

## Putting the Social Into Social Learning: Explaining Both Selectivity and Fidelity in Children's Copying Behavior

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## Putting the Social Into Social Learning: Explaining Both Selectivity and Fidelity in Children's Copying Behavior

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Many previous accounts of imitation have pointed out that children's copying behavior is a means by which to learn from others, while virtually ignoring the social factors which influence imitation. These accounts have thus far been unable to explain flexibility in children's copying behavior (e.g., why children sometimes copy exactly and sometimes copy selectively). We propose that the complexity of children's imitation can only be fully understood by considering the social context in which it is produced. Three critical factors in determining what is copied are children's own (learning and/or social) goals in the situation, children's identification with the model and with the social group in general, and the social pressures which children experience within the imitative situation. The specific combination of these factors which is present during the imitative interaction can lead children to produce a more or less faithful reproduction of the model's act. Beyond explaining flexibility in children's copying behavior, this approach assumes the developmental study of imitation within a broader social psychological framework, linking it conceptually with closely related topics such as mimicry, conformity, normality, and the cultural transmission of group differences.

**Keywords:** imitation, overimitation, identification, conformity, normality

The empirical literature on children's imitation presents an apparent paradox: whereas children sometimes copy selectively (e.g., copying intentional actions but not mistakes or failed attempts), at other times they copy surprisingly faithfully. Recently, much has been made of children's tendency to "overimitate" (that is, to reproduce even the causally irrelevant actions of a model). There are various explanations for this tendency, most of which center around children's need to learn about causally opaque cultural artifacts (Gergely & Csibra, 2006; Lyons, Young, & Keil, 2007; Whiten, McGaughey, Marshall-Pescini, & Hopper, 2009). To varying extents, each of these accounts implies that imitation is relatively inflexible. Consequently, they do not fully explain selectivity in children's copying behavior. The existence of selective imitation, on the other hand, has typically been explained in terms of children's understanding of others' goals and intentions (e.g., Bekkering, Wobschläger, & Gattis, 2000; Tomasello, Kruger, & Ratner, 1993). These accounts, however, cannot easily explain the existence of overimitation. There is thus an urgent need for a theory which can explain both behaviors.

Here, we provide such a theory. We argue that the failure of previous accounts to explain flexibility in children's copying be-

havior is the result of a tendency to disregard the deeply social nature of imitation. Drawing on developmental research on the social functions of imitation (e.g., Nielsen, Simcock, & Jenkins, 2008; Over & Carpenter, 2009; Uzgiris, 1981, 1984), as well as the adult social psychology literature (e.g., Chartrand & Bargh, 1999; Deutsch & Gerard, 1955; Turner, 1991), we argue that imitation can only be understood by viewing it through a social lens. We propose that the fidelity with which a child copies an action can be explained through a combination of the child's own (learning and/or social) goals in the imitative situation, the child's identification with the model, and with the social group in general, and the social pressures experienced by the child within the imitative situation.

We begin this paper by explaining our use of the term imitation and then briefly reviewing the literature on selective and exact copying in young children. Following this, we outline existing theoretical accounts of imitation and demonstrate that, in their current form, they are unable to fully capture the nature of children's copying behavior. In the latter half of the paper, we introduce our own framework for understanding imitation in which copying is viewed as the product of a combination of social factors.

### Imitation: A Broader Perspective

Before going any further, it would be helpful to explain our use of the term imitation. In the past, there has been a great deal of discussion about how best to define imitation. For some purposes, it is useful to define imitation very precisely as, for example, learning novel actions (Tharpe, 1963), reproducing bodily movements (Hilme & Whiten, 2005), or copying actions based on an understanding of the goals and intentions underlying them (Tomasello et al., 1993). However, for other purposes, it is also useful to

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consider the bigger picture. Thus, in this paper, we use the term initiation very broadly to refer to matching the behavior of a model after observing it. The most important advantage of this broader use of the term is that it allows us to take a very wide-ranging perspective on imitation, including not only matching of actions, but of opinions and attitudes as well. Consequently, it allows us to link research on imitation with closely related research areas such as those on normative learning and conformity. We do not argue that each of the different types of copying behavior we discuss necessarily involve the same cognitive mechanisms; rather our focus is on the functions of imitation in learning and social interaction.

**A Brief Overview of the Empirical Evidence**

Recent empirical research has demonstrated that children are often surprisingly faithful in their imitation of modeled actions. In fact, when shown a demonstration which includes both causally relevant and causally irrelevant actions, children often copy even the irrelevant actions. In one of the clearest demonstrations of this phenomenon, Horner and Whiten (2005) presented 3- to 4-year-old children with a demonstration of how to retrieve a reward in which some of the actions were causally necessary (e.g., using a tool to remove the reward from inside a narrow tube) and some were unnecessary (e.g., inserting the tool into the top of the apparatus and tapping it against an internal ledge). Importantly, the box on which these actions were performed was either opaque or transparent. In the opaque condition, it was not possible to tell which actions were necessary in order to achieve the end result. In the transparent condition, however, it was clear which actions were important and which were not. When offered the opportunity to imitate, children copied the irrelevant actions even in the transparent condition (when the irrationality of the modeled actions should have been clear to them). This behavior differs markedly from the behavior of chimpanzees tested in the same paradigm, who followed a more rational strategy. When offered the opportunity to retrieve the reward for themselves, chimpanzees were more likely to produce the model's irrelevant actions in the opaque condition than in the transparent condition.

Other research has demonstrated that young children copy the specific actions of a model even when it results in less efficient performance on their part. For example, Nagell, Olguin, and Tomasello (1993) presented 2-year-old children and chimpanzees with a demonstration in which a model used a rake tool to retrieve an out-of-reach reward. In one condition, the model used this tool efficiently (with the prongs facing upward) and, in other condition, the model used the tool inefficiently (with the prongs facing downward, such that the reward often slipped through the widely spaced prongs). When offered the opportunity to retrieve the reward themselves, children copied the model's actions even when it was inefficient to do so, thus reducing their ability to retrieve the reward for themselves. Chimpanzees, on the other hand, did not copy the model's specific behaviors, but simply learned the affordances of the tool—that it could be used to bring in the reward—in both conditions.

More recently, Lyons et al. (2007) have demonstrated that children often copy the specific actions of a model even when they have been explicitly instructed not to. In an initial training phase, Lyons et al. (2007) presented 3- to 5-year-old children with a

model who demonstrated how to retrieve toys from a series of containers. Some of the actions the model used were relevant to the achievement of the end result (e.g., unscrewing the lid of a jar), and some were irrelevant (e.g., tapping the side of the jar with a feather). After each demonstration, children were questioned about the actions involved and rewarded for correctly identifying the irrelevant actions. At test, the model demonstrated another series of actions and children were explicitly instructed to copy only the relevant actions. However, even under these circumstances, children copied the irrelevant actions.

Children's tendency to copy modeled actions faithfully is thus well-established in the empirical literature (and, recently, has even been demonstrated in a cross-cultural context; Nielsen & Tomasello, 2010). However, there is another, seemingly contradictory, line of research demonstrating that children can be highly selective in their imitations. For example, infants copy intentional actions but not mistakes or failed attempts. In one demonstration of this, Carpenter, Akbar, and Tomasello (1998) presented 14- to 18-month-old infants with a demonstration in which a model performed a series of two actions. The model marked one of these actions as intentional by saying "There!" as she performed it and marked the other as accidental, by saying "Whoops!" as she performed it. Results showed that infants copied the actions marked as intentional more often than those marked as accidental. A similar study by Meltzoff (1995) demonstrated that when 18-month-olds observe a failed attempt to produce an action, for example, a model trying but failing to pull two halves of a dumbbell apart, they do not copy the specific action they observe but instead reproduce the perceived goal behind the action, pulling the dumbbell in half.

Related research has demonstrated that other children imitate the same action differently depending on its perceived goal. Bekkering et al. (2000) presented 3- to 6-year-old children with one of two demonstrations. In one condition, a model placed her hand over one of two dots on a table. In the other condition, the model placed her hand on the same location in space, but there were no dots present. Rather than copying the modeled actions exactly, children's copying behavior varied according to condition. When asked to imitate, children in the "dot" condition tended to touch the same dot as the experimenter (presumably the most important goal of the action) but made errors in which hand they used to do so. Children in the "no dot" condition, in contrast, tended to match the experimenter's actions exactly, using the same hand as she had done. Presumably, children in this condition viewed the model's hand choice as the main goal of the action (see Carpenter, Cail, & Tomasello, 2005, for a related result with 1-year-old infants and Woldschlager, Bekkering, & Gattis, 2003, for a similar result with adults). Further research has demonstrated that selectivity in imitation is not limited to cases in which children copy based on an understanding of the goals and intentions behind the demonstration. For example, children also copy selectively on the basis of the constraints on the model (Gergely, Bekkering, & Király, 2002), the age of the model (McGuigan, Makinson, & Whiten, in press; Seeberger & Herbert, 2011), and the causal relevance of the model's actions (Brugger, Lariviere, Blumme, & Bushnell, 2007).

The empirical evidence thus presents a puzzle for theories of imitation. Under some circumstances, children copy observed actions faithfully but, under other circumstances, they copy observed actions selectively. This puzzle is further enhanced by results showing that these two types of copying behavior often occur

within similarly aged children (e.g., see Lyons et al., 2007 vs. Bekkering et al., 2000). The challenge for theories of imitation is thus to explain how these seemingly contradictory behaviors can be present at once. In the following section, we discuss how previous theoretical accounts of imitation have attempted to resolve this puzzle.

**Theoretical Explanations for Selective and Exact Copying Behavior**

Selectivity in children's imitation has often been explained in terms of children's understanding of goals and intentions. According to this perspective, children copy actions in terms of the mental states which underlie them (Bekkering et al., 2000; Tomasello et al., 1993). The most detailed version of this perspective has been provided by Bekkering and colleagues. Bekkering et al. (2000) argue that observed actions are broken down and then reconstructed in terms of their goals. These goals are represented in a hierarchical fashion such that goals at the top of the hierarchy are initiated accurately and goals further down the hierarchy are neglected. This theory explains a great deal of data on selective imitation (e.g., Bekkering et al., 2000; Carpenter et al., 2005; Perra & Gattis, 2008, although see Bird, Brinadley, Leighton, & Heyes, 2007; Heyes, 2001; in press and Leighton, Bird, & Heyes, 2010, for an alternative, nonimitative, account of selectivity in imitation). However, as this theory predicts, only goals at the top of the hierarchy are accurately reproduced, it cannot easily explain cases in which children reproduce multiple irrelevant actions.

Other theorists have concentrated on explaining the existence of overimitation. For example, Whiten and colleagues (Whiten, Horner, & Marshall-Pescini, 2005; Whiten et al., 2009) have argued that children's tendency to copy actions exactly is an evolved heuristic for learning about causally opaque cultural artifacts. According to this perspective, the sheer quantity of cultural artifacts that children need to learn about during their development has produced a general tendency to copy the actions of others exactly. The small percentage of these actions which prove to be irrelevant can later be "weeded out" through individual learning. The automaticity of this system means that children copy actions faithfully even when it appears irrational for them to do so (Whiten, Horner, & Marshall-Pescini, 2005; Whiten et al., 2009). Although this heuristic may plausibly explain overimitation, it cannot explain the existence of selective imitation. In Whiten and colleagues' (2009) own words it leaves us with "an apparent paradox" in which children sometimes copy selectively and sometimes copy exactly. Whiten et al. (2009) suggest that one potential route out of this paradox is to consider the age of the children in the relevant studies. According to Whiten et al. (2009), whereas infants have been shown to copy selectively, older children and adults have been shown to copy more exactly. However, this assumption is not borne out by the data. There are studies demonstrating that, at times, infants copy exactly (e.g., Meltzoff, 1988; Nielsen, 2006) and that older children (e.g., Bekkering et al., 2000; DiYanni & Kelemen, 2008; Perra & Gattis, 2008), and even adults (Horowitz, 2003), copy selectively.

Lyons and colleagues (Lyons, 2009; Lyons et al., 2007; Lyons, Damrosch, Liu, Nielsen, & Keil, 2011) have attempted to explain overimitation by arguing that children have an automatic tendency to encode all of a model's intentionally produced, object-directed

actions as causally relevant. When children observe a causally irrelevant action on an object, they revise their implicit understanding of the causal relations behind the demonstration and, consequently, interpret the action as causally relevant. This reevaluation leads them to produce faithful reproductions of modeled behavior even in cases where the actions appear, from an adult's perspective, at least, to be clearly unnecessary. According to this perspective, overimitation is thus "unavoidable." Lyons (2009) attempts to explain the existence of selective copying by arguing that actions not directed toward objects (e.g., those used in the Bekkering et al., 2000 study) may be copied selectively. However, this theory, along with the somewhat related theory of Kenward, Karlsson, and Persson (2011) that children learn a generalized norm that unnecessary actions ought to be performed, are brought into question by data demonstrating that some intentionally produced, object-directed actions are imitated selectively. For example, in one demonstration of this, DiYanni and Kelemen (2008) presented 2- to 4-year-old children with a demonstration in which a model intentionally rejected a functionally affordant tool in favor of a nonaffordant tool. When offered the opportunity to imitate, children ignored the model's demonstration and used the functionally affordant tool (see also Brugger et al., 2007, for a similar result with 14- to 16-month-old infants). Furthermore, Nielsen and Blank (in press) have demonstrated that, within a task analogous to that used by Lyons et al. (2007), 4- to 5-year-old children are less likely to copy causally irrelevant actions when the model who demonstrated those actions is not there to see their imitation. Overimitation is thus far from "unavoidable."

Finally, Gergely and Csibra (2006, see also Csibra & Gergely, in press, and Gergely & Csibra, 2005) have argued that children's tendency to copy actions exactly is a product of an innate pedagogical learning system which allows for the fast transfer of information between individuals. According to this perspective, humans have an evolved tendency to respond to pedagogical cues such as ostensive eye contact. These cues signal to the child that the information about to be communicated is publically shared and generally applicable cultural knowledge. When ostensive cues are present, and a model produces her actions freely and intentionally, children automatically encode the demonstrated actions as important to copy regardless of whether they are seemingly irrelevant to the task at hand. This theory is supported by evidence suggesting the presence of eye-contact. However, the scope of the theory is too narrow to explain flexibility in children's copying behavior. For example, children sometimes regard actions as representing culturally shared and generalizable knowledge even when the model provides no ostensive/pedagogical cues (Schmidt, Rakoverly, & Tomasello, in press). Schmidt et al. presented 3-year-old children with a situation in which they observed a model perform a novel action. Crucially, this model acted as though he did not realize that he was being observed and produced no ostensive cues as he performed the novel action. When offered the opportunity to interact with the object themselves, children copied the model's action. Furthermore, they protested when a third party performed the action differently, thus demonstrating that they had learned the action as culturally shared and generalizable. Other research shows that children's copying behavior varies even when the ostensive cues provided by the model (and thus the model's communicative

intentions toward the child) are held constant across conditions. Zmyj, Buttellmann, Carpenter, and Daum (2010), for example, demonstrated that 14-month-old infants are more likely to copy previously reliable models than previously unreliable models even though the demonstration itself was identical in the two conditions.

The data provided by Zmyj et al. (2010) bring us to another problem with existing accounts of imitation. Thus far, we have discussed flexibility in terms of what children copy. However, in order to understand the nature of imitation it is also important to consider who children choose to copy and when children choose to copy. Not only do children imitate previously reliable models over previously unreliable models (Klemer & Hartz, 2004; Zmyj et al., 2010), they also copy ingroup members over outgroup members (Kinzler, Corriveau, & Harris, 2011) and models who have acted in a warm and friendly manner over individuals who have acted in a cold and aloof manner (Nielsen, 2006). Furthermore, 5-year-old children copy more often when they have been primed with ostracism than when they have been given a neutral prime (Over & Carpenter, 2009). Thus, the flexibility in children's copying behavior is far greater than has previously been acknowledged. The theories of imitation discussed above are not, in their current form, able to explain such flexibility. Below, we provide an account which we think can.

#### The Instrumental and Social Functions of Imitation

The first step toward explaining flexibility in children's copying behavior is to acknowledge that imitation serves more than one function in development. The theories outlined above suggest that imitation serves a single function: to learn about the physical world (and particularly to learn about socially opaque cultural artifacts). It is well established in the adult literature, however, that, in addition to acting as a learning mechanism, imitation serves important social functions (e.g., Chartrand & Bargh, 1999; Deutsch & Grant, 1955; Dijksterhuis, 2005; Lakin, Jeffers, Cheng, & Chartrand, 2003). As Ugeuxis (1981, 1984) has pointed out, this is also true of imitation in development. When children copy an action, they may either seek to learn a new skill (the instrumental function of imitation) or seek to "affirm a shared state" with a model (the social function). This perspective goes a long way toward explaining flexibility in children's copying behavior because children presumably copy actions differently depending on their own goals in the situation. Carpenter (2006), for example, argues that when children seek simply to learn how a novel object works, they will be inclined to copy selectively. This is because successfully operating the objects involved in the demonstration is more important to them than reproducing the specific actions used by a model. When a child seeks to "affirm a shared state" with a model, on the other hand, the match between the model's behavior and the child's own actions is of much greater importance (Carpenter & Call, 2009; Nielsen, 2009). Consequently, the child is more likely to copy the modeled actions exactly.

In developing our own framework for imitation, we expand upon this perspective and, in doing so, demonstrate that imitation is more deeply social than even this account suggests. Our first step is to specify the social function of imitation more precisely. Building on the work of Ugeuxis (1981), Nielsen (2009), and others (e.g., Lakin et al., 2003; Hobson & Lee, 1999; Meltzoff & Moore, 1995; Nadel, Góeltz, Pez, & Rivet, 1999), in the following

section we argue that the social function of imitation is closely tied to identification: children use imitation in order to be like, or communicate likeness, to their social partners. Next, we elaborate on the relationship between learning and social/identificatory goals in imitation. We argue that, rather than always being two distinct functions of imitation, the learning and social functions of imitation often interact in important ways. When a child imitates an action, learning goals may predominate, social goals may predominate, or both goals may be simultaneously important. This means that even imitative learning can be a highly social process. Following this, we argue that, in order to understand flexibility in imitation, it is necessary to consider not only the child's own goals but also the social pressures that children may experience within the imitative situation. Throughout this discussion, we emphasize that imitative interactions can take place not only on an interpersonal level but on a group level as well. For example, a child may seek to identify with a particular model or with the social group in general. The specific combination of social motivations and pressures, which are present within an imitative situation together determine what (and whom and when) children choose to copy.

#### A Social Framework for Imitation

##### The Social Function of Imitation as Identification

The social function of imitation was described by Ugeuxis (1981) as "affirming a shared state" and "communicating manually" to a model. More recently, it has been defined in terms of attempts to be liked by a model and to communicate that "we are alike" (Carpenter, 2010; Nielsen et al., 2008; Nadel et al., 1999). Although there may be other social functions of imitation as well, each of these different descriptions, in essence, involve goals to identify<sup>1</sup> and affiliate with a model.

When individuals have an identificatory goal, they seek to make themselves more similar to others, to "be like" them. It is important to recognize that these goals need not be consciously held: an individual may have either a conscious or a subconscious goal to identify with another (Lakin & Chartrand, 2003). Furthermore, identificatory goals need not be communicative; an individual can have a goal to identify with a social partner without seeking to communicate that goal to her. In fact, the social partner need not even be aware of the individual's imitation. One example of this may be when adults imitate the gestures of a person on a video (e.g., Lakin & Chartrand, 2003; see McGuigan, Whiten, Flynn, & Horner, 2007, for related work with 5-year-old children).

Often, however, identificatory goals are combined with a goal to communicate. In these cases, an individual attempts to convey the message "I am like you" to a social partner. Rather than being communicative in the Gricean (1957) sense, imitation of this type is typically communicative in the simpler sense that it is produced with the goal of having a particular effect on the recipient (Chartrand & Bargh, 1999; Lakin, Chartrand, & Aikin, 2006). In order for this form of imitation to succeed, it is critical for the recipient to observe, and perhaps respond to, the behavior. Communicative goals need not be conveyed directly to the model, however; they can also be intended for third parties. That is, an individual can use

<sup>1</sup> We thank M. Tomasello for suggesting the use of this term.

social goals. In contrast to this perspective, we argue that the learning and social goals which motivate imitation can interact in important ways. When a child imitates an action, learning goals may predominate, social goals may predominate, or both may be important. The specific combination of these goals which is present when a child imitates an action leads to three basic forms of imitation. When learning goals predominate, imitation is essentially explorative and individualistic (Carpenter & Call, 2009). Children attempt to gather information from the model without any regard for their social relationship with her. When both learning goals and social goals are important, a more social type of learning occurs in which children learn to be like a model or learn how to do things the way their group does them. The prototypical example of this type of imitation is normative learning. Finally, when social goals predominate, children do not seek to learn from the model but simply to be like her or communicate to her that they are like her. These three forms of imitation are discussed in more detail below.

#### Learning Goals Predominate

In situations in which learning goals predominate, children imitate a model's actions in order to learn a new skill. Children copy these elements of the model's actions which they take to be most relevant for achieving a particular effect. Consequently, children are more focused on the characteristics of the task (e.g., the properties of the objects and the efficiency of the actions involved in the demonstration) than in their relationship, or interaction with the model. This sort of imitation is a relatively individualistic form of social learning (Carpenter & Call, 2009).

Unfortunately, there is very little work directly addressing how children copy when their motivation is simply to learn from the model (This gap in the literature may be attributable to the largely unquestioned assumption that learning is the primary function of imitation.) However, a recent study by Yu and Kushnir (in press) suggests that when young (27-month-old) children have instrumental, as opposed to social goals, they are more likely to copy selectively.

Although children may typically copy selectively when they have learning goals, it is important to recognize that learning goals can also lead children to copy demonstrated actions quite faithfully. One case in which this is particularly likely is when the child is uncertain how to solve a problem (see Kendi, Crohn, van Bergen, & Laland, 2005, for a review of the role of uncertainty in social learning). For example, Williamson, Meltzoff, and Markman (2008) demonstrated that 3-year-old children are more likely to copy a model's actions on an object when they had previously had trouble operating the object themselves. Williamson et al. randomly assigned children to have either an easy or a difficult experience opening a drawer. In one condition the drawer opened easily, but in the other condition the drawer was jammed in such a way that it was very difficult to open. Following this experience, the model demonstrated how to open another drawer using a distinctive action style—pushing a button on the front of the drawer and then pulling it open. Children who had had a difficult prior experience were more likely to copy the model's distinctive means than children who had had an easy prior experience.

#### Children's Own Goals in the Imitative Situation

Thus far, researchers working on the learning and social functions of imitation have assumed that they represent two different categories of copying behavior when children imitate an action they may either seek to learn from the model or seek to fulfill

imitation in order to convey the message "I am like them," where "them" may refer to another high status individual or group. One example of this may be individuals copying the actions and clothing styles of celebrities.

The identificatory goals, which lie at the heart of social imitation can form the basis for affiliation. Social psychological research has demonstrated that, as adults, we prefer individuals who are similar to ourselves. In fact, even very subtle cues to similarity are sufficient to increase our liking for those around us. For example, adult participants are more attracted to confederates whose surnames appear to resemble their own and whose experimental code numbers share digits with their own birthdays (Jones, Pelham, Carvallo, & Nirenberg, 2004). Conveying the message "I am like you" can therefore serve affiliative purposes (Chartrand & Bargh, 1999). As a consequence of this, imitation can be used, whether consciously or unconsciously, as a strategy to increase rapport with others (Lakin & Chartrand, 2003). This can be done either for prosocial, affiliative reasons, or for more selfish reasons: an individual may imitate another purely for his or her own benefit, for example in a strategic attempt to obtain something from the other person (Thelen, Fehrentsch, Frautschi, & Fiebichner, 1980).

It is also important to note that the goal to identify with another person can occur on either an interpersonal level or a group level. When two (or more) individuals interact on an interpersonal level, their idiosyncratic similarities and differences come to the fore within the interaction. When two (or more) individuals interact on a group level, they interact as representatives of particular social groups (Turner, 1991). Consequently, when children seek to identify on an interpersonal level, they seek to make themselves more similar to a particular social partner, perhaps copying their idiosyncratic mannerisms or opinions. When children seek to identify on a group level, on the other hand, their goal is to make themselves more similar to the group in general. Given this goal, children may seek to copy behavior which is representative of the group in general, for example adopting a particular group marker. Indeed, children may even copy behaviors which are characteristic of the group in general but do not represent any single individual's behavior (e.g., they may adopt the general opinion of the group even when that opinion diverges from that of the individual group members). It is worth noting that other group members need not be present in order for a child and model to interact on a group level. The child may view the model as a representative of a particular group without any interaction with other group members. The social group can thus be "in the background" of the interaction.

Now that we have established a more precise definition of one of the main social functions of imitation as involving identificatory and affiliative goals (at either the interpersonal or the group level), we move on to discuss how learning and social goals influence children's copying behavior.

### Learning Goals and Social Goals Are Both Important

There are some forms of social learning which are more truly social in that they involve both learning and social goals. These two goals may be held simultaneously (Deutsch & Gerard, 1955) or may be so closely intertwined that they are impossible to separate (Turner, 1991). Probably the best example of this form of social learning involves learning cultural norms. Norms are behaviors which are accepted as appropriate ways of acting by members of a particular group (Kallgren, Reno, & Cialdini, 2000). They specify how individuals typically behave and, more strongly, how they ought to behave in particular circumstances (Kallgren et al., 2000; Rakoczy, Warneken, & Tomasello, 2008). Thus when children learn a norm, they learn how to be like other members of their group.

Slanting from at least the age of three, children learn from others in this deeply social way. Rakoczy et al. (2008), for example, demonstrated that 3-year-old children imitate and then enforce what they have learned as a social norm on those around them. Rakoczy et al. presented children with demonstrations of how to play a novel game in which they were shown how to perform a particular action called 'daxing'. Children imitated the action, and then a puppet joined the game and announced that he was going to dax it. However, rather than performing the action learned by the child, the puppet performed a different action. Children protested against this, in some cases even telling the puppet how dazing ought to be performed, showing that they saw the puppet's actions as a violation of the norms of the game. A subsequent study showed that children enforce norms learned in this way on ingroup members but not on outgroup members (Schmidt, Rakoczy, & Tomasello, submitted). Taken together, these studies show that in these kinds of situations, children not only learn the actions involved in the demonstration, they learn how members of their particular culture ought to perform the specified behavior (see also Kenward et al., 2011, for further evidence of the role of norms in imitation).

Another area in which goals to learn and goals to identify are difficult to separate (Turner, 1991) is children's tendency to preferentially imitate ingroup members. Buttelmann, Zmyj, Daum, and Carpenter (submitted) presented 14-month-old infants with a model who used an unusual means to perform an action, for example turning on a lightbox with his head instead of his hands. In one condition, the model appeared to be an ingroup member (having previously spoken in the infants' native language) and, in the other condition, the model appeared to be an outgroup member (having previously spoken in a foreign language). Results showed that infants were more likely to copy the unusual action when the model appeared to be an ingroup member.

Thus far, we have discussed imitation as a means by which to learn from others (whether that involves learning about the physical world or learning about the social world). However, there are also forms of imitation which do not involve any learning at all; in these cases, social goals predominate.

### Social Goals Predominate

In situations in which social goals predominate, the child seeks to be like the model without any attempt to learn a new skill. In these cases, the match between the child's behavior and the mod-

who imitates them than an individual who engages in equally contingent but nonimitative behavior. Further research has demonstrated that 18-month-olds are more likely to help (Carpenter, Uebel, & Tomasello, 2008) and 5-year-olds are more likely to trust (Over, Carretero, Smith, & Gintis, submitted) individuals who have imitated them. For example, Over et al. engaged 5-year-olds in a social interaction in which one experimenter consistently imitated their choices and another experimenter consistently made independent choices. Children were subsequently presented with two tests. In one test, the two experimenters expressed conflicting preferences for the contents of two opaque boxes. In the other test, the two experimenters offered conflicting claims about the referent of a novel word. Results showed that children were significantly more likely to endorse both the preferences and the factual claims of the experimenter who had previously imitated them.

The vast majority of research on the social function of imitation has investigated social influences on copying behavior within interpersonal interactions. However, there are hints that children also consider their position within the group as a whole when deciding what to copy. For example, Over and Carpenter (2009) demonstrated that 5-year-old children who have been primed with ostracism from the group copy the actions of a model significantly more closely than children who have been given a neutral prime. One interpretation of these data is that the ostracism primes indirectly threatened children's need to belong (Baumeister & Leary, 1995) and that children in this condition then used imitation as a means by which to convey their similarity to the group and to affiliate with other group members.

Throughout this section, we have emphasized that social-identificatory goals can lead children to faithfully imitate the actions of a model. However, it is important to note that copying a model too closely or too overtly may have unintended negative consequences, leading the model to view the imitator as sycophantic or insufficiently independent (Lubin & Field, 1981). Furthermore, there are some actions that it may not be wise to imitate even within affiliative contexts; copying a model's accidental actions or mistakes, for example, would likely not typically increase rapport with that individual.

Although social goals are a critical factor in leading children to faithfully reproduce observed actions, they are not the only one. Social pressure can also push children toward a more faithful imitation of a demonstrated act, as we will see next.

### Social Pressures

In order to fully understand the nature of imitation, it is important to think beyond the imitator's own goals within the imitative situation and consider the goals others have toward the imitator. The way the model and the social group in general behave within an imitative situation can put pressure on an individual to imitate in particular ways. Although social pressure can be exerted directly by the model and other group members through their explicit behavior, it can also be indirectly felt by the individual without any explicit behavior on the part of those around them. Individuals may feel internal pressure to imitate for a number of reasons, for example, as a result of a need to 'fit in' and conform to the positive expectations of others (Deutsch & Gerard, 1955) or as a

result of an expectation that they ought to act in a similar way to their group (Turner, 1991).

One situation in which a model may put pressure on a child to imitate is in a particular way is teaching. Adults, and even children (Whalen & Flynn, 2010), regularly teach those around them about the physical world and about social norms to which they should adhere. A model's behavior may thus be experienced as pressure to learn, pressure to identify, or as a combination of the two. The social pressure experienced within teaching situations can take a number of forms. Sometimes the pressure can be quite direct: adults are often ready with sanctions if children do not act in the prescribed way (Schmidt et al., in press). At other times, however, pressure may be more subtle and take the form of active encouragement to imitate in a particular way. Gergely and Csibra (2006) have demonstrated that even infants respond to subtle teaching cues, such as ostensive eye contact, provided by adults. They report an experiment in which 14-month-olds were presented with a demonstration in which a model used her head to turn on a lightbox. In one condition, the model marked this information as important with ostensive eye-contact. In the other condition, the model did not provide any teaching cues. Results showed that infants were significantly more likely to copy the unusual action when it was accompanied by ostensive eye contact (see Brugger et al., 2007, for similar findings). Of course, the extent to which teaching is experienced as social pressure depends partly on the child's own goals in the situation. If the child is an active participant in the learning situation and eager to learn, then teaching may be experienced as cooperation or helping rather than pressure (Carpenter & Call, 2009). However, if the child is more reluctant to participate in the learning situation, then teaching involves an element of social pressure.

Social pressure need not be exerted directly by a single model. It can also be experienced on a group level. In fact, pressure to act in accordance with the behavior of other group members can be so strong that it leads children to act in ways that appear completely irrational. This phenomenon has been clearly demonstrated by Haun and Tomasello (in press), who tested children within a modified version of the Aisch (1956) conformity paradigm. Four-year-old children were placed in a room with three of their peers and asked to estimate the relative size of different pictures. On test trials, the three peers gave an answer which was, from the child's perspective, incorrect. Following this, children were required to give their own answer. Results showed that children conformed to the majority's incorrect judgment on approximately 40% of trials (see also Cariveau & Harris, 2010 and Walker & Andrade, 1996). The social pressure children experienced within this situation is underscored by a second experiment which compared children's responses when they were given in public versus in private. When children were allowed to give their responses in private (posting their answer covertly rather than expressing it verbally so that everyone could hear) conformity dropped to almost zero (see Cariveau, Fusaro, & Harris, 2009, and Fusaro & Harris, 2008, for further evidence of group-level social pressures on children's copying behavior).

Further research has demonstrated that the group does not even need to be physically present in order for children to feel social pressure to imitate in a particular way. Over and Carpenter (2009), for example, demonstrated that simply watching a short video of shapes interacting in ways suggesting ostracism is sufficient to

lead to changes in 5-year-old children's imitation. Furthermore, in Schmidt and colleagues' (in press) normative study, even when the model used no normative language, and no other group members besides the model were physically present during the learning situation, 3-year-old children still felt pressure to act in accordance with what was demonstrated and even subsequently enforced what was learned on another group member. Thus, in many cases, even when the group is not physically present, it seems to be kept in mind "in the background" so to speak.

In summary, children feel social goals, motivations, and pressures to imitate, and this may explain their tendency to often copy others faithfully. As we will see below, these social goals, motivations, and pressures may not be found to anywhere near the same extent in our closest living primate relatives, chimpanzees.

**Imitation in Nonhuman Primates**

The question of whether chimpanzees imitate in order to learn is highly controversial and has been discussed in detail elsewhere (e.g., Horner & Whiten, 2005; Tennie, Call, & Tomasello, 2009). Rather than focusing on that debate here, we focus on the more social aspects of imitation, which have been less widely discussed in the literature. Regardless of whether chimpanzees imitate in order to learn new skills, there is little evidence to suggest that chimpanzees imitate for social-identification reasons (Carpenter & Call, 2009; Nielsen, 2009; Tennie et al., 2009). At the very least, it seems that they do not do so to anywhere near the same extent as humans do (see de Waal, 1998). For some anecdotal reports of social imitation in chimpanzees, chimpanzees do engage in some relatively restricted examples of mimicry, for example conspecific yawning (Anderson, Myowa-Yamamoto, & Matsuzawa, 2003), but there is not yet any convincing evidence that this behavior is motivated by a desire to be like their group members (see Yoon & Tennie, 2010, for possible alternative explanations).

However, there are some hints that imitation in nonhuman primates may be more social than previously thought. Perry (2011), for example, has suggested that some capuchin species show social traditions in behaviors such as hand-sniffing, body-part sucking, and cymbal-gouging. The motivations underlying their these behaviors, as well as the mechanisms underlying their acquisition, warrant further investigation. Further, there is some evidence to suggest that being initiated has social consequences in nonhuman primates. Pakser, Suomi, Visalberghi, and Ferrari (2009) presented capuchin monkeys with two human experimenters, one of whom initiated their behavior and one of whom performed equally contingent but nonimitative actions. Across a series of experiments, Pakser et al. demonstrated that the monkeys not only preferred to look at the experimenter who initiated them, but also sat closer to that experimenter and exchanged more tokens with him. Although these data suggest that being initiated has social consequences for nonhuman primates, as it does for human children, it is not yet clear whether monkeys' responses were attributable to affiliation or dominance or to some other factor (Call & Carpenter, 2009). The relationship between initiation and affiliation/identification in nonhuman primates thus remains an important topic for future research.

In contrast to human children, there is also no convincing evidence to suggest that nonhuman primates experience social pressure to imitate in particular ways. Recently, there has been

some suggestion that chimpanzees show conformity to the behavior of their group members. Whiten, Horner, and de Waal (2005) trained two high-ranking females drawn from two separate groups of chimpanzees to use a particular technique in order to retrieve food from a novel apparatus. Once trained, these two females were returned to their respective groups and the extent to which their group members adopted their technique to retrieve food from the apparatus was assessed. Whiten, Horner, and de Waal (2005) found that a majority of chimpanzees adopted the technique they observed. Furthermore, a minority of these individuals first discovered an alternative technique but subsequently went on to match the technique used by the majority of their group.<sup>2</sup> Whiten, Horner, and de Waal (2005) argue that these chimpanzees were discounting their personal preference in favor of the group norm. Chimpanzees in this study were clearly influenced by the behavior of their group members. However, this study does not demonstrate that subjects felt social pressure to adopt the method most common within their group. One means by which to investigate whether chimpanzees experience social pressure of this kind would be to test whether they are more likely to adopt the specified technique in public than in private. Relatedly, there is little evidence that chimpanzees exert social pressure on their group members to copy in particular ways. Although mother chimpanzees may facilitate their offspring's learning of novel skills (e.g., through leaving tools in easily accessible places; Boesch, 1991) they do not appear to actively teach them new skills (Tomasello, 1999).

Imitation in humans thus appears to be a much more deeply social process than it is in other primates. Below we summarize the functions which imitation serves in human learning and social interaction.

**What Is Imitation For?**

The social framework we suggest in this paper suggests that the functions of imitation are far broader than is generally recognized within developmental psychology. Previous accounts of imitation have emphasized that imitation allows us to learn about the physical world and, in particular, to learn about causally opaque cultural artifacts (Lyons et al., 2007; Whiten et al., 2009, see also Gergely & Csibra, 2005, 2006). This is indeed one important function of imitation, but it is not the only one. In addition to allowing us to learn how to manipulate the physical world, it allows us to learn about the social world. Through imitation, we learn how members of our group tend to behave and even how they ought to behave. Not only do we learn cultural practices and rituals through imitation (Heyes, in press), we also learn social norms. These social norms may be directed toward objects (e.g., how a particular game with tools is played; Rakoczy et al., 2008) or toward other individuals. For example, children may learn how to treat particular individuals, and groups of individuals, through imitating the behavior of those around them (for a study related to this idea see Fein, 1975). Thus not only is the process of imitation social, the content of imitation can also be social. Beyond learning, there are also more purely social functions of imitation. Children use imitation as a means by which to identify with those around

them and to convey that identification to others. Thus imitation can help build rapport with other individuals (e.g., Lakin & Chartrand, 2003; Nielsen et al., 2008) and with the group in general (e.g., Lakin et al., 2008; Over & Carpenter, 2009).

**Conclusion**

At the start of this paper, we outlined an apparent paradox in the study of social learning: whereas children sometimes copy selectively (e.g., copying intentional actions but not mistakes or failed attempts; Carpenter et al., 1998; Meltzoff, 1995), at other times, they copy surprisingly faithfully (e.g., reproducing a model's actions so precisely that they imitate even causally irrelevant actions; Lyons et al., 2007). We demonstrated that, in their current form, some influential theories of imitation (Belkinger et al., 2000; Gergely & Csibra, 2006; Lyons, 2009; Whiten et al., 2009) are unable to explain how both of these forms of copying behavior can occur within similarly aged children.

We have argued that this apparent paradox can only be resolved by viewing imitation through a social lens. We have proposed that three critical factors in determining what children copy are children's own learning versus social goals in the situation, children's identification with the model and the social group in general, and the social pressures children experience to imitate in particular ways. The strength of these three factors and the particular combination in which they occur within the imitative situation play a crucial role in influencing what children copy. For example, when children have goals to identify or affiliate with those around them and/or experience strong social pressure to imitate, they should copy modeled actions relatively faithfully. These social motivations and pressures may be so strong that they lead children to act in ways that appear irrational, for example imitating the causally irrelevant actions of a model (e.g., Nielsen & Blank, in press) or conforming to a clearly incorrect majority (Haun & Tomasello, in press). In contrast, when children seek simply to learn about the external world, and experience little social pressure to match the behavior of those around them, then they should reproduce only those actions which they believe necessary to reproduce the same end result as a model. Needless to say, we do not wish to argue that other factors, such as children's age, their understanding of the objects and actions involved in the demonstration (e.g., Hamrick, 1978), and their experience with different social partners (e.g., Seehagen & Herbert, 2011) are irrelevant to understanding social children copy, but simply to highlight how important social motivations and pressures are to understanding imitation.

Beyond explaining the apparent paradox between selective and exact copying, this approach has further advantages for the study of imitation. By providing a bridge between developmental research on imitation and social psychological work on mimicry (e.g., Chartrand & Bargh, 1996; Lakin & Chartrand, 2003), norm learning (Cialdini, 2001), conformity (Asch, 1956; Deutsch & Gerard, 1955), and group membership (Turner, 1991), it adds a new perspective on the functions of imitation in development and its role in cultural transmission. In doing so, it opens up interesting new avenues for both developmental and comparative research on the social factors which influence imitation. By viewing social learning from the perspective developed in this paper, it becomes clear that imitation, and indeed the creation and maintenance of human culture, is a profoundly social process.

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## An Overview of Imitation Skills in Autism: Implications for Practice

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Research findings suggest certain forms of imitation may be relatively more difficult for individuals with autism compared to typically developing peers. Findings of deficits in imitation skills have significant implications for intervention approaches given the critical nature of imitation to one's ability to learn from the environment. This article provides an overview of the research findings in behavioral and cognitive developmental psychology on imitation skills in autism. Implications of current findings for intervention are presented and recommendations for practice-relevant research are also made.

### Implications for Practice

Autism spectrum disorders involve a complex array of learning and behavioral deficits and excesses. Although autism is characteristically heterogeneous, individuals with autism display these deficits and excesses in the following three areas: communication, social relationships, and behavioral perseveration and rigidity. The heterogeneity of autism allows for few conclusive statements about learning styles of individuals with autism. The learning characteristics that have been identified include problems with perseverative responding (e.g., position preferences), overserselective responding, and poor skill generalization.

Recent research in cognitive developmental and neuropsychology suggests that another possible characteristic learning deficit in individuals with autism may include imitation. Much of the research on imitation deficits in individuals with autism is drawn from between-group designs comparing the skills of primarily children with autism to children matched on verbal or non-verbal mental age. In various studies, children with autism underperform on various imitation tasks compared to the control groups (Herzmann, et al., 1992; Ohta, 1987; Jones & Prior, 1985; Hammes & Langdell, 1981). However, these findings appear to be in contradiction with clinical observations of excessive imitative ability (e.g., echolalia) and findings from applied behavior analytic research indicating success in teaching imitation to children with autism.

Given the critical nature of imitation to learning, understanding the nature of imitation skills in individuals with autism is necessary to developing effective early intervention and instructional practices. This article will highlight relevant research and practices on imitation skills in individuals with autism. Behavioral and cognitive developmental disciplines have been the most prolific in the study of imitation skills in individuals with autism. As such this article will focus primarily on the contributions of these disciplines.

Our fairly limited understanding of the nature and impact of deficient imitation skills in children with autism are in part due to disparate theoretical and methodological approaches between behavioral and cognitive developmental research. Cognitive developmental theories view imitation as a keystone skill representing a child's understanding of the relationship between himself and the environment. Imitation represents a child's first understanding of person-environment relationships within cognitive developmental theories. Thus, imitation is thought to allow for the development of other critical person-environment relationships such as communication and social skills.

While the focus of cognitive theories on hypothetical constructs such as "theory of mind" are less useful, studies of typical and atypical development of imitation in autism is an important contribution of this approach. The methods employed in cognitive developmental research typically evaluate whether the imitation skills of children with autism are typical for their intellectual level. Thus, between-group

designs are almost exclusively used by cognitive developmental researchers matching control and experimental groups on standardized test variable reflecting either verbal or non-verbal mental age.

Initiation in behavior theory has been conceptualized in both strict operant and cognitive behavioral terms. Kymissis & Poulson (1990) provided one of the most comprehensive reviews of the history of imitation research from a learning theory perspective. Conclusions from Kymissis & Poulson (1990) suggest that Baer & Deguchi's (1985) operant conceptualization of imitation and generalized imitation may be the most useful in accounting for the development of complex imitative behavior in humans. Albert Bandura's research on imitation (1969, 1977) provided groundwork for contemporary social learning perspectives on imitation and observational learning. In behavioral investigations of imitation in children with autism, emphasis is often placed on factors influencing skill acquisition including teaching factors such as presentation mode and model type. Independent variables evaluated in behavioral analytic literature typically include response class generalization, peer modeling, and video modeling and are investigated within single-subject designs. The focus of behavioral research in autism is primarily on factors influencing instruction.

Different disciplines also have different vocabularies for describing imitation. Unfortunately, the distinctions between these terms have not been presented consistently within or across disciplines. Behavioral theorists have distinguished between many types of imitative behavior including conditioned reflexes (Kymissis & Poulson, 1990), matched dependent behavior vs. copying (Miller & Dollard, 1947), generalized imitation (Baer & Deguchi, 1985), and modeling vs. vicarious learning (Bandura, 1977).

Cognitive developmental theorists also distinguish between types of imitative behavior, distinguishing between imitation, emulation, mimicry, and social facilitation (Roeyers, Van Oost, & Boelhuysne, 1998). Imitation refers to the reproduction of a model's actions in topography and function for novel actions only. It is distinguished from mimicry in which the reproduction of the action occurs outside of the functional context used by the model and from emulation in which a different topographical response is used to obtain the same functional goal as the model. Finally, facilitation is used to refer to reproduction of an action that was already within the child's repertoire. Given the lack of congruence between the vocabularies for distinguishing between types of imitative behavior, the remainder of this article will use the term "imitation" to refer to all categories of actions in which reproduction of a model's behavior is involved.

### Cognitive Developmental Findings

As indicated above, cognitive developmental research on imitation in autism primarily focuses on the presence or absence of an autism-specific imitation deficit. Early research in this field generally used Piagetian models of sensorimotor development and compared children with autism to mental-age matched peers on a series of sensorimotor tasks (Charman & Baron-Cohen, 1994; Dawson & Adams, 1984). DeMyer, et al. (1972) were among the first to investigate imitation skills in autism. In the experiment, 12 children with autism and early childhood schizophrenia were compared to a control group of children with mental retardation. The groups were evaluated on a variety of body movement (i.e. gestural) and object manipulation imitation tasks. Children with autism exhibited significantly less imitation overall than children in the control group and had particular difficulty with gestural imitation.

DeMyer, et al.'s (1972) initial research generated subsequent studies supportive of the general findings of imitation deficits in autism (Herzmann, Ullstadius, Dahlgren, & Gillberg, 1992; Ohta, 1987; Jones & Prior, 1985; Hammes & Langdell, 1981). The few studies (Charman & Baron-Cohen, 1994; Morgan, et al., 1989) that did not find group differences on imitation tasks may have encountered ceiling effects as evidenced by Charman & Baron-Cohen (1994) use of task designed for infants with a group of relatively high functioning children and adolescents with autism.

In addition to the presence or absence of an imitation deficit in autism, another debate in the autism literature is whether different task types have differential influences on performance. This research line

arose out of the cognitive developmental research on imitation in typically developing infants and children in which distinctions are often made between domains of imitation. In typical development, imitation of skills varies depending upon the domain. In general, imitations using objects appear before gestural imitations. Symbolic imitations appear around 1-2 years, in congruence with neo-Piagetian theory.

A substantial amount of research supports the finding that imitation in children with autism may be at least partially controlled by the type of task that is presented. Hertzog, et al. (1989) found low-functioning autistic subjects performed worse on sensorimotor and symbolic tasks than an MR and typical preschool controls. Hammes & Langdell (1981) found that subjects with autism had deficits in symbolic imitations compared to children with mental retardation, but performed equivalently on simple sensorimotor imitations using objects. Heiman, Ullstadius, Dahlgren, & Gillberg (1992) also found that level of imitation in children with autism varied with the domain-membership of the task presented. While children with autism performed worse on all tasks than controls, they imitated object manipulation tasks and vocal imitation tasks most frequently. Motor tasks were the least frequently imitated categories for children with autism. Many additional studies confirmed the above findings of a relative deficit in gestural imitation in children with autism. (Stone, Ousley, & Littleford, 1997; Heiman, Ullstadius, Dahlgren, & Gillberg, 1999; Soorya & Romanczyk, 2000).

In addition to the parameters of gestural vs. object manipulation tasks, cognitive developmental studies have also evaluated parameters such as the familiar vs. unfamiliar actions and sequential vs. static actions. Roeyers, et al. (1998) found that young children with autism performed worse than children with mental retardation matched on either mental age or chronological age. Children with autism performed worse than the control group on all tasks with the largest between group differences found for novel gestural tasks. The results of this study suggest the novelty of the task may influence imitation performance, at least with young children with autism. The results of Roeyers, et al. (1998) are supported by previous findings by Dawson & Adams (1984) who found that children with autism had an intact ability to imitate familiar, learned gestures. The length and sequential nature of tasks was evaluated by Libby, Powell, Messer, & Jordan (1997). Children with autism unexpectedly performed better than children with Down syndrome and typically developing children on symbolic imitation tasks involving one action. However, children with autism were found to have more difficulty than controls on tasks with multiple components.

#### *Behavioral findings*

Behavioral research on imitation skills in individuals with autism has the distinction of focusing on factors influencing learning. Several parameters that influence imitation in individuals with autism have been identified through behavioral research, including reinforcement, response class, type of model, and presentation mode.

Similar to cognitive research on the influence of task type on performance, Young, Krantz, McClannahan and Poulson (1994) evaluated generalized imitation in children with autism within and across response classes. In particular, this study examined three imitation response classes: vocal, toy play and pantomime. Interestingly, imitation generalized within the vocal response class and the pantomime response class. Imitation did not generalize within the toy play response class. Imitation also did not generalize across response classes. The authors suggest that toy play behavior may be the most difficult of the three response classes due to perseverative and self-stimulatory behavior observed that could have interfered with imitation. A similar finding of limited generalization across response classes also found by Neef, Shafer, Eget, Cataldo and Parrish (1983). The same finding is shown when mothers were by Neef, Shafer, Eget, Cataldo and Parrish (1983). That is, imitation was shown to generalize within the response classes, but not across response classes (Poulson, Kyprisinos, Andreatos, Kymissis, & Parnes, 2002).

There is a substantial behavior analytic literature that has assessed imitation using different types of models (peer and adult) for teaching children with autism. Ithig and Wolchik (1988) conducted a study to

compare adult versus peer models in teaching children with autism. They found that both models resulted in equivalent learning. In addition, high levels of generalization and maintenance of imitative behaviors were shown for children in both conditions (adult or peer).

Peer modeling has been shown to facilitate the acquisition of several types of behaviors, including motor, communication and social skills (Carr & Darcy, 1990; Peck, Apollini, Cooke, & Braver, 1978) for children with autism. Variables contributing to the successful modeling of peer behavior include the close physical proximity of the peer (Charlop, Schreibman & Tryon, 1983; Coleman & Steadman 1974), the prompting of specific behaviors by the adult (Peck et al., 1978) or by the peer (Carr & Darcy, 1990) and using a progressive time delay procedure (Venn et al., 1993). Using typical children as peer models for autistic children in the classroom environment to address academic related skills such as following directions and attention to task was shown to increase such skills. (Lanquar, 1989). Peer modeling has also been shown to be effective with the teaching of functional skills to children with autism (Pepperberg & Sherman, 2000).

Peer modeling has also been shown to facilitate stimulus generalization, response generalization, and improved social interactions. For example, Carr & Darcy (1990) suggest that using multiple objects and actions (stimuli) during training may facilitate generality of responses to other settings. Venn et al. (1993), using an errorless learning approach, showing that a lower rate of errors is observed in the acquisition of novel behaviors following the peer modeling procedure.

Recently, research has examined videotaped modeling as an alternative mode of presentation. Video modeling has been used to successfully teach conversational skills (Charlop & Milstein, 1989), purchasing skills (Haring, et al., 1987), and daily living skills (Shipley-Bennaman, Lutzker, & Taubman, 2002) to individuals with autism. For example, results from Haring et al (1987) study of instruction in purchasing skills in young adults with autism indicated a significant increase in both purchasing behaviors and social behaviors after implementation of the videotape training phase. While video modeling and peer modeling have shown positive effects in many studies, it remains to be seen whether the modeling procedures have differential impact compared to their counterparts (e.g. live modeling, adult modeling).

#### *Instructional Practices*

Because of the importance of imitation to typical development of language, social, and cognitive skills, imitation is often targeted early in intervention plans and continues to be addressed throughout the child's treatment. Treatments for autism based on either behavioral or cognitive developmental models emphasize imitation skills particularly with young children with autism. The methods and treatments used within cognitive developmental approaches remain to be empirically validated. Applied behavior analysis (ABA) as an intervention approach for children with autism is strongly recommended (New York State Department of Health, 1999). As indicated in the review above, ABA research typically focuses on issues influencing learning, this review of instructional methods of teaching imitation will focus primarily on behavioral approaches.

There are a variety of behavioral treatment approaches aimed at treating children with autism including discrete trial teaching, verbal behavior, natural language procedures, incidental teaching, errorless learning, etc. At their core, all such procedures use basic ABA procedures such as stimulus control, prompts, modeling, shaping, and reinforcement to teach imitation skills, and regardless of the specific approach chosen, all procedures consider imitation skills to be near-essential to new learning.

In discrete trial teaching, skills are broken into small steps and each step is systematically taught using strategies derived from basic principles of behavior. Imitation skills are typically among the first to be taught in a discrete trial program because they are often considered to be prerequisite abilities for learning other skills. For example, motor imitation (clapping, standing, rolling a car) might be taught so that the child can later be taught to follow the verbal instructions of a teacher or parent. Similarly, teaching verbal



imitation (say "cookie") can aid in later teaching of spontaneous speech skills. Once basic imitation skills are established, they can be used as building blocks for more complex skills. Discrete trial procedures typically makes generous use of prompting procedures in order to increase the likelihood that the child will respond correctly and receive subsequent reinforcement. Prompts that require imitation skills include verbal directions ("say 'I want car'") and modeled prompts (demonstrating how to use a toy and then asking the child to imitate the toy play behavior). Similarly, imitation skills are part of the basis of the Verbal Behavior approach to treatment. This approach is based on Skinner's conceptualization of language as similar to other types of learned behavior. Verbal behavior approaches to teaching language to children with autism emphasize teaching language in its many functional components. That is, language is perceived as having many functions, including to alter one's environment (manding), to respond to sensory stimuli (tacting), and verbal behavior in response to another person's verbal behavior (intraverbals). Imitation is used throughout the teaching of mands, tacts, and intraverbals primarily in form of verbal models to engage in the correct form of speech to complete the target function.

Imitation also plays an important role in naturalistic teaching procedures such Pivotal Response Training (Koegel & Schreibman, 1996) and incidental teaching. The goal of Pivotal Response Training is to teach pivotal skills that affect a broad range of functions. Pivotal skills include responsibility to multiple cues, motivation, and self-management (Stahmer, 1999). The approach capitalizes on the child's motivation by using strategies such as child choice and turn taking to teach new skills. For example, a child might be offered a choice between a two toys and might then be prompted to imitate the label of the approached toy. Similarly, incidental teaching uses child initiated interactions as opportunities to prompt the child to make appropriate responses. Imitation is a critical skill needed to respond to many prompts. For example, a child who begins to approach a stuffed animal may be prompted to say "dog" in order to gain access to the toy.

#### *Language Instruction*

Communication instruction is a critical component of most autism treatment programs. Most children with autism display prominent delays in these areas and those that are not delayed in acquiring language typically have difficulty with its pragmatic use. Both Skinner and Bandura theorized that children learn language through processes of reinforcement and extinction. That is, speech is acquired through reinforced imitation of desired adult speech and extinction of undesirable sounds for a given culture. While speech instruction is often seen as the domain of speech and language therapists, ABA trained individuals across all disciplines use behavioral theories of language acquisition to facilitate communication skills in both verbal and non-verbal domains.

An example of a behavioral language training approach is demonstrated in a study by Charlop and colleagues (1985). The authors demonstrated that children with autism could be taught to make spontaneous verbal responses through an imitation promoting procedure (Charlop, Schreibman, Thibodeau, 1985) in this study, the experimenter initially presented the child with a visual stimulus such as a cookie and modeled the response, "I want cookie." The verbal model was slowly delayed to encourage a spontaneous response from the child. Children participating in this study learned to spontaneously request the items taught using this imitation procedure. Further, the spontaneous speech generalized from the teaching situation to other people, places and stimuli. In a different study, the authors used both video modeling and in vivo modeling with reinforcement training to teach two similar receptive and expressive language. Results indicated that even though modeling improved performance on both receptive and expressive tasks, no generalization to other receptive and expressive tasks was observed (Charlop-Chirsty, Le, & Freeman, 2000).

Imitation has also been successfully used to teach gestural communication (Buffington, Krantz, McCannahan, & Poulson, 1998). Children with autism often show deficits in their use of communicative gestures. Buffington and colleagues taught children to use attentional (e.g. raising one's hand), affective (e.g. shaking one's head), and referential (e.g. gesturing 'tiny') gestures by modeling the correct gesture following incorrect responses and then providing the child with the opportunity to correct

his or her response. The authors also used physical prompts along with verbal and token reinforcement of correct responses to teach the gestures. Children in this study learned to use the gestures being taught and generalized these responses to new stimuli and settings.

#### *Social Skills Instruction*

In addition to building communication skills, most or all intervention programs focus on development of socialization. Social deficits are considered to be a defining characteristic of autism. Not surprisingly, social skills are also among the most difficult skills to teach. Social deficits in this population include deficits in social use of language, poor recognition and response to emotions, deficient peer interactions, and more. One reason that social skills are difficult to teach is that typically developing children rarely require direct instruction to acquire these skills; they learn through imitation of the social mores of adults in their play (e.g. playing store or having a tea party) and in their interactions with others (e.g. a very young child may imitate the script of social greetings and farewells).

Unlike typically developing children, children with autism are often unable to acquire social skills through observational learning alone. For example, children with autism who are placed in a class with typically developing peers will typically not acquire needed skills simply by watching and imitating these peers. Children with autism often require direct instructions, modeling, role-playing, practice and reinforcement in order to acquire new social skills.

While many programs for social skills instruction are available, little systematic research on effective instructional practices is available. Buggay, Toombs, Gardener, and Cervetti (1999) found increased appropriate play interactions when using video samples of the participants themselves as their own models. Buggay and colleagues (1999) spliced together videotapes of children with autism appropriately responding to questions. Participants who viewed this tape almost doubled their rates of appropriate responding to the target questions during a subsequent play session (Buggay, Toombs, Gardener & Cervetti, 1999).

#### Summary

The review above reflects the current state of knowledge about imitation skills in individuals with autism. Cognitive developmental research indicates that children with autism have deficits in imitation that cannot be better accounted for by intellectual status. These deficits are most severe in the domains of gestural and motor imitation (Stone, et al., 1997). Behavioral studies have revealed a wealth of information regarding the influence of many parameters of instruction. The Young et al. (1994) study suggests that that imitation must be taught within response classes for individuals with autism (e.g. toy play should be taught separately from motor imitation). Various studies of peer modeling suggest that peer modeling can be a cost effective tool for teaching communication and social skills (e.g. Carr & Darcy, 1998). Important variables in using peer models include prompting, progressive time-delays, and the physical proximity of the peer.

Despite the relative abundance of information on the imitative skills of individuals with autism, much remains to be explored given the primacy of imitation to learning from one's environment. Differences in imitation performance between subgroups of children with autism (e.g. high vs. low functioning), developmental changes across childhood, observational learning, differences between spontaneous vs. prompted imitation, and differences between immediate and deferred imitation in autism have not received attention in the literature to date.

In addition, assessments of imitation in individuals with autism or typically developing children are also limited. Elements of various standardized infant development tests such as the Bayley Scale of Infant Development are often used. Standardized tests of developmental dyspraxia, which have limited construct validity, have also been used. However, assessments that incorporate contemporary research

findings for children across the developmental spectrum and allow for progress monitoring are not available. These types of assessments are clearly needed to improve instructional methods in imitation.

Additional research investigating information that can be utilized in interventions is also needed. An integration of the findings and methods across the cognitive, developmental, and behavioral research would be a first step in aiding intervention approaches. While it may seem as if cognitive developmental research may have little to offer behavioral intervention approaches, some researchers have produced findings that could be utilized given better cross-discipline communication. For example, Dawson & Galpert (1990) evaluated outcomes when parents imitated their child with autism's social gaze and play. The study found positive correlations between parental imitation and improved social gaze and play behaviors. However, adult imitation of child behavior is not systematically used within empirically supported treatments for autism (i.e. ABA). ABA methods could also be used to likely improve the effectiveness of the findings from cognitive developmental research given the emphasis of motivational variables, which is often not addressed within cognitive developmental studies.

A significant problem in the behavior analytic literature is the lack of large N studies that evaluate specific characteristics of the participants such as age, intellectual ability, social interactive ness, presence/absence of verbal speech, etc. The focus on developmental changes and large group investigations of the cognitive developmental field could be utilized to better address the current limitation of the behavioral research on imitation in children with autism.

With the limitations above in mind, some recommendations for practice can be made based on the current findings. Table 1 below presents the authors' recommendations for effective instruction of imitation in individuals with autism based on the current research across disciplines. The table is organized by parameters of imitation primarily affecting instruction of basic skills. Research on instruction on higher level tasks such as social skills and complex procedural tasks is limited. Future expansion and integration of research in this field will hopefully address the many parameters that are absent from following list.

Initiation parameters	Research Findings(s)	Clinical Implication
Task type	Motor imitations are more difficult than object imitation (Stone, et al., 1997), but object imitation may display poorer generalization (Young, et al., 1994).	Instructional programs should explicitly teach motor, object, vocal, and symbolic imitation separately to promote generalized imitation in each category. Motor imitation may require additional focus given relative difficulty in performance of this task.
Child vs. adult directed	Adult imitation of child behavior found to promote increased toy play (Dawson & Galpert, 1990).	Incidental and natural language approaches may be useful in teaching generalized imitation for objects.
Familiarity	Imitation of familiar gestures are intact, but children with autism have a relative difficulty with novel gestures (Dawson & Adams, 1984).	Performance of gestures such as waving may not generalize to learning novel gestures such as communicative signs.
Task Length	Imitation of single-component symbolic actions intact, but multi-component actions are more difficult (Libby, et al., 1997).	Instructional programs may benefit from developing protocols for teaching imitation from simple to complex actions.
Model type	Peer modeling is an effective method of teaching skills, but increased effectiveness of peers compared to adults has not been demonstrated in autism (Iring & Wolchick, 1988).	Research in typical development suggests modeling is facilitated by factors such as model similarity. Findings suggest peer modeling particularly for increasing social contact may be useful, but not necessary.
Presentation mode	Video modeling has been effectively used to teach many skills, but its relative effectiveness compared to in-vivo modeling has not been demonstrated (e.g., Charlop & Milstein, 1989).	Video modeling has practical benefits in terms of portability, but must be weighed with costs such as production time and expense.

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