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Becoming a Social Partner With Peers: Cooperation and Social Understanding in One- and Two-Year-Olds

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One- and two-year-old peer dyads were presented with a simple cooperative task. Age differences were found in amount of coordinated activity, monitoring the peer's activity and location in relation to the goal, and attempting to achieve the goal when the peer was (or was not) available as a partner. One-year-olds' coordinated actions appeared more coincidental than cooperative whereas older children appeared to be more actively cooperating toward a shared goal. Differences in coordinated activity with peers were associated with differences in attention sharing with an adult and with language about self and other. The ability to cooperate with peers, becoming a true social partner, develops over the 2nd and 3rd years of life in concert with growing social understanding.

Development of the ability to cooperate with peers is a signal achievement. Theorists have long maintained that critical social and cognitive developments are born in the context of cooperative play with other children (Dunn, 1988; Garvey, 1990; Hartup, 1983; Piaget, 1932). Indeed, cooperation may constitute a social imperative (Hartup, 1996) and it forms the foundation for human culture (Rogoff, 1990; Tomasello, 1999a). The beginnings of peer cooperation represent the child's entry into peer culture. However, the origins and early development of children's ability to cooperate with peers are little studied and remain poorly understood. Moreover, despite the likely involvement of developing social understanding in the growth of early peer interaction (Brownell, 1986; Brownell & Hazen, 1999; Dunn, 1988; Eckerman & Peterman, 2001) and the last decade's burgeoning research on very young children's understanding of others' desires, intentions, and goals, there have been few efforts to relate toddlers' nascent social skills to their emerging social understanding. The purpose of this study was twofold: to examine developments in children's early cooperative abilities with peers, and to examine associations between cooperation and social understanding in a period when both are rapidly developing.

Early Developments in Cooperation With Peers

In the 2nd year of life, children begin to move out of the exclusivity of adult–child relationships into the larger, novel world of peers. Before 18 months, peer interactions are rare, primitive, and minimally coordinated, even though children exhibit social interest in one another as early as 6 months of age (see Brownell & Brown, 1992; Eckerman & Peterman, 2001, for reviews). In a longitudinal study, Eckerman, Davis, & Didow, (1989) found a dramatic increase between 20 and 24 months of age in spontaneous, novel cooperative activity between unfamiliar toddler peers. This was almost entirely accounted for by mutual imitation of nonverbal actions such as jumping or running. Others have also reported marked increases in imitative and/or reciprocal peer play at about 24 months (Eckerman & Whitehead, 1999; Howes, 1988; Maudry & Nekula, 1939; Ross, 1982), and one study using a structured problem-solving task found that 24- and 30-month-old children could reliably cooperate with each other but younger children could not (Brownell & Carriger, 1990). Thus, peer cooperation appears to emerge at the end of the 2nd year of life. During the 3rd year, children's cooperative play becomes more

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responsive to their peer's actions and desires, and they actively influence one another's behavior and goals. For example, between 27 and 40 months children are more likely to take their peer's desires or needs into account, such as offering or sharing toys that the peer actually wants (Smiley, 2001); they also produce more other-focused speech during peer play and cooperation, such as asking or telling the peer to do something (Brownell & Carriger, 1991; Eckerman & Didow, 1996; Smiley, 2001). Therefore, children's cooperative activities with peers appear to begin with imitative games and simple routines at the end of the 2nd year, and become more coordinated and fully cooperative during the 3rd year when children consider, accommodate to, and influence one another's actions and goals. However, little is known about the earliest forms of peer cooperation, when they emerge, or under what conditions very young children can share activities and goals to cooperate with one another.

Interestingly, this general progression in early peer cooperation is consistent with the sequence of complexity in coordinated behavior identified in a formal analysis of cooperative hunting among nonhuman primates (Boesch & Boesch, 1989). Although not developmental, this analysis presents a detailed articulation of four increasingly complex levels of coordinated behavior that may provide an analog for age-related changes in children's early cooperation. At the lowest level, hunters perform similar actions toward the prey at the same time but without any other spatio-temporal relations among them, i.e., they act independently and do not consider the behavior of their partners. At the second level, they still behave similarly but now coordinate their behavior temporally, for example adjusting their relative running speeds to remain near each other. At the third level they adjust both their position and their speed relative to each other, and at the highest level they adopt complementary roles and actions, i.e., different hunters behave differently such as one chasing the prey and one blocking the escape. In this framework, actors at the lowest level do not take others or their behavior into account although their actions are sometimes coordinated, while at the highest level actors' behavior appears genuinely collaborative, with multiple accommodations in time, space, and behavior relative to their partners and the goal. Thus, cooperation varies from simple to complex as a function of how the actors organize their behavior relative to one another and to the common goal.

This conceptual framework can serve as a useful heuristic for characterizing developmental progressions in young children's cooperation. Primitive forms of coordinated activity among 1-year-olds may be based on similar but independent actions performed at the same time toward a common goal such as acting together on the same toy (Eckerman et al., 1989; Mueller & Brenner, 1977), which then progress to spatially and temporally coordinated cooperative behavior in 2-year-olds based on a shared goal (Brownell & Carriger, 1990; Howes, 1988). Complex coordinations of roles and behavioral timing with multiple shared goals emerge still later among 3-year-olds and indicate explicit collaboration (Ashley & Tomasello, 1998; Smiley, 2001). One purpose of the current study was to examine age differences in the earliest forms of children's cooperation with peers. To this end, a cooperative task was designed that permitted children to behave imitatively in pursuing a single goal to correspond to the putatively most primitive level of coordination based on similar actions produced at the same time. We also designed a sequential version of the task that required temporal coordination of behavior to achieve the goal, to correspond to the second, more difficult level. We expected that 1-year-olds' actions would be coordinated largely by chance if they act at the same time but independently and cannot yet share the goal and organize their behavior jointly around it, whereas 2-year-olds would be able to share the goal and coordinate their behavior with one another more systematically to achieve it.

Social Understanding and Peer Cooperation

The preceding conceptualization of the development of cooperation is anchored in assumptions about young children's social understanding, especially what they understand about one another's intentions and goals. At the simplest level identified above, in which actors perform similar actions independently while achieving a single goal, primitive forms of coordination do not necessarily rest on awareness of a partner's intentions and goals, and coordinated activity can be achieved without actively considering the partner's behavior. However, the ability to cooperate by coordinating behavior temporally and spatially with a partner presumably does require such awareness (Brownell & Carriger, 1991; Moore, in press; Povinelli & O'Neill, 2000; Smiley, 2001; Tomasello, 1999a). Developmental changes in early peer cooperation may thus be at least partly a function of growth in children's representation of their own and others' intentions and goals, and of relations between their own behavior and their partner's behavior. Links between social

understanding and social behavior have rarely been investigated in this age group, however. Thus, the second purpose of this research is to examine how young children's emerging ability to cooperate with a peer partner relates to their early social understanding.

Early Developments in Social Understanding

Recent empirical work points to rapid and profound changes in the first 2 years of life in children's social understanding. Particularly relevant for the current study, considerable evidence suggests that 1-year-olds attend to and perhaps understand others' perceptions, desires, intentions, and goals (Brooks & Meltzoff, 2002; Caron, Kiel, Dayton, & Butler, 2002; Carpenter, Nagell, & Tomasello, 1998; Dunphy-Lelii & Wellman, 2004; Gergely, Nadasdy, Csibra, & Biro, 1995; Kuhlmeier, Wynn, & Bloom, 2003; Moll & Tomasello, 2004; Repacholi, 1998; Tomasello & Haberl, 2003; Wellman, Phillips, & Spelke, 2002; Woodward, 1999, 2003), and are able to take these into account in reasoning about others' actions (Behne, Carpenter, Call, & Tomasello, 2005; Carpenter, Call, & Tomasello, 2005; Gergely, Bekkering, & Kiraly, 2002; Liszkowski, Carpenter, Henning, Striano, & Tomasello, 2004), even when others' intentions are not fully realized in their actions (Bellagamba & Tomasello, 1999; Carpenter, Ahktar, & Tomasello, 1998; Meltzoff, 1995) and when others' desires conflict with the child's own (Repacholi & Gopnik, 1997). Thus, by 9–15 months of age infants appear able to detect others' intentions and goals in their behavior and to use this awareness to govern their own behavior.

This nascent social understanding continues to develop over the 2nd year and beyond. For example, 1-year-olds are limited in the range of actions they can detect as goal directed (Poulin-duBois & Forbes, 2002; Sodian & Thoermer, 2004), whereas 2-year-olds can infer agents' intentions from a variety of more and less subtle behavioral cues (Hollich, Hirsh-Pasek, & Golinkoff, 2000; Poulin-duBois & Forbes, 2002). Moreover, 1-year-olds can ''read'' adults' goals from their actions (Meltzoff, Gopnik, & Repacholi, 1999), i.e., they appear to understand ''intentions-in-action,'' but they do not yet understand ''prior intentions,'' the mental states that precede and motivate actions (Meltzoff, 1995). The latter understanding develops over the 2nd and 3rd years of life as children come to understand others as knowledgeable about the world and not only as actors (Baldwin & Moses, 1996; Carpenter, Call, & Tomasello, 2002; Moore, in press; Smiley, 2001). Growth in social understanding over this age period is reflected in many aspects of early development, including expanded ability to use and respond to others' communicative intentions (Baldwin, 1993, 1995; Schwe & Markman, 1997; Smiley, 2001; Tomasello, 2001) as well as growth of internal state words to refer to others' emotions, desires, perceptions, and physiological states (Bartsch & Wellman, 1995; Bretherton & Beeghly, 1982; Shatz, Wellman, & Silber, 1983), increasing use of action words to describe or comment on one's own or others' goal-directed behavior (Bartsch & Wellman, 1995; Smiley, 2001), and using personal pronouns to denote the distinct perspectives of self and other on the world (Bates, 1990; Lewis & Ramsay, 2004; Ricard, Girouard, & Decarie, 1999).

Links With Early Cooperation

Insofar as the ability to cooperate depends on being able to represent and to share goals and intentions with a partner, growth in early social understanding should support developing cooperative abilities. Infants can cooperate with adults in simple games and routines by 12–18 months of age (Hay, 1979; Ross & Lollis, 1987; Warnecken, Chen, Liebal, & Tomasello, 2005). But when they must take a more active role in structuring the interaction, their ability to cooperate with adults improves dramatically after 24 months of age (Rutter & Durkin, 1987). Similarly, as reviewed above, children are unable to cooperate with peers until the close of the 2nd year of life or later. This suggests that 1-year-olds' ability to attend to adults' goal-directed behavior and to detect adults' intentions may not yet support the ability to integrate their own intentions with a peer's intentions to achieve goals jointly. As children's social understanding develops over the 2nd and 3rd years of life, perhaps through cooperative games and interactions with adults, and children are better able to infer and to integrate their own and others' intentions (Barresi & Moore, 1996), they should be able to cooperate with one another more systematically as well, recognizing and generating joint intentions and goals. Thus, they should become progressively more able to take their peer's goal-related activity into account in concert with their own, and to adjust their own behavior accordingly by monitoring, timing, and sequencing their behavior together with the peer to attain a shared goal.

The Current Study

To examine age-related changes in early cooperation with peers and associations with early social

understanding, we created a task in which 18- to 30-month-old children had to coordinate their activity with one another to achieve a single goal. The goal was provided by the task itself so that the children did not have to invent or discover it on their own, and the means to achieve the goal were demonstrated by an adult. The task also permitted children to capitalize on the imitative skills that they use in their earliest instances of joint play with peers (Asendorpf & Baudonniere, 1993; Camaioni, Baumgartner, & Perucchini, 1991; Eckerman et al., 1989). It was thus well within the capabilities of young toddlers and much simpler than previously used cooperation tasks (Ashley & Tomasello, 1998; Brownell & Carriger, 1990), making it possible to observe very early forms of peer cooperation.

We constructed two versions of the task; in both versions each child had to perform the same single behavior (pull a handle) to activate an interesting toy. In the first version each child pulled a separate handle and the two handles had to be pulled at approximately the same time to activate the toy. In the second version children again performed the same behavior with two separate handles, but sequentially, pulling the handles one after the other. Both versions of the task were first demonstrated to the children by an adult; in the second version children were also individually trained to produce the sequential handle-pulling actions on a smaller version of the task before being presented with the larger, cooperative version.

On the first version of the task, in which the goal could be achieved imitatively and required nominal temporal coordination, coordinated activity could arise adventitiously, with minimal social understanding, as a result of independently performing similar behaviors to achieve the same goal. Or it could be the result of the children using their emerging intention understanding to share the goal with their peer partner and cooperating to achieve it. On the basis of the preceding conceptualization we expected age differences on this version of the task, with 1-year-olds' coordinations remaining primitive and infrequent, as a result of failing to share the goal with their partner, whereas older children would be able to cooperate more readily and with greater coordination of their goal-related activity. The second version of the task required more complex temporal coordination in the form of turn taking. We expected this version to be more difficult for all children, but that older children would again succeed more often by explicitly cooperating to achieve a shared goal.

To index early social understanding, we assessed children's ability to share attention with an adult and their language about self and other. These represent different but related components of understanding others' perceptions, intentions, desires, and goals. We assessed children's ability to share attention with an adult because gaze and attention provide information about what someone could be wanting or intending (Dunphy-Lelii & Wellman, 2004; Wellman et al., 2002), especially when combined with the direction of their body movements (Mundy, in press). Establishing joint attention by following another's gaze or point may also require that the child represent the other's communicative intention (Baldwin, 1993; Brooks & Meltzoff, 2002; Dunphy-Lelii & Wellman, 2004; Tomasello, 1999b), and some scholars have suggested that joint attention is necessary for cooperation (Brinck & Gardenfors, 2003).

Second, we assessed language about self and other, particularly personal pronouns, action words, and internal state words. Language development has been shown to relate to the development of mental state understanding across a variety of paradigms, and one central mechanism appears to be the child's exposure through discourse to varying perspectives between self and others (Harris, deRosnay, & Pons, 2005; Symons, 2004). For example, toddlers' understanding of others' behavior and internal states is associated with their mothers' talk about the children's own goals in response to the children's requests (Smiley & Greene, 1995), and family conversation at age 2 about feelings and mental states predicts a child's emotion understanding and emotion talk in the preschool years (Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991; Jenkins, Turrell, Kogushi, Lollis, & Ross, 2003). Syntax acquisition may also provide children with the means for representing reality as embedded in mental states (''He thinks it's really a pencil'') (Astington & Jenkins, 1999; deVilliers & deVilliers, 2000; Lohmann & Tomasello, 2003; but see Cheung et al., 2004), and even earlier in childhood, the means for encoding and coordinating intentions (''He wants me to get it'') (Bartsch & Wellman, 1995; Smiley, 2001).

In very young children, before syntax, developmentally earlier aspects of language also relate to emerging social understanding (Bloom & Tinker, 2001; Farrar & Maag, 2002; Hollich et al., 2000). Relevant to the current study, personal pronoun comprehension and use reflects an understanding of the complementary and reversible equivalence relation between self and other (Bates, 1990; Kagan, 1981; Lewis & Ramsay, 2004; Ricard et al. 1999). This is similar to the self–other representations involved in joint goal-directed behavior with a partner (Asendorpf & Baudonniere, 1993; Brownell & Carriger,

1990, 1991). Similarly, early verb usage may build on children's understanding of intentional action in themselves and others (e.g., Kagan, 1981; Poulin-Dubois & Forbes, 2002; Smiley, 2001; Smiley & Huttenlocher, 1995), which is critical to being able to share intentions and goals with others. Finally, internal state terms are presumed to reflect children's early understanding of others' psychological states, including others' goals and intentions (Bretherton & Beeghly, 1982; Shatz et al., 1983). Insofar as early language can act as a catalyst in developing an initial understanding of others' internal states (Baldwin & Moses, 1996; Shatz, in press), children with more advanced language about self and others may be also better able to use their linguistic skills to learn about and to infer others' intentions, desires, and goals. Thus, because young children's language both contributes to and indexes their growing social understanding, we expected these language-based indicators of early social understanding to be associated with developments in children's ability to cooperate with a peer partner to achieve a joint goal.

The first hypothesis examined was that the development of cooperation with peers progresses from a relatively primitive form in 1-year-olds, based on chance coordinations of independent but similar actions, with little evidence of understanding or sharing the peer partner's intentions or goals, to more genuine cooperation in 2-year-olds, when children can coordinate their behavior by sharing the goal and monitoring and accommodating their behavior to one another and their joint goal. We thus expected age differences in the frequency of coordinated behavior with a peer, in monitoring the peer's activity when children themselves were attempting to achieve the goal, in pulling the handle when the peer was nearby and available as a partner, and in interference with the peer's goal-directed activity. Second, we hypothesized that developments in cooperation would occur in concert with growth in children's social understanding, and thus that children who were better at coordinating attention with an adult and more skillful in using language referring to self and other would be more successful in cooperating with a peer.

Method

Participants

Participants were 88 children (48 girls) divided into three age groups: 19 months ($SD = 0.91$; $N = 34$; 18 girls); 23 months ($SD = 0.95$; $N = 28$; 16 girls); and 27 months ($SD = 1.1$; $N = 26$; 14 girls). Children were scheduled together with a same-age (within 1 month), same-sex unfamiliar peer. Families were from a medium-sized urban area and varied from working class to upper middle class by parent report; 94% were Caucasian, 5% African-American, and 1% Hispanic. Most children had some playgroup or child-care experience; data from the children who were in child care did not differ from those who were not. Most children had no siblings; the number of siblings did not differ by age and there were no sibling effects on any dependent measure. Several recruited dyads could not be used for the following reasons: one child in the dyad refused to engage the cooperation task ($N = 9$); one child in the dyad became distressed ($N = 2$); experimenter error ($N = 2$).

General Procedure

The session began with a 10–15-min period of warm-up freeplay, which included a standard set of toys that children could play with individually or together. The cooperation task was presented in one room and videotaped through a one-way mirror. The Early Social Communication Scales (ESCS, described below) were administered individually in a second room, with a video camera placed unobtrusively in a corner approximately 2.5 m away from the child. Parents remained with their children at all times.

Cooperation Task

The cooperation task was modeled after tasks used by Ashley and Tomasello (1998), Brownell and Carriger (1990), and Chalmeau, Visalberghi, and Gallo (1997). It consisted of a colorful wooden box (1 m × .4 m × .3 m) with two small plastic handles protruding horizontally from one side of the box (see Figure 1), mounted on a small table approximately .4 m high. The handles were just below shoulder height for most children and moved freely back and forth, in and out of the box. An animated musical toy, mounted on top of the box behind a Plexiglas barrier, was surreptitiously activated by remote control when both handles were pulled. From the children's perspective, their handle pulling was the apparent causal mechanism. To make the task cooperative, the two handles were mounted too far apart for one child to reach them both, requiring each child to pull one of the handles.

A female experimenter demonstrated the task three times in succession, pulling both handles, with a simple directive, "Watch! If you pull both handles, the doggie will sing!" Parents remained uninvolved.

Figure 1. The cooperation task.

The experimenter encouraged the children with nondirective comments. Once the children were successful, the task was repeated as often as the children wished. If one or both children were not engaged, or if they were unsuccessful after the 1st minute, the experimenter initiated a series of prompts such as "Can you help each other?" or "Pull your handles to make the doggie sing." These more directive prompts were infrequent, occurring in fewer than a third of the dyads, generally only once. Two versions of the task were presented to all children, as described below.

Simultaneous actions version. In this version of the task, the two handles were the same color. The experimenter demonstrated the task by pulling the handles simultaneously. Each child had to pull one handle within 3 s of the other child's pull of the other handle; no other coordination was necessary to activate the toy. For example, one child might repeatedly push and pull one handle back and forth while the other child pulled and held the second handle extended. Such minimal coordination would be sufficient to activate the toy. This version of the task was always presented first because both our conceptual analysis and pilot testing established that this version was easier; by presenting it first, we hoped to maximize the youngest children's success on the second, more difficult version of the task.

Sequential actions version. In this version the two handles were different colors. The experimenter demonstrated that each handle had to be pulled in turn, one after the other, to activate the toy; either handle could be pulled first, and one handle was fully extended before initiating the second handle pull. Children had to pull the second handle within 3 s of the first; if the children pulled the handles simultaneously, nothing happened. Thus, this version required greater temporal coordination than the first version and the children had rudimentary roles to play, one child starting and the other child following.

Before they were presented with the second version of the task, children were individually trained to pull the two handles sequentially on an identical smaller version (0.3 m × 0.6 m × 0.35 m) complete with animated toy, placed on the floor; the children could reach both handles on this smaller version. The experimenter used a verbal cue while training the child that would be used later as a reminder in the cooperation version: "Pull both handles, One! Two!" All children were successfully trained to a criterion of three successive correct handle pulls or four total correct handle pulls.

The second version of the cooperation task was administered much like the first. In this case, when the experimenter demonstrated the task she used the verbal cue to remind the children of their experience with the individual training task and of the sequential actions. There was no evidence of fatigue or loss of interest on the second version of the task as a result of its being presented last.

Cooperation Coding

The videotapes from each task were event coded using the Noldus™ Observer 3.0 observation software. Specific task-related behaviors adapted from Brownell and Carriger (1990) and Chalmeau et al. (1997) were defined (see Table 1 for definitions). These were grouped into four categories: coordinated behaviors; communicative behaviors; uncoordinated behaviors; time on task (a single duration score). The set of coordinated behaviors reflects the children's appropriate timing of their handle pulling relative to one another, their appropriate location at the task and the handles relative to the peer's location, and their monitoring of the peer's activity and location at the task. Communicative behaviors index children's gestures and verbalizations to one another about the task. Uncoordinated behaviors reflect the various ways in which children could interfere with one another's activity at the task as well as their attempts to achieve the goal on their own without the peer.

Interobserver reliability was established between two raters who independently coded tapes from 31 children (35%), approximately equally distributed over age and the two versions of the task. Percent agreement and interrater correlations are shown in Table 1. Because individual behaviors in the coding system were not mutually exclusive (e.g., monitoring

Table 1
Behaviors Coded From Cooperation Task and Interrater Reliabilities

Behavior	Definition	% Agree	Interrater correlation
Coordinated behaviors			
Spontaneous coordinated pull	Child pulls handle within 3 s of peer's handle pull	96	0.95***
Directed coordinated pull	Child pulls handle within 3 s after highest level verbal directive from adult	50	− 0.03
Cued coordinated pull	Child pulls handle within 3 s after "One . . . Two!" cue from adult (Sequential task only)	90	0.87***
Monitor partner's activity	Child focuses gaze on peer's face or hands within 2 s preceding or following his/her own handle pull	97	0.81***
Peer proximal pull	Child pulls his or her own handle when peer is within arm's length of other handle	97	0.98***
Communicative behaviors			
Declarative communications	Child gestures or verbalizes to peer about task in a nondirective manner (e.g., points to toy or says "Doggie!")	28	0.94***
Imperative communications	Child gestures to peer about task in a clearly directive manner (e.g., points to peer's handle while looking at peer) or verbally directs peer's behavior on task or requests peer to perform an action (e.g., "Pull it," "Help")	75	1.00
Uncoordinated behaviors			
Individual pull	Child pulls own handle and peer's handle is not pulled within 3 s preceding or following	98	0.97***
Control	Child interferes with peer's manipulation of his or her handle (e.g., displaces peer at handle)	100	0.85***
Join	Child moves next to peer at peer's handle	92	0.86***
Leave task	Child moves more than arm's length away and disengages from task for 5 s or longer	81	0.90***
Time on task			
Duration (s)	Child is facing task and visually or manually engaged, with interruptions of less than 5 s	na	0.94***

peers and pulling the handle could be coded at the same time), κs were not calculated. Directed coordinated pulls and declarative communications were infrequent, and were excluded from analyses because of their low reliability.

Social Understanding

Two measures of social understanding were obtained. One was based on a procedure individually administered by a female experimenter to index children's social understanding in social and communicative exchanges with adults. The second was based on questionnaires about children's language that parents completed during the visit.

Joint attention. Each child was individually administered the ESCS (Seibert, Hogan, & Mundy, 1982), a standardized, structured procedure to index social understanding in children between 8 and 30 months of age using nonverbal communication tasks. Children's behavior was coded from videotapes using the criteria established by Mundy, Hogan, and Doehring (1996). Joint attention indexes the degree to which children understand and respond appropriately to others' communicative and social intentions and is the measure used in the current study. Joint attention is further categorized into *initiating joint attention* (IJA) and *responding to joint attention* (RJA). High-level joint attention (child points or shows to share experiences with the experimenter; child turns head and eyes to follow experimenter's visual regard and pointing gesture to something out of his or her immediate vision) is presumed to reflect communicative intent or awareness of another's communicative intent, and is distinguished from lower level behaviors such as simple eye contact. Because understanding others' goals and intentions is at the heart of cooperation, we focused on these high-level dimensions. The frequencies of IJA and RJA were standardized for analysis. Interobserver reliability was established between two raters who independently coded data from 24 children (27%) approximately equally distributed across age. Percent agreement ranged from 79.5% to 90%. Correla-

tions between the two raters for the frequency of high-level IJA and high-level RJA over the 24 children were $r = .89$ and .95, $p < .001$, respectively.

Language about self and others. Parents completed the toddler form of the MacArthur Communicative Development Inventory (CDI; Fenson et al., 1994), a widely used instrument to assess language comprehension and production in 12- to 36-month-old children. It yields frequency measures for specific categories of words and gestures as well as for overall vocabulary. Because we were interested in words referring to self and other and to goals and intentions, we used the Pronouns subscale and the Action Words subscale. These scales indicate whether the child understands (scored as 1) or understands and says (scored as 2) eight personal pronouns (e.g., her, you, me) and 55 action words (e.g., bite, feed, run). The scores were summed over all words checked ($M = 81.8$; range = 12–126 for the two scales combined).

Parents also completed the State Words Checklist (SWCL; see appendix), adapted for this study from Bretherton and Beeghly (1982) and Shatz et al. (1983), to index children's use of words referring to emotion, perception, desire, intention, pretense, thought, and physiological state. The parent indicated for each of 70 words how often the child had used the word in the past 6 months (0 = *never*; 1 = *once or twice*; 2 = *3–5 times*; 3 = *often*). Ratings were summed over all words for a total internal state words usage score ($M = 44.1$; range = 0–155).

Two composite scores were created. Children's scores on the two CDI scales and the SWCL were correlated; therefore, the three scores were standardized and summed to create a total self–other language score (Cronbach's $\alpha = .90$). Because older children's generally larger vocabularies could account for age differences on these subscales, we also weighted children's individual scores by creating proportions for each one with the total CDI as the denominator. We then standardized and summed these proportion scores to yield a weighted summary score of language about self and others.

Results

Means and standard deviations for the dependent measures are presented in Table 2. Preliminary *t* tests confirmed that there were no sex differences; thus all analyses were conducted on data collapsed over sex. *T* tests were also conducted to test for age differences in the amount of time that children spent on task and for differences between the two task versions for time on task. There were no significant differences.

We first report results for age and task-version differences in children's ability to coordinate their behavior with the peer, using the measures of coordinated handle pulls and other coordinated behavior

Table 2
Means and Standard Deviations for Children's Performance as a Function of Age

	19 months		23 months		27 months	
	M	*SD*	*M*	*SD*	*M*	*SD*
Cooperation task[a]						
Coordinated behavior						
Spontaneous coordinated pulls	3.03	2.9	5.66	3.7	7.85	3.1
Cued coordinated pulls	0.50	0.55	0.95	0.66	1.67	0.79
Peer proximal pulls[b]	3.46	2.6	5.89	3.9	6.44	5.3
Monitor peer	5.38	2.5	7.23	2.1	8.80	3.3
Imperative communication	0.21	0.20	0.35	0.47	0.48	0.83
Uncoordinated behavior						
Individual pulls	8.04	2.2	9.38	5.6	10.10	7.9
Other uncoordinated behavior	1.94	1.4	0.91	0.90	1.50	1.9
Joint attention[c]						
Initiate	2.9	3.5	5.4	6.5	4.1	3.6
Respond	2.5	0.83	2.9	0.64	2.9	1.0
Self/other Language[d]	−1.2	1.9	0.15	1.7	0.96	1.5

[a]Frequencies averaged over the two children in a dyad and over the two versions of the task.
[b]Does not include coordinated pulls.
[c]Frequencies of high-level joint attention.
[d]*Z* scores.

(see Tables 1 and 2 for definitions and descriptive statistics). We supplement these analyses with person-level non-parametric analyses to clarify and strengthen the findings. Second, we report results for age and task-version differences in uncoordinated behavior, i.e., individual handle pulls and other uncoordinated behavior (see Tables 1 and 2). Third, we report results from a series of analyses addressing whether coordinated behavior was coincidental or cooperative, also considered as a function of age. Fourth, we report results for age differences in the measures of social understanding (joint attention; language about self and others), and finally we present analyses of associations between measures of peer cooperation and measures of social understanding.

Age and Task Differences in Coordinated Behavior

To test for age and task-version differences in coordinated behavior, we conducted a 2×3 repeated measures multivariate analysis of variance (MANOVA) with task version (simultaneous; sequential) as the within-subjects factor and age group as the between-subjects factor (19 months; 23 months; 27 months) on the set of coordinated behavior measures (spontaneous coordinated pulls; monitor peer; peer proximal pulls). Significant multivariate effects emerged for age, $F(6, 78) = 2.80$, $p < .05$, and for task version, $F(3, 39) = 14.45$, $p < .001$, on the measures of coordinated behavior (see Figure 2). The interaction between age and task version was not significant (similar results were obtained using age as a continuous variable in regression analyses). The findings from the post hoc univariate analyses following the main effects for age and task version are reported below.

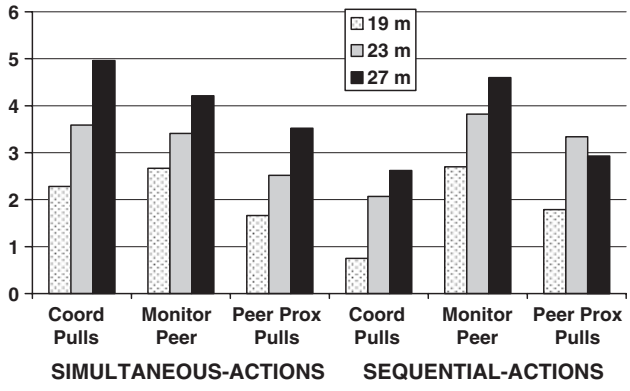

Figure 2. Age differences in frequency of cooperative behaviors for each task version.

Age differences: Coordinated pulls. Across tasks, older children more often coordinated their handle pulling with their peer partner than did younger children (see Table 2), $F(2, 41) = 7.37$, $p = .002$. Specifically, 19-month-old dyads produced the fewest coordinated pulls ($M = 3.0$), followed by 23-month-olds ($M = 5.7$) and 27-month-olds ($M = 7.6$), all of whom differed significantly from one another. Likewise, the proportion of toddler dyads' total handle pulls that were coordinated with the peer doubled between 19 and 27 months, from 27% at 19 months to 54% at 27 months, a significant difference, $F(2, 41) = 4.8$, $p < .01$. An additional one-way ANOVA with age group as the factor was conducted on cued coordinated pulls, which were unique to the sequential version. Significant effects emerged for age on cued coordinated pulls, $F(2, 41) = 11.46$, $p < .001$. The youngest toddlers produced significantly fewer cued coordinated actions on the sequential version of the task than did older children (Ms = 0.50, 0.95, and 1.67 for 19-month-olds, 23-month-olds, and 27-month-olds, respectively), and 23-month-olds produced significantly fewer than did 27-month-olds. Thus, 1-year-old peers coordinated their behavior relatively infrequently overall, whereas 2-year-olds did so regularly.

Not only were 1-year-olds' efforts less often coordinated, but more of them failed to produce any spontaneous coordinated pulls at all. On the simultaneous-actions version of the task, 24% of the 1-year-olds were unable to coordinate their behavior at all and another 12% could do so only once, unable to repeat their initial success. This compares to 14% of the 23-month-olds who never coordinated their behavior with the peer, and 14% who could do so only once. All of the 27-month-old dyads coordinated their actions at least once and, with only one exception, were able to cooperate multiple times. These age differences, while striking, were not significant. On the sequential version, for which they had received individual training, 29% of 1-year-old dyads were unable to produce any coordinated handle pulling and another 35% were unable to coordinate their behavior more than once. This compares to 7% of the 23-month-old dyads with no coordination and 14% with just one instance. All of the 27-month-olds were able to cooperate with the peer multiple times. These differences were significant, likelihood ratio ($df = 4$) = 23.76, $p < .001$.

Finally, few 1-year-olds were able to achieve multiple successes on both versions of the cooperation task whereas nearly all of the older 2-year-olds could do so, suggesting that the older children were more skilled at achieving a goal jointly. Only 30% of

the 19-month-old dyads were successful more than once on both versions of the task, compared to 64% of the 23-month-old dyads and 92% of the 27-month-old dyads, χ^2 (2) = 12.28, $p < .01$.

Age differences: Other coordinated behavior. We also examined whether there were age differences in children's task-relevant monitoring of the peer and in adjusting their goal-directed actions in relation to the peer's location relative to themselves and the goal (see Table 2). Univariate tests showed that the 27 month-olds more often monitored their peer partner while they were pulling their own handle ($M = 8.80$) than did 19-month-old children ($M = 5.38$), $F(2, 41) = 6.18$, $p < .01$. The 27-month-old children were also nearly twice as likely to pull their own handle when the peer was in proximity to the other handle ($M = 6.44$) than were 19-month-olds ($M = 3.44$), although the univariate test was only marginally significant, $F(2, 41) = 2.49$, $p < .10$.

A separate 2 (task version) × 3 (age group) repeated measures univariate ANOVA was conducted on imperative communication because it was not correlated with other measures. There were no significant effects for either age or task version on imperative communications.

Task differences: Coordinated pulls. The sequential version of the task proved more difficult for all children than the simultaneous-actions version, $F(1, 41) = 34.12$, $p < .001$, with fewer spontaneous coordinated pulls per dyad in the sequential ($M = 3.6$) than in the simultaneous version ($M = 7.2$).

Task differences: Other coordinated behavior. There were no significant multivariate or univariate effects as a function of task version on monitoring the peer's activity at the task or in pulling the handle when the peer was near the other handle (see Figure 2).

Age and Task Differences in Uncoordinated Behavior

A second 2 × 3 repeated measures MANOVA with task version (simultaneous; sequential) as the within-subjects factor and age group as the between-subjects factor (19 months; 23 months; 27 months) was conducted on the measures of uncoordinated behavior (individual pulls; sum of control, join, and leave task). There were no significant multivariate effects for either age or task version on uncoordinated behavior. Children at all three ages often pulled the handles by themselves and these individual attempts to achieve the goal did not decline significantly with age (see Table 2). Moreover, the frequency of children's individual pulls was not significantly associated with their coordinated pulls, $r(44) = -.016$, *ns*; thus pulling the handle by oneself more often was not related to greater success on the task. Children also engaged in a variety of other individual behaviors that either did not consider their partner's role and activity in achieving the goal (i.e., join) or interfered with rather than coordinated with the partner's behavior (i.e., control; leave task); these also did not decline significantly with age. Not surprisingly, a dyad's uncoordinated behavior was negatively associated with the frequency of their coordinated handle pulls, $r(44) = -.33$, $p < .05$; therefore, engaging in noncooperative behavior was related to lower chances of success. Nevertheless, children at all three ages engaged in similar rates of these unproductive behaviors. Hence, even the 27-month-old children continued to display relatively high frequencies of uncoordinated behavior at the same time as they were also able to coordinate behavior with a peer to achieve a shared goal.

To What Extent Was Coordinated Behavior Coincidental?

Because the task used in this study was simplified to permit primitive, low-level forms of cooperative activity, it was possible for children's behavior to be coordinated without actively taking into account their partner's goal-directed actions. That is, children could simply attempt to achieve the goal individually when both happened to be positioned at the task. In this case, the goal is not shared; neither child is adjusting or accommodating behavior to the other in the service of a common goal, rather they simply happen to act in parallel as they each independently pull their own handle to achieve their own personal goal. It is important, therefore, to determine not only whether older children's behavior was more often coordinated with their peer's behavior, but also whether they were actually more cooperative, that is, whether they appear to have understood their partner's goal and to have shared it. There are several indirect means of addressing this question that converge into a coherent pattern. These strategies are adapted from work with nonhuman primates in which similar issues were addressed (e.g., Chalmeau et al., 1997; Povinelli & O'Neill, 2000; Visalberghi, Quarantotti, & Tranchida, 2000).

First, we asked whether older dyads were more likely to pull their handles cooperatively than individually. The ratio of dyads' coordinated pulls to individual pulls increased significantly with age, albeit marginally, $F(2, 41) = 2.99$, $p = .056$, with the youngest children differing significantly from the oldest group. The 19-month-old dyads more often pulled their handles individually than cooperatively; indeed, they were more than twice as likely to pull

the handle individually than cooperatively (*M* ratio of coordinated pulls:individual pulls = 0.40). The 27-month-olds, on the other hand, were almost twice as likely to pull their handles cooperatively than individually (*M* ratio = 1.6). The 23-month-old dyads fell in the middle, pulling about equally often individually and cooperatively (*M* ratio = 1.1), and did not differ from either the youngest or the oldest groups. Thus, the predominant pattern in the 1-year-old dyads was to try to achieve the goal independently, whereas the predominant pattern among the 2-year-olds was to attempt to achieve the goal together. This suggests that coordination in the youngest dyads may have been serendipitous, whereas the oldest dyads had figured out how to achieve the goal cooperatively.

Next, we asked whether among all of a child's handle pulls, more of them occurred when the peer was near the other handle and available as a partner. The ratio of peer-proximal pulls to all handle pulls increased significantly with age, $F(2, 41) = 8.57$, $p < .001$. Post hoc tests showed that the youngest dyads differed from both older groups, and the two older groups did not differ significantly from one another. Among the 27-month-olds, 83% of their handle pulls occurred when the peer was available as a partner and 78% of 23-month-olds' handle pulls occurred when the peer was nearby, in contrast to 55% of handle pulls among the 19-month-olds. Thus, among 1-year-olds only half of their handle pulling occurred when their peer was close enough to the other handle to serve as a partner, whereas among the older children most of their handle pulling occurred when the partner was near the handle. One-year-olds generally were not taking their partner's position into account when they pulled their own handle, but 2-year-olds were considering the partner's location in relation to themselves and the goal.

Finally, we asked whether children's individual handle pulls were more probable when a partner was available than when the child was all alone at the task. That is, when children pulled the handle by themselves, was it mostly when they were all alone at the task or was it mostly when the peer was near the task? To address this question, we compared the frequency of each child's solitary handle pulls, when their peer partner was off-task and more than arm's length away from the other handle, with the frequency of his or her peer-proximal individual handle pulls (see Figure 3). Among 19-month-olds, there was no significant difference between the number of individual handle pulls when children were alone at the task ($M = 4.6$) and when the peer was present ($M = 3.4$). However, in the two older age groups children pulled their own handles significantly more often when the peer was nearby ($M = 5.9$, 6.5 for 23-month-olds and 27-month-olds, respectively) than when the children were alone at the task ($M = 3.5$, 3.6, respectively), paired samples $t(27) = 2.04$, $p < .05$, and $t(25) = 2.56$, $p < .05$, respectively. Thus, when older children were pulling their handles on their own, without a partner's coordinating pull, they were more likely to do so when the peer was near the other handle than when no partner was available, capitalizing on the possibility that the peer would begin to pull his or her handle and the two could achieve the goal together. One-year-olds, in contrast, were just as likely to pull their handle when they were all alone at the task as when a potential partner was nearby, indicating that their peer's position and activity did not affect their decision to pull their own handle in trying to achieve the goal.

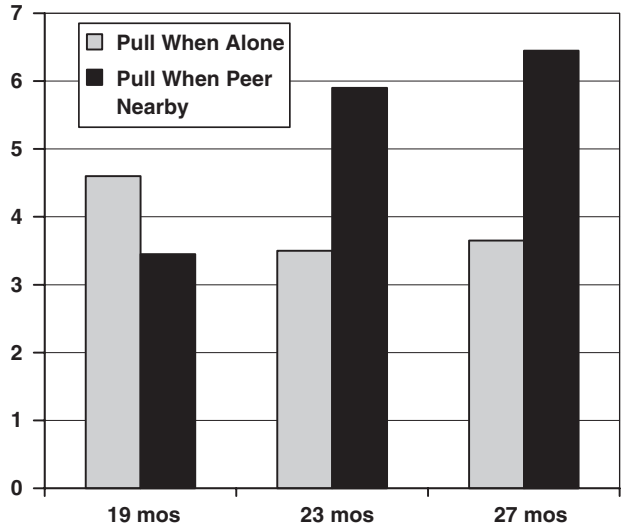

Figure 3. Age differences in frequency of solitary and peer-proximal individual handle pulls.

Age Differences in Joint Attention and Self–Other Language

To identify age differences in the two indices of social understanding, separate one-way ANOVAs were conducted with age group as the factor on the scores of individual children.

Joint attention. There were no age differences in high-level IJA (*M*s = 2.9, 5.4, 4.1 at 19, 23, and 27 months, respectively). For high-level RJA, the effect for age was marginally significant, $F(2, 85) = 2.41$, $p < .10$, and post hoc tests were not significant (*M*s = 2.5, 2.9, 2.9 at 19, 23, and 27 months, respectively). Thus, communicating with the experimenter about toys and objects by pointing to them and

showing them did not change with age, whereas following the experimenter's gaze and pointing to targets outside the child's own visual field trended upward between 19 and 23 months slightly, but not significantly.

Language about self and others. Age differences emerged in the total self–other language score, $F(2,74) = 19.89$, $p < .001$. The 27-month-olds had higher scores than did 23-month-olds, who had higher scores than 19-month-olds (M z-scores = 2.0, 0.23, −1.9, respectively). The summary score weighted by total vocabulary size also exhibited age differences, $F(2,74) = 10.32$, $p < .001$, with 27-month-olds producing a higher proportion of language about self and others than did 23-month-olds, who produced a higher proportion than did 19-month-olds (M z-scores = 0.96, 0.15, −1.2, respectively). Thus, children's production and comprehension of personal pronouns, actions, and internal state words increased between 19 and 27 months in both absolute number and as a proportion of their total vocabulary.

Associations Between Coordinating Behavior With Peers and Social Understanding

To determine whether children's social understanding predicted their individual behavior in attempting to cooperate with a peer, Pearson correlations were conducted using individual scores (the same results were obtained when parallel analyses were conducted for each dyad member separately). Children who were better at following and sharing the adult's attention (RJA) also coordinated their handle pulling with the peer more often, $r(88) = .30$, $p < .005$, monitored their peer more often while they pulled their own handle, $r(88) = .25$, $p < .01$, and more often pulled their own handle when the peer was within arm's length of his or her handle, $r(88) = .18$, $p < .05$. Conversely, the rate of uncoordinated behavior was negatively associated with RJA, $r(88) = -.20$, $p < .05$. Similar associations emerged with children's language about self and others (using the weighted summary score), which was positively correlated with children's coordinated handle pulls, $r(88) = .34$, $p < .001$, monitoring the peer while pulling their own handle, $r(88) = .38$, $p < .001$, and peer-proximal handle pulls, $r(88) = .36$, $p < .001$ (parallel results were obtained when children's self–other language was categorized via median split and then used as the independent variable in ANOVAs). Language about self and others was not correlated with uncoordinated behavior.

Generally these associations remained significant with age partialled out, although reduced in magnitude (rs = .18 −.26), confirming that the relations between social skill and social understanding were not a simple artifact of general age trends. The two exceptions were the association between RJA and peer-proximal handle pulls which was no longer significant with age controlled, and between language about self and others and coordinated handle pulls which became marginally significant, $r(88) = .15$, $p < .10$.

To determine the relative contributions of age, joint attention, and language about self and others to children's coordinated behavior, they were entered together as predictors into separate multiple regression analyses using coordinated pulls, monitor peer while pulling, and peer-proximal pulls as dependent measures. Three hierarchical linear regression models were run, one for each dependent measure. In each analysis age was entered first, followed by RJA, followed by the weighted measure of language about self and others. The language measure was entered last because language develops later than, and depends on, joint attention (Baldwin, 1995; Tomasello, 1999a). The results are shown in Table 3. For coordinated pulls, the model predicted nearly a third of the variance, and RJA continued to predict coordinated pulls with age controlled. However, language about self and others did not predict coordinated pulls when both age and RJA were controlled. For monitoring the peer while pulling one's own handle, the model explained about 17% of the variance, but only language about self and others was predictive after controlling age and RJA. Age was associated with children's tendency to pull their own handle when the peer was nearby, but neither RJA nor language about self and others was predictive in this joint model.

Table 3
Hierarchical Regression Predicting Toddlers' Coordinated Behaviors on the Cooperation Task From Their Age, Response to Joint Attention, and Language about Self and Other

	Coordinated pulls	Monitor peer	Peer-proximal pulls
R^2	0.32	0.17	0.27
F of R^2 change	11.12***	5.14**	8.84***
Age[a]	0.44***	0.18	0.42***
RJA[a]	0.24*	0.09	0.04
Lang[a]	0.06	0.27*	0.15

Note. RJA = response to joint attention, high; Lang = language about self and others
[a]standardized βs.
*$p < .05$. **$p < .01$. ***$p < .001$.

Discussion

In this study we examined very early developments in children's ability to cooperate with peers. We found age-related changes in toddlers' ability to coordinate their activities with one another on a simple task to achieve a common goal, and associations with their growing social understanding. Coordinated activity between 19-month-old peers was sporadic and primitive at best. Although they sometimes produced coordinated behavior, their efforts appeared to be more coincidental than cooperative and many dyads could not coordinate their behavior even once. Thus, 1-year-olds were relatively unskilled at taking a peer's behavior into account even when this was relevant for their own attempts to achieve a desired outcome. In contrast, 2-year-olds appeared to be more actively cooperating toward a shared goal. By 27 months of age children were considerably more skilled at coordinating their behavior with a peer, both monitoring and accommodating to the partner's activity and location as they attempted to achieve the goal together. Children's ability to share attention with an adult and to understand and use language about self and others were associated with their skill in peer cooperation. These findings suggest that children begin to become true social partners with one another late in the 2nd year or at the beginning of the 3rd year of life, in concert with developing social understanding, thereby initiating their entry into peer culture.

Development of Peer Cooperation in Toddlers

We capitalized on toddlers' propensity to imitate others to create a simple task with a single, motivating goal so that we could examine the earliest forms of cooperative activity among young peers. In the only other published study of goal-directed cooperation with peers in this age group, Brownell and Carriger (1990) found that 18-month-olds could not systematically coordinate their behavior on tasks that required complementary behavior. Similarly, on the simpler tasks used in the current study, 19-month-old children performed quite poorly overall and they did not otherwise appear more capable or cooperative than did the 18-month-olds of Brownell and Carriger (1990). Although adults demonstrated and reminded the children of the common goal, removing the need for children to discover or generate a goal together, this was not sufficient to assist 1-year-olds in sharing the goal and cooperating to achieve it. Even on the easier simultaneous-actions version of the task, a quarter of the 1-year-old peer dyads were unable to generate any coordinated behavior at all, and many others were able to generate only one instance. In contrast, all of the 27-month-olds were able to cooperate readily with their peer partners and did so often, repeating their initial success several times, suggesting true cooperation.

Children at all three ages found it more difficult to coordinate their behavior on the sequential version of the task that required them to take turns. However, nearly all of the older children were able to do so multiple times, whereas two-thirds of the youngest dyads were never able to coordinate their activity or could do so only once. This is despite the fact that the children had been individually trained on the turn-taking version: they knew that it took two handles to activate the toy and they knew how to pull the handles sequentially to make it go. Notably, the only difference between the individual, trained version of the sequential task and the cooperative version was that a partner was needed in the latter. In spite of their training, 1-year-olds were unable to generalize their understanding from the individual version to the cooperative version of the task, even though they had already interacted with the same partner on the easier task. Together these findings suggest that despite their social interest in one another, 1-year-olds are not yet aware of their peers as potential partners and cannot yet share intentions and goals with peers to create cooperative activity. These abilities emerge at the end of the 2nd year and continue to develop into the 3rd year.

This conclusion is reinforced by the findings suggesting that coordinated activity among 1-year-old dyads, when it occurred, was inadvertent, whereas 2-year-olds were more actively and explicitly cooperating. The oldest dyads predominantly pulled their respective handles cooperatively, but 1-year-olds pulled their handles on their own more than twice as often as they acted in concert. Moreover, the youngest children's efforts failed to take the peer's position or activity at the task into account; they tried just as often to achieve the goal when it was impossible because they were all alone at the task as they did when the peer was near the other handle and available as a partner. Older children, in contrast, were more likely to pull their own handle when the peer was nearby and available than when they were alone at the task. Thus, 1-year-olds coordinated their behavior much less frequently than did 2-year-olds, they monitored one another's goal-directed activity less, and they were more likely to try to achieve the goal entirely on their own. This suggests that 1-year-olds do not understand the role of their peers as potential partners even at the most

elemental level. Their coordinated activity appeared to be serendipitous, a chance outcome of acting independently to achieve their own goal irrespective of the whereabouts or activity of the peer and potential partner. In comparison, 2-year-olds were more often cooperating, accommodating their behavior to the peer's location or activity, and thus acting together with the peer as a partner in achieving the goal jointly.

Although the older children were better able to coordinate their behavior with a peer, they were hardly perfect. Nearly half of the oldest dyads' efforts were not coordinated with each other, and many of their handle pulls occurred when the peer was not at the other handle. Moreover, children at all ages engaged in similar rates of uncoordinated behavior, including leaving their own side of the task to join the peer next to the other handle and thus making it impossible to achieve the goal, or interfering with the peer's activity by taking over the peer's handle, or leaving the task altogether as the peer was pulling his or her own handle. Thus, it remains unclear how much even the 2-year-olds, as a group, actually shared the goal. It is possible that they were responding more basically to the behavioral topology of the task, recognizing that their own efforts were more likely to be successful when the other child was in a particular location or engaging in a particular action, but not understanding that the other child held the same intention or goal. They may have understood the peer's goal-directed behaviors without understanding goals as internal states.

Together, these results extend prior research in finding that coordinated activity with peers emerges between 18 and 30 months of age even on highly simplified cooperation tasks in which the joint goal and the means to achieve it are provided so that children do not have to generate either by themselves, the goal can be achieved imitatively with identical behavioral roles, and requirements for spatial and temporal coordination of behavior are minimized. The findings are consistent with the hypothesis that early developments in peer cooperation progress from a primitive form of simple, unsystematic, serendipitous coordination of activity among 1-year-olds, with limited recognition of the peer as a social partner, to more collaborative and temporally coordinated cooperative behavior among 2-year-olds that takes into account the partner's actions and location in relation to their common goal. Becoming a social partner with peers may be grounded in early forms of coordinated activity that children can manage without fully understanding their peers as partners. Participating in such interactions may help children progress from being able to coordinate goal-directed actions with one another to being able to share goals and intentions cooperatively.

Associations With Social Understanding

Although behavior can be coordinated between actors fortuitously, without understanding the partner as an agent of his or her own behavior or representing the partner's goals or intentions, which some nonhuman primates can do (Chalmeau et al., 1997; Povinelli & O'Neill, 2000; Visalberghi et al., 2000), uniquely human forms of cooperation depend on understanding, representing, and sharing goals and intentions (Tomasello, Carpenter, Call, Behne, & Moll, 2005). We thus expected that very young children's developing understanding of others' desires, intentions, and goals would be reflected in their performance on the cooperation tasks. Consistent with this hypothesis we found that children with more advanced social understanding were better able to cooperate with a peer partner.

Children can put their incipient social understanding to work in cooperative activities with adults by late infancy (Hay, 1979; Ross & Lollis, 1987; Warnecken et al., 2005). As infants come to produce and share intentions with adults ''in the frame of established activity'' (Nelson, in press), they can detect and interpret adults' intentional actions and use their own gestures and words to affect those actions. This also permits them to engage in cooperative play with adults well before they can do so with agemates. In the current study, 1-year-olds were not able to cooperate with one another even though the goal was demonstrated by adults and the adults reminded them how to achieve it, much as in adult–child cooperative play.

Cooperative activities with peers may represent a boundary condition in very young children's ability to reason about their own and others' intentions and behavior and to put their understanding to use in interaction. To cooperate with one another, children must integrate their own intentions and their peers' intentions with respect to a common goal, which means that they must be able to recognize or infer their peers' intentions and goals from their behavior. Toddlers' nascent understanding of goals and intentions is put to a stringent test in exchanges with one another, in part because intentions are likely not as evident in peers' behavior as they are in adults' behavior when adults interact with young children. Adults' communications are clearer than those of toddlers, and adults' social behavior is more

predictable and perhaps more rational, even in strange experimental settings, than that of toddlers with limited and rudimentary social skills (Ross & Kay, 1980). When others' intentions and goals are not directly and unambiguously conveyed in their immediate behavior, very young children may find it especially difficult to detect them, much less to join, accommodate to, or influence them. Peers may be a bit of a mystery, their intentions inscrutable, their behavior often uninterpretable.

Moreover, in children's early cooperative play with adults, the adult partner structures and supports the interaction, establishing and defining the joint goal or discerning the child's goal and intentions and accommodating behavior accordingly (Bakeman & Adamson, 1984, 1986; Bruner, 1982; Rocissano, Slade, & Lynch, 1987). By uniquely timing and adjusting their behavior to the immaturities in children's social skill and social understanding (Bornstein et al., 1992; Callanan & Sabbagh, 2004; Flom & Pick, 2003; Kochanska & Aksan, 2004; Lillard & Witherington, 2004; O'Neill, Bard, Linnell, & Fluck, 2005; Pan, Imbens-Bailey, Winner, & Snow, 1996), adults help children integrate their own intentions with the adults' intentions to achieve goals jointly. Even when adults violate toddlers' social expectations in experimental manipulations (Agnetta & Rochat, 2004; Ross & Lollis, 1987; Warnecken et al., 2005), the violations are scripted within predictable, contingent sequences of adult-defined games and communicative routines (Ross & Kay, 1980). However, children receive no such support or scaffolding from one another. Thus, putting their emerging social understanding to work in cooperative interactions with peers may be especially challenging for toddlers because it is difficult to apprehend or infer one another's intentions and goals from unclear or unpredictable behavior, and because the children must figure out by themselves how to integrate their intentions with a peer partner and organize their behavior with respect to a joint goal when they have no frames of established activity or active support from their partner in doing so.

Although the simplifications in the tasks used in the current study were meant to compensate for some of these demands unique to interactions between young children, the fact that 1-year-olds were still unable to coordinate their behavior with one another suggests that their social understanding may be too immature to support peer cooperation. This may be especially true when the cooperation task or setting is relatively unfamiliar. Under such circumstances lower level strategies might carry over from one task or trial to another, especially if they have been successful, because children's fragile social understanding is not readily accessible or is easily disrupted when the task is difficult or the setting nonroutine and unfamiliar. As social understanding develops over the 2nd and 3rd years of life, and toddlers are increasingly able to detect, generate, and share intentions with others outside of established social and communicative routines and familiar activity, young peers can invent and share novel goals and intentions with one another and can monitor and join one another's behavior related to those goals, permitting true cooperation. Perhaps for very young children, social understanding emerges and consolidates in play and communicative routines during the dynamic give-and-take of social interaction with adults and then later generalizes to the less familiar, less routine, and less predictable world of peers.

Consistent with this conjecture, we found that toddlers who demonstrated greater social understanding in social interaction with an adult were also more skilled in coordinating their behavior with a peer partner. Children who were more skilled in sharing an adult's perspective and could better talk about their own and others' actions and internal states and refer to themselves and others using personal pronouns were also better at cooperating with their peers. This research design does not tell us, of course, whether advances in social understanding with adults precede advances in social skill with peers, whether growth in adult–child and child–child social understanding and social skill occur in tandem, or whether participation in progressively more challenging social interactions with adults and/or peers drives changes in social understanding (Carpendale & Lewis, 2004; Zerwas, Balaraman, & Brownell, 2004). Longitudinal studies will be necessary to distinguish possible patterns of influence.

Responding to joint attention bids by an adult and language about self and other are distinct measures of social understanding, and both were associated with measures of peer cooperation in the current study. When examined together, taking into account their shared variance, they uniquely predicted different aspects of children's cooperative efforts. Skill in joint attention was uniquely associated with more coordinated behavior with peers, whereas self–other language was uniquely related to monitoring the peer while engaging in goal-directed activity oneself.

We can only speculate about why these particular associations emerged. With respect to joint attention, following into and sharing another's attention to things in the world is a form of coordinated activity

much like cooperation. Indeed, true collaboration, whether in communication, game playing, or problem solving, depends on shared attention to the same external object or goal. Joint attention is thus a basic prerequisite for cooperative activity (Brinck & Gardenfors, 2003; Tomasello et al., 2005). With respect to language about self and other, our measure was derived in part from children's use of words referring to others' actions and behavior. Greater interest in and talk about others' actions may reflect greater awareness of the goal directedness of others' behavior. More generally, however, using words grounded in self–other representations and talking about others' feelings, actions, and internal states involves relatively sophisticated interpersonal understanding (Bates, 1990; Lewis & Ramsay, 2004), including both differentiation of self and other and understanding of self–other equivalence. Insofar as language about self and other and cooperation both require the integration of first-person and third-personal intentional perspectives (Moore, in press), monitoring a partner's actions in relation to one's own intentions and to the same shared goal may reflect this understanding. At the same time, participating in communicative routines and cooperative play may promote and fine-tune developing social understanding. Questions about relations between social understanding and social skills are the focus of increasing research interest in preschoolers; such questions may be especially fruitfully addressed during the toddler years when both are undergoing rapid transition, and in the context of cooperative activity with peers where children are independently putting their emerging social understanding to use.

References

Agnetta, B., & Rochat, P. (2004). Imitative games by 9-, 14-, and 18-month-old infants. *Infancy, 6*, 1–36.

Asendorpf, J. B., & Baudonniere, P. M. (1993). Self-awareness and other-awareness: Mirror self-recognition and synchronic imitation among unfamiliar peers. *Developmental Psychology, 29*, 88–95.

Ashley, J., & Tomasello, M. (1998). Cooperative problem-solving and teaching in preschoolers. *Social Development, 7*, 143–163.

Astington, J., & Jenkins, J. (1999). A longitudinal study of the relation between language and theory-of-mind development. *Developmental Psychology, 35*, 1211–1320.

Bakeman, R., & Adamson, L. (1984). Coordinating attention people and objects in mother–infant and peer–infant interaction. *Child Development, 55*, 1278–1289.

Bakeman, R., & Adamson, L. (1986). Infants' conventionalized acts: Gestures and words with mothers and peers. *Infant Behavior and Development, 9*, 215–230.

Baldwin, D. A. (1993). Early referential understanding: Infants' ability to recognize referential acts for what they are. *Developmental Psychology, 29*, 832–843.

Baldwin, D. A. (1995). Understanding the link between joint attention and language. In C. Moore & P. Dunham (Eds.), *Joint attention: Its origins and role in development* (pp. 131–158). New Jersey: Erlbaum.

Baldwin, D., & Moses, L. (1996). The ontogeny of social information. *Child Development, 67*, 1919–1939.

Barresi, J., & Moore, C. (1996). Intentional relations and social understanding. *Behavioral and Brain Sciences, 19*, 107–154.

Bartsch, K., & Wellman, H. M. (1995). *Children talk about the mind*. London: Oxford University Press.

Bates, E. (1990). Language about me and you: Pronominal reference and the emerging concept of self. In D. Cicchetti & M. Beeghly (Eds.), *The self in transition: Infancy to childhood* (pp. 165–182). Chicago: University of Chicago Press.

Behne, T., Carpenter, M., Call, J., & Tomasello, M. (2005). Unwilling versus unable: Infants' understanding of intentional action. *Developmental Psychology, 41*, 328–337.

Bellagamba, F., & Tomasello, M. (1999). Re-enacting intended acts: Comparing 12- and 18-month-olds. *Infant Behavior and Development, 22*, 277–282.

Bloom, L., & Tinker, E. (2001). The intentionality model and language acquisition. . Monographs of the Society for Research in Child Development, 66(4; Serial No. 267).

Boesch, C., & Boesch, H. (1989). Hunting behavior of wild chimpanzees in the Tai National Park. *American Journal of Physical Anthropology, 78*, 547–573.

Bornstein, M., Tamis-LeMonda, C., Tal, J., Ludemann, P., Toda, S., Rahn, C., et al. (1992). Maternal responsiveness to infants in 3 societies: The United States, France and Japan. *Child Development, 63*, 808–821.

Bretherton, I., & Beeghly, M. (1982). Talking about internal states: The acquisition of an explicit theory of mind. *Developmental Psychology, 18*, 906–921.

Brinck, I., & Gardenfors, P. (2003). Co-operation and communication in apes and humans. *Mind & Language, 18*, 484–501.

Brooks, R., & Meltzoff, A. N. (2002). The importance of eyes: How infants interpret adult looking behavior. *Child Development, 38*, 958–966.

Brownell, C. (1986). Convergent developments: Cognitive-developmental correlates of growth in the infant/toddler peer skills. *Child Development, 57*, 275–286.

Brownell, C., & Brown, E. (1992). Peers and play in infants and toddlers. In V. B. Van Hasselt (Eds.), *Handbook of social development: A lifespan perspective* (pp. 183–200). New York: Plenum Press.

Brownell, C., & Carriger, M. (1990). Changes in cooperation and self–other differentiation during the second year. *Child Development, 61*, 1164–1174.

Brownell, C., & Carriger, M. (1991). Collaborations among toddler peers: Individual contributions to social contexts. In L. B. Resnick (Eds.), *Perspectives on socially shared*

cognition (pp. 365–383). Washington, DC: American Psychological Association.

Brownell, C., & Hazen, N. (1999). Early peer interaction: A research agenda. *Early Education and Development*, *10*, 403–413.

Bruner, J. (1982). The organization of action and the nature of adult-infant transactions. In E. Tronick (Ed.), *Social interchange in infancy: Affect, cognition, and communication* (pp. 23–36). Baltimore: University Park Press.

Callanan, M., & Sabbagh, M. (2004). Multiple labels for objects in conversations with young children: Parents' language and children's developing expectations about word meanings. *Developmental Psychology, 40*, 746–763.

Camaioni, L., Baumgartner, E., & Perucchini, P. (1991). Content and structure in toddlers' social competence with peers from 12 to 36 months of age. *Early Child Development and Care*, *67*, 17–27.

Caron, A., Kiel, E., Dayton, M., & Butler, S. (2002). Comprehension of the referential nature of looking and pointing between 12 and 15 months. *Journal of Cognition and Development*, *3*, 445–464.

Carpendale, J., & Lewis, C. (2004). Constructing an understanding of mind: The development of children's social understanding within social interaction. *Behavioral and Brain Sciences*, *27*, 79–96.

Carpenter, M., Akhtar, N., & Tomasello, M. (1998). Fourteen- through 18-month-old infants differentially imitate intentional and accidental actions. *Infant Behavior and Development*, *21*, 315–330.

Carpenter, M., Call, J., & Tomasello, M. (2002). Understanding "prior intentions" enables 2-year-olds to imitatively learn a complex task. *Child Development*, *73*, 1431–1441.

Carpenter, M., Call, J., & Tomasello, M. (2005). Twelve- and 18-month-olds copy actions in terms of goals. *Developmental Science*, *8*, 13–20.

Carpenter, M., Nagell, K., & Tomasello, M. (1998). Social cognition, joint attention, and communicative competence from 9 to 15 months of age. Monographs of the Society for Research in Child Development, 63(4, Serial No. 255).

Chalmeau, R., Visalberghi, E., & Gallo, A. (1997). Capuchin monkeys, *Cebus apella*, fail to understand a cooperative task. *Animal Behavior, 54*, 1215–1225.

Cheung, H., Hsuan-Chih, C., Creed, N., Ng, L., Wang, S., & Mo, L. (2004). Relative roles of general complementation language in theory-of-mind development: Evidence from Cantonese and English. *Child Development*, *75*, 1155–1170.

deVilliers, J., & deVilliers, P. (2000). Linguistic determinism and the understanding of false beliefs. In P. Mitchell & K. Riggs (Eds.), *Children's reasoning and the mind* (pp. 191–228). Hove, UK: Psychology Press.

Dunn, J. (1988). *The beginnings of social understanding*. Cambridge, MA: Harvard University Press.

Dunn, J., Brown, J., Slomkowski, C., Tesla, C., & Youngblade, L. (1991). Young children's understanding of other people's feelings and beliefs: Individual differences and their antecedents. *Child Development*, *62*, 1352–1366.

Dunphy-Lelii, S., & Wellman, H. (2004). Infants' understanding of occlusion of others' line of sight: Implications for an emerging theory of mind. *European Journal of Developmental Psychology, 1*, 49–66.

Eckerman, C. O., Davis, C. C., & Didow, S. M. (1989). Toddler's emerging ways of achieving\social coordinations with a peer. *Child Development*, *60*, 440–453.

Eckerman, C. O., & Didow, S. M. (1996). Nonverbal imitation and toddlers' mastery of verbal means of achieving coordinated action. *Developmental Psychology, 32*, 141–152.

Eckerman, C. O., & Peterman, K. (2001). Peers and infant social/communicative development. In A. Fogel & G. Bremner (Eds.), *Blackwell handbook of infant development* (pp. 326–350). Malden, MA: Blackwell.

Eckerman, C., & Whitehead, H. (1999). How toddler peers generate coordinated action: A cross-cultural exploration. *Early Education & Development*, *10*, 241–266.

Farrar, J., & Maag, L. (2002). Early language development and the emergence of a theory of mind. *First Language*, *22*, 197–213.

Fenson, L., Dale, P. S., Reznick, J. S., Bates, E., Thal, . D., Pethick, S. J., et al. (1994). Variability in early communicative development. Monographs of the Society for Research in Child Development, 59(5, Serial no. 242).

Flom, R., & Pick, A. (2003). Verbal envouragement and joint attention in 18-month-old infants. *Infant Behavior and Development*, *26*, 121–314.

Garvey, C. (1990). *Play*. Cambridge, MA: Harvard University Press.

Gergely, G., Bekkering, H., & Kiraly, I. (2002). Rational imitation in preverbal infants. *Nature*, *415*, 755.

Gergely, G., Nadasdy, Z., Csibra, G., & Biro, S. (1995). Taking the intentional stance at 12 months of age. *Cognition*, *56*, 165–193.

Harris, P., de Rosnay, M., & Pons, F. (2005). Language and children's understanding of mental states. *Current Directions in Psychological Science*, *14*, 69–73.

Hartup, W. (1983). Peer relations. In P. Mussen (Series Ed.) E. Hetherington (Vol. Ed.), *Handbook of child psychology, Vol. 4: Socialization, personality, and social development* (pp. 103–196). New York: Wiley.

Hartup, W. (1996). Cooperation, close relationships & cognitive development. In W. Bukowski, A. Newcomb, & W. Hartup (Eds.), *The company they keep: Friendships in childhood & adolescence*. Cambridge, UK: Cambridge University Press.

Hay, D. F. (1979). Cooperative interactions and sharing between very young children and their parents. *Developmental Psychology, 15*, 647–653.

Hollich, G., Hirsh-Pasek, K., & Golinkoff, R. (2000). Breaking the language barrier: An emergentist coalition model of the origins of word learning. Monographs of the Society for Research in Child Development, 65(3, Serial No. 262).

Howes, C. (1988). Peer interaction of young children. Monographs of the Society for Research in Child Development, 53(1, Serial No. 217).

Jenkins, J., Turrell, S., Kogushi, Y., Lollis, S., & Ross, H. (2003). A longitudinal investigation of the dynamics of mental state talk in families. *Child Development*, *74*, 905–920.

Kagan, J. (1981). *The second year: The emergence of self-awareness*. Cambridge, MA: Harvard University Press.

Kochanska, G., & Aksan, N. (2004). Development of mutual responsiveness between parents and their young children. *Child Development*, *75*, 1657–1676.

Kuhlmeier, V., Wynn, K., & Bloom, P. (2003). Attribution of dispositional states by 12-month-olds. *Psychological Science*, *14*, 402–408.

Lewis, M., & Ramsay, D. (2004). Development of self-recognition, personal pronoun use, and pretend play during the 2nd year. *Child Development*, *75*, 1821–1831.

Lillard, A., & Witherington, D. (2004). Mothers' behavior modifications during pretense and their possible signal value for toddlers. *Developmental Psychology, 40*, 95–113.

Liszkowski, U., Carpenter, M., Henning, A., Striano, T., & Tomasello, M. (2004). Twelve-month-olds point to share attention and interest. *Developmental Science*, *7*, 297–307.

Lohmann, H., & Tomasello, M. (2003). The role of language in the development of false-belief understanding: A training study. *Child Development*, *74*, 1130–1144.

Maudry, M., & Nekula, M. (1939). Social relations between children of the same age during the first two years of life. *Journal of Genetic Psychology, 54*, 193–215.

Meltzoff, A. (1995). Understanding the intentions of others: Re-enactment of intended acts by 18-month-old children. *Development Psychology, 31*, 1–16.

Meltzoff, A., Gopnik, A., & Repacholi, B. (1999). Toddlers' understanding of intentions, desires and emotions: Explorations of the dark ages. In P. Zelazo, J. Astington, & D. Olson (Eds.), *Developing theories of intention: social understanding and self-control* (pp. 17–41). Mahwah, NJ: Erlbaum.

Moll, H., & Tomasello, M. (2004). Twelve- and 18-month-old infants follow gaze to spaces behind barriers. *Developmental Science*, *7*, 1–9.

Moore, C. (in press) Understanding self and others in the second year. In C. Brownell & C. Kopp (Eds.), *Transitions in early socioemotional development: The toddler years*. New York: Guilford Press.

Mueller, E., & Brenner, J. (1977). The origins of social skills and interaction among playgroup toddlers. *Child Development*, *48*, 854–861.

Mundy, P. (2006) Motivation, self-regulation and the neurodevelopment of intention sharing. *Behavioral and Brain Sciences*, *28*, 709.

Mundy, P., Hogan, A., & Doehring, P. (1996). *A preliminary manual for the Early Social Communication Scales (ESCS)*. University of Miami Psychology Department, Coral Gables, FL, (http://www.psy.miami.edu/faculty/pmundy/ESCS.pdf).

Nelson, K. (in press). Becoming a language user: Entering a symbolic world. In C. Brownell & C. Kopp (Eds.), *Transitions in early socioemotional development: The toddler years*. New York: Guilford Press.

O'Neill, M., Bard, K., Linnell, M., & Fluck, M. (2005). Maternal gestures with 20-month-old infants in two contexts. *Developmental Science*, *8*, 352–359.

Pan, B., Imbens-Bailey, A., Winner, K., & Snow, C. (1996). Communicative intents expressed by parents in interaction with their young children. *Merrill-Palmer Quarterly, 42*, 248–266.

Piaget, J. (1932). *The moral judgment of the child*. London: Routledge & Keegan Paul.

Poulin-Dubois, D., & Forbes, J. (2002). Toddlers' attention to intentions-in-action in learning novel action words. *Developmental Psychology, 38*, 104–114.

Povinelli, D., & O'Neill, D. (2000). Do chimpanzees use their gestures to instruct each other? In S. Baron-Cohen, H. Tager-Flusberg, & D. Cohen (Eds.), *Understanding other minds: perspectives from developmental cognitive neuroscience* (2nd ed., pp. 459–487). Oxford, UK: Oxford University Press.

Repacholi, B. M. (1998). Infants' use of attentional cues to identify the referent of another person's emotional expression. *Developmental Psychology, 34*, 1017–1025.

Repacholi, B. M., & Gopnik, A. (1997). Early reasoning about desires: Evidence from 14- and 18-month-olds. *Developmental Psychology, 33*, 2–21.

Ricard, M., Girouard, P. C., & Gouin Decarie, T. (1999). Personal pronouns and perspective taking in toddlers. *Journal of Child Language*, *26*, 681–697.

Rocissano, L., Slade, A., & Lynch, V. (1987). Dyadic synchrony and toddler compliance. *Developmental Psychology, 23*, 698–704.

Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context*. New York: Oxford University Press.

Ross, H. S. (1982). Toddler peer relations: Differentiation of games and conflicts. *Canadian Journal of Behavioural Science*, *14*, 364–379.

Ross, H. S., & Kay, D. (1980). The origins of social games. In K. Rubin (Ed.), *Children's play* (pp. 17–31). San Francisco: Jossey-Bass.

Ross, H. S., & Lollis, S. P. (1987). Communication within infant social games. *Developmental Psychology, 23*, 241–248.

Rutter, M., & Durkin, K. (1987). Turn-taking in mother–infant interaction: An examination of vocalizations and gaze. *Developmental Psychology, 23*, 54–61.

Schwe, H., & Markman, E. (1997). Young children's appreciation of the mental impact of their communicative signals. *Developmental Psychology, 33*, 630–636.

Seibert, J., Hogan, A., & Mundy, P. (1982). The Early Social-Communication Scales. *Infant Mental Health Journal*, *3*, 244–258.

Shatz, M. (in press) Revisiting *A Toddler's Life* for *The Toddler Years*: Conversational participation as a tool for learning across knowledge domains. In C. Brownell & C. Kopp (Eds.), *Transitions in early socioemotional development: The toddler years*. New York: Guilford Press.

Shatz, M., Wellman, H., & Silber, S. (1983). The acquisition of mental verbs: A systematic investigation of the first reference to mental state. *Cognition*, *14*, 301–321.

Smiley, P. (2001). Intention understanding and partner-sensitive behaviors in young children's peer interactions. *Social Development*, *10*, 330–354.

Smiley, P., & Green, J. (1995). Learning about self and other during requests. In L. Sperry & P. Smiley (Eds.), *Exploring young children's concepts of self and other through conversation* (pp. 7–19). San Francisco: Jossey-Bass.

Smiley, P., & Huttenlocher, J. (1995). Conceptual development and the child's early words for events, objects, and persons. In W. Merriman & M. Tomasello (Eds.), *Beyond names for things: Young children's acquisition of verbs* (pp. 21–61). Hillsdale, NJ: Erlbaum.

Sodian, B., & Thoermer, C. (2004). Infants' understanding of looking, pointing, and reaching as cues to goal-directed action. *Journal of Cognition and Development*, *5*, 289–316.

Symons, D. (2004). Mental state discourse, theory of mind, and the internalization of self–other understanding. *Developmental Review*, *24*, 159–188.

Tomasello, M. (1999a). *The cultural origins of human cognition*. Cambridge, MA: Harvard University Press.

Tomasello, M. (1999b). Having intentions, understanding intentions, and understanding communicative intentions. In P. D. Zelazo (Eds.), *Developing theories of intention: Social understanding and self control* (pp. 63–75). Mahwah, NJ: Erlbaum.

Tomasello, M. (2001). Perceiving intentions and learning words in the second year of life. In M. Tomasello & E. Bates (Eds.), *Language development: The essential readings* (pp. 111–128). Malden, MA: Blackwell.

Tomasello, M., Carpenter, M., Call, J., Behne, T., & Moll, H. (2005). Understanding and sharing intentions: The origins of cultural cognition. *Behavioral and Brain Sciences*, *28*, 675–735.

Tomasello, M., & Haberl, K. (2003). Understanding attention: 12- and 18-month-olds know what is new for other persons. *Developmental Psychology, 39*, 906–912.

Visalberghi, E., Quarantotti, B., & Tranchida, F. (2000). Solving a cooperation task without taking into account the partner's behavior: The case of capuchin monkeys (*Cebus paella*). *Journal of Comparative Psychology, 114*, 297–301.

Warnecken, F., Chen, F., Liebal, K., & Tomasello, M. (2005). Cooperative problem-solving and play in toddlers, children with autism and chimpanzees. Poster presented at the biennial meeting of the *Society for Research in Child Development*, Atlanta, GA.

Wellman, H. M., Phillips, A. T., & Spelke, E. S. (2002). Infants' ability to connect gaze and emotional expression to intentional action. *Cognition*, *85*, 53–78.

Woodward, A. (1999). Infants' ability to distinguish between purposeful and non-purposeful behaviors. *Infant Behavior and Development*, *22*, 145–160.

Woodward, A. (2003). Infants' developing understanding of the link between looker and object. *Developmental Science*, *6*, 297–311.

Zerwas, S., Balaraman, G., & Brownell, C. (2004). Constructing an understanding of mind with peers. *Behavioral and Brain Sciences*, *27*, 130–131.

Appendix: State Words Checklist

How often has your child said each word over the past 6 months: 0 = *never*; 1 = *once or twice*; 2 = *3–5 times*; 3 = *often*

Mad
Sad
Scared
Happy
Like/Don't like
Want/Don't want
Need
Tired
Hungry
Thirsty
Sick
Cold (a feeling)
Hot (a feeling)
Warm (a feeling)
Sleepy
Good (as in "good dog")
Bad (as in "bad dog")
Hurt
Funny
Feel good
Feel bad
Nice
Mean
Naughty
Afraid
Surprised
Think
Thought
Try
See/Can't see
Hear/Can't hear
Taste
Look
Listen
Angry
Worried/worry
Excited
Upset
Proud
Smart
Dumb
Stupid
Feeling (an emotion)
Love
Hate
Find
Know
Know/Don't
Pretend
Remember
Lie/fib
Jealous
Interested
Wonder
Understand
Guess
Disappointed
Disgusting
Dream
Believe
Imagine
Frustrated
Mistake
On purpose
By accident
Didn't mean to
Right (correct)
Wrong
True/Truth
Because (used correctly)
Secret (used correctly