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Infants' Behavioral Styles in Joint Attention Situations and Parents' Socio-economic Status

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Abstract

In this study the eco-cultural model of parenting (Keller, 2007) was applied to the study of joint attention behavior of children from families with different socioeconomic status (SES). It was hypothesized that infants' early communication styles would differ with SES reflecting more independent or interdependent interactions with their caregivers. It was also hypothesized that infants would use the same types of behaviors whether they have declarative or imperative communication goals. The Early Social Communication Scales (ESCS, Mundy et al., 2003) was administered to 103 typically developing infants of 12 months (half of them siblings of children with autism). A factor analysis, yielding four behavioral factors, namely pointing, eye contact, actions and following points, confirmed the hypothesis that infants use behaviors consistently across situations independent of their communicative intent. MANOVAs (comprising parental education and income) Revealed that higher SES infants showed actions more frequently in the ESCS whereas lower SES infants followed experimenter's points more frequently. The results are discussed in the context of presumably differing socialization goals for infants and the divergent contribution of parental education and income that seem to have additive contribution to some factors (actions, following points) but divergent contributions to others (pointing, eye contact).

Keywords

joint attention; eco-cultural model of parenting; Early Social Communication Scales (ESCS); communicative intent; 1-year-olds

It is a basic problem in communication to create a joint focus of attention towards an entity outside the interacting dyad. Attending to a common object or event outside the dyad while being aware of the shared focus has been labeled joint attention. Usually, one interactional partner alerts the other and directs the other's attention to the target of interest. Joint attention requires the interactional partners to monitor simultaneously (a) the interactional partner and (b) the outside entity. Infants progress from dyadic attention to this more complex form of triadic attention. Initially infants focus on either the interactional partner or an outside entity and only learn to integrate the two at approximately nine months (Trevvarthen & Hubley, 1978). Sharing focus of attention with an interactional partner

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enables the dyad to communicate about outside entities. These exchanges lay the foundation for the infant's acquisition of a symbolic mode of reference, such as language. The achievement of joint attention skills has been considered an important psychological process that supports the development of social cognition and communication (e.g., Mundy, Gwaltney, & Henderson, 2010). Empirically, joint attention has been related to infants' development of language (Brooks & Meltzoff, 2008; Morales et al., 2000) and other social skills (Colonesi, Rieffe, Koops & Perucchini, 2008).

The robust finding that joint attention skills are impaired in autism spectrum disorders (ASD; e.g. Mundy, Sigman, Ungerer & Sherman, 1986) reflects a breakdown in attentiveness to the attentional patterns of others. Compared to typically developing or developmentally delayed children, children with ASD are less prone to employ gestures and eye contact as a means of sharing interest and directing interactional partners' attention to objects of interest. They are also less likely to be responsive to other people's attention-directing gestures such as shifting gaze and pointing. Instrumental use of the same gestures, e.g., pointing to request an object, is less likely to be impaired (Dawson et al. 2004; Mundy et al. 1986 ; Sigman and Ruskin 1999). Atypical and reduced joint attention behaviors in both their spontaneous/initiated and responsive forms are early indicators of ASD (Landa, Holman & Garrett-Meyer, 2007; Rozga et al., 2011; Yoder et al., 2009). Language deficits associated with ASD may be secondary to the more fundamental impairment in joint attention (Mundy, Sigman & Kasari, 1990; Sigman & Ruskin, 1999). Siblings of children with autism are more likely to develop an ASD themselves but even if they do not, there may be specific ways in which their joint attention skills differ from typically developing children.

There are several specific joint attention skills in infancy that are recognized as milestones in the development of triadic interactions, such as gaze following and pointing. A child can initiate triadic episodes or follow another person's initiative (e.g. Mundy et al., 2007; Colonesi et al., 2010), though not all behaviors are equally easy to interpret. The infant can alternate gaze between an interactional partner and an object for purposes of sharing interest, to request the object, and to obtain information about the object (social referencing). The infant can use a pointing gesture to direct another person's attention or can follow another person's point. Gaze shifting has been studied more frequently than pointing as a cue to be followed by the infant (e.g., Moore & Corkum, 1998; Morales, Mundy & Rojas, 1998). Generally, infants follow triadic cues before producing them (Mundy et al., 2007; Carpenter et al., 1998).

One of the earliest joint attention skills is in the visual modality: the ability to follow another person's gaze, head turn, or point to locate a proximal referent. As early as 2–3 months of age, infants appear to follow adults' attention-directing cues in the correct general direction (Butterworth & Cochran, 1980; D'Entremont, Hains & Muir, 1997; Scaife & Bruner, 1975). The ability to locate precisely an object or event in the environment coalesces from 6–18 months, with most rapid changes occurring from 8–12 months (e.g. Morales et al., 2000). Up to nine months, infants follow head turns more consistently than gaze shifts (Brooks & Meltzoff, 2005). The ability to follow attention-directing cues has been associated with

language acquisition (Morales, Mundy & Rojas, 1998) and theory of mind (e.g., Baron-Cohen, 1994).

The standard experimental protocol to assess the infants' ability to follow another person's gaze starts with the examiner facing the child to secure the child's attention. Next, the examiner gazes toward an object to the right or left. Gaze following is counted as successful if the child follows the examiner's gaze to the intended referent, but some studies involving infants less than 6 months addressed the ability to follow the examiner's head turn in the correct direction (e.g. Butterworth & Cochran, 1980; Scaife & Bruner, 1975).

Another early referential skill - in the manual gestural modality - that develops at around twelve months of age is the production and comprehension of pointing gestures (Blake, O'Rourke & Borzellino, 1994; Colonnese, Rieffe, Koops & Perucchini, 2010). Response to pointing gestures emerges later than response to head turn and gaze. From 6–9 months, infants are still equally likely to orient to the pointing hand itself as they are to follow the point either in the correct direction or to a target object (Butterworth & Grover, 1988, 1990). Between 12 months (Butterworth & Grover, 1988, 1990; Carpenter, Nagell & Tomasello, 1998) and 15 months (Desrochers, Morissette & Ricard 1995; Morissette, Ricard & Decarie, 1995), most infants are able to locate the target of another person's pointing gesture. Pointing can be used for different purposes or communicative intents. Most authors distinguish between an imperative and declarative use (Bates, Camaioni, & Volterra, 1975), that is to demand something or to show and share the attention. The use of pointing for these two types of communicative goals may emerge at different times (e.g. Colonnese et al., 2010) with the imperative usage emerging earlier than the declarative one. The distinction has been applied to early communication in general. Declarative communicative intents have been labeled as "joint attention," which is contrasted with "behavioral regulation," as the imperative usages have been called (e.g. Mundy et al., 2003). Earlier studies suggest that infants select different gestures according to their communicative intention (Franco & Butterworth, 1996). There are other behaviors that can be used to achieve triadic communication such as body orientations (Abels, in prep.) and vocalisations (e. g. Tamis-LeMonda, Bornstein & Baumwell, 2001; Gros-Louis, West, Goldstein & King, 2006). However, this study focuses on behaviors specified in the Early Social Communication Scales (Mundy et al., 2003) which focus on gaze, pointing and a few additional behaviors such as reaching and showing.

Researchers disagree whether infants need to understand others as intentional agents in order to demonstrate joint attention (e. g. Tomasello, 1995; Barresi & Moore, 1996; Carpendale & Carpendale, 2010). Some argue that only declarative behaviors express a true understanding of others as intentional agents (Baron-Cohen, 1999). However, others have questioned the distinction between declarative and imperative gestures (e. g. Antinucci 1973, cited in Bates, Camaioni, & Volterra, 1975; Leavens, Russell & Hopkins, 2005). From this latter perspective, both declarative and imperative behaviors can be understood as attempts to manipulate the other person's behavior and infants may therefore use the same behavioral strategies to evoke either type of response.

There is a consensus that the development and use of joint attention behaviors vary depending on the reactions of the child's interactional partner(s). Experimental studies have shown that the adult's sharing of the infant's interest and attention and the adult's affective response increase the frequency of infants' pointing (Liszkowski, Carpenter & Tomasello, 2007; Liszkowski et al., 2004; Iverson et al., 2008). There may even be a strong and unique influence of the caregiver-infant interaction, which leads to an idiosyncratic gesture repertoire for each individual child (Carpendale & Carpendale, 2010). The child's interactional partners not only play a role in infants' gesture production, but also in their gaze-following behaviors. At 6 months, infants are more likely to follow their interactional partner's gaze if they are addressed vocally (with infant-directed speech) and/or visually before the gaze-following prompt (Senju & Csibra, 2008).

In the experimental studies reviewed above, the adults' behaviors have been manipulated with a short-term effect on the infants' behaviors. These results imply that the caregiving behavior that infants experience in their daily life will influence their joint-attention strategies. Environmental and socio-economic effects on caregivers' interactions with infants have long inspired research. In terms of communication development children from families with lower socioeconomic status have been shown to use fewer gestures (Rowe & Goldin-Meadow, 2009) and are more likely to have a delayed language development (e. g. Ginsborg, 2006). The eco-cultural model of parenting (Keller, 2007) provides a framework to relate environmental and socio-economic factors to child-rearing practices and learning environments (Greenfield, 2009). Two prototypical approaches to childrearing and family life have been identified- an independent or pedagogic model and an interdependent or pediatric model (Keller, 2007, LeVine et al., 1994) differing on aspects such as the attentional focus of the caregiver (Chavajay & Rogoff, 1999) and the frequency of face-to-face interactions (Keller, Abels et al., 2005).

Joyful exchanges involving pointing and alternating gaze between child and caregivers as well as labeling routines reflect an independent or pedagogic ethnopsychology of the infant (Keller, 2007, LeVine et al., 1994). Here, the child is seen as an equal partner (that is, a putatively co-equal communicator, even though of course not yet functionally so) in an interaction with the caregiver. Almost from birth, personal preferences and characteristics are ascribed to babies in more independent ethnopsychologies (Demuth, 2008). Their signals are interpreted as communicative and a quasi-dialogic interactional structure is established by the caregiver (Ginsburg & Kilbourne, 1988; Demuth, 2008). In this model, the communicative development of the infant would be welcome. Pointing and looking behaviors can be regarded as the infant's expression of interest in something and thereby a personal preference. This perceived interest elicits explanations and labels by the caregiver and these responsive behaviors accelerate the infant's speech development (Brooks & Meltzoff, 2008). Routines involving pointing and labeling are common for infants and their caregivers in these cultural communities (Bruner, 1995; Kishimoto, Shizawa, Yasuda, Hinobayashi, & Minami, 2007). Furthermore, early signs of communication of this kind are seen as signs of impending verbal communication by the child. Verbal precocity is, in turn, a sign of "intelligence" in such ethnopsychologies, both social and cognitive, and is therefore highly desirable.

In the interdependent or pediatric model, the infants' signals are answered as well— but most often only if they are interpreted as expressing child needs (Demuth, 2008). Therefore it is mainly infants' distress signals that are answered quickly and if the mother is with the child, her reaction is frequently to breastfeed the child (Keller et al., 2005). Exclusive attention towards infants and face-to-face interactions with them are rare behaviors (Abels et al., 2005; Keller, Abels et al., 2005). Rather, caregivers share their attention between the child and other tasks or interactions (Chavajay & Rogoff, 1999; Abels et al., 2005). A child's points or gazes toward an object may go unnoticed by caregivers, who are not exclusively attentive to the child in the absence of signs of distress or clear needs. Moreover, pointing at something or someone, if it does happen, may not be regarded as desirable in these communities, because children are expected to be adjusted to the hierarchical structures, neither to stand out nor to draw attention to themselves overtly (Markus & Kitayama, 1991). Pointing might be interpreted as drawing attention in this kind of ethnopsychological model. It seems unlikely that behavior is modeled and encouraged in the same ways in these communities as in independent communities. It may generally be reduced or may be directed at different goals. On the other hand, children in these cultural communities are expected to learn through observation (Rogoff et al., 2003) and can be assumed to start recognizing and following their caregivers' cues early on. Some of these differences can be seen in the contrast between Dutch and Mayan interactional patterns reported by Salomo and Liskowski (2013; with the Chinese sample presenting a different case probably due to the one child policy in China).

While these distinct interactional patterns have generally been associated with “cultural” differences, according to the eco-cultural model, differences are also related to caregivers' levels of formal education and income. It has been proposed that parents' work environments and requirements drive these differences (Tudge et al., 1999) or that specific ways of interaction are learnt through formal education and then generalized to interactions with infants and children (Richman et al., 1992). Differences in the economic situation may also correspond to a specific family organization and time allocation, which may then cause differences in interactions (Greenfield, 1999). Empirical results show that caregivers with lower levels of income and education show more interdependence, caregivers from more educated families with a higher income demonstrate more independent behaviors. For instance Greenfield (1999) has shown that, in the same community, the interactional model between mothers and their daughters while learning to weave has changed with changes in the economy in the community. In infancy, more maternal education is related to an increased verbal responsivity of mothers toward their babies and increased face-to-face interactions (Richman et al., 1992) and there are consistent differences between rural and urban mothers' behavior (rural and urban being characterized by contrasting socio-economic conditions such as source of income, level of formal education, possessions; e.g. Abels et al., 2005; Keller, 2007). We expect that these differences in interactional style experienced by infants belonging to different socio-economic groups within a community will be related to their way of interacting in early social communication situations. We expect that infants from higher socio-economic groups will use gestures more frequently than infants from lower socio-economic groups, replicating earlier findings that infants from a lower SES

group used fewer gestures than infants from a higher SES group (Rowe & Goldin-Meadow, 2009).

However, we would also like to propose that infants from families with lower socio-economic status will make use of gaze as a mode of communication and follow pointing more. This would be in line with the interdependent cultural model that expects infants to follow their caregivers' cues. As joint attention behaviors in different modalities seem to emerge at approximately the same time and independently of one another (i.e. if infants can do one, they may not necessarily be able to do the other; Striano & Bertin 2005) and both gestural communication and gaze following are linked to later language development, these types of joint attention behaviors may represent different styles or pathways in infant development. If these modalities of joint attention behaviors represent different general ways of interacting with the social world, we can expect them to be used by infants consistently, regardless of their communicative intent.

To summarize our hypotheses:

Infants use the same behaviors regardless of their communicative intent (e. g. children who use pointing frequently to initiate joint attention, also use pointing to request objects frequently).

Infants from families with a higher socio-economic status use gestures more and gaze less as a means for social communication than infants from families with a lower socio-economic status. Infants from families with lower socio-economic status follow points more than infants from families with a higher socio-economic status.

Data from the Early Social Communication Scales (ESCS; Mundy et al., 2003) was used to test these hypotheses. The ESCS is a semi-structured measure that aims to elicit non-verbal communication behaviors from infants during playful interactions with a researcher. The interaction is video-recorded and then coded in terms of joint attention behaviors. Additional information on the infants and caregivers' socio-economic status was collected through a questionnaire.

Method

156 infants living in Southern California entered the study at 6 or 12 months of age. Sixty percent of the sample was considered to be at elevated risk for autism because they had at least one older sibling with autistic disorder (Ozonoff et al., 2011). Inclusion of infants at high and low risk for autism aimed to maximize variability in the development of joint attention skills. High-risk participants were recruited through the UCLA Autism Evaluation Clinic, other autism-related studies at UCLA, and organizations offering support for children with autism. The older sibling's autism diagnosis was confirmed at the UCLA Autism Evaluation Clinic to justify the infant's inclusion in the high-risk group. Following the confirmation of diagnosis, the older sibling had no further involvement in the study. Low-risk controls, with no family history of autism, were recruited by means of fliers placed in local pediatricians' offices and a mass mailing to families based on birth records indicating that they had an infant in the target age range. The data presented in this report are based on

an assessment with the Early Social Communication Scales (ESCS) that took place in our lab at the UCLA Medical Center at twelve months.

Since the siblings of children with autism are themselves at risk for being diagnosed with autism, all participants were screened at 36 months of age for autism using the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) and a follow up by the Autism Diagnostic Interview-Revised (ADI-R; Lord, Rutter & Couteur, 1994). 53 participants who developed an autism spectrum disorder or another type of developmental concern by the age of 36 months were excluded from the current analysis. The UCLA Human Subjects Protection Committee approved the research protocol and parents provided informed consent for participating probands and infants. Characteristics of the sample are summarized in Table 1. All the mothers were living with a spouse/partner at the time of data collection and almost all the partners were working fulltime. Data presented below were collected at the twelve-month visit (mean chronological age = 12.2 months, $SD=0.37$).

ESCS

The Early Social Communication Scale (ESCS; Mundy et al., 2003) is a semi-structured measure that aims to elicit non-verbal communication behaviors from infants during playful interactions with a researcher. The child sits opposite a trained staff examiner at a small table and a set of toys is arranged in the child's line of sight, but out of reach. For this study, we focus on the tasks and codes that specifically concern joint attention behaviors (both initiating and responding to declarative behaviors) and requests to the researcher (imperative behaviors). In the "object spectacle" task, the examiner presents the toys to the child one at a time, and initiates playful interactions. Children's declarative (IJA: initiating joint attention) and imperative (IBR: initiating behavioral regulation) behaviors are coded in this task. In another task the examiner points at posters on the wall of the room, saying the child's name three times in an attempt to attract the child's attention to the posters ("distal points"). Finally, the examiner shows images in a picture book to the child. The examiner points to 3 pictures on 3 successive pages of the book while saying the child's name ("book points"). In these two tasks, infant responses to the examiner's bids for joint attention are coded (RJA: responding to joint attention).

The assessment is filmed using two cameras simultaneously in order to generate a split-screen image of the child's and the examiner's face. Trained research assistants reviewed the video recorded ESCS using observational software (The Observer, Noldus) and coded frequencies of communicative acts as described in the ESCS manual in three mutually exclusive categories.

Initiating joint attention (IJA)—The use of gaze and gesture to coordinate the child's and the examiner's focus of attention toward objects or events of interest to the child. IJA behaviors were sub-classified as:

- Initiating eye contact with the examiner while manipulating a toy;
- alternating gaze between an active toy and the examiner;

- pointing to objects or images in the picture book (pointing at book; with or without eye contact);
- clearly holding up an object to show it to the examiner (showing).

Initiating behavior regulation (IBR)—The use of eye contact and/or gesture to recruit help in acquiring or activating a toy. Sub-categories of IBR were:

- making eye contact to request a toy;
- reaching or otherwise indicating a desired toy (with or without eye contact) (reach);
- reaching or otherwise indicating a desired toy while vocalizing (with or without eye contact) (appeal);
- pointing to a desired, out-of-reach toy (requesting point);
- giving an object to the examiner obtain help operating it (with or without eye contact).

Responding to joint attention (RJA)—The ability to follow the examiner's gaze direction and pointing gestures. Coders record the number of times the child turned his gaze in the direction of the examiner's points to posters on the wall (maximum = 6) (distal points) and pictures in a book (maximum = 9) (book points).

Reliability—Reliability was calculated by the second author (TH) at the level of the specific behavior (i.e., eye contact, alternating gaze, pointing, etc.) using intra-class correlations (ICC; Shrout & Fleiss, 1979) based on 15% of the sample. Individual measure ICC statistics ranged from .91 to .97, with a mean of .94, indicating a high level of agreement among coders.

Due to variation in infants' interest in the toys and differences in exposure time to each toy, the duration of the ESCS ranged from 9.2 to 34.8 minutes ($M = 18.9$, $SD = 4.9$). Consequently, IJA and IBR behaviors were expressed as rates per minute relative to the total duration of the ESCS. For a subset of cases, the examiner administered fewer than the required number of point-following trials, which were used to measure RJA. The infants' point-following scores were calculated as a ratio of successful trials divided by total number of prompts administered. The number of correct responses to the point-following tasks was not correlated with the total number of trials administered, in the sample as a whole ($r = -.02$, $p = .78$) or in the sub-sample of infants with fewer than the required number of trials ($r = -.23$, $p = .28$).

SES

The background questionnaire contained questions about the parents' highest level of education and their income. Income was measured in six groups in steps of \$25,000 ranging from below \$25,000 (1) to above \$125,000 (6). Education was measured in 7 steps, namely: below high school diploma(1), high school diploma (2), some college education (3), college degree (4), some graduate school education (5) and graduate school degree (6). There was an

eighth category “other”. Only six of these categories were relevant for the selected subsamples as none of the participants had not been to high school and only few selected “other” as their answer. Income and education were split into three groups for the further analyses.

SES score—The SES score was calculated as an average of the mother’s and her partner’s educational score and the doubled income score. This procedure is based on the Hollingshead Four Factor Index (Hollingshead, 1975) which has often been reduced to contain education and occupational status. In our data occupational status was replaced with income to which it loosely corresponds. Because family income rather than individual income was assessed it was doubled in the score in order to weigh income (one value) and education (a value for each parent) equally. This resulted in SES scores between 1 (income below \$25,000 and both parents not having a high school diploma) to 6 (income above \$125,000 and both parents have a graduate degree). These were split into three SES groups consisting of approximately equal numbers of participants. Details of the three SES groups are presented in table 2. The groups did not differ in terms of mother’s employment, marital status, infants’ birth rank or risk group.

Results

There are two main sections of the results. The first one concerns the factor analysis which was conducted to answer the question whether infants use the same behaviors in their declarative and imperative communication. The second section is devoted to the relation between the communicative behaviors extracted from the factor analysis and SES. This will be analyzed both for the compound SES score and for maternal education and family income treated as separate independent variables.

Factor analysis

A factor analysis was done on the ESCS codes to determine whether the infants use consistent behavioral strategies independent of their communicative intent. For the correlation matrix of the behaviors included in the factor analysis see appendix 1. While there were six factors with Eigenvalues larger than 1, two of these were very close to 1 (1.03 and 1.01). The scree plot also indicated the appropriateness of four factors. The rotated four-factor solution is presented in Table 3. After IBR appeal was removed because it loaded on both factors 3 and 4, the factor structure remained unchanged (table 3 in brackets). The factor structure reveals that following joint attention (RJA) forms a separate factor that we have called “following points”. Behaviors to initiate joint attention and to initiate behavioral requests fall into three distinct factors that are characterized by certain behaviors but that do not correspond to infants’ presumed declarative or imperative communicative intents. The three factors are “pointing” at objects, communicating through gaze, and “eye contact”, and communicating through “actions” such as reaching for, holding out or giving an object to the interactional partner. Scores for the four factors were obtained by calculating the mean z-standardized values of the behaviors that loaded on each factor for each participant. These were used in the analyses that follow.

MANOVAs

Risk group and ethnic group—We tested whether the infants' risk group or their ethnic group makes a significant difference for their communication behavior.

The first MANOVA addresses the question whether the infants' communication differs according to whether they have a sibling with autism or not. The two risk groups did not differ in terms of their communication behavior ($F(4, 92) = 0.632, p = .641$, partial $\eta^2 = .027$) or their families' socio-economic status ($F(3, 91) = 0.343, p = .794$, partial $\eta^2 = .011$).

The four ethnic groups did not differ significantly in their early communication behavior ($F(4, 89) = 0.541, p = .887$, partial $\eta^2 = .023$) or in terms of socio-economic factors ($F(9, 258) = 0.961, p = .473$, partial $\eta^2 = .032$). The two risk groups and the four ethnic groups were therefore analyzed together in the following analyses.

Socio-economic status—The second analysis addressed the question whether infants from families with different socio-economic status differ in their early social communication. SES was used as the independent variable while the four social communication scores were used as dependent variables. Descriptive statistics of behaviors by SES group are shown in table 4.

The infants' behavior differed with SES ($F(8, 184) = 2.568, p = .011$, partial $\eta^2 = .100$). While they did not differ in their pointing ($F(2, 94) = 0.804, p = .451$, partial $\eta^2 = .017$) or their eye contact ($F(2, 94) = 0.248, p = .781$, partial $\eta^2 = .005$), they differed in the frequency of actions ($F(2, 91) = 3.937, p = .023$, partial $\eta^2 = .077$) and following points ($F(2, 94) = 3.836, p = .025$, partial $\eta^2 = .075$). LSD post hoc tests show that infants from lower SES families react significantly more to pointing by the researcher than infants from medium ($p = .009$) and higher ($p = .040$) SES families. On the other hand, infants from higher SES families show significantly more actions than their medium ($p = .039$) and lower ($p = .011$) SES peers.

Mothers' education, family income, and social communication—The last MANOVA tested the relation between two aspects of SES, namely mothers' education and family income, and the infants' early social communicative behavior. The MANOVA revealed no significant effect for mothers' education ($F(8, 168) = 0.893, p = .523$, partial $\eta^2 = .041$) but a significant effect of family income ($F(8, 166) = 2.119, p = .037$, partial $\eta^2 = .092$) and a marginally significant interaction between mothers' education and family income on the infants' social communication ($F(16, 344) = 1.585, p = .071$, partial $\eta^2 = .069$).

While the infants' behavior did not differ with family income in terms of actions ($F(2, 86) = 0.577, p = .564$, partial $\eta^2 = .013$), following points ($F(2, 86) = 0.677, p = .511$, partial $\eta^2 = .016$) and gaze ($F(2, 86) = 1.217, p = .301$, partial $\eta^2 = .028$), they did differ in terms of pointing ($F(2, 86) = 7.060, p = .001$, partial $\eta^2 = .141$). It is predominantly the lower and higher income groups that differ (LSD post hoc test, $p = .060$) with infants from higher income families showing more points than those from lower income families. The medium income group falls in the middle and does not differ from the lower ($p = .827$) or the higher income group ($p = .112$). The marginally significant interaction effect is depicted in figure 2

and can be explained in the following way: for infants from lower income groups, maternal education does not change their frequency of points, for infants from medium income families, maternal education is positively associated with frequency of points and for infants from higher income families with more maternal education, the frequency of infants' pointing decreases. While infants from higher income families with less educated mothers point the most frequently, infants from higher income families with medium or highly educated mothers and infants from medium income families with mothers with highly educated mother show approximately the same frequency of pointing gestures.

Discussion and conclusions

In a factor analysis, behaviors observed during the ESCS load onto four distinct factors (pointing, eye contact, actions and following points). The distinction among factors is better explained by the infants' behaviors rather than by apparent communicative intent. Moreover, there are differences between SES groups on two of these factors in the frequency with which these behaviors are used in joint attention situations: actions are used more frequently by infants from higher SES families, points are more often followed by lower SES families. A third factor, namely pointing, is positively related to family income and shows a complex relation to the interaction of maternal education and family income. These results support the hypothesis derived from the eco-cultural model of parenting (Keller, 2007) that infants from families with different socio-economic status learn different interaction styles. In this sample of typically developing children, infants' ethnic background and whether or not they had siblings with autism was not related to the frequency with which they demonstrated joint attention behaviors.

As described above, we found that producing and following points load onto different factors. Producing pointing gestures is done to achieve joint attention or to make a behavioral request. Following points means that the infant is responding to bids for joint attention. That producing and following points load on different factors is consistent with reports of distinct neural pathways underlying initiation and response to joint attention (Caplan et al., 1993; Frieschen, Bayliss, & Tipper, 2007; Henderson, Yoder, Yale, & McDuffie, 2002; Materna, Dicke, & Thern, 2008; Schilbach et al., 2010; Torkildsen, Thormodsen, Syvonen, Smith, & Lingren, 2008) and distinct developmental sequelae associated with each of these behaviors (Mundy, Sullivan & Mastergeorge, 2009).

The factor analysis confirmed our hypothesis that twelve-month olds use similar behavioral strategies independent of the communicative intent. For instance, infants who point frequently do so both to share interest (initiate joint attention) and to request an object. Similarly, infants who rely on eye contact to communicate do so consistently and across categories of intention. In previous studies (e. g. Mundy, Sigman & Kasari, 1994), different types of behaviors have been classified as "high" and "low" level behaviors in relation to the complexity of the behavior and the timing of its emergence, where low-level behaviors emerge first. While this distinction may be useful in some contexts, we would like to suggest that differences in typically developing infants' social communication may reflect different communication styles rather than different developmental levels. According to the eco-

cultural model of infant care these differences are acquired in interactions with their families and other social partners.

This hypothesis is strengthened by the behavioral differences according to SES that we found in the MANOVAs we conducted. Though it could have been expected, in this study, ethnic group was not a significant predictor of the infants' behavior. While this may be attributable to the small sample size for all but the Euro-American subsample, it might also be due to very similar socio-economic conditions among the ethnic groups. Although some studies have varied only ethnic groups while controlling for SES, in many previous studies there has been significant co-variation between ethnicity and measures of SES, leaving room for interpretation whether ethnicity or SES underlies observed group differences.

In spite of a high general level of both education and income in our sample, observed differences in infants' behaviors are related to SES. This was hypothesized based on the eco-cultural model of parenting (Keller, 2007). While infants from families with higher SES communicate more through actions, lower SES infants are more likely to follow the experimenter's points which is in line with independent and interdependent interaction strategies identified in earlier studies (cf. Keller, 2007 for an overview). It also ties in well with discussions of parents' expectations about their children's agency and compliance. In a study on parents' education and their expectations for their children's behavior, Tudge et al. (1999) found that working class parents in four different countries believe more in controlling and disciplining their children than middle class parents. They also felt that their children would become spoiled if they received too much attention. This is similar to more interdependent socialization strategies identified in cross-cultural studies (cf. Keller, 2007). Middle class parents on the other hand embraced their children's freedom to explore in and around the house. Their children experienced more conversations with adults than the working class children. This interactional style has been labeled independent in cross-cultural studies (cf. Keller, 2007). In our study, both the lower frequency of actions and the more responsive, following behavior in the lower SES infants can be understood as a more obedient, respectful way of interacting with the world and therefore falls in line with Tudge et al.'s (1999) report on social class differences in socialization goals. The higher SES infants show a more assertive, agentic way of interacting with the world through actions. It can be assumed that the higher SES infants are accustomed to turn-taking and are encouraged to participate with actions and gestures before they can participate in verbal conversations.

In addition to these two types of behaviors for which parents' education and family seem to have additive effects, there are two other types of behavior for which the relationship descriptively seems to be inverse. These are the child's gazes and the child's points, which we expected to differ with SES according to our hypothesis. The marginally significant effect of income indicates that income possibly drives the differences in these behaviors more than education. These results also suggest that it may be worthwhile considering several indicators of SES and evaluating their distinctive contribution to SES differences and their association with socialization goals and practices. For future research it would be interesting to test for ethnic group differences on a larger sample to explore whether the differences between ethnic groups really become negligible if socio-economic status is

controlled and the families are as acculturated as the ones in this study (English being spoken in the home was one of the inclusion criteria for the families). Studies on families from a wider range of socio-economic backgrounds may reveal larger effects on some of the child behaviors. From a developmental point of view, the infants' interactional experiences that support different styles of early social communication should be investigated. It would also be interesting to see whether the behavioral styles that infants have developed at twelve months are stable and whether they have effects on other areas of development such as initiative taking in play situations or compliance with parental demands. Future research should also relate these behavioral styles to language development. A particularly interesting question would be whether different behavioral styles are similarly supportive to language acquisition. Additionally it should be examined whether the factor structure found here with a typically developing, predominantly Euro-American sample of twelve-month-old infants can be replicated with different populations.

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Appendix 1 correlation table of early social communication behaviors

	1	2	3	4	5	6	7	8	9	10	11
1 Eye contact	-										
2 Alternating gaze	.27 ^b	-									
3 Pointing	.12	-.23 ^a	-								
4 Showing	.07	0	-.04	-							
5 Pointing at book	.13	-.17	.21 ^a	-.05	-						
6 Eye contact	-.06	-.15	.13	.14	.13	-					
7 Reach	.17	.45 ^b	-.30 ^b	.00	-.20 ^a	-.30 ^b	-				
8 Appeal	0	.01	-.08	.02	.14	.32 ^b	-.11	-			
9 Requesting point	.05	-.24 ^a	.67 ^b	-.09	.37 ^b	.25 ^a	-.23 ^a	-.01	-		
10 Give	-.27 ^b	.08	.12	.13	.03	.38 ^b	-.06	.19	.08	-	
11 Distal points	-.10	-.22 ^a	.13	.06	.08	.06	-.07	.20 ^a	.00	.04	-
12 Book points	.02	.04	.10	.05	.16	.05	.05	.22 ^a	.15	.11	.27 ^b

Highlights

- infants use behaviors consistently, independent of their communicative intent
- infants with higher SES create joint attention more frequently through actions
- infants with lower SES create joint attention more frequently through following points
- parental education and income have additive effects on actions and following points
- parental education and income have divergent effects on pointing and eye contact

Figure 1.
Boxplot: Difference in actions and following points among SES groups

Figure 2.
Infants' pointing: Interaction effect between maternal education and family income

Table 1

Sample description

N (without diagnosis at 36 months)	103
High-risk group (21 male)	52
Low-risk group (29 male)	51
Family income	
Below \$ 100 000	47
Above \$ 100 000	52
Mother's education	
Below college degree	18
Below graduate school degree	39
Graduate school degree	42
Father's education	
Below college degree	20
Below graduate school degree	41
Graduate school degree	40
Child's birthrank	
Firstborn	29
Laterborn	73
Mother's current employment status	
Not employed	60
Employed part- /fulltime	41
Ethnic group	
Euro-American	63
Hispanic	12
Asian	11
Other	10

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Table 2

Descriptive statistics for SES groups

	SES score			
	N	Mean	SD	Minimum Maximum
Lower	28	3.17	0.51	1.75 3.75
Medium	32	4.45	0.34	4 5
Higher	37	5.75	0.29	5.25 6
Total	97	4.58	1.12	1.75 6

Table 3

Factor analysis of ESCS behaviors

		Pointing	Eye contact	Actions	Following points
Eigenvalue		2.5 (.2.5)	1.7 (1.5)	1.4 (1.4)	1.2 (1.2)
IJA	Eye contact	.325 (.348)	.676 (.655)	-.178 (-.229)	.016 (-.059)
	Alternating gaze	-.241 (-.229)	.784 (.788)	.176 (.158)	-.111 (-.125)
	Pointing	.811 (.792)	-.121 (-.118)	-.01 (.04)	-.032 (.033)
	Showing	-.093 (-.108)	.087 (.116)	.367 (.446)	.049 (.152)
	Pointing at book	.573 (.594)	.006 (-.018)	.007 (-.021)	.256 (.161)
IBR	Eye contact	-.36 (-.357)	.648 (.666)	-.137 (-.099)	.044 (.122)
	Reach	.264 (.275)	-.21 (-.222)	.729 (.688)	.037 (-.08)
	Appeal	-.024 (-)	.003 (-)	.459 (-)	.535 (-)
	Requesting point	.864 (.854)	-.089 (-.097)	.051 (.07)	-.026 (-.017)
	Give	.029 (.018)	-.08 (-.06)	.79 (.837)	-.005 (.024)
RJA	Distal points	-.012 (.003)	-.281 (-.268)	-.082 (-.014)	.752 (.797)
	Book points	.166 (.188)	.191 (.203)	.09 (.158)	.715 (.749)

Table 4

Infants' behaviors (means of z-standardized scores) by SES group

	SES			
	Lower n = 28	Medium n = 32	Higher n = 37	Total N = 97
Pointing	−0.09 (0.49)	0.16 (1.08)	0.11 (0.76)	0.07 (0.82)
Eye contact	−0.06 (0.61)	−0.00 (0.59)	0.31 (0.74)	0.1 (0.67)
Actions	−0.11 (0.82)	0.00 (0.63)	−0.01 (0.66)	−0.07 (0.69)
Following points	0.36 (0.81)	−0.15 (0.78)	−0.02 (0.64)	0.05 (0.76)

SD in brackets