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Infant Imitation of Peer and Adult Models: Evidence for a Peer Model Advantage

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The imitation behavior of 30 infants, ages 14 to 18 months, were studied using both peer and adult models in an elicited imitation paradigm. Infants watched either a peer or an adult model perform four 3-step sequences (i.e., put teddy to bed). Imitation was measured immediately after modeling and 1 week later. Results indicated significant memory for the sequences both immediately after modeling and 1 week later (compared with baseline performance). In addition, children in the peer model group outperformed children in the adult model group at both test times. The implications of these findings are discussed.

Cognitive and social learning theorists have long emphasized the importance of the influence of others on a child's learning, behavior, and development. Much attention has been focused on the child's imitation of others, a process Bandura (1977) labeled "modeling." In his classic "Bobo doll" study, Bandura (1965) had children watch adults behave in aggressive or nonaggressive ways toward an inflatable Bobo doll. Later, when left alone with the Bobo doll, the children exhibited strong imitation of the adult behavior to which they were previously exposed. Although children involved in Bandura's study were preschool aged, imi-

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tation has been shown to occur in infants as well. For example, both Meltzoff, and Bauer and colleagues (Bauer, 1992, 1993, 1995; Bauer & Dow, 1994; Meltzoff, 1988b) have used an elicited imitation procedure extensively to show child imitation of adult models and long-term memory for the modeled behaviors. The procedure is ideal for infants because the elicited imitation procedure does not require complex instruction or extensive verbal interactions with the child in order to test the child's imitation of others. The elicited imitation procedure consists of an experimenter's use of simple props to perform a sequence of events (e.g., put teddy to bed) in the presence of a child. The props are then given to the child, and the child is encouraged to imitate the sequence of events observed. Because behaviors are the focus of the elicited imitation procedure, preverbal children can be easily tested. Using this paradigm, researchers have shown that children as young as 9 months and as old as 30 months can learn from adults through imitation in a variety of circumstances (see Bauer & Fivush, 1992; Carver & Bauer, *in press*; Meltzoff, 1988b).

Recently, Hanna and Meltzoff (1993) provided compelling evidence that this imitative behavior and learning also occur when peers, rather than adults, act as models in the elicited imitation paradigm. They exposed 14- to 18-month-old infants to novel stimuli and behaviors by using a 14-month-old peer model, sufficiently trained to demonstrate the target behaviors to the children in the study. By using the elicited imitation paradigm, verbal instruction was kept to a minimum. Instead, the peer model demonstrated various target actions to the child, whereas the experimenter simply encouraged the child to pay attention to the model. The experimenter waited for a delay of either 5 min or 48 hr, then placed the stimuli used by the model in front of the child, in the absence of the peer model. Using this paradigm, Hanna and Meltzoff (1993) demonstrated imitation of peer behavior both immediately and after a significant (48-hr) delay. The infants also consistently showed imitation of peer behavior in both laboratory settings and naturalistic day care settings. Taken together with the extensive evidence of the effectiveness of adults as models (e.g., Bandura, 1965; Bauer, 1995), the evidence strongly suggests that imitation of behaviors by children occurs with peer models, adult models, and across a variety of settings.

What remains unclear is the relative influence of peer and adult models on a child's imitative behavior and memory. Different theoretical approaches to child development have argued both sides of the issue, and for a variety of reasons there is cause to believe that there may indeed be a difference. Vygotsky (1987) argued for the relative importance of

adult influence on a child's cognitive development. In Vygotsky's view, adults are relatively more influential to cognitive development in a child because of the cultural expertness adults provide to the child. According to Vygotsky (1987), the adult provides detailed verbal instructions, information about cultural expectations and limitations, and other information about which a child's peer has little or no knowledge. Because of the adult's cognitive advantage, a zone of proximal development is created when working with the child, into which the child's understanding expands.

However, Piaget (1962) emphasized the relative importance of peers on a child's cognitive development. In a variety of domains (e.g., overcoming egocentric thought), Piaget held that children were the most important aspect in a child's environment in facilitating cognitive development and learning. Piaget believed that children use peers as sources of learning because peers are similar to the child, resulting in the child's assumption that the peer must therefore have a similar worldview (Piaget, 1932, 1962; see also Brainerd, 1978; Duncan, 1995; Glassman, 1994). Peer similarity elicits a child's attention to the peer and also elicits a child's assumption that the peer shares a common cognitive base from which the child can learn.

Piaget's belief in the relative influence of children is further supported by Festinger's (1954) social comparison theory, which predicts that peers are more influential than adults on a child's behavior because of a child's perceived similarity to the peer. Social comparison theory holds that humans use other people as social yardsticks, to learn about their own behaviors and talents and to gain information on how to behave. The importance of similarity in this theory has been borne out in a variety of contexts. In crises, people prefer to seek out similar others in order to gain information about the situation (Schachter, 1959). Similarity to others has a strong influence on friendships (Newcomb, 1956), the commitment to romantic relationships (White, 1980), and processes of self-evaluation (Festinger, 1954). It is reasonable to expect that similarity should have an effect on imitation behavior in children as well, and there is evidence that similarity between model and child has an effect on the learning of the target behavior in some contexts. For example, a preference for models that are the same sex as the observer has been demonstrated (Bandura, Ross, & Ross, 1961).

As stated earlier, although a wealth of evidence indicates that children imitate the behaviors of both adults and peers effectively, little research has been done to directly compare the relative influence of the age of the model on children's imitation despite theoretical arguments concerning potential differences in influence. In one of the few studies of

imitation using both peer and adult models, Owens and Ascione (1991) examined the imitation behavior of third, fourth, and fifth graders by exposing them to both a peer model and an adult model. These authors found increased imitation when the model was of similar age to the child. However, there are at least two limitations to the Owens and Ascione study that need to be addressed. First, the study involved older children (mean age = 10.2 years) whose cognitive capacity far exceeds infants'. Owens and Ascione (1991) also employed an arguably limited altruism paradigm, testing the child's willingness to imitate helping behavior. It is difficult to determine the extent of a peer model's influence on imitative behavior from one study directly investigating only altruism. In the present study, by investigating infants in a more general setting, a more accurate picture of the relative influence of peer and adult models should emerge. We are especially interested in infants in part because their cognitive capacity is limited, and any imitation behavior seen should not be overly affected by other potential influences such as admiration of the model, attempts to ingratiate oneself, or other complicated social and cognitive factors.

McCall, Parke, and Kavanaugh (1977) investigated the effects of television-based models and live models and commented that infants imitate live adults more effectively than televised peers. However, McCall et al. did not manipulate the age of the model as an independent variable. Rather, the results of two separate experiments were compared *post hoc*, and only qualitatively. Because of the many inherent problems with conclusions based on two different studies using two different paradigms, further investigation is necessary. Understanding the relative influence of peers and adults is an important step toward a complete understanding of the development of long-term memory and may have important instructional implications.

In the only direct comparison study involving infants of which we are aware, Abravanel and DeYong (1997) attempted to test the imitation behavior of infants using peer and adult models but reported largely non-significant results, with no advantage of similarity of age to imitation, and no consistent imitative behavior whatsoever. However, in their study videotaped models were used, an arguably different situation than live models, especially given the limited cognitive capacity of the infant population under investigation (*cf.* McCall et al., 1977). They also explored the time of onset of imitative behavior, rather than the relative effectiveness of peer versus adult models. As stated, Abravanel and DeYong (1997) found no consistent imitative behavior at all. However, given the strong evidence found by researchers for infant imitation with both peer and adult models (Bauer, 1992, 1993, 1995; Bauer & Dow, 1994; Hanna

& Meltzoff, 1993; Meltzoff, 1988a, 1988b; Meltzoff & Moore, 1989), we believed the topic to be worthy of further investigation. In the present study, we explored the relative influence of peers and adults using an infant elicited imitation paradigm similar to one successfully employed in the Hanna and Meltzoff (1993) and Bauer (e.g., 1992; 1993; Bauer & Dow, 1994) studies. This study was similar to Hanna and Meltzoff's Study 3 in that 14- to 18-month-olds saw a peer model demonstrate an action and then were later given a chance to imitate the modeled behavior. This study differed from Hanna and Meltzoff's, however, in that a second group of 14- to 18-month-olds were exposed to an adult model demonstrating the same acts. We posited that children imitate peers more effectively than adults because of the similarity between the children and the peer model.

In addition to manipulating the age of the model, the present study differed from Hanna and Meltzoff's study in at least two important ways. First, instead of using simple one-step sequences like those used by Hanna and Meltzoff, we used more complex three-step event sequences similar to those previously used by Bauer and her colleagues. Second, infants were tested both immediately after modeling and after a 1-week delay, a delay significantly longer than the 48-hr delay used by Hanna and Meltzoff. Using more complicated sequences and a longer delay allowed us to investigate the possibility that exposure to different-aged models might differentially affect both the quality and duration of the infants' memory.

METHOD

Participants

Children between the ages of 14 to 18 months ($n = 36$) were recruited for the study through a newspaper advertisement requesting commitment to two sessions separated by a week. The majority of children were Caucasian and of middle socioeconomic status. Six of the participants were excluded from the study due to the failure of the peer model to effectively model the desired behaviors, leaving a total of 30 participants. Of those, 16 were female and 14 were male. The mean age was 16.2 months old ($SD = 1.39$ months). All of the children were seen on two separate occasions in the laboratory, with a 1-week delay between sessions. Of the children, 27 were accompanied by their mothers during the testing sessions, and 3 children were accompanied by their fathers. The same parent accompanied all children during both testing sessions. At the end of each session participants received a free toy of their choice.

Target Events and Stimuli

All children were exposed to four different three-event sequences similar to the sequences employed by Bauer and Dow (1994). All materials used in the study were commercially available through a local toy store. The four events were:

1. Put teddy to bed. Using a 12-in. stuffed bear and a proportional cradle and blanket, the correct event sequence consisted of putting teddy into bed, covering teddy with a blanket, and rocking the cradle.
2. Clean the table. Using a paper towel, an empty spray bottle, and a small wastebasket, the correct event sequence consisted of pretending to spray the table with the bottle, wiping the table with the paper towel, and throwing the towel in the wastebasket.
3. Make a rattle. Using a large plastic egg and a small ball, the correct event sequence consisted of putting the ball in the egg, closing the egg, and shaking the egg to make it rattle.
4. Make spaghetti. Using a commercial toy dough extruder, toy dough, and a plastic knife, the correct event sequence consisted of putting the dough into the extruder, pressing the handle to force the dough out of the extruder, and cutting off the "spaghetti" with the plastic knife.

Design and Procedure

A 2 (age of model: peer or adult) \times 3 (time of test: baseline, immediate, or delayed) mixed design was employed, with the age of model as a between-subjects factor and the time of test as a within-subjects factor. The procedure used was similar to the Hanna and Meltzoff (1993) study, with some minor variations. First, the models were trained. The peer model was a 3-year-old boy taught in the proper manipulation of the objects, including the proper sequencing of events. He was also familiarized with proper experimental procedure by exposure to pilot participants until comfortable with the experimental routine. The adult model was a female college student. Once the peer model was comfortable with the procedure, the adult model watched videotapes of the peer model's pilot tests in order to match her modeling behavior to the peer model's behavior as closely as possible (i.e. movement, expression, etc.).

Children were tested individually and were randomly assigned to either the peer model or adult model condition. Each child was tested in a small laboratory room containing the event stimuli, necessary furniture, and a video camera for recording the session. Before the modeling

behaviors began, the child was allowed to acclimate to the environment for 5 min, meeting both the model and the experimenter while accompanied by his or her parents. During acclimation, practice play sequences were demonstrated to the child by the model, to familiarize the child with the procedures to be used throughout the experiment. There were two 3-step practice sequences: (a) Roll a ball across the table, place it in a box, and cover the box with the lid; and (b) Pick up a ball, place it on top of a perforated box, and strike the ball to make it fall through one of the holes in the box. If the child did not imitate the practice sequences spontaneously, the sequence was modeled again and the child was encouraged by the experimenter through verbal prompts such as, "See? You pick up the ball, put it on top, then hit it!" When the child did attempt to imitate the model's specific actions, he or she was rewarded by the experimenter with social praise, such as clapping and words of encouragement. This encouragement and social praise was given only for the practice sequences, not during the actual target behavior sequences.

After acclimation the child sat in the parent's lap at the table, across from the model and the experimenter. The parent was instructed not to direct or assist the child in any way during the experiment. Before modeling the target events, the child was given the props to see if he or she spontaneously performed the target behaviors on his or her own, in the absence of any modeling. Each set of props was placed in front of the child for 2.5 min, and a baseline measure for performance of the target behaviors was obtained.

After the baseline period, the model demonstrated each target sequence to the child twice, and the child was then immediately given the props. To keep the two conditions as identical as possible, the target behaviors were always demonstrated by the models but the experimenter always narrated the actions. For each event, the child had a 2.5-min imitation period in which to perform the target event. With the props in front of the child, the experimenter instructed the child to perform the target behavior with a statement such as, "Now you make spaghetti just like (the model) did." The statement always referred only to the overall target event and never to the specific behaviors required to complete the event. The statements were repeated as long as the child did not attempt the specific target actions. If the child produced all of the target behaviors before 2.5 min, the imitation period was ended. The event sequences were modeled in the following order for all children: put teddy to bed; clean the table; make a rattle; and make spaghetti. After all four target event sequences were completed, the child and parent were thanked, and the child was scheduled for the follow-up session 1 week later. Neither the

parent nor the child was given any indication as to the events that were to occur during the follow-up session.

At the follow-up session, an identical experimental situation was employed, except the model was not present at the time of retest. The child sat in the parent's lap at the testing table across from the experimenter. The two practice sequences (rolling the ball, and putting the ball in the box) were performed by the experimenter to remind the child of the elicited imitation procedure. Immediately after the practice sequences were completed, the child was given the props for the first target behavior, prompted with statements such as "Do you remember what to do with these things?" or "Show me what to do with this stuff," and given 2.5 min to perform the target actions. Each set of props was presented to the child in the same order used during the initial session, and a delayed recall measure was established for all target behaviors.

Coding Procedures

All testing sessions were videotaped for analysis. One rater was trained to note the occurrence and order of the target behaviors produced. The rater, unaware of the purpose of the study and the hypotheses under investigation, was trained to record the total number of individual target acts produced, as well as the number of different pairs of target acts produced in the correct sequence. For example, if the child produced all three of the target acts in the "put teddy to bed" sequence (put teddy to bed; cover it up with blanket; and rock the cradle), the rater recorded three total individual target acts produced. A separate score was then tallied for correct sequencing of acts by giving one point for the first correct sequence pairing (put teddy to bed, then cover with blanket), and another point if the child correctly produced the second sequence pairing (cover with blanket, then rock the cradle). Therefore, for each sequence, a child could receive a maximum of three points for producing all acts in each target event, and a maximum of two points for doing so in the correct sequence. The child's scores for each target event were totaled, then averaged over all four target events to produce two dependent variables, one for average individual target acts reproduced (maximum mean = 3 points) and one for average number of pairs correctly sequenced (maximum mean = 2 points).

The second author also coded 25% of the tapes to check the reliability of the rater. The level of agreement between the two raters on individual target acts recorded was 89% (Cohen's kappa = .79). The level of agreement between the two raters on pairs of actions recorded was 95% (Cohen's kappa = .88).

RESULTS

As discussed earlier, two dependent variables were examined in this study: (a) the average number of target behaviors the child demonstrated (individual acts); and (b) the correct sequencing of those behaviors (pairs). The number of pairs that are produced in the correct order is a stronger test of recall than the number of individual acts produced because the order in which the steps were produced is not available in the immediate environment (see Bauer & Hertsgaard, 1993).

Preliminary analyses revealed no significant main effects or interactions involving the variables of age of child or gender of child, and they were excluded from further analysis. Using 2 (age of model: peer or adult) x 3 (time of test: baseline, immediate, or delayed) mixed design ANOVAs, analyses were performed on both dependent variables.

The first question addressed was whether children actually learned any of the target behaviors from the model. A significant main effect of time of test was found for both the individual acts, $F(2, 56) = 58.82$, $p < .01$, and the pairs scores, $F(2, 56) = 32.28$, $p < .01$. Post hoc tests (Tukey's HSD) indicated that, across modeling conditions, the mean number of individual acts performed in the baseline condition was significantly different from both the immediate test condition and the delayed test condition, which did not differ from each other (see Table 1). Similarly, the same post hoc tests on the pairs data indicated that, across modeling conditions, performance in the baseline condition was significantly different from both the immediate test condition and the delayed test condition, which in turn did not differ from each other (see Table 1). As evi-

Table 1 Means and Standard Deviations for Individual Acts and Correct Pairs by Time of Test and Modeling Condition

	Time of test					
	Baseline		Immediate		Delay	
Modeling condition	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Individual acts						
Peer model	1.07	0.44	2.28	0.50	2.17	0.43
Adult model	1.33	0.46	1.92	0.42	1.92	0.40
Overall	1.20	0.46	2.10	0.49	2.04	0.43
Pairs						
Peer model	0.32	0.24	1.08	0.44	1.02	0.37
Adult model	0.32	0.28	0.77	0.38	0.75	0.45
Overall	0.32	0.25	0.93	0.44	0.88	0.43

Note. Maximum scores: individual acts = 3; pairs = 2.

denced by the main effect of time of test for both dependent variables, children did learn the target behaviors by watching a model perform them, and that learning was still evident after a 1-week delay.

The second and more important research question addressed whether children displayed more imitation when exposed to a peer versus an adult model. Analysis of both the individual acts data and pairs data indicated superiority of a peer model over an adult model on children's learning. Specifically, for independent acts, a significant interaction was found between age of model and time of test, $F(2, 56) = 6.587$, $p < .01$. Post hoc tests (Tukey's HSD) revealed that the difference between the peer model and adult model groups was significant immediately following modeling (see Table 1). However, the difference between conditions was not significant either in the baseline measure or one week after modeling (see Table 1). Using pairs as the dependent variable, a main effect of age of model was found, $F(1, 28) = 4.386$, $p < .05$. Overall, children exposed to a peer model showed more ability to perform target event sequences correctly as compared with children exposed to an adult model (see Table 1). There was no interaction between the age of model and the time of test when pairs was used as a dependent variable; however, simple effects analyses indicated that the difference between conditions was significant immediately following modeling and 1 week later, but not prior to modeling in the baseline condition.

Because the number of correct pairs produced is dependent on the number of individual acts produced, a final analysis was conducted to ensure that the number of pairs produced in the correct order exceeded the number expected by chance. Specifically, within-subject *t*-tests (one-tailed) were conducted for each modeling condition for both the immediate and delayed time of test comparing the number of correct pairs produced with the number expected by chance (total number of pairs produced, correct and incorrect, divided by two). In the peer model condition, the number of pairs correctly ordered was significantly higher than chance both immediately after testing and 1 week later, $t = 3.48$ and 2.84 , respectively, both $p < .05$. Similarly, in the adult model condition the number of pairs correctly ordered also was significantly higher than chance both immediately after testing and 1 week later, $t = 2.75$ and 2.67 , respectively, both $p < .05$.

DISCUSSION

The implications of the present research will be discussed with reference to our understanding of children's memory in general and, more

specifically, the relative influence of peers versus adults on children's learning and memory.

The present study contributes to our general understanding of infant learning and memory in that it replicates and extends the findings of Hanna and Meltzoff (1993). These researchers were interested in exploring the "cognitive side of imitation" to determine whether infants retain only simple nonspecific behaviors after watching another infant or if they would show the same type of specific object-related memory that infants show after watching an adult model. Using a between-subjects paradigm, Hanna and Meltzoff demonstrated that, indeed, infants can form very specific object-related memories for novel acts after watching a peer model and that they can retain these memories for at least a 48-hr delay. In the present study, using a within-subjects design to test memory, more complex target sequences, and an older peer model, we replicated Hanna and Meltzoff's finding that infants who observe a peer model can form very specific memories. Further, we extended their findings by demonstrating that infants can retain specific information acquired through observation of a peer for up to 1 week. In fact, although memory performance was slightly lower after a 1-week delay, the decline was nonsignificant in both the peer and adult model conditions. The present findings are consistent with research showing that infants as young as 14 months of age who watch an adult model can retain information for at least 1 week (Meltzoff, 1988a) and demonstrate that a peer model is as effective over a 1-week delay as an adult model.

In addition to extending the work of Hanna and Meltzoff, we also explored the characteristics of modeling that determine later performance by manipulating the age of the model. We found that infants who observed a peer model demonstrated higher levels of performance than infants who observed an adult model both immediately after modeling (in both individual acts and pairs of acts) and 1 week later (in pairs of acts, the more complex form of memory). Mere presence of the peer model was not sufficient to stimulate such a difference in performance, however, as performance in the baseline period was the same in the peer and adult model conditions. Although previous research with school-age children involving imitation of altruistic behaviors demonstrated an advantage for a peer model over an adult model (Owens & Ascione, 1991), this is the first demonstration of such an effect with infants (see Abravanel and DeYong, 1997, for a null effect).

The finding of a peer model advantage is consistent with the predictions of both Piagetian (Piaget, 1962) and social comparison theory (Festinger, 1954). This finding is consistent also with decades of research with adults and children demonstrating that similarity between individu-

als affects both attitudes and behaviors. What remains indeterminate, however, is exactly what difference between the models underlies the present findings. According to Piagetian theory, children recognize the similarity between themselves and other children and thus assume a similar cognitive level. Although the two models in the present study obviously differed in age, it is possible that other, more subtle differences are responsible for the difference in performance. That is, it is possible that the infants in the peer model condition performed better not because they recognize the peer as a peer, but because they recognize some more general type of similarity, or, perhaps, because children are simply more interesting to watch. This last possibility implies a very different sort of mechanism than that entailed in Piagetian and/or social comparison theory.

The adult model in the present study studied tapes of the peer model and attempted to mimic the child model's movement and behavior. However, it is possible that differences in behavior remained. To address this possibility, two adults unaware of the hypotheses of the study were asked to watch tapes of both models. These adults consistently rated the peer model as noisier and more active (in movement). Thus, perhaps the peer model was more interesting and likely to draw attention. However, these adults also rated the peer model as more "distracting" than the adult model. These ratings must be interpreted with caution because there were only two raters and it is difficult to conclude that what is distracting to an adult is also distracting to an infant. In short, further work is necessary to determine whether the advantage of a peer model is due to perceived similarity in age, perceived similarity overall, or some other difference in behavior completely unrelated to the similarity of the model and participants.

Although the present research effectively demonstrates that an infant's learning and memory can be affected by the age of the model, further research is necessary to determine the specific limiting conditions that work to increase or decrease performance in this paradigm and others. For example, the peer model in the present study was somewhat older than the infant participants. Hanna and Meltzoff involved a peer model of exactly the same age as the infant participants. One interesting question concerns how close in age the match between peer model and participant must be for a memory advantage to emerge and if the strength of the effect is modulated by this similarity. Also, whereas the race and gender of the peer model was not manipulated systematically in the present research, social comparison theory predicts that these aspects also are likely to be important (see Bandura et al., 1961, for information concerning the influence of gender similarity with older children).

In summary, similar to the work of Hanna and Meltzoff, the present research demonstrated that infants can learn and retain complex behaviors by watching peers. Further, this work extended their findings by demonstrating that the age of the model can influence infants' memory performance, and that differences in performance due to the age of the model remain for at least 1 week. Future research is necessary to explore the robustness of this effect and to determine whether the mechanism underlying the peer model advantage is the same or different from that posited by Piaget and/or social learning theorists. The answers to such questions have important implications not only for our understanding of learning and memory in infancy but also for classroom instruction. If learning is reliably facilitated by a near-age model, as is suggested by the present study, early childhood educators may wish to incorporate more peer interaction in the classroom and/or make use of peer instructors to ensure that learning and retention are maximized.

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