections during posttest as the dependent variable and teaching partner (parent, sibling, or peer) as the independent variable. Results indicate no significant effect of condition for either age group (younger age group: $F(2,42)=.712$, $p=.50$; older age group: $F(2,43)=1.128$, $p=.33$).

Total attempts.

Due to the means above being really low, perhaps the task was too hard for children, so I looked at total attempts (whether they tried or not) during the process of constructing the final product. A 3x2 between-subjects ANOVA was conducted with

total attempts at making connections during posttest as the dependent variable and teaching partner (parent, sibling, or peer) and age (younger age group: 36-48 months, older age group: 49-59 months) as the independent variables. The results indicated that there was a significant main effect of age, $F(1, 79)=8.43$, $p<.05$, partial $\eta^2=.096$, with children in the older age group ($M=7.16$, $SD =6.12$) making significantly more total attempts at building the car during posttest than children in the younger age group ($M=4.02$, $SD =3.57$). No other effects were significant (teaching partner: $F(2,79)=1.48$, $p=.235$, partial $\eta^2=.04$; teaching partner by age interaction: $F(2,79)=.033$, $p=.967$, partial $\eta^2=.001$). However, the means indicate a trend in an unexpected direction with those who worked with parents ($M=5.91$, $SD=5.33$) and those who worked with an older peer ($M=6.60$, $SD =5.27$) making more total attempts at building the car during posttest than those who worked with older siblings ($M=4.39$, $SD =4.71$).

Then, data were split by child's age to examine if a correlation between the total pieces connected and condition existed within the two age groups. A one-way ANOVA was conducted with total attempts at making connections during posttest as the dependent variable and teaching partner (parent, sibling, or peer) as the independent variable. Results indicate no significant effect for condition in either age group (younger age group: $F(2,43)=1.162$, $p=.32$; older age group: $F(2,42)=.838$, $p=.44$).

Table 11

Children's Post Test Performance in the Younger Age Group in Study 2, Separately by Teaching Partner

	Teaching Partner (younger age group)			
Post test performance	Parent	Sibling	Peer	ANOVA
Total correct connections	$M = 2.12$ $SD = 2.23$	$M = 0.92$ $SD = 1.51$	$M = 1.47$ $SD = 2.42$	$F = 1.142$ $p = .33$
Total connections	$M = 3.74$ $SD = 4.08$	$M = 2.36$ $SD = 2.25$	$M = 2.73$ $SD = 2.81$	$F = .712$ $p = .50$
Total attempts	$M = 5.05$ $SD = 4.39$	$M = 2.75$ $SD = 2.70$	$M = 4.20$ $SD = 4.59$	$F = 1.162$ $p = .32$

Note: No mean comparisons were significantly different

Table 12

Children's Post Test Performance in the Older Age Group in Study 2, Separately by Teaching Partner

	Teaching Partner (older age group)			
Post test performance	Parent	Sibling	Peer	ANOVA
Total correct connections	$M = 5.83$ $SD = 6.00$	$M = 3.14$ $SD = 4.59$	$M = 3.47$ $SD = 5.54$	$F = 1.195$ $p = .31$
Total connections	$M = 6.06$ $SD = 5.97$	$M = 4.00$ $SD = 5.23$	$M = 7.27$ $SD = 6.79$	$F = 1.128$ $p = .33$
Total attempts	$M = 7.19$ $SD = 6.15$	$M = 5.79$ $SD = 5.66$	$M = 8.67$ $SD = 6.14$	$F = .838$ $p = .44$

Note: No mean comparisons were significantly different

Conclusions for children's performance during post test.

Results did not confirm either prediction that children will perform better at post test when they worked with their parents and siblings than when they worked with peers and those children who worked with parents will perform better at post test than those who worked with peers or siblings. No significant differences between children's performance when they worked with parents, siblings, or peers were found. Children performed similarly at constructing correct pieces, making total connections, and attempting to make connections during post test. Although child's age was significant for total correct constructions, total attempts, and total connections, given the unexpected floor effect, we cannot conclusively draw conclusions from these results.

Sibling age-spacing effects on post test performance.

Total Correct Connections.

An independent samples t-test was conducted with total correct connections during posttest as the dependent variable and sibling age spacing (closer-spaced sibling dyads: 26-51 months; farther-spaced sibling dyads: 52-76 months) as the independent variable. Results indicate there was no significant main effect of condition $t(25)=1.677$, $p=.11$, $d=.64$. Next, a 2x3 between-subjects ANOVA was conducted to investigate interactions between sibling age spacing, target child's age, and target child's gender on total number of correct connections during post test. Sibling age spacing, child's age (younger age group: 38-50 months; older age group: 51-59 months), and child's gender served as independent variables with total correct connections as the dependent variable. Results indicate a significant main effect for child's age, $F(1,23)=9.923$, $p=.00$, partial

$\eta^2=.30$. The means indicate that 4-year-old children made significantly more correct connections ($M=3.73$, $SD=4.13$) than 3-year-old children ($M=0.00$, $SD=0.00$). No other main effects were significant (child's gender: $F(1,23)=.008$, $p=.93$, $\eta^2=.00$; sibling age spacing: $F(1,23)=1.994$, $p=.17$, $\eta^2=.08$; sibling age spacing x child's age: $F(1,23)=1.994$, $p=.17$, $\eta^2=.08$)).

Total connections.

An independent samples t-test was conducted with total connections during posttest as the dependent variable and sibling age spacing (closer-spaced sibling dyads: 26-51 months; farther-spaced sibling dyads: 52-76 months) as the independent variable. Results indicate there was no significant main effect of condition $t(25)=1.855$, $p=.08$, $d=.70$. Next, a 2x3 between-subjects ANOVA was conducted to investigate interactions between sibling age spacing, target child's age, and target child's gender on total number of connections during post test. Sibling age spacing, child's age (younger age group: 38-50 months; older age group: 51-59 months), and child's gender served as independent variables with total connections as the dependent variable. Results indicate a significant main effect of child's age, $F(1,23)=8.962$, $p=.01$, partial $\eta^2=.28$, with 4-year-old children connecting significantly more pieces ($M=5.13$, $SD=4.72$) than 3-year-old children ($M=1.00$, $SD=1.48$). No other significant effects were found (child's gender: $F(1,23)=.240$, $p=.63$, $\eta^2=.01$; sibling age spacing: $F(1,23)=3.615$, $p=.07$, $\eta^2=.14$; sibling age spacing x child's age: $F(1,23)=2.562$, $p=.12$, $\eta^2=.10$)).

Total attempts.

An independent samples t-test was conducted with total attempts at making connections during posttest as the dependent variable and sibling age spacing (closer-spaced sibling dyads: 26-51 months; farther-spaced sibling dyads: 52-76 months) as the independent variable. Results indicate a significant main effect of condition $t(25)=2.309$, $p=.03$, $d=.89$. The means indicate that children who worked in closer-spaced siblings dyads made significantly more attempts at connecting pieces ($M=6.31$, $SD=5.72$) than children who worked in farther-spaced sibling dyads ($M=2.50$, $SD=2.24$). Next, a 2x3 between-subjects ANOVA was conducted to investigate interactions between sibling age spacing, target child's age, and target child's gender on total number of attempts during post test. Sibling age spacing, child's age (younger age group: 38-50 months; older age group: 51-59 months), and child's gender served as independent variables with total attempts as the dependent variable. Results indicate a significant main effect for sibling age spacing, $F(1,23)=4.307$, $p=.05$, partial $\eta^2=.16$. The means suggest that children in the closer-spaced sibling dyads made significantly more attempts ($M=6.31$, $SD=5.72$) than children in the farther-spaced sibling dyads ($M=2.50$, $SD=2.24$). A significant main effect was also found for an interaction between sibling age spacing and child's age, $F(1,23)=6.125$, $p=.02$, $\eta^2=.21$. The means indicate that within the closer-spaced sibling dyads, 4-year-old children made significantly more attempts at connecting pieces ($M=8.75$, $SD=5.65$) than 3-year-old children ($M=2.40$, $SD=3.36$). However, the opposite was found with 3-year-old children in the farther-spaced sibling dyads making significantly more attempts at connecting pieces ($M=3.00$, $SD=2.38$) than 4-year-old

children ($M=2.00$, $SD=2.16$). No other main effects were significant (child's age: $F(1,23)=3.260$, $p=.08$, $\eta^2=.12$; child's gender: $F(1,23)=.021$, $p=.89$, $\eta^2=.001$)).

Conclusions of sibling age-spacing on post test performance.

Results partially confirmed the hypothesis that predicted children in farther-spaced dyads will perform better at post test than those in closer-spaced dyads. For total correct connections and total connections, there were no significant differences between closer and further spaced siblings. However, significant effects were only found for children's attempts at connecting pieces. First, sibling age-spacing was found to have a significant effect on children's total attempts at connecting pieces. In particular, children who worked with closer spaced siblings made significantly more attempts at connecting pieces during post test than children who worked with further spaced siblings. Second, a significant main effect was found for the interaction between sibling age spacing and child's age. In closer spaced sibling dyads, 4-year-olds made significantly more attempts at connecting pieces than 3-year-olds. The opposite was found in farther-spaced sibling dyads, with 3-year-olds making significantly more attempts at connecting pieces than 4-year-olds.

General Conclusions From Study 2

Building trial.

Results indicate that although peers are significantly worse at scaffolding and orienting children than parents, they do not significantly differ from siblings. Parents used significantly more scaffolding and orienting behaviors, as well as made more appropriate shifts, than both siblings and peers. Siblings and peers did not differ in the

amount of appropriate shifts made. Further, no significant differences were found between sibling age spacing, target child's gender, and target child's age on the amount of scaffolding behaviors used.

Post test.

The current research found no significant differences between teaching partner and children's performance during independent post test. Child's age was significant across conditions with 4-year-olds performing better during post test than 3-year-olds. However, given the unexpected floor effect, conclusions cannot be conclusively drawn from these results. Lastly, a significant effect was found between sibling age-spacing and children's post test performance, but only with respect to total attempts.

Study 3: Reward Study

It is unclear why we see these differences between parents and siblings because parents and siblings have similar amounts of experience with the child, so familiarity could not be accounting for this difference (Study 2). It could be that parents are more motivated to help the child succeed than older siblings are. In other words, parents may view the task as an opportunity to give their child skills that they will be able to extend to other problems they may encounter, whereas siblings may view the goal of the scaffolding interaction to just complete the task as quickly as possible. Thus, this study attempted to change siblings' goal so that it is more in line with the parents' goal, by offering an incentive to control for motivation. Study 3 uses a different methodology to explore parental and sibling scaffolding to give a broader picture of these behaviors; while this study has separate goals of its own, it also is designed to complement the methodological particulars of Study 2.

Specifically, this study is designed to test the following hypothesis:

Hypothesis 1: With respect to knowledgeability, parents may use significantly more scaffolding and orienting behaviors than siblings.

Hypothesis 2: With respect to motivation, siblings may significantly improve in the amount of scaffolding and orienting behaviors they use in this study than in Study 2.

Hypothesis 3: With respect to contingency and sensitivity, parents may make significantly more appropriate shifts when children fail and succeed than siblings.

Hypothesis 4: Siblings in farther-spaced dyads may use more scaffolding behaviors and orienting behaviors, and may make more appropriate shifts than siblings in closer-spaced dyads.

Hypothesis 5: Children who worked with their parents may perform better during post test than children who worked with their older siblings.

Hypothesis 6: Children in farther-spaced dyads may perform better at post test than those in closer-spaced dyads.

Participants and Procedure

In this study, 63 children aged 3;0 to 4;11 participated in the same two sessions as in Study 2. During the building trial, children were randomly assigned to build the replica with either the help of their parent (N=32) or a sibling (N=28) who is 2-6 years older than the target child. Teaching partners received no formal training on the paradigm. During this initial session, motivation was controlled by introduction of a reward in the sibling condition that if the child succeeds in the final session, both the

sibling and child will receive a reward. In the posttest, children built a replica of a new Constructor toy car on their own to determine how well they generalize the skills acquired during interaction dependent on who helped them. In addition, because two children could not be left alone together in the experimental room unsupervised, in all conditions and both trials (building trial and post test) of this study an undergraduate research assistant, whose only task was to sit in the corner and read, was present in the research room. This research assistant was not an active part of the study and did not interact with the parents, children, or siblings. The participants were told that the research assistant was working on another project, and that the research assistant would not interrupt their play, and should not be talked to.

Data Analysis

A video recording was made of the conversation between parents, siblings, and children, and these recordings were transcribed for data analysis. The conversations were coded using the same scaffolding behaviors coding used in Study 2. For transcriptions, interrater reliability was calculated by taking the number of times two independent transcribers agreed on transcript lines divided by the total number of lines in a given file. The percentage agreement between the transcribers was .95 averaged across subjects. For coding, interrater reliability was calculated by taking the number of times two independent coders agreed on codes divided by the number of codes in a given file. A team of eight coders were used, with two coders paired up on a given set of files. The percentage agreement between the coders was .95 averaged across subjects. In addition,

the same scaffolding behaviors, orienting, and appropriate shift coding schemas used in Study 2 will be applied to this data as well.

Building trial analyses.

In order to investigate the binary outcome of differences in scaffolding behaviors, orienting behaviors, and appropriate shifts dependent on condition, target child's age (in months, as a continuous variable), and target child's gender, a 2-level HLM model was conducted. First, scaffolding was added as a level-1 outcome variable with teaching partner, target child's age, and target child's gender added as level-2 predictor variables. Second, orienting was added in as a level-1 outcome variable in the model with teaching partner, target child's age, and target child's gender added as level-2 predictor variables. Third, appropriate shift was added as level-1 outcome variable, with teaching partner, child's age, and child's gender added as level-2 predictor variables

Lastly, in order to examine sibling age-spacing effects on scaffolding behaviors, a two-level HLM was conducted. Scaffolding was added as a level-1 outcome variable with gender of the target child, target child's age, and sibling age-spacing (as a continuous variable) added as predictor variables in level-2.

Post test analyses.

In order to examine whether post test performance varied dependent on teaching partner two analyses were conducted. First, a series of independent samples t-tests were conducted across dyadic conditions, with teaching partner as an independent variable and post test performance (e.g. total correct connections, total connections, total attempts) as

dependent variables. Second, a series of between-subjects ANOVAs were also conducted to investigate sibling age-spacing effects on children's post test performance. Second, a series of between-subjects ANOVAs were also conducted to investigate sibling age-spacing, target child's age, and target child's gender on children's post test performance. In particular, 3 separate ANOVAs were run for each age group with independent performance as the dependent variable and teaching partner (parent or sibling) as the independent variable.

Results

Building trial.

Raw numbers of teaching partner behaviors while interacting with the target child in Study 3 appear in Tables 13, 14, and 15. Total behaviors represent all scaffolding and orienting behaviors, appropriate shifts, as well as other behaviors not investigated in this research. 18,806 total behaviors were made and of that, parents made 8,976 total behaviors with siblings making 9,830 total behaviors. Further, percentages represent the number of occurrences out of total occurrences within conditions based on percentage of likelihood within that specific condition. For example, out of 12,452 total behaviors made by parents, 1,568 or 17% of them were labeled as scaffolding behaviors with 7,408 or 83% of them some other behavior not categorized as scaffolding.

Descriptive statistics for all measures and outcomes in Study 3 appear in Table 16. Numbers represent probabilities or likelihoods using a particular type of behavior within condition, not within the total occurrence of behaviors. Although teaching partners

displayed a variety of behaviors, analyses only focus on the sub-class of behaviors (e.g. scaffolding, orienting, and appropriate shifts).

Table 13

Number of Scaffolding and Non-Scaffolding Behaviors Produced While Interacting with the Target Child in Study 3, Separately by Teaching Partner

	Behaviors while interacting with target child		
Teaching partner	Total behaviors	Scaffolding behaviors	Non-scaffolding behaviors
Parent	8,976	1,568 (17%)	7,408 (83%)
Sibling	9,830	650 (7%)	9,180 (93%)

Table 14

Number of Orienting and Non-Orienting Behaviors Produced While Interacting with the Target Child in Study 3, Separately by Teaching Partner

	Behaviors while interacting with target child		
Teaching partner	Total behaviors	Orienting behaviors	Non-orienting behaviors
Parent	8,976	425 (5%)	8,551 (95%)
Sibling	9,830	327 (3%)	9,503 (97%)

Table 15

Number of Appropriate Shifts and No Shifts Produced While Interacting with the Target Child in Study 3, Separately by Teaching Partner

Teaching partner	Behaviors while interacting with target child		
	Total behaviors	Appropriate Shifts	No shifts
Parent	8,976	931 (10%)	8,045 (90%)
Sibling	9,830	306 (3%)	9,524 (97%)

Scaffolding behaviors.

First, parents and siblings were added as level-2 predictor variables. The regression coefficient comparing scaffolding behaviors between parents and siblings was statistically significant ($b=2.123$, $p=0.000$). It appears that parents used significantly more scaffolding behaviors than older siblings did. It implies differences in proportions of scaffolding behaviors between parents and siblings with parents having an increased likelihood of using scaffolding behaviors (14%) than siblings (2%).

Second, target child's age (in months) and gender were added as level-2 predictor variables. The regression coefficient relating the target child's age to scaffolding was not statistically significant ($b=-0.012$, $p=0.72$). This indicates no significant effect of target child age on the amount of scaffolding behaviors they receive from parents and siblings. The regression coefficient relating target child gender to scaffolding behaviors was also

not statistically significant ($b=0.219$, $p=0.47$). There appears to be little evidence of a gender effect. This indicates no significant effect of the child's gender on the amount of scaffolding they receive from parents and siblings.

In order to compare siblings from Study 2 with siblings from Study 3 to see if providing a reward improved their scaffolding behaviors, a two-level HLM was conducted. Siblings from Study 2 and siblings from Study 3 were added as level-2 predictor variables. The regression coefficient comparing scaffolding behaviors between these two sets of siblings was not statistically significant ($b=0.251$, $p=0.69$). It appears that siblings who were offered an incentive did not use significantly more scaffolding behaviors than older siblings who were not offered a reward.

Orienting the child.

First, parents and siblings were added as level-2 predictor variables. The regression coefficient comparing orienting behaviors between parents and siblings was statistically significant ($b=0.602$, $p=0.02$). It appears that parents used significantly more orienting behaviors than older siblings did. This implies differences in proportions of orienting behaviors between parents and siblings with parents having a higher probability of using orienting behaviors (5%) than siblings (3%).

Then, target child's age and gender were added as level-2 predictor variables. The regression coefficient relating the target child's age to orienting was negative and not statistically significant ($b=-0.006$, $p=0.72$). This indicates no significant effect of target child age on the amount of orienting behaviors they receive from parents and siblings.

The regression coefficient relating target child gender to orienting behaviors was also negative and not statistically significant ($b=-0.022$, $p=0.88$). This indicates no significant effect of the child's gender on the amount of orienting they receive from parents and siblings.

Appropriate shifts.

Parent was added as a level-1 predictor variable, while sibling was the reference category. The regression coefficient comparing appropriate shifts between parents and siblings was statistically significant ($b=2.371$, $p=0.000$). Parents made significantly more appropriate shifts than siblings did. This implies differences in proportions of appropriate shifts used during scaffolding between parents and siblings with parents having an increased likelihood of making an appropriate shift (10%) than siblings (1%).

Next, target child's age and gender were added as level-2 predictor variables. The regression coefficient relating target child gender to appropriate shifts was statistically significant ($b=0.037$, $p=0.21$). This indicates no significant effect on the amount of appropriate shifts children receive whether they are male or female. The regression coefficient relating the target child's age to scaffolding was negative and not statistically significant ($b=-0.016$, $p=0.95$). This indicates no significant effect of target child age on the amount of appropriate shifts in scaffolding they receive from parents and siblings.

Table 16

Percent Chance of Behaviors Produced While Interacting with the Target Child in Study 3, Separately by Teaching Partner

Teaching partner	Probability of behaviors while interacting with target child		
	Scaffolding behaviors	Orienting behaviors	Appropriate shifts
Parent	.14 ^a	.05 ^a	.10 ^a
Sibling	.02 ^b	.03 ^b	.01 ^b

Note: Probabilities or likelihoods of producing a specific behavior while interacting with the target child

Note: Entries with different superscripts are significantly different from each other, $p \leq .05$

Conclusions building trial results.

Results confirmed the first hypothesis which predicted that parents will use significantly more scaffolding and orienting behaviors than siblings. Parents did use significantly more scaffolding and orienting behaviors than siblings did. This confirms results from Study 2 and supports the prediction that teaching partner knowledgeability plays an important role in how effective they scaffold children's learning. However, target child's age and gender did not play a significant role in the amount of scaffolding and orienting behaviors they received. Results did not support the second hypothesis that siblings in this study would use more scaffolding and orienting behaviors than siblings used in Study 2. This suggests that, at least under these conditions, motivation does not seem to play in role in siblings' scaffolding and orienting behaviors. With respect to contingency and sensitivity, results support the third hypothesis finding that parents made

significantly more appropriate shifts when children failed and succeeded during scaffolding interventions than siblings did.

Sibling age-spacing effects on scaffolding behaviors

Of specific interest was the relation between scaffolding behaviors (level-1 outcome variable) and sibling age-spacing, child's age, and child's gender (level-2 predictor variables). In the first level of analysis, whether the child received a scaffolding or not (dependent variable) was examined with sibling age-spacing as the level-2 predictor variable. The regression coefficient relating sibling age-spacing to scaffolding was statistically significant ($b=0.077$, $p=0.03$). It appears that there are significant differences in the amount of scaffolding older siblings give at various age-spacing intervals, with further spaced siblings using significantly more scaffolding behaviors than closer spaced siblings. From the smallest (25 months) to the median age-spacing (42 months) and the largest age-spacing (76 months), there were differences in proportions of turning it back responses. In largest age spaced sibling pairs, older siblings used more scaffolding (10%) than both the median age spaced siblings (.07%) and the smallest age spaced siblings (.02%). Further, median age spaced siblings used more scaffolding behaviors than the smallest age spaced siblings.

In a second analysis, child's gender and age of the target child were added as level-2 predictor variables (with age-spacing removed from level 2). The regression coefficient relating target child gender to scaffolding behaviors was not significant ($b=-1.087$, $p=.25$). This indicates there is no significant effect of target child gender on the

amount of reformulations older siblings use. Third, sibling age-spacing, target child's age, and child's gender were included as level-2 predictor variables in a final analysis, to see if there was an effect of child's gender while controlling for sibling age-spacing. The regression coefficient relating the effect of child's gender ($b=-1.017$, $p=.28$) was not statistically significant. The regression coefficient relating the effect of sibling age ($b=0.069$, $p=.06$), while controlling for target child's gender, was also not statistically significant.

Conclusions from sibling age-spacing on building trial.

These results confirmed the fourth hypothesis with siblings in farther-spaced sibling dyads using more scaffolding behaviors and orienting behaviors, and making more appropriate shifts while interacting with children than siblings in closer-spaced dyads. Results also indicate that target child's age and gender do not significantly affect the amount of scaffolding behaviors siblings used when interacting with children during the building trial.

Post test.

Descriptive statistics for all measures and outcomes in Study 3 appear in Tables 17 and 18. Numbers represent means and standard deviations within target child age group.

Total correct.

First, a 2x2 between-subjects ANOVA was conducted with total connections in the final product as the dependent variable and teaching partner (parent or sibling) and age (younger age group: 36-48 months, older age group: 49-59 months) as the independent

variables. No effects were significant (child's age in years: $F(1,62)=.005$, $p=.947$, partial $\eta^2=.000$ teaching partner: $F(1, 62)=1.937$, $p=.169$, partial $\eta^2=.03$; interaction: $F(1,62)=2.263$, $p=.138$, partial $\eta^2=.04$). However, the means indicated that there is a trend in the expected direction with children who worked with a parent ($M=4.27$, $SD=.978$) constructing more total connections in their final product than those who worked with an older sibling ($M=2.27$, $SD=1.057$), however, this difference is not statistically significant.

Second, a more fine grain approach was taken with respect to the target child's age by splitting the data by child's age to see whether there was a correlation between the total correct pieces and condition within the two age groups. An independent samples t-test was conducted with total correct connections during posttest as the dependent variable and teaching partner (parent or sibling) as the independent variable. Results indicate there was a significant main effect of condition $t(31)=2.43$, $p=.021$, $d=.84$, within the older age group. For older children, those who worked with their parents connected significantly more correct pieces in their final product ($M=6.13$, $SD=7.88$) than children who worked with their older siblings ($M=1.24$, $SD=2.54$). However, condition was not significant, $t(31)=-.207$, $p=.837$, $d=.07$ within the younger age group.

Total connections.

Perhaps the task was too hard for children, due to the low means above, so total connections (incorrect pieces included) during the process of constructing the final product was examined. A 2x2 between-subjects ANOVA was conducted with total connections in the final product as the dependent variable and teaching partner (parent or sibling) and age (younger age group: 36-48 months, older age group: 49-59 months) as

the independent variables. No effects were significant (child's age in years: $F(1,62)=.148$, $p=.317$, partial $\eta^2=.002$ teaching partner: $F(1, 62)=1.019$, $p=.317$, partial $\eta^2=.016$; interaction: $F(1,62)=1.897$, $p=.173$, partial $\eta^2=.030$). However, the means indicated that there is a trend in the expected direction with children who worked with a parent ($M=4.62$, $SD =6.84$) constructing more total connections in their final product than those who worked with an older sibling ($M=2.78$, $SD =4.38$), although this difference is not statistically significant.

Next, data were split by child's age to see whether there was a correlation between the total pieces connected and condition within the two age groups. An independent samples t-test was conducted with total connections during posttest as the dependent variable and teaching partner (parent or sibling) as the independent variable. Results indicate there was a significant main effect of condition $t(31)=2.08$, $p=.04$, $d=.72$, within the older age group. Children who worked with their parents connected significantly more pieces in their final product ($M=6.56$, $SD=7.94$) than children who worked with their older siblings ($M=2.12$, $SD=3.76$). Condition was not significant, $t(31)=-.355$, $p=.725$, $d=.12$ within the younger age group.

Total Attempts.

Due to the means above being really low, connecting any pieces within the task may have been too difficult for children, total attempts (whether they tried or not) during the process of constructing the final product were examined. A 2x2 between-subjects ANOVA was conducted with total attempts at making connections during posttest as the dependent variable and teaching partner (parent or sibling) and age (younger age group: 36-48 months, older age group: 49-59 months) as the independent variables. No effects

were significant (target child's age: $F(1, 62)=.126$, $p=.724$, partial $\eta^2=.002$; teaching partner: $F(1, 62)=.965$, $p=.330$, partial $\eta^2=.015$; teaching partner by age interaction: $F(1, 62)=.1913$, $p=.172$, partial $\eta^2=.03$) . However, the means indicate a trend with those who worked with parents ($M=4.59$, $SD =6.81$) making more total attempts at building the car during posttest than those who worked with older siblings ($M=2.81$, $SD =4.37$).

Then, data were split by child's age to examine if a correlation between the total pieces connected and condition existed within the two age groups. An independent samples t-test was conducted with total attempts at making connections during posttest as the dependent variable and teaching partner (parent or sibling) as the independent variable. Results indicate there was a significant main effect of condition $t(31)=2.03$, $p=.05$, $d=.70$, within the older age group. Children who worked with their parents making significantly more attempts at connecting pieces in their final product ($M=6.50$, $SD=7.89$) than children who worked with their older siblings ($M=2.18$, $SD=3.76$). Condition was not significant, $t(31)=-.355$, $p=.725$, $d=.12$ within the younger age group.

Table 17

Children's Post Test Performance in the Younger Age Group Study 3, Separately by Teaching Partner

	Teaching Partner (younger age group)		
Post test performance	Parent	Sibling	t-test
Total correct connections	$M = 2.17$ $SD = 5.42$	$M = 2.53$ $SD = 4.60$	$t = -.207$ $p = .84$
Total connections	$M = 2.89$ $SD = 5.33$	$M = 3.53$ $SD = 5.01$	$t = -.355$ $p = .73$
Total attempts	$M = 2.89$ $SD = 3.53$	$M = 5.33$ $SD = 5.01$	$t = -.355$ $p = .73$

Note: No entries were significantly different from each other

Table 18

Children's Post Test Performance in the Older Age Group in Study 3, Separately by Teaching Partner

	Teaching Partner (older age group)		
Post test performance	Parent	Sibling	Peer
Total correct connections	$M = 6.13$ $SD = 7.88$	$M = 1.24$ $SD = 2.54$	$t = 2.43$ $p = .02^*$
Total connections	$M = 6.56$ $SD = 7.94$	$M = 2.12$ $SD = 3.76$	$t = 2.08$ $p = .04^*$
Total attempts	$M = 6.50$ $SD = 7.89$	$M = 2.18$ $SD = 3.76$	$t = 2.03$ $p = .05^*$

Note: Entries with asterisks indicate $p \leq .05$

Conclusions of children's performance during post test.

Although child's age was not significant for total correct constructions, total attempts, and total connections, when the data were ranked by child's age in months and split, a significant effect of condition appeared, but only within the older age group. No significant effects were found within the younger age group, similar to post test results in Study 2.

Sibling age-spacing effects on post test performance.

Total correct.

An independent samples t-test was conducted with total correct connections during posttest as the dependent variable and sibling age spacing (closer-spaced sibling dyads: 26-51 months; farther-spaced sibling dyads: 52-76 months) as the independent variable. Results indicate there was no significant main effect of condition $t(29) = .34$, $p = .74$, $d = .12$. Next, a 2x3 between-subjects ANOVA was conducted to investigate interactions between sibling age spacing, target child's age, and target child's gender on total number of correct connections during post test. Sibling age spacing, child's age (younger age group: 38-50 months; older age group: 51-59 months), and child's gender served as independent variables with total correct connections as the dependent variable. Results indicate a significant main effect for child's age, $F(1,23) = 4.362$, $p = .04$, partial $\eta^2 = .16$. No other main effects were significant (child's gender: $F(1,23) = 1.131$, $p = .30$, $\eta^2 = .05$; sibling age spacing: $F(1,23) = .737$, $p = .40$, $\eta^2 = .03$).

Total connections.

An independent samples t-test was conducted with total connections during posttest as the dependent variable and sibling age spacing (closer-spaced sibling dyads: 26-51 months; farther-spaced sibling dyads: 52-76 months) as the independent variable. Results indicate no significant main effect of condition $t(29)=.41$, $p=.69$, $d=.15$. Next, a 2x3 between-subjects ANOVA was conducted to investigate interactions between sibling age spacing, target child's age, and target child's gender on total number of connections during post test. Sibling age spacing, child's age (younger age group: 38-50 months; older age group: 51-59 months), and child's gender served as independent variables with total connections as the dependent variable. Results indicate no significant main effects (child's age, $F(1,23)=2.727$, $p=.11$, partial $\eta^2=.11$; child's gender: $F(1,23)=.154$, $p=.70$, $\eta^2=.01$; sibling age spacing: $F(1,23)=.511$, $p=.48$, $\eta^2=.02$)).

Total attempts.

An independent samples t-test was conducted with total attempts at making connections during posttest as the dependent variable and sibling age spacing (closer-spaced sibling dyads: 26-51 months; farther-spaced sibling dyads: 52-76 months) as the independent variable. Results indicate no significant main effect of condition $t(29)=.37$, $p=.72$, $d=.13$. Next, a 2x3 between-subjects ANOVA was conducted to investigate interactions between sibling age spacing, target child's age, and target child's gender on total number of attempts during post test. Sibling age spacing, child's age (younger age group: 38-50 months; older age group: 51-59 months), and child's gender served as independent variables with total attempts as the dependent variable. Results indicate no significant

main effects (child's age, $F(1,23)=3.731$, $p=.07$, partial $\eta^2=.01$; child's gender: $F(1,23)=.184$, $p=.67$, $\eta^2=.14$; sibling age spacing: $F(1,23)=.515$, $p=.48$, $\eta^2=.02$).

Conclusions of sibling age-spacing effects on post test performance.

Contrary to the third hypothesis that children in farther-spaced dyads will perform better at post test than those in closer-spaced dyads, no significant differences between sibling age-spacing and how children performed during post test were found. Children who worked with closer spaced siblings performed similarly to those children who worked with further spaced siblings. Children built similar amounts of correct connections and total connections, and made similar amounts of attempts at constructing pieces during post test. There was also no evidence of a significant gender difference between children's performance in relation to sibling age-spacing.

General conclusions from Study 3.

Building trial.

Results indicate that siblings are significantly worse at scaffolding and orienting children than parents. Parents used significantly more scaffolding and orienting behaviors, as well as made more appropriate shifts, than did siblings. Compared to study 2, siblings in this study did not improve in the amount of scaffolding behaviors used despite the introduction of a reward. However, sibling age-spacing was significant with farther-spaced siblings providing more scaffolding behaviors than closer-spaced siblings. Lastly, no significant differences were found between target child's gender and target child's age on the amount of scaffolding behaviors used.

Post test.

The current research found no significant differences between teaching partner and children's performance during independent post test. Only when children were split into two groups based on age, was a significant effect found for condition in the older age group. Child's age was significant across conditions with 4-year-olds performing better during post test than 3-year-olds. However, given the unexpected floor effect, we cannot conclusively draw conclusions from these results. Further, no significant effects were found between sibling age-spacing and post test performance.

CHAPTER III: DISCUSSION

Summary

This research set out to address four research questions related to children's conversation with people other than their parents and differences in scaffolding behaviors between parents, siblings, and peers. Results are summarized here:

1. Do children benefit with conversation equally from people other than their parents?

For some outcomes, children receive more beneficial information from other people than from their own parents. However, in other situations, parents are more beneficial conversational partners for children.

2. Who is better at scaffolding among parents, siblings, and peers?

Consistently across behaviors, parents are most skilled at scaffolding their children's learning. Siblings and peers remain less adept. However, how this translates to children's individual post test performance remains inconclusive.

3. Why are certain teaching partners better than others with respect to scaffolding, and what role is played by: knowledgeability, familiarity, and motivation?

Knowledgeability and familiarity both seem to play a role in scaffolding effectiveness. At least in the current context, more knowledgeable and more familiar teaching partners seem to be better at scaffolding. However, motivation, as it was studied in this dissertation, seems not to play an important role in teaching partner's scaffolding abilities.

4. What role does sibling age-spacing play? In the current studies, sibling age

spacing did not make a significant difference on their behavior during conversation or a scaffolding situation with a younger sibling. Closer-spaced siblings behaved similarly to farther-spaced siblings across tasks.

Findings pertaining to these questions will now be discussed in more detail.

Do Children Benefit With Conversation Equally From People Other Than Their Parents?

The first question of whether children benefit with conversation equally from people other than their parents was addressed in Study 1. Children engaged in a free play task with either their parent, older siblings, or other adults. As discussed in the introduction, previous research suggests that children discriminate between different sources of knowledge, and do not treat all sources of information as being equally reliable (e.g. Corriveau and Harris, 2009b). Further, differences between different conversation partners would seem to predict different patterns of interaction with children; conversation partners who are more knowledgeable or who are more familiar to the child should lead to greater question-asking. Partners who are less knowledgeable, less familiar with the child's needs, and less motivated to assist the child should provide less information, turning it back responses, and reformulations to children.

In addition, as discussed in the introduction, one example of the overlap between conversation and scaffolding are reformulations, a process by which conversation can scaffold language itself. Previous research has found that parents provide corrective information for as many as two-thirds of children's erroneous utterances (Chouinard & Clark, 2003). Although parent reformulations have been investigated in the conversation literature, they have not been examined with respect to scaffolding, and it is unclear

whether other people would be equally likely to reformulate children's erroneous utterances.

These possibilities were only partially confirmed by the current research. Children asked significantly more information-seeking questions of parents and siblings than of other adults. Further, a pattern of results emerged that partially seems to indicate that familiarity and motivation leads to a higher level of response. Parents were actually significantly less likely to answer their children's questions informatively than the other adults were, but significantly more likely to reflect a question back to children. Although siblings did not provide more informative or turning it back responses than other adults, surprisingly, they provided significantly more informative responses than parents. Both parents and other adults were significantly more likely to provide reformulations to children's erroneous utterances than siblings were, but they did not differ from each other. This study provided an important first step in testing the primary question of interest, because very little prior research (e.g. Perez-Granados, 2002) had examined children's conversations with people other than their parents and more importantly, whether children equally benefit from these conversations with other people. In addition, previous research had not explored the effect of sibling age-spacing during conversation, but that was done in this study.

Who is Better at Scaffolding Among Parents, Siblings, and Peers?

The question of who is better at scaffolding among parents, siblings, and peers was addressed in both Studies 2 and 3, where children engaged in a building task with either their parent, older sibling, or an older peer (age-matched to the siblings). After the

building task, children built the same car independently during post test. As discussed in the introduction, much previous work has focused on parental scaffolding, finding that they are very skilled tailoring their instruction to their children's learning needs (e.g. Wood & Middleton, 1975). However, less research has examined peer and sibling scaffolding, but available research suggests that they are not as effective at scaffolding as are parents (e.g. Cicirelli, 1976; Shute, Foot, & Morgan, 1992).

The current research supports previous findings in the literature. Both peers and siblings used significantly less scaffolding and orienting behaviors than parents, but did not differ from each other. Parents also made significantly more appropriate shifts when children failed and succeeded than did both siblings and peers. However, whether different teaching partners lead to better or worse independent performance during post test remains inconclusive. The current studies are the first to test difference among teaching partners and their effect on children's independent performance. Whereas a significant direct effect of condition on post test performance was not found, a few noteworthy and important trends did emerge from Studies 2 and 3. For example, the means of children's performance during post test indicate a trend in the expected direction. That is, children who worked with their parents constructed more correct and total pieces in their final product than those who worked with an older sibling or older peer. Interestingly, the means of total attempts made by children indicate a trend in an unexpected direction, where children who worked with peers making more total attempts than those who worked with parents and siblings.

In addition, there are some hints as to why no significant differences in children's post test performance was found. For one, these findings may be due to the task being

too hard for children to complete independently. Although child's age was significantly associated with performance during post test, we cannot draw firm conclusions from these results because of the unexpected floor effect. One should be cautious about concluding that teaching partner has no effect on independent performance because the task may have been too difficult. More research is needed with an easier task before we can conclusively state that children benefit equally from all teaching partners.

Why Are Certain Teaching Partners Better Than Others With Respect to Scaffolding?

The roles of knowledgeability, familiarity, and motivation were examined to learn why certain teaching partners do better than others with respect to scaffolding. Study 2 and Study 3 provided important first steps in testing this question, which is the first attempt ever, to our knowledge, to investigate *why* differences in scaffolding behaviors exist between teaching partners. Differences between varying teaching partners would seem to predict different patterns of interaction with children; teaching partners who are more knowledgeable, familiar with the child, and motivated should be more likely to provide scaffolding and orienting to the child. They should also be more sensitive to the child's cognitive needs and be more adept at providing appropriate shifts throughout the course of interaction. Partners who are less knowledgeable, familiar with the child's needs, and motivated to assist the child should provide less scaffolding, orienting, and appropriate shifts to the child.

These propositions were partially confirmed. At least in the current situations, it appears that more knowledgeable and more familiar teaching partners, such as parents, are more skilled at scaffolding children's learning than less knowledgeable and less

familiar partners, such as siblings and peers. To investigate the role of motivation, Study 3 introduced an important control for motivation. The procedure remained the same as in Study 2, except during the teaching trial where a reward was introduced to the siblings to manipulate motivation. Previous research has shown that siblings and parents may have important differences in goals during scaffolding interactions, but this has not previously been controlled. This difference in goals may result from a difference in motivation. In this study, providing a reward was an attempt to change the siblings' goal so that it is more similar to the parents' goal.

Despite enhancing motivation for the siblings, parents still provided significantly more scaffolding and orienting behaviors and appropriate shifts than did siblings. Further, no significant effect on the amount of scaffolding behaviors was found due to sibling motivation in Studies 2 and 3. It appears that siblings who were provided an incentive did not use more scaffolding behaviors than siblings who were not. This suggests that, at least under these conditions, motivation does not seem to play a role in siblings' scaffolding behaviors.

What Role Does Sibling Age-Spacing Play?

The role of sibling age-spacing on siblings' behaviors was addressed in all three studies. Previous research is mixed with respect to the effect of sibling age-spacing during scaffolding. Some research has suggested that that further spaced older siblings are better teaching partners than closer spaced siblings (e.g. Maynard, 2000), while other research has not found this effect at all (e.g. Pepler et al., 1981). The present research attempted to reconcile this inconsistency in the literature.

Across all studies, sibling age-spacing does not seem to have a significant effect on siblings' behaviors during conversation and scaffolding interactions with children. Only in Study 2, did a significant effect emerge for sibling age-spacing for children's independent performance during post test. Children who worked in closer-age-spaced sibling dyads made significantly more attempts at connecting pieces than children who worked in father-age-spaced dyads during independent post test. Although sibling age-spacing has never been examined before in conversation research, these findings were consistent with previous studies in the scaffolding literature (e.g. Dunn & Kendrick, 1981b). Although some previous research has found that close age-spacing is beneficial for girls, but detrimental for boys (e.g. Sutton-Smith & Rosenberg, 1970), the current studies gave no evidence of a significant gender difference. Males and females performed similarly regardless of how close or far apart sibling age spacing was.

General Discussion

This research is among the first to investigate whether children equally benefit from conversation during interactions with people other than their parents and why some

teaching partners are better at scaffolding than others by examining three possible underlying factors. Not only did these studies implement better methodology, but they are also the first to measure children's *independent* performance after the scaffolding interaction. Taken together, these findings indicate that children do not benefit equally from conversation with people other than their parents. The current research also echoes the findings of previous studies in that parents are most effective at scaffolding when compared to siblings and other adults.

Applied Implications

While the results from the present research have direct implications for the field of conversation and scaffolding, they may also have implications for parenting practices. For example, this research can inform the strategies parents use when helping their children with homework and how their involvement contributes to their children's learning. Parents and others who interact regularly with children often bring a major strength to the children's learning process, especially their knowledge of individual children's learning styles and preferences. To help effectively, a parent needs to recognize what his/her child currently understands and what guidance and activities are likely to help the child achieve the next level of understanding. Scaffolding provides a framework for parents to do this. For example, parents should offer much parental support and intervention during the initial phase of learning, followed by less help and movement towards learner independence as the child gains skill and confidence in the area.

Another example of how this work informs parenting relates to emergent literacy skills in very young children. Conversation and scaffolding provide a guide for a variety of strategies parents can use to keep their children involved. Examples are asking questions, labeling pictures, elaborating on actions in the book, and responding to children's questions while adapting the literacy interaction to fit within the child's current developmental level.

In addition, these results help to further spread knowledge of how children learn from a variety of partners. If children are willing to ask questions of and receive help from siblings, and even strangers, such as other adults and unfamiliar peers, and can count on getting informative responses from them, they are likely to rely on these strangers helping them in other ways as well. These studies suggest that other aspects of learning through conversation and scaffolding may not be limited to just parents. Instead, they support the possibility that other people give children information both when asked and without waiting to be asked. So, conversation not only allows children the opportunity to learn from their parents, but from the other individuals they encounter in their day, as well.

It is important to understand the process of scaffolding for children's learning, and how it varies depending on a variety of factors. This research contributes to the growing body of scaffolding literature and provides evidence supporting previous results finding that siblings and peers are not as effective at scaffolding as parents are. Although the studies reported here emphasize the facilitating role in children's learning from effective scaffolding, they do not suggest that peer and sibling interaction plays no role in

children's cognitive development. Rather, these studies simply conclude that, during problem-solving tasks, there are more cognitive benefits from interacting with a parent, who is more skilled and adept at scaffolding. This does not rule out the possibility that children may gain additional benefits from working with siblings and other adults during problem-solving tasks that were not addressed herein.

Limitations and Future Research Directions

One limitation of the current research was the difficulty of the scaffolding task for children, especially the younger age group of 3-year-olds. Findings were inconclusive with respect to the effects of teaching partner on children's independent performance. Given the unexpected floor effect for the younger age group, it appears that this task may have been too difficult for them to attempt, let alone complete successfully. Research using an easier task is needed before it is possible conclusively to state that teaching partner does not have an effect on children's performance. Future research need to use more age-appropriate tasks to ascertain that differences in individual post test performance is due solely to a difference in teaching partner.

Another limitation of this work is that, at least in the scaffolding studies, all peers who participated were unfamiliar to the target children. It is unclear what role peer familiarity may have played in scaffolding. Perhaps more familiar peers would be better able to scaffold children's learning. In addition, children may be more receptive to their efforts of familiar peers. Future work should investigate this possibility by using both familiar and unfamiliar peers. Examining the similarities or differences that emerge

between the two groups of peers may also help to tease apart the underlying role that familiarity plays in a teaching partner's ability to scaffold effectively.

Further, this work was limited in that participants' primary language was English. It is unclear if and how the benefits of conversation and scaffolding would change if other languages were included. For example, reformulations of children's erroneous errors may be manifested differently in different languages. Also, based on cross-cultural work, native Latino-speaking siblings may be better at scaffolding due to increased experience in the caregiving role (Janes & Kermani, 1997). Future research should include a variety of primary languages to examine if this has any effect on conversation and teaching partners' scaffolding behavior.

In addition, this research did not measure the goals of parents or siblings. Previous work has suggested that they have different goals, which may impact their scaffolding behaviors (e.g. Verba & Marcos, 1995). Taking a measure of explicit goals before the building trial takes place would accomplish this. If siblings maintain the goal of completing the task as quickly as possible, even at the expense of engaging the child in the task, this may contribute to differences in motivation and why they are not as effective at scaffolding as parents are.

Lastly, this research is limited by the fact that it only takes into account immediate performance and does not examine any sustainable, long-term learning effects. This could be examined by an investigation of whether or not children actually retain what they have learned from these interactions differently dependent on who they interacted with. There would need to be some evidence that working with a particular

partner resulted in better independent learning and performance at a later point in time (e.g. 2 weeks later).

More generally, future studies should take account of the effects of children's current cognitive abilities and perceived task demands/difficulty on teaching partners' scaffolding behaviors. Previous work has found that parents' awareness of children's cognitive abilities/age, task demands, difficulty, concepts and context had strong effects on their scaffolding behaviors (e.g. Sonnenschein, et al., 1993), but failed to examine how these may influence siblings' and peers' scaffolding behaviors. It is important to investigate the role of these variables, not only when examining parental scaffolding, but also scaffolding provided by other teaching partners.

Future research should also examine the effects of sibling gender. Previous research has suggested that older sisters are more effective teachers than older brothers, both utilizing different teaching strategies (e.g. Brody et al, 1985) and that younger siblings also respond differently to sisters and brothers (e.g. Cicirelli, 1974). It is important for future research to examine how teaching partner gender may influence scaffolding behaviors as well as children's willingness to learn from people of different genders. Similarly, although previous work has focused on teaching behavior differences between same-sex versus opposite-sex sibling pairs, this research is mixed. Some researchers have found more positive teaching behavior between opposite-sex sibling pairs than same-sex sibling pairs (e.g. Stoneman et al., 1984), while others have found just the opposite (e.g. Dunn and Kendrick, 1981). Future research should strive to reconcile this.

With respect to application in education, future research should focus on extending parent-child scaffolding to scaffolding within the classroom by adapting findings from this research. In particular, it is important that we develop tools and resources to scaffold students in the classroom most effectively. Once we understand underlying factors, this might speak to what occurs in the classroom. For example, are peer collaborations more beneficial in some learning situations than individual learning? The related concepts of zone of proximal development (ZPD) (REFS) and scaffolding provide a theoretical framework which can help teachers to situate and understand their professional role in children's learning and enhance their practice, further understanding what works and what does not work for students of varying ages.

Finally, future research should investigate conversation and scaffolding differences between cultures. With regard to sibling and peer scaffolding studies, nearly all the studies have been conducted in industrialized nations or in non-Western cultures with naturalistic observations. To provide a more sound comparison, future work should investigate cross-cultural differences with respect to structured problem-solving tasks between siblings and peers.

Conclusion

Overall, this series of studies extends past research by highlighting the important role parents play in their children's learning, providing empirical evidence regarding the benefits of conversation, and demonstrating a relationship between type of teaching partner and scaffolding behaviors. Findings indicate that children do not benefit equally from conversation with people other than their parents. In some situations, such as

asking information-seeking questions, parents seem to be equally beneficial as other adults. However, in other situations, such as receiving an informative response, other people are more beneficial conversational partners than parents. Further, parents are more beneficial when it comes to reformulating children's erroneous errors, compared to other adults and siblings. Parents provided children with more scaffolding and orienting behaviors, as well as making more appropriate shifts based on their child's current cognitive performance and needs. This work also deepens our understanding of contributing factors to teaching partner differences in scaffolding.

This research has illuminated how children learn differently from people other than their parents through both conversation and scaffolding. It has also identified possible factors responsible for the differences in scaffolding behaviors that exist between teaching partners. This discovery, however, is only the beginning of the path towards understanding why various people scaffold differently.

APPENDIX

List of Free Play Stimuli

1. Stethoscope
2. Band-Aid
3. Thermometer
4. Eye chart
5. Body chart
6. Blood pressure cuff
7. Syringe
8. Ear scope
9. Table
10. Chair
11. Truck
12. Boat
13. Couch
14. Slinky
15. Motorcycle
16. Doll
17. Barrel of monkeys
18. Moose
19. Rhinoceros
20. Lion
21. Monkey – Gorilla
22. Tiger
23. Leopard
24. Dog
25. Monkey – Orangutan
26. Bear
27. Wolf
28. Frog
29. Lizard – Iguana
30. Pet carrier
31. Bulldozer
32. Dump truck
33. Car
34. Bus
35. Plate
36. Cat
37. Egg
38. Ice cream
39. Donut
40. Hot dog
41. French fries

- 42. Spaghetti
- 43. Tomato
- 44. Hamburger bun
- 45. Hamburger patty
- 46. Lettuce
- 47. Mustard
- 48. Ketchup
- 49. Soda bottle
- 50. Fork
- 51. Spoon
- 52. Pizza slicer/cutter
- 53. Spatula

Questions Coding Schema

Purpose: The purpose of this coding is to examine:

- 1) What sorts of information children attempt to get by using questions
- 2) Whether the children do get the information they seek, get more information, or get less information.

All of the coding that you do should keep these goals in mind. This is important because questions that are not designed to get information will be treated a bit differently (as noted in the coding system below), and in some cases won't be coded at all (when they ask a question because they were told to do so, rather than it being a question they spontaneously asked themselves). Also, everything that you will be coding should be ***rooted in the child's initial question***—so, when you are coding a parent's response, you should be asking yourself 'did it answer the child's question?', etc. The parent's response is only important to us in as much as it does or does not give the child the information they were seeking.

You will be asking yourself 2 main questions for each utterance you are dealing with:

- 1) What is the child asking about? This often will not be exactly what the literal form of the question seems to be asking. For example, if the child asks 'can you pass me the salt?' they aren't asking for a yes/no answer here—they aren't literally asking about the person's physical ability to pass the salt. They are requesting an action. So, for each question, ask yourself what the child is really trying to accomplish with each question, meaning, what information or action they are actually trying for. This 'underlying' meaning is what you'll be coding.
- 2) Does the child get a response from the parent? Does this response give the requested information? Does the child answer his/her own question?

Step 1: Coding the utterances.

For every child utterance, determine if the child is asking a question. If the child is not asking a question, leave everything blank, and move on to the next utterance.

If the child is asking a question, determine what type of question it is, and enter the appropriate code:

a = getting/direction another's attention ('See?' 'Know what?' 'Guess what?', saying 'what' in response to someone else saying 'know what'); **in this case, only 'response' code is needed.**

c = clarification (asking 'huh' or 'what' because he/she doesn't understand what was said, repeating something that has been said by another); **in this case, only 'response' code is needed.**

pl = question asked to an object during play. Use PL when the child is asking the question OF an OBJECT (and so the child can't actually be expecting to get information in answer to the question). An example of this would be the child asking a doll *'are you hungry?'*.

noans= child is asking question of someone who can't answer (a baby, an animal, or another young child, even if that child does answer). An example of this would be if he asks his baby brother *'do you want your bottle?'*.

fact= Child is asking for a fact (*'What is that?'* *'Where is my toy?'* *'What is that for?'*).

explanation= Child is asking for an explanation about something (*'Why does the dog sleep there?'* *'How come you did that?'*). This is used when there is a causal element to something—asking what caused something, or what will be the causal response of something.

procedural = Asking for instruction on about how to accomplish steps in a procedure (*'How do you draw a tic-tac-toe grid?'* *'How do you make this work?'*).

action= A request for action (*'Can you fix this for me?'* *'Can you help me?'* *'Can you move the chair?'*).

r = asking permission (*'Can I have some soda?'* *'Can I go outside?'* *'Can I keep this?'*).

u = unknown: to be used when you can't figure out what the child is trying to ask. Try to code response, but if you just don't know, put question marks in the response column.

Some special cases you'll see:

- 1) 'what's that noise' = explanation; s/b interpreted as 'what caused that noise?'
- 2) Similarly, 'who did that', 'what did that' = explanation; s/b interpreted as 'who caused that?'
- 3) putting together a puzzle or the likes, asking how to do it, where pieces go = procedural
- 4) 'what happened' usually will be an explanation question.

Step 2: Coding the responses.

For every child question, determine what type of answer they received, and put the relevant code into the 'answer' column:

- c** = child answers own question
- n** = no answer
- r** = other person responds, but doesn't answer question (reply does not give the information the child was looking for)
- t** = other person turns question back to child ('You tell me' or 'What do you think?')
- y** = other person gives an answer that gives the child the information they were asking for (informative response)

Note: the type of response depends on the type of question. So, for an attention question ('a'), where the purpose is to get the parent's attention, a 'y' response would be any response that gives attention to the child. For a clarification question 'c', any response that gives clarification to the child is a 'y' response. For an action question, any response where the adult either tells the child that they'll take the appropriate action, or where the adult just takes the action (as reflected in comment lines, etc.), should be a 'y' response.

- **Important note on side-sequences:** Sometimes the adult only answers the question after taking a brief aside to clarify what the child is asking for. This is called a side-sequence, and it will look something like this:

Child: Can you hand me that one?
 Mother: which one?
 Child: the blue one.
 Mother: Okay, here it is.

When this happens, count the eventual answer (in this case 'Okay, here it is') as the response.

Some special cases you'll see:

- Note: If the child asks what letters, words, or a page in a book (etc.) say, and the parent reads the passage/word/letters aloud, this counts as an **informative** ('y') answer.
- 'I read that' or 'I just told you' or some such counts as an **informative** answer ('y').
- 'I don't know' is an 'r' question for 'fact', 'procedural' and 'explanation' questions.

NOTE: Again, all of these codes are **determined by the nature of the child's question.**

Reformulation Coding Schema

Preparing the file:

- 1) Save the file under a new name: keep name as is, but put –Ryourname at the end of the file name, before the .xls.
- 2) Open the file, and insert the following coding columns after the speaker column:
 - a. Error
 - b. Reformulation
 - c. Child response
 - d. In my words, put what the child is trying to say
 - i. E.g. “Gonna get it” – “I’m gonna get it”
 - ii. E.g. “Goed to the park” – “I went to the park”

Coding:

Step 1: Error Column - identify if the utterances has an error

If yes, put an ‘E’ in the error column.

If no, leave blank and move on.

NOTE: Do not code speech where the child is speaking to or for a doll or a younger child.

NOTE: Beware of dialects. If something could possibly be an acceptable slang in a dialect, it is not an error.

E.g. “gonna” “wanna” “ain’t” – these are not errors

NOTE: There can be more than one error, and more than one type of error. Enter a code for each error. So, if there are two errors, you would put ‘E, E’ in the **error column**.

Step 2: Reformulation Column - if there is an error, determine if the child’s error(s) have been reformulated.

In the **reformulation column**, go through and put R or leave it blank (for no R) first

Then go through and put the asterisk (*) if the error was reformulated (marked with R)

If one or more of the errors have been reformulated, put an ‘R’ in the reformulation column.

For each error that was reformulated, put an asterisk after the code in the relevant error column. So, if the parent/other adult reformulated an error, you would add an asterisk after the ‘E’, so that it would now read ‘E*’

If the parent/other adult doesn't reformulate the error, do nothing to 'E'.

Step 4: Child Response - determine how the child responds to the reformulation(s).

Go through and code for response in the **child response column**

Then go back to the top and see which errors (the 'E' in the error column) were taken up and put the ^

1. If the child takes up the reformulation, put a '**U**' in the child response column (for 'Uptake'). For every reformulation that the child takes up, put a '^' next to the code in the corresponding error column. So, if the child is taking up the reformulation of an error, the code in that column would now look like this: '**E*^**'.

*Example of uptake: Child says "I want butter on."
Parent says "You want butter on it?"
Child says "Yes, I want butter on it."*

2. If the child rejects the reformulation, put an '**R**' in the child response column.

*Example of rejection: Child says: "The plant didn't cried."
Parent says "The plant didn't cry?"
Child says: "No, the plant did."*

3. If the child agrees to the reformulation, put an '**A**' in the child response column.

*Example of agreement: Child says: "I want go park."
Parent says: "You want to go to the park?"
Child says: "Yes."*

4. If the child uses the same error in the next utterance despite the reformulation, put '**E**' in the response column.
5. If the child does none of these, leave the response column blank.

Scaffolding Behaviors Coding Schema

Purpose: The purpose of this coding is to examine:

- 3) What sorts of behaviors do the teaching partners use during this interaction

All of the coding that you do should keep this goal in mind.

Preparing the file:

- 3) Save the file: Keep name as is, but put –SByourname at the end of the file name, before the .xls.
- 4) Open the excel file, and insert the following coding columns after the speaker column:
 - a. Event

Coding:

Step 1: Coding event

In this column you will be marking the events that occur during the building phase of the study, using very general codes. Remember that you are looking for events that might be VERBAL and GESTURAL or a combination of the three--you are not looking for verbal instructions only, and so it is very important to look at the recording and not just the transcript.

A) Code for the teaching partner *only*:

orient = Use this code whenever the teaching partner directs the child's attention in one of three ways

- 1) initially gets the child to being working on the task
- 2) orients the child to where they should be looking (e.g. if they are not engaged/doing something else not relevant)
- 2) orients the child to look at a different part of the overall goal than the child is trying to work on. (e.g. comparing the model car to the construction they are building)

Some examples:

‘Look, what do we need here?’

'Our is different—can you see this piece here?'
'Please watch what I'm doing'
'See this block between here? We need one of those'
'Okay T let's finish building'
'Come here and help me'

There must be a **clear verbal or non-verbal signal** here that indicates the child must look in a desired location.

NOTE: The teaching partner may use more than one utterance line for a single orientation. If so, please mark the first line that starts setting out the goal with '**orient-b**' and the last line that sets out the goal with '**orient-e**'.

NOTE: most cases of 'orient' also will include the 'follow-up' code as well. ONLY code 'orient' without follow-up if there is no aspect of helping the child with a goal involved--for example, when the parent is just trying to get the child to stop spinning the chair and turn back toward the task.

Some examples:

- a) If the child is not paying attention: 'Okay, Steven, turn around.' = 'orient' only
- b) If the child is trying to decide which color screw to use: 'Look at the one they already made' = 'orient' AND 'follow-up'
- c) If the parent is pointing out a piece: 'See this block between here? We

need one of those' = 'orient' AND 'follow-up'

initial = initial intervention. Use when the teaching partner sets out a new goal/step for the child to accomplish within the task.

Anytime the teaching partner moves on to a new piece/construction (e.g. finding wheels to finding green screws, getting the top 4-hole plank to putting a red screw into it, putting the green screw into the wheel to connecting both pieces to the 4-hole plank) you will mark it as initial.

This might be asking the child to find the right piece that is needed ('what do we need here?'), put the piece in the right place ('where do we put that'), or even to figure out on their own what the next step is ('what do we need to do now?').

The initial goal might be stated very generally as in "What should we do next?" or "What should we start with?" or very specifically as in "Okay,

now find the yellow block” or “We have the wheel, what piece goes inside of it?”

NOTE: The teaching partner may state the initial goal over more than one utterance line. If so, please mark the first line that starts setting out the goal with **initial-b** and the last line that sets out the goal with **initial-e**.

follow-up = follow-up intervention within the same goal. Use when the teaching partner intervenes in some way to help the child along during the **SAME GOAL** that has already been stated and marked **initial**.

For example, let's say the teaching partner initially asked the child where they should place the first wheel, and the child puts it next to the wrong piece. Then the teaching partner says 'do you think it goes over here instead?'--this would be a **follow-up** to the same goal.

NOTE: The teaching partner may state the follow-up over more than one utterance line. If so, please mark the first line with **follow-up-b** and the last line that sets out the goal with **follow-up-e**. However, if the parents states the goal, then **pauses** to give the child a chance to answer, or **pauses** and then restates or adds on, this is a new **follow-up** segment.

teaching partner = teaching partner takes over and achieves (succeeds) the goal. For example, the mother might take over screwing in the screw and complete it for the child. If the mother just helps the child and the child is still screwing too, you would NOT use this code. This goes on the last line of final success, whether it is a verbal utterance (e.g. M: Here's two green blocks) or an action (e.g. X: [M finishes screwing the yellow screw + yellow block together])

NOTE: You are **only** counting teaching partner in terms of **final success**, not subgoal success. Success-subgoal is **only** for the child, not the teaching partner.

B) Code for the child *only*:

success-final = Use when the child successfully completes the current goal. Put the code in on the transcript line where the child fully succeeds with the complete goal, NOT while the action is still in progress, even if child succeeds with some small part of the overall goal (such as using fingers to screw in a piece rather than the wrench).

NOTE: Be careful with verbal answers; a verbal answer should not be marked as a success-final unless the current goal only requires a verbal

answer to be completed. For example, if the mother asks 'What do we need to put here?' and the child says 'A green block', but the goal is to put the green block on the car, do not code the child's verbal answer as success-final; this would only be **success-subgoal**.

This goes on the last line of final success, whether it is a verbal utterance (e.g. C: Here's two green blocks) or an action (e.g. X: [C finishes screwing the yellow screw + yellow block together])

success-subgoal = Use when the child completes part of the current goal.

For example, if the child needs to find four of the same part, and finds one, this would be '**success-subgoal**'--once they find all four, this would be marked '**success-final**'.

Also, parents will often break goals down into subgoals; for example, if the mother says 'Okay, now we need to screw the block on to the plank', and as the child struggles with this the mother may break this goal down for the child a bit, saying 'okay, what do we need to make sure we have on the plank first?'. If the child then puts the block on to the plank, this would be coded as '**success-subgoal**', because it gets part of the job finished, but the child still needs to place the screw in correctly to join them all and complete the main goal that the mother set out (says 'Okay, now we need to screw the block on to the plank').

NOTE: This code is used *only* for the child, not the teaching partner.

failure = Use when the child fails at completing the goal that the teaching partner initially set out; note, this can be used in the process of attempting to complete the goal. How the teaching partner states the goal and responds to the child's action or response, will determine if it is failure or not.

For example: if the teaching partner says, "What do we need next?" and the child pulls out a 6-hole plank, this is failure if the teaching partner is clearly not looking at the model car.

However, if the teaching partner says "We have a wheel, a plank, and a block, what do we need next?" And the child pulls out a green block, this is failure because it is clear that the child should get the green screw next to connect the pieces.

not engaged = Use when the child is not paying attention to the task or the proper part of the task. Only code this **once** until the teaching partner says something to the child.

child initiated = Use when the child initiates the next step of the building task,

rather than waiting for the teaching partner to do so. ONLY use this code when the teaching partner goes along with what the child has decided is the next step in the task. If the teaching partner states a different goal and has the child focus on that, this code would not be used.

NOTE: this should be treated just the same as a goal initiated by the teaching partner; so, all other events should be coded just as though it was initiated by a teaching partner.

NOTE: this should not be used if the child is doing something *wrong*, not a normal part of the procedure. So, for example, if the child attempts to add the blue nut onto the car at the end, this would not be counted as child initiated, but if the child attempts to tighten the screws after the teaching partner has confirmed that the child is finished, this is coded as child initiated because tightening the screws is a correct part of the procedure.

Additional notes:

Especially when coding sibling files, please make sure you're really careful as to what you count as scaffolding with these sorts of files. It is **not** scaffolding unless the **sibling is directly addressing the target child** or showing the target child how to do something.

Be careful if the sibling is merely talking to themselves, this is very different than asking the target child "where does this go?" vs. talking to themselves trying to figure out a piece and saying out loud "where does this go?" – The video will give you clues about this, so watch carefully

If the sibling and child are just doing their own thing (e.g. not communicating with each other and just building their own pieces of the car), then there should **not** be any follow-up or initial.

Also, pay close attention to when the target child is not engaged, initiates h/her own activity, and when the teaching partner initiates h/her own activity.

Lastly, you are still coding if/when the target child succeeds at a part (sub-goal) or entire piece (final) and when the child fails and putting something together.

Make sure you're watching the video to see when the target child succeeds or fails at a part that s/he is trying to construct/work on.

Appropriate Shift Coding Schema

Purpose: Now that scaffolding interventions have been coded, you will code for appropriate shifts in scaffolding based on the child's performance

Step 1: Insert coding column

Insert a new column next to the Event (column B) and label this Appropriate Shift (this should now be column C)

Step 2: Coding

You will be looking at the **Event column** codes when you code for appropriate shifts

Failure:

When the child **fails**:

If the teaching partner (M, F, S, or P) has a follow-up code after this (it can be follow-up-b, follow-up-e or follow-up), please mark "App" in the Appropriate shift column

If the teaching partner does anything other than this, leave it blank

Succeed-final only:

When the child **succeed-final** (has to have the 'final' attached to it):

If the teaching partner (M, F, S, or P) has an initial code after this (it can be initial-b, initial-e, or initial), please mark "App" in the Appropriate shift column

If the teaching partner does anything other than this, leave it blank

Succeed-subgoal only:

When the child **succeed-subgoal** (has to have the 'subgoal' attached to it):

If the teaching partner (M, F, S, or P) has a follow-up code after this (it can be follow-up-b, follow-up-e or follow-up), please mark "App" in the Appropriate shift column

If the teaching partner does anything other than this, leave it blank

NOTE: The teaching partner follow-up and initial codes may not occur in the very next line, but it may be a few lines down from the child's failure or success.

Some examples:

C: One, two. [C touches each 4-hole plank on each side of the model car and counts] **event coded as fail**

M: Um, do you see this one? Here's one and here's one. **event coded as follow-up-b → appropriate shift**

M: How many red screws do we need? **event coded as initial**

C: One **event coded as succeed-final**

M: Okay so we're gonna make one that looks like that. [M holds the 4-hole plank that she has in her hand over, on top of the two side 4-hole planks that C placed on the table] **event coded as follow-up**

M: Now let's look how are they... [M tilts the model car upside down to look how the planks are connected and turns it towards C so she can see] **event coded as initial → appropriate shift**

X: [C finishes tightening the green screw into the wheel] **event coded as succeed-final**

M: Nice **event coded as cf**

M: Wow so look it's getting to be closer, what can we add next? What do you see?

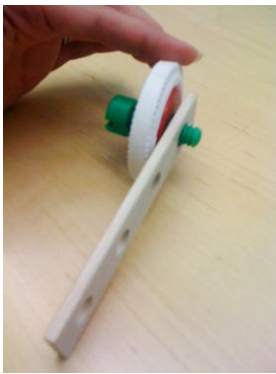
[M takes their construction and sets it on the table, then she moves the model car right next to their construction] **event coded as initial → appropriate shift**

List of Final Product Correct Connection

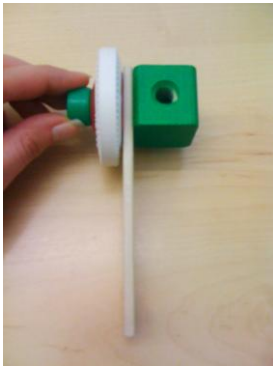
Green screw + wheel



Green screw + wheel + 4-hole plank (left side)



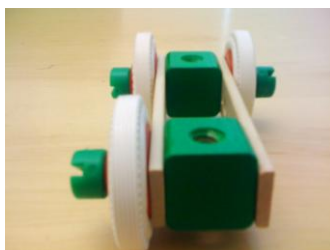
Green screw + wheel + 4-hole plank (left side) + green block (back)



Green screw (2) + wheel (2) + side 4-hole plank (2) + green block (2 – back)



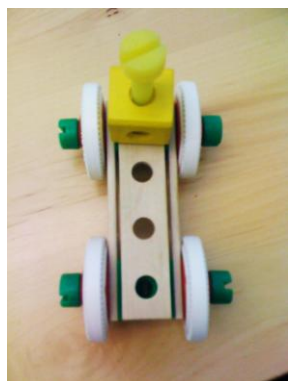
Green screw (3) + wheel (3) + side 4-hole plank (2) + green block (2 – back & front)



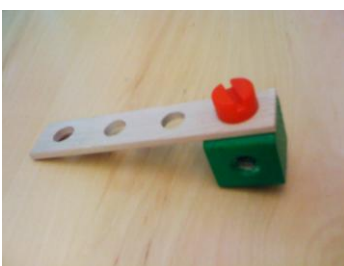
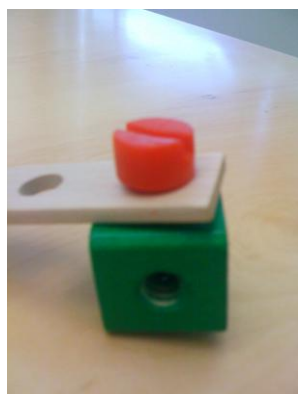
Yellow block + yellow screw



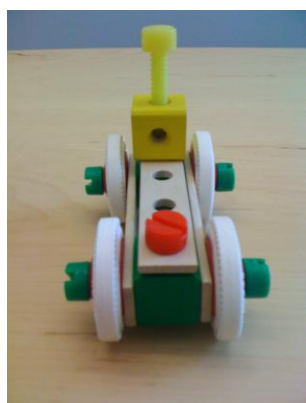
Yellow block + yellow screw + top 4-hole plank + green block (back)



Top 4-hole plank + red screw + green block (front)



Finished product (aerial view)

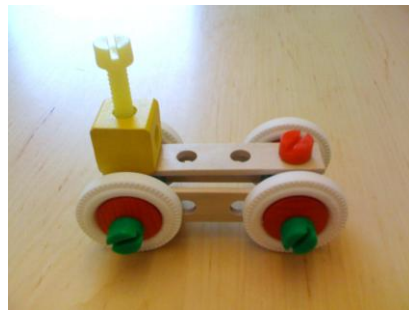
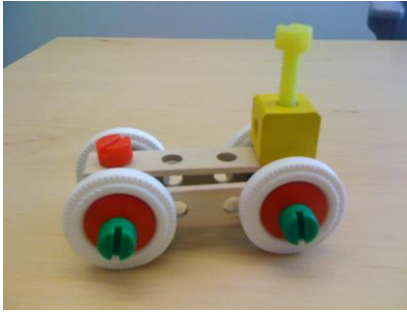


Finished product (back view)



Finished product (right side)

Finished product (left side)



Scaffolding Studies: Post Test Coding Schema

Purpose: The purpose of this coding is to examine:

- 4) The process while the child is building the car
- 5) The final product

All of the coding that you do should keep this goal in mind.

Preparing the file:

- 5) Save the file:
 - a. Keep name as is, but put –PTCyourname at the end of the file name, before the .xls.
- 6) Open the post test coding template

SIDE NOTE:

- 1) During the process coding, if there is an error, put what that error is
 - a. For example: in the yellow screw + yellow block column if the child connects a green screw + yellow block, you would code it as: X (green screw)
 - b. Noting the error was the connecting a green screw instead of a yellow screw
- 2) During the final product coding, if there is a piece constructed incorrectly, mark what was wrong or incorrect
 - a. For example: X (green screw instead of yellow screw)
- 3) The last time when child adds something to the structure that is considered the final product, any removing of pieces after this is deconstruction or cleaning up
- 4) Next to each 'X,' please stop the video and record the time
 - a. For example: X (3:36)

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