Coordinating Attention to People and Objects in Mother-Infant and Peer-Infant Interaction

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BAKEMAN, ROGER, and ADAMSON, LAUREN B. *Coordinating Attention to People and Objects in Mother-Infant and Peer-Infant Interaction.* CHILD DEVELOPMENT, 1984, **55**, 1278–1289. In a longitudinal study, infants 6–18 months of age were observed in their homes playing with their mothers and with peers. Of primary concern was how they coordinated their attention to people and objects. Observations were coded using a state-based scheme that included a state of coordinated joint engagement as well as states of person engagement, object engagement, onlooking, and passive joint engagement. All developmental trends observed were similar regardless of partner: person engagement declined with age, while coordinated joint engagement increased. Passive joint engagement, object engagement, and onlooking did not change with age. However, the absolute amount of some engagement states was affected by partner: both passive and coordinated joint engagement were much more likely when infants played with mothers. We conclude that mothers may indeed support or "scaffold" their infants' early attempts to embed objects in social interaction, but that as attentional capabilities develop even quite unskilled peers may be appropriate partners for the exercise of these capacities.

The emergence of the ability to coordinate attention toward a social partner and an object of mutual interest is often regarded as an important developmental milestone. In several accounts of early communication development, this pattern of attention marks a pivotal change in the infant's communicative competence (Werner & Kaplan, 1963). It has been viewed both as the "developmental heir" of the very young infant's interactions with caregivers (Trevarthen & Hubley, 1978) and as the foundation for subsequent symbolically mediated conversations (Bruner, 1975).

According to most accounts, the developmental course of this pattern of coordinated attention spans much of infancy. Prior to its advent, infants engage solely in dyadic interactions. When they are engaged with a person, their attention seems confined to the process of interaction itself. Thus, while young infants can participate in finely tuned exchanges of affect, the system of communication is essentially expressive (Brazelton, Koslowski, & Main, 1974; Stern, 1974; Tronick, Als, & Adamson, 1979). When, as is increasingly the case by the middle of the first year, infants turn away from face-to-face interactions toward object exploration, they still seem to attend to only a single aspect of their surroundings (Kaye & Fogel, 1980; Trevarthen & Hubley, 1978); now they focus intently on objects, providing few indications that they desire to share this new interest with their partners.

Gradually, infants' interactions become triadic as object-focused attention becomes embedded in social contexts. Around 6 months of age, babies begin to switch their gaze back and forth between caregiver and object (Newson & Newson, 1975). Soon gestures become clear signals that infants are actively attempting to share attention to something external to the social interaction, establishing that object or event as the "topic" of joint concern (Leung & Rheingold, 1981; Murphy & Messer, 1977). Finally, by about 13 months of age, this ability to coordinate attention becomes consolidated, allowing infants to enter readily into nonverbal

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referential communication with a person about a present object (Bates, 1979; Harding & Golinkoff, 1979).

The foregoing account of the developmental course of coordinated attention is drawn from several sources. The purpose of the research reported here is to document—within the confines of one study and one sample followed longitudinally—the sequence proposed. In particular, we are concerned with two main issues: (*a*) the sequence and timing of normative changes in the patterning of infant attention in potentially social situations, and (*b*) the uniqueness of the role adults may play in fostering rudimentary forms of coordinated attention. To address these issues, we performed an observational study aimed at describing how 6–18-month-old infants distributed their attention to people and objects as they played in their homes with mothers and peers.

An important aspect of the first issue concerns when coordinated attention appears. In particular, it seems likely that a considerable gap exists between when infants are first able to display coordinated attention and when they do so routinely during free play. Knowing when infants typically begin to integrate social and object realms would be helpful in two ways. First, such norms for the performance of coordinated attention would be useful during clinical assessments of infants experiencing developmental difficulties (Seibert, Note 1). Second, such information could help clarify the relationship between major changes in the attentional structure of social interaction and the development of specific communicative skills. In particular, it may help explain why, even after the capacity to coordinate attention appears to be consolidated, it is often several months before the transition to a linguistically based communication system occurs (Nelson, 1979).

The second issue addressed here concerns how partners may affect the way infants deploy their attention. Some investigators of early communication development emphasize the essential nature of partner support when infants first begin to maintain engagement with an object to which the partner is also attending. For example, Bruner (1982) suggests that caregivers provide a necessary "scaffold" or supportive structure for infants as they begin to employ referential communicative actions during shared activities such as picture-book reading (Ninio & Bruner, 1978) and object hide-and-seek (Ratner & Bruner, 1978). If this view is correct, we would expect considerably more coordinated attention when infants are observed with mothers than with same-aged peers, assuming, as seems reasonable, that mothers are both more "competent" than peers in assisting shared activities and more motivated to complement their infants' attention.

Indeed, mothers may be such eager and able supporters of joint attention that they in effect free their infants of the need, at least initially, to shift attention back and forth between the mother and the object of mutual concern. To assess this possibility, we distinguish between what we call "passive joint engagement" and "coordinated joint engagement." In both cases, infants attend to the same object as their partners do. For example, during an episode of passive joint engagement, a baby might look intently at a string of beads, attempting to grasp it as the mother dangles it invitingly. Although the infant might be interacting with the beads in a way that would not be possible if the mother were not also involved, the baby's attention appears to be primarily on the beads while the mother complements this engagement. During an episode of coordinated joint engagement, however, the baby might not only attempt to manipulate the beads but also to glance briefly at the partner, perhaps smiling at her and pointing to the beads as she moves them about. Because passive joint engagement places fewer attentional demands on infants, we expect it would occur more often at the younger ages than coordinated joint engagement. We also expect that, like coordinated joint engagement, passive joint engagement would occur more often when infants are with their presumably more supportive mothers than when with peers.

The present study segments infants' attention during play with mothers and peers into sequences of "engagement states." These include not only the two kinds of joint engagement just described but also person engagement, object engagement, onlooking, and unengaged (cf. Parten, 1932). Pilot work with our videotapes suggested that passive joint engagement, although qualitatively different from coordinated joint engagement, was more similar to it than solitary object engagement (which it clearly resembles). To test this notion, we examined how engagement states were sequenced, reasoning that if the two kinds of joint engagement were similar—in the sense of

"functioning" the same way within the stream of behavior observed—then they should both occupy similar "positions" in that stream, that is, be preceded and followed by the same other states. Finally, differences in sequencing between mothers and peers are examined. If mothers deliberately foster both passive and coordinated joint engagement far more than peers do, then we might expect that antecedents of these states of joint attention would be considerably more systematic when playing with mothers than with peers.

Methods

Subjects

Twenty-eight infants participated in this study. They were divided into two cohorts of 14 infants each, based on their age at the first of four recording sessions. Infants in cohort 1 were observed when they were within 2 weeks of 6, 9, 12, and 15 months of age (except for one 9-month and one 12-month session that occurred 8 and 10 days, respectively, after the 2-week time interval). All infants in cohort 2 were observed when they were within 2 weeks of 9, 12, 15, and 18 months of age. An equal number of boys and girls were in each cohort; cohort 2 comprised an equal number of first- and later-born infants, while cohort 1 contained five first- and nine later-born infants.

The infants' mothers were volunteers who had been contacted initially through several community organizations. All subjects were living in intact, middle or professional class, nuclear families. The mothers' mean age was 29.7 years (range = 23–38 years), and 75% had completed college. Although only two of the mothers were employed full-time, 64% worked outside the home or attended school on at least a part-time basis.

Each mother recruited a peer who had had some previous contact with her infant. This was done to avoid the "stranger" or "novelty" effects an unfamiliar peer might evoke. Mothers reported that in the month prior to 77% of the sessions, the infant and peer had played together two or more times; an additional 20% of the sessions had been preceded by one contact in the past month, while no contact had occurred in the prior month for 3% of the sessions. In 23 of the 28 cases, the same peer was retained for all four sessions. The mean age difference between the peers and infants was 3.3 weeks (range of age difference = 1–55 days).

Recording Sessions

Procedure.—All recording sessions took place in the infants' homes. They were scheduled at the mother's convenience and lasted between 1½ and 2 hours. The mothers of both the infants and peers were informed that we were interested in observing healthy infants as they developed ways of communicating with adults and peers. They were told that we needed videotapes of their babies' typical performances, not records of their "best" ones. Yet, if they thought an infant was becoming overly tired or upset, we urged them to suggest we stop our videotaping either briefly or for the day. In 12% of the sessions, we did terminate our videotaping before the full session was completed. Ten of these interrupted sessions were completed within the next week, two of the remaining three were finished within the next 3 weeks, and only one (that of a 15-month-old girl from cohort 1) could not be rescheduled, resulting in missing data for one peer-infant observation.

Conditions.—Each session consisted of three conditions. (*a*) In the mother condition, the infant and mother were observed while they played on the floor with a set of toys we provided. Mothers were asked to play with their infants as they might if they had a few minutes to devote to a spontaneous play period. (*b*) In the peer condition, the two infants were placed in the center of the room near an array of toys. Their mothers were asked to sit to the side of the room and to carry on a conversation wth minimal attention to their infants. (*c*) In the alone condition, the infant was placed on the floor in the room's center near a group of toys and the mother sat off to one side on a chair or couch. Data from this condition are not used in this report.

The mother and alone conditions were counterbalanced over sessions and subjects. The peer condition alternated between being the first and the last condition of a session; it was not scheduled as the middle condition in order to minimize the disruption that might be caused by peer's arrival and departure.

Toys.—Three similar but nonidentical sets of toys were used. Each set contained a toy telephone, a picture book, a four-piece wooden puzzle, a set of colorful nesting cups, a doll, a rattle with movable parts, and a soft plastic toy with wheels. The order of presentation of the three sets was counterbalanced over conditions by sessions and by subjects.

Video recording.—Two black-and-white video cameras (Sanyo VCM-20N50 with Newvicon tube), capable of recording with no more light than is available in most homes, were set up facing each other in the largest room in which the infant typically played. In this way, two different views of the same events were obtained; later, coders could either view both tapes or select the one that gave the best view of the particular behavior being coded. Every effort was made to be as unobtrusive as possible. The images from the camera were recorded on two ¾-inch portable video cassette recorders (JVC CR-4400U). A time-code generator (For.A TCG-3200) was connected to both recorders so that the same moment in time could be located on playback on both tapes. The time code was recorded on one of each cassette's two audio tracks so that it was "internal" to the tape, not part of the picture. The standard time code defined by the Society of Motion Picture and Television Engineers (SMPTE) was used; it consists of eight digits, two for hours, two for minutes, two for seconds, and two for frame number. The other audio track of each cassette was used to record sound from one of two microphones (Shure 571 Lavalier) that were placed on the floor at two opposing points of the room's perimeter.

Camera operators were instructed to obtain approximately 10 min of usable recording in each condition, stopping when they estimated this time period had elapsed, regardless of the subjects' activities at that moment. They were also to stop recording if events moved substantially beyond the boundaries of the conditions as we defined them or if the mother requested an interruption. In the mother condition, breaks in taping were relatively rare; most of the sessions consisted of a single segment of uninterrupted recording such that the mean number of interruptions per mother condition was 0.2. Interruptions were more frequent in the peer and the alone conditions, when the mean numbers of interruptions per condition were 2.8 and 1.6, respectively.

Once the times that the baby was off-camera or times an adult intervened were excluded (see definitions below), the mean time per condition was 10.1 min (SD = 1.8). Reasons for variable times include: some children became unduly fussy before 10 min had expired, when interruptions occurred camera operators did not keep track of elapsed time accurately, operators could not know what later would be coded an adult interruption instead of adult intervention (see below), and operators were constrained to fit two of the conditions on one 20-min cassette even though part of a condition might later be coded as "off-condition."

Coding

The coding scheme used here segments the infant's activity exhaustively into distinct and mutually exclusive periods that are characterized in terms of the infant's engagement with objects and/or people in the environment. We conceptualize these periods as "states" that have some duration, and so very brief fluctuations in attention, those lasting less than 3 sec, are not regarded as indicating an engagement state change.

Categories.—Six categories of engagement were defined. The categories are as follows. (*a*) *Unengaged:* The infant appears uninvolved with any specific person, object, or activity, although he or she might be scanning the environment as though looking for something to do. (*b*) *Onlooking:* The infant is observing another's activity, often quite intently, but is not taking part in that activity. (*c*) *Persons:* The infant is engaged just with the other person. Typically such engagement involves face-to-face or person play. For example, a baby giggles and coos as his mother places her face close to his and tickles him, or the baby looks at the peer's face, vocalizes, and then reaches toward the peer. (*d*) *Objects:* The infant is involved in playing with objects alone, attending just to the toys at hand. (*e*) *Passive joint:* The infant and the other person (the mother in the mother condition, the peer in the peer condition) are actively involved in the same object, but the baby evidences little awareness of the other's involvement or even presence. Mothers often attempt to induce this state in their babies. They will manipulate objects (e.g., shake rattles, ring toy telephones, etc.) in ways that seem designed to capture their infants' attention by making the objects "come alive" for them. (*f*) *Coordinated joint:* The infant is actively involved with and coordinates his or her attention to both another person and the object that person is involved with. For example, the baby pushes the truck the mother has been pushing and then looks back and forth between the mother's face and the truck; or the baby bangs his hand onto the same toy the peer is manipulating and then looks at the peer, bangs the toy, and then looks at the peer once again. This is similar to Sugarman-Bell's (1978) "co-ordinated person-object orientation" and it would include what Eckerman has called "coordinate play" (Eckerman, Whatley, & Kutz, 1975).

Three additional codes were used to indicate times when we did not regard the infant as in any of the six states described above. (*a*) *Off-camera:* In spite of the best efforts of our camera operators, neither cassette contained an adequate view of the infant; this was a rare event. (*b*) *Adult intervention:* The infant (or peer) became sufficiently upset that adult intervention was required to soothe and comfort him or her. This usually occurred only during the alone or peer conditions, and typically the cameras were turned off until the baby's equilibrium was restored. (*c*) *Adult interruption:* The adult became concerned by something the infant was doing and tried to redirect his or her attention. By definition, this could occur only in the alone or peer conditions. Periods coded as off-camera or adult intervention were not included in subsequent analyses. Periods coded as adult interruption were retained because they did not represent a major break in the condition.

Coding procedures.—Two teams of two coders each coded engagement state. Tapes were viewed using an editing VCR (JVC CR-8200U), a SMPTE time-code reader (For.A TCR-3100), and a 19-inch monitor (Panasonic TR-195 MB). With this equipment, coders can play tape at variable speeds, from one-fifth real time to five times real time, forward and backward, while both maintaining a picture and displaying the current time code; playback can also be stopped or "frozen," again with the current time code displayed. In practice, coders would play a tape in real time until they decided that the current engagement state had changed. They would then reverse the tape, positioning it before the suspected "break point" in engagement states, and then play forward again in real time. This fast-backward, real-time-forward procedure might be repeated several times until the team felt certain about the timing of the break point. They would then stop the tape at the break point and record the time code, accurate to the second. In sum, the coders' task was to segment the stream of behavior into sequences of the engagement states we defined, identifying "break points" in the stream of behavior in the sense that Newtson (1973) and others use that term.

Interobserver reliability.—Somewhat more than 15% of the sessions were coded independently by both teams. These reliability checks were not announced to the coding teams and were interspersed randomly throughout coding. Each team's coding was compared with a "standard" version prepared by the two principal investigators. The amount of agreement was gauged with Cohen's kappa (Cohen, 1960), a statistic that corrects for chance agreement and so produces lower values than the percentage agreement statistics often given (Hollenbeck, 1978). For the 20 mother sessions checked, kappas ranged from .62 (77% agreement in this case) to .91 (93% agreement), with a mean of .77 (85% agreement); for the 18 peer sessions checked, kappas ranged from .62 (75% agreement) to .92 (94% agreement), with a mean of .79 (88% agreement); and for the 17 alone sessions checked, kappas ranged from .58 (82% agreement) to 1.00 (100% agreement), with a mean of .86 (96% agreement). An agreement was tallied only if a given second was coded in the same state as the standard. The unit used—a second—seems reasonable, if arbitrary, but changing it to a half second, for example, would not change values for kappa.

Results

Not all babies were observed in each engagement state in both mother and peer conditions at all ages. At each age, most babies were observed at least once unengaged, onlooking, and engaged in objects, while only about two-thirds were observed once or more engaged with persons. All babies were observed at least once in the passive joint state when with their mothers, but only about two-thirds were when with a peer. The percent of babies engaging at least once in coordinated joint activity increased quite sharply with age and was usually greater when with the mother than when with a peer.

The average percents of time infants spent in the various engagement states are given in Table 1. These percents were analyzed with sex × partner (mother/peer) × age (6, 9, 12, 15, or else 9, 12, 15, 18) repeated-measures analyses of variance, run separately for each cohort. A second set of otherwise identical analyses substituted parity for sex so that the effects of parity could be examined. To examine order effects, a third set substituted order—peer first or peer last—for sex. When age effects were significant, they were decomposed into linear, quadratic, and cubic trends; we then report which trends were significant because this provides information as to the exact form of the age effect. Effects of all kinds are mentioned only if they were significant in both cohorts, thus providing within-sample replication. For economy of presentation, only p values and not F values are given here, although complete ANOVA statistics are available from the au-

TABLE 1

PERCENT OF TIME IN ENGAGEMENT STATE

STATE AND CONDITION	AGE (in Months)				
	6	9	12	15	18
Unengaged:					
Mother	20.9	13.3	13.1	6.1	2.9
Peer	27.3	25.1	31.5	16.4	9.7
Onlooking:					
Mother	11.9	13.5	12.9	14.0	7.5
Peer	24.7	10.3	12.5	15.5	9.8
Persons:					
Mother	11.7	12.2	7.6	4.6	4.6
Peer	11.8	8.2	4.6	5.3	3.3
Objects:					
Mother	36.7	42.1	43.4	40.7	36.7
Peer	32.1	50.0	44.9	51.5	58.7
Passive joint:					
Mother	16.6	16.9	19.3	23.1	21.5
Peer	3.4	3.4	3.2	1.9	4.3
Coordinated joint:					
Mother	2.3	2.0	3.6	11.2	26.6
Peer	.3	1.7	1.8	4.2	7.2

NOTE.—Numbers are mean percents, based on 14 infants at 6 and 18 months, 27 infants at 15 months in the peer condition, and 28 infants otherwise. Because adult interruption occupied some time, especially for older infants in the peer condition, not all percents add to 100.

thors. (Data for the one missing condition—a 15-month-old infant in the peer condition—were replaced with means.)

Age effects.—As the babies became older, they spent more time in coordinated joint play (linear trend $p < .05$ and .01 for cohorts 1 and 2, respectively), less time engaged with the other person (i.e., the mother in the mother condition and the peer in the peer condition; linear trend $p < .05$ and .01), and less time unengaged (linear trend $p < .01$ and .001). In general, the amount of time spent engaged in passive joint activity, in onlooking, and with objects did not change significantly as the infants became older.

Partner effects.—When with their mother instead of a peer, the infants spent more time in both coordinated joint ($p < .05$ and .01) and passive joint activity ($p < .001$ for both), and less time unengaged ($p < .01$ and .001). There were no significant differences between mother and peer conditions in the amount of time spent onlooking, engaged with objects, or engaged with the other person.

Other effects.—Finally, there was no consistent pattern of either sex, parity, or order effects with respect to percent of time spent in the various engagement states.

Durations.—Mean durations—that is, the average number of seconds each kind of engagement state lasted, computed for each infant—were also analyzed. These results largely parallel the ones reported above: mean durations for coordinated joint play became longer with age (linear trend $p < .01$ for both cohorts), and when with their mother instead of a peer, episodes of both coordinated joint ($p < .01$ and .05) and passive joint play ($p < .001$ for both) lasted longer. Mean durations for episodes of coordinated joint engagement were 7.1, 5.7, 10.6, 19.5, and 33.8 sec at 6, 9, 12, 15, and 18 months when with mothers and 1.6, 5.3, 4.7, 5.3, and 8.8 sec for those ages when with peers. Mean durations for episodes of passive joint engagement were 15.1 and 5.6 sec when with mothers and peers, respectively (averaged over all ages). There were no consistent effects for the other states; mean durations, averaged over all ages and conditions, for episodes of unengaged, onlooking, person, and object engagement were 10.9, 8.8, 9.3, and 19.6 sec, respectively.

At most ages, more infants were observed at least once in passive and in coordinated joint play when with the mother instead of a peer. This raises the possibility that the differences claimed above for both percents and mean durations between the mother

and peer conditions might not hold if infants who were never observed in the passive or coordinated joint states at a particular age were excluded from the analysis. In fact, when such infants are excluded the differences reported remain.

Sequences.—The analyses of variance just reported indicate that, as infants in our study became older, they became more likely to coordinate their attention to people and objects. They also spent more time in both passive and coordinated joint engagement when with mothers than when with peers. Thus these data tell us something about the amount of time spent in different engagement states, but they do not tell us whether infants' attention to people and/or objects was sequenced in any systematic way within an ongoing period of play. In particular, they do not reveal whether there were characteristic ways of attending to people and objects just before periods of joint engagement were begun or just after such periods ceased.

To answer such questions, we next examined how episodes of passive and coordinated joint engagement were positioned relative to other engagement states within the observation sessions. The primary statistic for these analyses is a z score comparing observed values for particular engagement state transitions to their expected ones. An advantage of this z score is that it takes base rate into account; if the z score is positive, then that particular transition is more likely to occur than would be expected just by chance, given the base rate of the consequent state. In addition, z scores can be tested for significance (Allison & Liker, 1982; Gottman & Bakeman, 1979; and Sackett, 1979).

For the first set of analyses reported here—those concerned with the antecedents and consequents of passive and coordinated joint engagement—subjects' data were pooled within each age and condition; even so, there were insufficient numbers of some sequences to report results (see Table 2). These analyses indicate that both passive and coordinated joint engagement were likely to be preceded by object play; when with both mothers and peers, the sequences object en-

TABLE 2

TRANSITIONS TO PASSIVE AND COORDINATED JOINT ENGAGEMENT

	AGE (in Months)				
ANTECEDENT-CONSEQUENT STATE CONDITION	6	9	12	15	18
Unengaged–passive joint:					
Mother	−1.3	−2.3*	−2.1*	−4.4***	X
Peer	...	−2.4*	−3.3***	−1.6	X
Onlooking–passive joint:					
Mother	4.6***	7.3***	7.6***	6.0***	...
Peer	...	2.8**	2.2*	...	1.8
Person–passive joint:					
Mother	−2.1*	−1.6	...	...	X
Peer	X	X	X	...	X
Object–passive joint:					
Mother	2.8**	3.6***	2.9**	5.1***	3.8***
Peer	1.4	1.5	3.0**	2.5*	3.4***
Unengaged–coordinated:					
Mother	X	X	−2.1*	...	X
Peer	X	−1.6	−2.3*	−1.3	−2.2*
Onlooking–coordinated:					
Mother	X	X	...	−2.3*	...
Peer	X	...	...	...	...
Object–coordinated:					
Mother	X	1.4	3.7***	4.5***	4.4***
Peer	X	2.0*	3.6***	2.4*	2.7**

NOTE.—Scores are z scores based on episodes pooled across subjects. In effect, these z scores compare a given transition to its base-rate expected value. Only z scores significant at the .20 level or better are shown. Z scores not computed because too few episodes were coded are marked with "X." To save space, scores for Person-Coordinated and Passive Joint–Coordinated are not given in the table; at most ages there were too few episodes to compute scores, and when there were, none was significant at the .20 level.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

TABLE 3

TRANSITIONS FROM PASSIVE AND COORDINATED JOINT ENGAGEMENT

ANTECEDENT–CONSEQUENT STATE CONDITION	AGE (in Months)				
	6	9	12	15	18
Passive joint–unengaged:					
Mother	...	...	...	−1.8	X
Peer	...	−1.9	−1.3	−2.3**	X
Passive joint–onlooking:					
Mother	...	−1.6	−3.5***	...	...
Peer	...	...	...	−2.0*	...
Passive joint–person:					
Mother	−2.5*	−1.9	...	...	X
Peer	X	X	X	...	X
Passive joint–object:					
Mother	7.5***	9.4***	12.3***	9.9***	4.6***
Peer	1.9	3.5***	3.8***	3.2**	4.0***
Coordinated–unengaged:					
Mother	X	X	...	...	X
Peer	X	...	−1.4	...	...
Coordinated–onlooking:					
Mother	X	X	−2.1*	−1.2	−1.7
Peer	X	−1.5	−1.9	−2.3*	...
Coordinated–object:					
Mother	X	3.0**	...	2.5*	4.6***
Peer	X	3.4***	3.8***	2.9**	4.4***

NOTE.—Scores are z scores based on episodes pooled across subjects. In effect, these z scores compare a given transition to its base-rate expected value. Only z scores significant at the .20 level or better are shown. Z scores not computed because too few episodes were coded are marked with "X." To save space, scores for Person-Coordinated and Passive Joint–Coordinated are not given in the table; at most ages there were too few episodes to compute scores, and when there were, none was significant at the .20 level.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

gagement to passive joint and object engagement to coordinated joint occurred at greater than chance rates for most ages. In addition, a period of onlooking occurring just before a period of passive joint engagement was also a likely sequence when 6–15-month-olds played with their mothers and when 9- and 12-month-olds played with their peers. Certain other sequences, however, did not characterize the flow of attention into joint states. In particular, person engagement was not a systematic precursor of either passive or coordinated joint engagement; when this sequence occurred sufficiently often to evaluate, rates were close to those expected by chance. Finally, the sequences unengaged to passive and unengaged to coordinated joint appeared significantly less often than one would expect by chance.

Object play was not only a likely antecedent to both passive and coordinated joint engagement, it was a likely consequent as well. When with both mothers and peers, both the passive joint to object and the coordinated joint to object sequences characterized the flow of attention at most ages. No other engagement states seemed to systematically follow passive or coordinated joint (see Table 3).

The analyses just reported suggest which sequences were more likely to occur than their base rates would suggest, but they do not tell us if the tendency to differ from base rate changed with age or differed significantly when infants were observed with mothers instead of peers. To answer these questions, repeated-measures analyses of variance were run (sex × partner × age, as before, on the two cohorts separately); analyzed were individual z scores associated with those transitions that the previous analysis identified as likely sequential patterns.

Neither infant age nor partner systematically affected the extent to which object engagement tended to precede passive or coordinated joint engagement or the extent to which unengaged tended not to precede passive joint engagement. In other words, these sequences tended to characterize all obser-

vational sessions. The only qualification arises when we consider the two cohorts separately. Then, both partner and age effects are significant ($p < .05$) for the sequence object engagement to coordinated joint engagement, but only in cohort 2, primarily because of the 18-month-old infants there.

The partner did affect the likelihood of the sequence onlooking to passive joint; this sequence was significantly more likely when with mothers than with peers ($p < .01$ and .05 for cohorts 1 and 2). Moreover, the partner also affected the organization of attention after a period of passive (but not coordinated) joint engagement; the sequence passive joint to object play was significantly more likely when with mothers ($p < .001$ for both cohorts).

Finally, age did not seem to affect the strength of any of the patterns found in the earlier sequential analysis, with the following qualification. There is some suggestion that the sequence coordinated joint to object play differed more strongly from base rate at later ages (linear trend $p < .001$ and .10 for cohorts 1 and 2).

Discussion

Our interpretation of these results is guided by the general notion that new communicative forms appear first embedded in and supported by a social context. This idea is central to the theories of Mead (1934) and Vygotsky (1978) and has been espoused recently by a number of investigators concerned with early communication development, including Bruner (1982), Newson and Newson (1975), and Trevarthen (1977). Within this social interactionist perspective, the achievement of joint engagement has particular significance for two reasons. First, it is thought to provide the social setting for the emergence of new forms of referential communication (Adamson & Bakeman, 1982). Second, the capacity to coordinate attention to objects and people is viewed as the culmination of a developmental sequence that begins with face-to-face interaction (Tronick, 1982) and continues as infants turn their attention increasingly toward objects (Trevarthen & Hubley, 1978).

The fact that we found a developmental decrease in person play coupled with an increase in coordinating attention to a partner and to the object the two share—and not an increase in solitary object play—provides support for this view of how early communication development is sequenced. Coordinated joint engagement may well be the developmental heir to face-to-face play, as Trevarthen suggests, but we would place this transition later than he and others do. Bates (1979) and Sugarman-Bell (1978), for example, report that by the end of the first year of life, infants can alternate glances back and forth between a person and a shared object. This may be so, but given our data we conclude that the performance of coordinated joint engagement does not become routine until several months later. After all, the average amount of time infants spent with their mothers in coordinated joint engagement did not exceed 10% until 15 months of age, and not until 18 months of age were all infants observed in this state at least once. Indeed, we probably did not follow the subjects in our study long enough to observe the amount of coordinated joint activity during free play stabilize. (With both partners, the prevalence of this state increased dramatically from 15 to 18 months, doubling both in terms of the proportion of time it occupied and the mean length of individual episodes.)

This relatively late appearance of coordinated joint engagement during free play is interesting for at least two reasons. First, such normative data are valuable for their own sake, if for no other reason than that they can inform clinical expectations. Second, they may have important implications for understanding communication development. For example, Nelson (1979) has asked why, since infants by the end of the first year of life seem equipped with cognitive and social skills required for language, they do not really begin to talk until several months later. She suggests that one reason for this apparent developmental plateau in communication development is that infants require this time to coordinate social and object realms before language development proper can proceed. In our study, we found that there were infant-based constraints on the flow of their attention between object and social domains during the 6–18-month-old age range. Not only were certain routes into and out of joint engagement more likely to be traveled than others, but also infants did not become jointly engaged unless they were first focusing on some aspect of the environment. Even more to the point, we found differences in attentional organization in the many months that separate the first performance of nonverbal referential actions and entrance into the linguistic realm: the coordination of people and objects, regardless of partner, was not mastered until near the end of infancy.

In addition to the normative development of coordinated joint engagement, we

are also interested in the role of the partner. Our suspicion is that mothers—or, in principle, any competent and willing adult or older child—may act in ways that support or scaffold performances by their infants even before the infants are capable of such performances unaided. And, indeed, we observed higher rates when with mothers instead of peers for those engagement states that offer some potential for referential communication—passive and coordinated joint engagement—and no partner effects for states that do not—person play, onlooking, and object play.

Part of the mothers' positive influence on joint engagement states can be viewed simply as a product of her greater skill in facilitating coordinated joint engagement once her infant is able to coordinate attention. Thus, although the absolute amount of time spent in coordinated joint engagement and the average length of an episode were markedly greater in the mother condition, coordinated joint engagement did increase with age for both peer and mother conditions. Moreover, sequential analyses of the ongoing flow of attention did not suggest that the mother was providing qualitatively different support that could draw the infant into a state of coordinated joint engagement.

The mothers' most striking contribution is evident when the mother/peer differences for passive joint engagement are examined. This state occurred during every mother-infant observation, and it typically characterized the infant's engagement for about 20% of the period, regardless of the infant's age. With a peer, however, about a third of the 10-min-long observations did not contain even a single episode of passive joint engagement; moreover, episodes that did occur tended to be very brief and to account for very little of the overall observation period. Mothers also seemed to work deliberately to induce passive joint engagement. Onlooking, for example, often led to a period of passive joint engagement with mothers, less so with peers. This suggests that mothers were more likely to use their capacity to capture their infants' attention to an interesting spectacle as a prelude to a period of mutual exploration of an object.

The passive joint engagement state thus seems to be closely tied to mothers' actions. It also appears to be an attention state that, unlike coordinated joint engagement, could be sustained by even the youngest infants in our study. These two characteristics suggest that it is this form of joint engagement that adults are most likely to foster as they scaffold their infants' activities during the period of development when new communicative skills are just forming (Bruner, 1975; Kaye, 1982). In a sense, during passive joint engagement, adults may provide an implicit social context for referential communication, a social context that will only become explicit once the infant can coordinate attention across the social and object domains—and which will then result in increasing amounts of coordinated joint engagement, such as we observed.

Why are adults and not peers better able to support passive joint engagement? Partly, no doubt, because adults are simply more willing and able to complement their infants' attention. In addition, they may provide predictably repeating patterns of actions as they interact with infants—patterns that may have developmental roots in the person-focused games of earliest infancy (Tronick et al., 1979). Further, adults may be able to foster passive joint engagement because they maintain a shared memory system with the infant (Kaye, 1982), which, like a repeating pattern, may also free the infant from a need to attend simultaneously to both partner and object. A peer, we expect, provides neither a predictable pattern of action nor access to a shared memory system. Indeed, even a familiar peer is a remarkably unpredictable partner, prone to sudden movements of self and toys. In a sense, then, infants can depend upon their mother's actions, and so they can join with her to examine objects beyond their interpersonal relationship. In contrast, rarely can such "trust" be extended to peers until the infant is able to also "keep an eye" on this relatively unsupportive partner, which may account for the fact that when with peers, passive joint engagement remained at uniformly low levels, while coordinated joint engagement steadily increased with age.

In some respects, however, infants' experience with mothers and peers was similar. With both, episodes of passive joint and of coordinated joint engagement were unlikely to follow unengaged episodes and were likely to be bracketed by periods of object engagement. Thus, while many more episodes of passive joint and coordinated joint engagement occurred with mothers, to be sure, when they did occur with peers, the moment-by-moment sequential patterns were similar, suggesting that at least some differences between mothers and peers may be more quantitative than qualitative.

In summary, communicating with others about objects demands attention to both social and object aspects of one's surroundings. Integrating attention is a process that is mastered only slowly during the latter portion of infancy. Moreover, it is a process that may well depend on the primacy of social relationships, which builds on skills nurtured during the earlier period of face-to-face play and which expands during the emergence of a "triadic" (infant-object-other) interactive system. Skilled adults clearly tailor their actions to suit their infant's changing attention capabilities. Thus they can "socialize" object attention, embedding it within the interpersonal sphere well before infants can structure this integration by themselves. But, as attentional capabilities develop, even quite unskilled peers may be appropriate partners for the exercise of these capacities. The infant interacting with a peer need not recapitulate a developmental course first traveled with an adult guide; rather, albeit less frequently and perhaps more clumsily, by the middle of the second year infants can also join with peers in a shared exploration of the environment.

Reference Note

1. Seibert, J. *The development of pre-linguistic communication skills: A neo-Piagetian analysis based on levels of cognitive organization.* Paper presented at the tenth annual Interdisciplinary Conference on Piagetian Theory and the Helping Professions, Los Angeles, 1980.

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