Triadic Attention and Gestural Communication: Hierarchical and Child-centered Interactions of Rural and Urban Gujarati (Indian) Caregivers and 9-month old Infants.

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I would like to thank all participating infants and their families for welcoming us into their homes and lives. I am gratefully indebted to my Indian assistants, particularly Dharti Shah and her extended family. I would also like to acknowledge Aruna Lakhani, Shroffs Foundation Trust and the local anganwadi workers who have helped introduce me to the rural families. I am grateful for the support of the cooperating birth and child clinics in Vadodara and the Chetan Balwadi at Maharaja Sayajirao University. I would like to acknowledge Annemarie Kelleghan and Tiffany Fung for their help with coding the data. Finally, I thank Patricia Greenfield and Thomas Weisner for their guidance during this project.

This research was supported by the German Research Foundation (dfg) with Grants AB276/3-1 and AB 276/4-1 and through a FPR-UCLA Center for Culture, Brain, & Development Research Award.

Manuscript accepted for publication in Developmental Psychology. This manuscript may differ from the final published version.

Abstract

In this study nine month old infants in rural and urban Gujarat, India were compared in how frequently and in which way they engage in triadic interactions. It was assumed that urban caregivers would engage in a child-centered interaction style, frequently creating triadic interactions and following infants' signals. It was also expected that they would engage in more gestural communication in line with results on young infants often being involved in distal interactions. Rural caregivers were assumed to engage in a hierarchical interaction style in which the caregiver directs the interactions. It was expected that they would engage more in bodily ways of communicating as young infants in these communities often experience large amounts of proximal interactions. Infants were observed in everyday situations to assess their everyday engagement in triadic interactions and experience with gestures. Additionally, infants' mothers were asked to show their children something distant to assess how triadic attention is created. These interactions were video recorded and analyzed in terms of gestures and bodily behaviors. The results indicate that urban infants experience more triadic interactions and have caregivers who are more likely to follow their initiatives than rural infants. In the observations, urban caregivers also use gestures more frequently than rural caregivers. For rural infants the results are less clear with some indications that caregivers direct their attention more, particularly using their bodies. These differences are only apparent in the video-recorded situations. Implications for infants' further development are discussed.

Key words:

Socio-cultural differences, non-verbal communication, distal and proximal parenting, directing attention, bodily communication, observations

The second half of infants' first year of life is characterized by an expansion of their socio-cognitive skills (Tomasello, 1995; Trevarthen & Hubley, 1978). Infants start to develop "the ability to monitor, control, and predict the behavior of others" (Rochat, 2014, p. 4). Given the great variations in both children's and caregivers' behaviors related to early socio-cognitive skills across socio-cultural environments (cf. Callaghan et al., 2011; Carpenter et al., 1998; Salomo & Liszkowski, 2013), this study attempts to shed light on rural and urban Gujarati, Indian infants' socio-cognitive development and their interactions with their caregivers at the age of nine months. These are understudied populations and therefore provide necessary additional insights into the diversity of human behaviors (Henrich et al., 2010). The age can be considered crucial as it represents the onset or improvement of some of the studied behaviors and therefore the experiences infants make during this phase can be expected to carry over to the speed of the development and style of interactions later on (Kishimoto, 2017; Mastin, 2013). These interaction styles may have long-term effects on developments such as infants' language acquisition (Rowe & Goldin-Meadow, 2009; Tomasello & Farrar, 1986). Infants and their caregivers were both observed in their everyday interactions and in a structured situation in which their mothers were asked to show them something. This was done in order to triangulate methods (Weisner & Duncan, 2013) and to avoid the pitfalls of relying on instructed video recordings only (Abels et al., 2017). Everyday observations provide an insight into the infants' triadic experiences during their normal days while the video-recorded interactions explicitly elicit strategies mothers use when they try to coordinate their own and their infants' attention.

Sharing Attention and Triadic Interactions

Triadic attention can be defined as two persons attending at one object with (at least) one of them attending additionally to the interactional partner. This definition is in line with others in that it includes two persons and an object that form an attentional triangle (e.g. Bard, 2017; 20Striano & Stahl, 2005). In contrast to "joint attention" (e.g. Carpenter et al., 1998) it does not assume that there is an ongoing, observable awareness of mutual attention. It therefore includes cases in which one of the interactional partners may (at least initially) not be aware that the other is sharing their focus. It also allows for both the infant and the caregiver coordinating their attention. The relevance of this will be elaborated in the subsequent paragraphs.

Infants have been shown to have awareness for others' triadic attention as early as three months of age (Striano & Stahl, 2005). This contradicts previous assumptions that triadic skills emerge later (e.g. Carpenter et al., 1998; Tomasello, 1999) to some extent. However, it seems that infants become more skilled at sharing attention and more active during these exchanges during the second half of their first year. For instance they start producing gestures, such as pointing (Leung & Rheingold, 1981) and become more skilled in following their interactional partner's gaze (Brooks & Meltzoff, 2005).

A common distinction can be made by who initiates and who follows in a triadic interaction (e.g. Bono & Stifter, 2003; Mundy et al., 2003). While some have argued that initiating and following cues to direct attention represent different cognitive levels (e.g. Mundy et al., 2003), others have argued that these may rather represent different interactional styles that are typical for different socio-cultural environments (cf. Abels &

Hutman, 2015). Some authors add a third type of triadic interaction, namely joining in by observing what others are doing (Bakeman & Adamson, 1984; Mastin, 2013).

While infants start following head turns of adults in experimental studies early on (D'entremont et al., 1997), actual gaze following seems to emerge at approximately nine months (Brooks & Meltzoff, 2005). These skills continue being fine-tuned, so that, for example it takes until approximately 12 months until the infant can distinguish between an adult with opened and closed eyes (Brooks & Meltzoff, 2002). Nine-month-old infants are also able to follow others' pointing gestures (e.g. Flom et al., 2004).

Infants gaze at objects from early on (e.g. Trevarthen & Hubley, 1978). Caregivers can and do interpret these gazes as expression of interest by the child. They can express their shared attention for example by labeling the objects the child focuses on (Tomasello & Farrar, 1986). Gestural communication is a more active or intentional way of directing an interactional partner's attention (cf. Camaioni, Perucchini, Bellagamba, & Colonnesi, 2004; Leung & Rheingold, 1981; Tomasello, 1995). It is therefore an indication of an underlying socio-cognitive development, although not all authors agree that an actual understanding of intentionality is necessary to effectively use gestures (e.g. Barresi & Moore, 1996). Pointing starts occurring from approximately 9 months of age (Bates et al., 1979; Leung & Rheingold, 1981). Infants point more frequently when their caregivers also point more frequently (Liszkowski et al., 2012) and if they have an interactional partner who reacts attentively and positively to their points (Liszkowski et al., 2007). Another gesture that has been considered in the literature as a gesture to direct attention is the showing gesture (Acredolo & Goodwyn, 1988; Bretherton & Bates, 1979; Iverson & Goldin-Meadow, 2005). Offering as well as the complementary requesting

gesture has been observed in some infants at nine months of age (Messinger & Fogel, 1998). Other gestures that are produced by most children by eight or nine months include the pick me up gesture (Caselli et al., 2012; Clements & Chawarska, 2010), and some conventional gestures, for example waving goodbye, are also produced early on (Blake et al., 2005).

The main focus of research on infants' triadic interactions has been directed at behaviors such as pointing and gazes, neglecting other ways of directing attention, as several authors have criticized in the past (Akhtar & Gernsbacher, 2008; Bard, 2017; Botero, 2016). An additional group of behaviors, which will be considered here, are bodily behaviors. These behaviors have occasionally been taken into account in the context of scaffolding play and learning situations (Hodapp et al., 1984; Maynard, 2002). In this context, the caregivers' behaviors are described as "attempts to put the child into a physical configuration optimal for game playing" (Hodapp et al., 1984, p. 775) or "guiding the child's body" (Maynard, 2002, p. 974). An aspect of this can be understood as bodily direction of the infants' attention by the caregiver. Changes in position as attention directing behaviors have also been discussed (Rogoff et al., 2003). It is important to include these behaviors because otherwise the frequency of triadic interactions may be underestimated in dyads that rely on more bodily ways to interact (see Bard, 2017). Additionally, bodily communication could be used as alternative route to interventions.

As sharing attention is an interactive process (e.g. Rochat, 2014) it is crucial not only to understand the infants' developing skills but also to take into account the interactional partners' reactions or opportunities for triadic interactions they provide

(Bard, 2017). This can be assumed to be related to general patterns of child rearing which have been shown to differ in different socio-cultural groups (Keller, 2007).

Cultural differences in interacting with infants

Caregivers in diverse socio-cultural groups show different styles of interacting with infants. One of them can be labeled *child-centered*, another as *hierarchical*. While this distinction between two patterns of interactions is a simplification, differences along these lines emerge between groups living in different socio-cultural environments (e.g. Greenfield, 2009; Kagitcibasi, 1996; Keller, 2007; Whiting, 1981). Rural and urban families can be considered representative of such a difference. Many families in rural areas are farmers in large parts of the world. They often have less access to educational and occupational opportunities and often have more children and larger families. Families living in rural environments lean more towards the hierarchical approach while urban families are often more child-centered, especially if they have access to the opportunities rural families lack. (This is usually not the case for families living in urban slums or similar circumstances.) Gujarat is a good place to study differences between rural and urban populations as living conditions and opportunities vary quite dramatically between rural and urban areas. For instance, in rural Gujarat almost half of the houses are made of mud, while this is only true for approximately 5% of the urban houses (Census of India, 2011). Two thirds of the rural households have no latrine and more than half have no drinking water on the premises; both water and toilets are common facilities in urban areas (Census of India, 2011). Literacy rates between rural and urban Gujarat differ by 15% (Census of India, 2011) and fertility is still higher in rural than urban areas (Census

of India, 2011). It has been found that caregivers' child-rearing behaviors are also reflected in their socialization goals for infants with child centered caregivers preferring individuality and hierarchical caregivers preferring hierarchy (e.g. Keller, 2007; Keller et al., 2006).

In the child-centered approach, caregivers perceive their children as quasi-equal interactional partners (Demuth, 2009; Snow, 1977). The infants here are seen as being unique individuals who are able to express interests, preferences and volitions from the very beginning (Keller, 2007; Meins et al., 2001). The interaction structure is dialogical, with breaks being made even for very small infants, in order to give them an opportunity to reply (Bloom, 1988; Gratier et al., 2015). The child-centered perspective on interacting with infants also entails a predominantly distal interactional style (Keller et al., 2009). Many exchanges take place in a face-to-face context in which the caregiver can observe and respond to the child's mimics (Abels et al., 2005; Richman et al., 1992). Caregivers rely on verbal interactions and use objects when interacting with infants (Richman et al., 1992; Keller, 2007). Their attention is focused exclusively on the infant during these exchanges (Abels et al., 2005; Chavajay & Rogoff, 1999). In the child-centered approach, play is considered as an important activity for an adult caregiver (Gaskins, 2014; Lancy, 1996; Seymour, 1999). Additionally, special settings are created for children's learning, for example child-care centers or schools (Rogoff et al., 2003).

In contrast, in the hierarchical approach, infants are seen as apprentices who need to be trained by their interactional partners who possess a greater knowledge of the world (Keller, 2007). Instead of the interaction being shaped by the infants' signals, the caregivers shape the interaction and the infants are expected to follow their lead (Keller et

al., 2010; Yovsi et al., 2009). Infants are embedded in their caregivers' daily activities (Rogoff et al., 2003). The interaction is characterized by body contact and body stimulation (Keller et al., 2009, Richman et al., 1992) and exclusive attention to infants is rather an exception than the norm (Abels et al., 2005; Keller, 2000). While activities may be adapted for the benefit of the observing child, special settings for learning that are detached from the interactional partners' daily life are uncommon (Lancy, 2010; Rogoff et al.., 2003; Rogoff et al., 2010).

Implications for triadic interactions

As proposed previously (Bard, 2017), implications of the child-centered and hierarchical style of interacting with infants for guiding attention can be expected, and there are some studies supporting these assumptions. It can be expected, that, compared to infants in hierarchical contexts, infants in child-centered communities will have more triadic interactions (Hypothesis 1 – frequency of triadic interactions), particularly child initiated triadic interactions as caregivers are more inclined to follow their signals (Hypothesis 2a – child initiates, adult follows). They will start using gestures earlier and both caregivers and infants produce them more frequently (Hypothesis 3- proximal vs. distal modality) because distal interactions provide infants with more opportunities to develop these skills and this style of communication is in line with overall distal interaction patterns.

Compared to child-centered caregivers, hierarchical caregivers will direct infants rather than follow their initiatives (Hypothesis 2b – adult initiates/directs). Additionally, it will be more common for infants to observe in triadic interactions (Hypothesis 2c - observing). Hierarchical infants and caregivers will use bodily cues to direct attention

more than their urban counterparts, in line with their general emphasis on body contact and body stimulation (Hypothesis 3- proximal vs. distal modality).

Evidence comparing cultures and rural and urban environments shows that infants in child-centered communities have more triadic interactions overall (Salomo & Liszkowski, 2013). However, infants in rural, presumably more hierarchical communities engage more in observations (Mastin, 2013). Research comparing infants from families with different socio-economic status showed that children from lower socio-economic status - presumably more hierarchical- families follow points more and use fewer actions to direct the experimenter's attention (Abels & Hutman, 2015). Cross-cultural evidence indicates that infants and caregivers from more child-centered communities point more frequently than those from less child-centered communities (Callaghan et al., 2011; Salomo & Liszkowski, 2013). This pattern also holds for showing gestures (Salomo & Liszkowski, 2013). For infants from lower socio-economic status families both gestures and attention-directing actions are less frequent (Abels & Hutman, 2015; Rowe & Goldin-Meadow, 2009). However, there is also evidence that children in different communities develop the pointing gesture at approximately the same age and use it equally frequently in an interesting novel environment with their caregivers (Liszkowski et al., 2012).

In this study, a comparison will be made between rural and urban Gujrati, India infants in terms of their triadic engagement and gesture use in everyday situations. Additionally, interaction styles between mothers and their infants will be analyzed in a situation in which the mother is asked to show the child something distant, as previous research has shown that gesture use can differ with the situation observed (see O'Neill et

al., 2014). The comparison between rural and urban families in the same location provides an insight into how factors related to living environment are related to interactional patterns while keeping influences such as political structure and climate constant. As described for the two locales below, there are many socio-economic differences between families in these settings, which can be considered as constituting the differences to some extent, though (Keller, 2007; Whiting, 1981). While the focus will be on triadic interactions and gestures that direct attention, other gestures that infants start using around nine months of age will be included, as well as caregivers' attempts to teach infants gestures. Additionally, mothers' endorsement of different socialization goals for their infants are assessed.

Method

Locales

Gujarat is a state located in the West of India. It shares borders with Pakistan in the North and the Indian states of Rajasthan, Madhya Pradesh and Maharashtra in the Northeast, East and Southeast. Besides food grains and dairy products, Gujarat is an important producer of groundnuts, cotton and tobacco. However, major parts of the state are prone to drought and/or need to be irrigated (Mehta, 2013). Gujarat has some of the largest businesses in India. The main industries are chemical and petroleum-related industries. Gujarat is among the most advanced states in India as far as economic wealth and general education are concerned. However, there are great disparities in wealth (Das & Pathak, 2012) and education between urban and rural areas (e.g. Census of India, 2011).

Urban locale: Vadodara

Vadodara (or Baroda) is a metropolitan area in the state of Gujarat with a population of approximately 1.5 million (Census of India, 2011). Vadodara is a thriving business center with oil-related and petrochemical industries as well as glass and electronics production sites. Overall literacy rates are high in the city compared to national Indian rates, and the city also houses Maharaja Sayajirao University, the state's only English medium university, catering to over 100,000 students.

Vadodara consists of several distinct parts that are very different in their age and structure. There are several older areas of the city with narrow, twisting lanes with small business and residential constructions intermingled. These areas contain the major street markets of the city. Living space in these areas is crowded and shared by extended families. The newer areas of Baroda contain both crowded and more spacious areas. Some of the more recently developed, spacious areas are only accessible by dirt roads. The new areas often contain park or sport areas, which are rare in the older areas where lanes or areas around temples are used by the children for playing and by adults for chatting with neighbors. There are Western-style shopping malls in several areas and squatter settlements are scattered throughout the city, supplying the upper middle-class with cheap labor. Cows and sometimes goats can be found in many of these areas. Areas are not strictly segregated by religion but smaller areas are often quite homogeneous.

Infants are generally taken care of at home. Often the mother is a main caregiver, but usually, there are several adult caregivers involved in taking care of the child. These are usually members of the extended family and additionally (or exclusively in the case of some nuclear families) non-related neighbors. Professional childcare is generally not

used for infants, though education plays a large role in families' lives and children start play school or preschool early on, some as early as 18 months.

Rural locale: four villages in Vadodara district

The four villages in which the rural data was collected are located in the Padra subdistrict (taluka) of the Vadodara district in Gujarat. The villages are located approximately 35 km to the south-east of Vadodara and have a population between 550 and 2200 (Census of India, 2011). The female to male ratio in these villages is between .86 and .93. That is, they are approximately at or below state average.

In Vadodara district almost 80% of the rural working population works as cultivators or agricultural laborers. The villages were all identified as "predominantly farming" by the staff of a local non-governmental organization[1]. All four villages are surrounded by fields and are not in close proximity to industrial sites or other sources of income. The villages are not isolated, however, as there is a bus service to three of them as long as the monsoon is not too severe and the fourth one is approximately 1 mile from the Vadodara-Jambusar highway. Most of the roads inside the villages are dirt roads. There are a few shops and temples in each of the villages, most of them also have a pond. There is an elementary school in all four villages, though some parents choose to send their children to schools outside the village. Each village also has at least one anganwadi (government child care center) in which the Government of India provides preschool education for children from 3-6 years of age (Government of India, Ministry of Women and Child Development, 2010). Infants are usually taken care of at home, mainly by their

[1] Shroffs Foundation Trust http://www.shroffsfoundation.org/

mothers and other family members but may be brought to the anganwadi by an older child or adult for a change or to play with the toys that are available there. The anganwadis are also the place where supplementary nutrition and vaccinations are available and the child care workers monitor the children's development. Caregivers may also take the infant on visits to other children in the village or neighbors. Older children often come to visit the babies at home and play with them, sometimes for extended periods of time, taking part in caregiving activities like calming or changing the infant.

Recruitment

Urban participants were recruited through doctors and clinics, an early education program and snowball sampling. In cases in which information on the participants' education was available beforehand from records, participants with at least high school education were selected. Families living in slums and squatter settlements were excluded, as were one child with a disability and a child with an obvious developmental delay. Potential participants were contacted either by phone or in person by the author and a native Gujarati assistant.

Rural participants were contacted through the local child care workers who have lists of all children and their birthdates in the community. The author and a native Gujarati assistant were introduced to the families by the child care worker.

The study was explained to the participants and any questions on purpose and procedure were answered. If the families agreed to participate, an oral consent procedure was performed with them and audio-recorded in accordance with UCLA's IRB.

Participants

28 urban and 25 rural families were recruited for the study. This sample size would have resulted in a power of >.8 for large effects and $p = .05$. However, only 23 rural and urban families each finally participated in the observational part of the study and 21 rural and 20 urban families participated in the video recordings due to drop-outs, technical problems and unavailability, because participants were travelling. While this reduction in sample size is unfortunate, the final sample size still yields a power of >.7 for large effects.

Some sample characteristics are shown in table 1a and 1b. All participating mothers were married. Nuclear families were rare in the rural sample (9%) but made up approximately one third of the urban families. In the other families, at least one additional relative lived with the family, mainly paternal grandparents and/or uncles with their families. Patrilineal family organizations were predominant in both samples, but in the urban sample approximately 25% of the mothers live in close proximity with the infants' maternal kin (e.g. in an apartment in the same house or down the road from the maternal grandparents) or keep close ties with the maternal kin (e.g. spend considerable proportions of the day together). The mothers were mainly housewives, but 5 rural mothers participated in farming or business activities in or close to their village. Of the urban mothers, 4 participated in business activities. None of the mothers were employed outside their home.

Tables 1a and 1b show the differences between the rural and urban samples. Obviously, the number of household members ($t(39) = -5.20$, $p < .001$) (adults and children) but also the number of regular caregivers ($t(39) = -4.17$, $p < .001$) was higher in

extended than in nuclear families. This indicates that the difference between rural and urban families in these variables is driven by the different frequency of extended families. Indeed, if only extended families were compared the rural and urban sample did not differ significantly in household size ($t(30) = 0.75$, $p = .460$) or in the numbers of the infants' regular interactional partners ($t(30) = -.66$, $p = .516$). Interestingly the child to adult ratio does not differ between samples ($t(40) = .971$, $p = .337$).

Table 1a: Sample description

	rural	urban	
Participating families	21	20	
Household members	7.02 (2.24)	5.60 (2.04)	t=2.13, p =.040
Adults	4.40 (1.56)	3.68 (1.58)	t=1.49, p =.144
Children	2.62 (1.07)	1.85 (0.75)	t=2.68, p =.011
Number of infant's regular interactional partners	6.62 (1.75)	6.30 (1.98)	t=0.55, p =.586
Mother			
Age	25.90 (4.98)	27.00 (3.80)	t=-0.79, p =.435
Years of formal education	6.38 (4.93)	12.70 (3.18)	t=-4.85, p <.001
Hours away from home	1.20 (2.26)	0.31 (0.32)	t=1.76, p =.087
Father			
Age	29.43 (4.76)	30.10 (3.42)	t=-0.52, p =.608
Years of formal education	9.14 (4.04)	12.75 (2.99)	t=-3.24, p =.002
Hours away from home	9.88 (3.37)	10.36 (3.32)	t=-0.46, p =.647

SD in brackets

Table 1b: sample description

	Rural	Urban	
Participating families	21	20	
% of Hindu families	100	95	X^2=1.08; p = .488
% of extended families	91	65	X^2=3.88; p = .067
% female children	67	33	X^2=4.11; p = .063
% firstborn children	19	60	X^2=7.22; p = .011
Main family occupation			X^2=16.75; p < .001
% Farming	57	0	
% Employment/ job	29	50	
% Self-employed/ own business	14	50	

Fathers' and mothers' ages (r(39) = .89, p < .001) and years of formal education (r(39) = .81, p < .001) were correlated. A MANOVA (F (4, 35) = 2.79, p = .02; partial eta^2 = .39) also revealed that the family occupation was significantly related to fathers' and mothers' educational level, and marginally significantly related to the amount of time the father but not the mother was reported to spend away from home (cf. table 2).

Table 2: family occupation and parents' education and time absent from home

	Main family occupation			Statistics (df = 2, 38)
	Farming	Self-employed	Employed	
Fathers' education	7.75[a] (3.65)	11.54[b] (3.04)	12.75[b] (3.59)	F = 7.56, p = .002; partial eta^2 = .29
Mothers' education	5.75[a] (4.31)	10.00[a,b] (4.60)	11.81[b] (4.98)	F = 2.72, p = .079; partial eta^2 = .13
Father away from home	8.46 (2.50)	10.21 (1.99)	11.28 (4.22)	F = 5.89, p = .006; partial eta^2 = .24
Mother away from home	1.51 (2.49)	0.67 (1.62)	0.29 (0.40)	F = 1.92, p = .161; partial eta^2 = .09

SD in brackets, [a, b] indicate homogeneous subsets with differences significant at $p < .05$

Procedure

Each child was visited at home – usually twice –by the author and a local assistant and observed for 2-4 waking hours from the age of approximately 9 months. The author took timed notes on infants' and caregivers' activities and gestures. At 9.5 months on average the infants and their caregivers were video-recorded in their routine activities for approximately 30 minutes. Each participating mother was then asked to show something distant to the child. This interaction was video-recorded for a maximum of 5 minutes by the author. By the time the mother was asked to show something to the child, mother and

child were well acquainted with the research team and also accustomed to the presence of a camera. During this visit the mother was also asked about the child's family background and her socialization goals for the child (which were noted by the author on questionnaire forms). Generally in a separate visit the research team came to say goodbye to the family and to give the families some toys for the infant as a token of appreciation for their participation.

Measures

Socialization Goals Questionnaire

The socialization goals questionnaire consisted of six statements, two each addressing hierarchy, connectedness and individuality. Each statement was compared pairwise to each other statement, leading to a total of 15 items (c.f. Kärtner, Borke, Maasmeier, Keller & Kleis, 2011, for a similar methodology). Based on prior fieldwork (Abels, 2008) this format was developed, as it proved easier to answer for rural participants than items with Likert-type scales. For each item, the number of times an item was preferred over the others (0-5 times) was used as a measure of the extent of preference for the goals. Two items each representing each of the concepts hierarchy, connectedness and individuality were combined in scores, with the minimum of 0 and a maximum of 8 (not 9 because the comparisons include the comparison of the two items representing the same concept). Each preference was counted as 1. If two concepts were evaluated as equally important, each received 0.5.

Observations of Infants' Daily Experiences

Timed notes were taken by the author of all the observations of rural and urban children. The observations were focused on gestures and triadic interactions produced by

the infants and their interactional partners, which were described in the notes. The observations were open ended rather than according to a predetermined scheme in order to allow for the observation of novel behaviors. The hand written observation notes were typed and coded with the help of Atlas.ti software (http://atlasti.com/) by the author and an undergraduate coder. All the material was coded by both coders, and cases of disagreement were resolved through discussions.

Caregivers' Gestures. Caregivers' gestures were coded independent of whether and how the child reacted. For all caregivers' gestures, it was crucial that a communicative intention towards the child was described in the notes. Gestures were coded as mutually exclusive.

Indicating. Any gesture that indicated something. The prototypical indicating gesture is the index finger point but indications with the hand, (parts of) the face, or objects were also coded. This code was assigned if the gesture is used to alert someone else to a referent (e.g. the presence of an (animate or inanimate) object or the occurrence of an event).

Showing. Showing was coded as a referential gesture, which included a hand-held object. It was coded if a person held or moved an object to attract the interactional partner's attention. This code was also assigned if an object was moved/ released in the interactional partner's line of vision. It was not assigned if one person just gave someone else an object or put it down without a clear communicative intent. In contrast to the pointing gesture with an object, in the showing gesture, the object was held out to the interactional partner, not used as an indicating device. This was also distinguishable by

how the object was held: presented on an open hand for showing vs. held in a closed hand often moved towards the indicated. object

Request. A request could be any type of gesture but typically involved either an open hand held towards someone to demand for an object or a "calling" gesture in which the hand was opened and closed repeatedly. A request was coded if the gesture was directed at a person or an animal requesting an action ("come here", "go away") or an object.

Conventional. Conventional gestures can only be understood on the basis of social conventions, such as putting together your hands, which is understood as a greeting in India. Other examples of conventional gestures that were coded were waving hello or goodbye or nodding in agreement.

Routine teaching. The caregiver tried to teach the child a gesture or behavioral routine. Usually this went along with a demonstration of the gesture (also coded as gesture in one of the above categories) and an explicit statement that the child should do the gesture ("call daddy like this" + request). It could also be conveyed by the caregiver gesturing with the child's arm/s or hand/s (e.g. shaking the child's hand to make a request on behalf of the child). When other ritualized actions or games were taught to the child (e.g. to do "radhe radhe radhe"- a rhyme/song in which the child is expected to clap) this was also coded here.

Children's Gestures. The same gesture types as specified for the caregivers could be observed, but because the children's gestures were infrequent, they were not assigned more specific codes.

Triadic Interaction. Triadic interaction was coded when the child and a caregiver simultaneously attended to the same referent and it can be assumed there is an awareness of (at least) one interactional partner of the shared focus. Attention could be expressed in many different ways for example by gesturing toward a referent, touching it, looking at it or referring to it verbally.

We distinguished the following codes:

- child-initiated: the child attended to something which was then acknowledged by the caregiver. (E.g. the child pointed at a cow and the mother said "yes, there's the cow")
- caregiver-initiated*:* the caregiver initiated the triadic interaction, attracting the child's attention to the referent (e.g. by moving an object, indicating gestures, noises…). The child followed the caregiver's initiative.
- observing*:* the caregiver engaged in an activity or handled an object that attracted the child's attention. The activity was not performed for the child's sake (as in caregiver-initiated triadic interaction) and participation in the activity could even be bothersome or dangerous. If a caregiver (another or the same) reacted to the child's attention, their reactions were additionally coded as "child-initiated".

If triadic interaction situations involved gestures, these were coded additionally.

Video Coding

The videos of the mother "showing the child something" were coded with the aim of assessing in a more fine-grained way how infants and their mothers direct each other's attention. The manual developed for coding follows the idea that different modalities can

be used to direct attention and to follow the interactional partner's leads. The software ELAN was used for coding.

Mothers' and children's behaviors were coded separately in an event sampling procedure. That is, each new occurrence of a behavior was coded. Non-maternal caregivers' behaviors were not coded and sequences in which the child was obviously interacting with somebody else were excluded from the analysis.

Gestures

The gestures were coded as described for the observations but due to the type of situation that was elicited only indicating, showing and request were coded. Quick successions of repetitions of the same gesture were coded as a single occurrence. If the gesture was changed, it was coded as a new occurrence.

Bodily

- Orienting: a person oriented his/her OWN body towards a referent. Minor adjustments due a change of the direction of gaze were not coded as orienting. Orienting thus consisted of
    - large turns of the shoulders of approximately 45° (that is: turning the head was not considered sufficient and generally the waist also had to move)
    - or bending the upper body forward or backwards (also rather large movements involving large parts of the upper body)
    - or getting up, sitting down
- Manipulating interactional partner's body
    - <u>Positioning</u>: The caregiver positioned child so that he/she faced in the intended direction, this could be either by changing the orientation of the

child's whole body or by moving his/her head/face. Also included placing the child somewhere (e.g. on the floor, on the mother's lap).

- Producing physical contact: Making the interactional partner touch something, for example by taking his/her hand and moving it to object.
- Alerting: one interactional partner touched the other or moved the other's body (e.g. shaking, bouncing an infant on the arms) to alert him/her or to catch his/her attention.

Inter-coder Reliability

The author and a trained undergraduate coder coded the video material. 16% of the video material was coded by both coders independently and an overall inter-rater agreement of 78% of the coded behaviors was attained. Reliability ranged from 74% agreement on bodily behaviors to 84% agreement on the gestures.

Results

Socialization Goals

T-tests were calculated to compare rural and urban mothers' agreement to the three aspects of socialization goals (cf. Table 3). The results show that urban mothers value individuality more than rural mothers. Rural mothers prioritize hierarchy significantly more than their urban counterparts. There is no difference in terms of connectedness.

Table 3: rural and urban mothers' socialization goals

	Rural (n =22)	Urban (n =21)	*t*(41)	*p*	Cohen's *d*
Hierarchy	6.16 (1.32)	5.33 (1.10)	2.22	.032	.68
Connectedness	3.91 (1.19)	3.64 (1.49)	0.65	.521	.20
Individuality	1.80 (1.23)	2.74 (1.50)	-2.26	.029	-.69

SD in brackets

Everyday Observations

Triadic Interactions

T-tests were calculated with locale as independent variable and child initiated, caregiver initiated and observing as well as total triadic attention per hour as dependent variables. Urban children engaged significantly more frequently in triadic interactions in general (H1) and particularly in child initiated interactions than their rural peers (H2a). There were no differences between rural and urban children in caregiver initiated and observing triadic interactions (H2b and H2c; cf. Table 4).

Table 4: Observed Triadic Interactions per Hour

	Rural	Urban	*t*(44)	*p*	Cohen's *d*
Child initiated	4.61 (2.03)	6.22 (2.54)	-2.38	.022	-.70
Caregiver initiated	2.46 (1.60)	3.12 (1.49)	-1.46	.152	-.43
Observing	1.25 (1.10)	1.05 (1.19)	0.60	.553	.17
Total	8.52 (3.06)	10.68 (3.35)	-2.28	.027	-.67

Mean behaviors per hour, SD in brackets

Gesture use by children and caregivers

A T-test was calculated to test the hypothesis that urban children would use more gestures than rural ones (H3). Only children who produced at least one gesture were included in this analysis reducing the sample to 17 rural and 15 urban infants (the proportion of children using gestures does not differ significantly between the rural and urban groups: X^2 (1, N = 46) =.41, p = .522). This was done due to the assumption that children who did not produce any gestures during the observations are unlikely to be able to do so, yet. The results show that urban children produce marginally significantly more gestures per hour (M = 1.26, SD = 0.88) than rural ones (M = 0.79, SD = 0.60, t(30) = -1.78, p = .085; Cohen's d = -.63).

A MANOVA was calculated to assess whether urban caregivers used more gestures than rural ones (H3). Overall urban caregivers used significantly more gestures (M = 5.00, SD = 2.86) than rural caregivers (M = 3.54, SD = 3.22; F(5, 40) = 2.57, p = .042; partial eta^2 = .24). This is mainly due to significant differences in conventional

gestures and gesture teaching while there are no significant differences in indicating, showing and requests (cf. table 5).

Table 5: Observed Caregivers' Gestures per Hour

	Rural	Urban	*F* (1,44)	*p*	partial eta^2
conventional	0.31 (0.42)	0.71 (0.61)	6.90	0.01	0.14
request	0.42 (0.38)	0.76 (0.98)	2.33	0.13	0.05
gesture teaching	0.56 (1.13)	1.45 (1.37)	5.79	0.02	0.12
indicating	1.58 (1.79)	1.63 (1.26)	0.01	0.91	0.00
showing	1.24 (1.33)	1.90 (1.52)	2.48	0.12	0.05

Means, SD in brackets

Attention-directing behaviors in the videos

Mothers' and children's gestures and bodily expressions of interest

T tests were calculated to test whether urban mothers and infants would use gestures more frequently and rural mothers would use their bodies more frequently in communication (H3). Neither mothers nor children differed in the number of gestures or number bodily cues they used (cf. table 6). Table 7 contains the frequencies of the different gesture types and bodily actions mothers and infants used. A T test on the ratio of orientation and body manipulation behaviors mothers used (H2b) revealed that urban mothers used more orientations (M = 1.31; SD =1.70) while rural mothers used more manipulations (M = 0.33; SD =0.46; $t(38) = -2.54$, p = .015; Cohen's d = .80)

Table 6: Video-recorded gestures and bodily behaviors per minute

	Rural	Urban	*t*(39)	*p*	Cohen's *d*
Gestures mother	5.68 (2.82)	4.55 (2.57)	1.33	.190	0.42
Gestures child	0.93 (0.74)	0.56 (0.94)	1.37	.178	0.44
Body mother	3.55 (1.72)	4.24 (1.87)	-1.21	.232	-0.38
Body child	2.05 (1.50)	1.72 (0.92)	0.85	.402	0.26

Mean behaviors per minute, SD in brackets

Table 7: Video-recorded mothers' and infants' gestures and bodily behaviors

	Mothers		Infants	
	rural	urban	rural	urban
GESTURES				
Indicating	4.23 (2.70)	3.39 (2.12)	0.44 (0.42)	0.44 (0.90)
Showing object	0.11 (0.27)	0.15 (0.35)	0.13 (0.25)	0 (0)
Request	1.22 (1.31)	0.93 (0.81)	0.31 (0.60)	0.11 (0.27)
BODILY				
Orient	0.65 (0.57)	2.10 (1.30)	2.03 (1.52)	1.70 (0.91)
Manipulate other's body	2.90 (1.60)	2.13 (1.30)	0.02 (0.07)	0.01 (0.05)

Mean behaviors per minute; SD in brackets

Children's bodily cues and mothers' reactions

A repeated measures ANOVA was calculated to test whether there were differences in the mothers' responses to the child's signals. As infants' gestures were very rare, orientations were chosen for this analysis. The response type (following the child or redirecting, H2a and H2b) and the modality (body or gesture, H3) in which a child's orientation was answered by the mother were analyzed as repeated measures factors; sample as group factor. The sample size in this analysis was 36 due to missing spontaneous orientations from five children. More than 50% of the infants' orientations did not elicit any immediate directional reference by the mother (urban 53 %, rural 63 %); and a proportion of the children's orientations were answered verbally which was not coded here. (Gestures were ignored less frequently overall (18 % urban, 27% rural) but show the same tendency as orientations of being ignored more often by rural mothers, cf. H2a.) Modality and response were entered as the repeated measures factors into the analysis, locale (rural or urban) as independent variable. The percentage of the infants' unanswered orientations were controlled.

The ANOVA revealed no significant effects for sample (F (1, 34) = 59.92, p = .782; partial eta^2 0.02) or the repeated measures factors response type (F (1, 34) = 1.85, p = .183; partial eta^2 = .05). The interactions between modality and response type (F (1, 34) = 0.08, p = .775; partial eta^2 < .01) and modality and sample (F (1, 34) = 1.39, p = .246; partial eta^2 = .04) also did not reach significance. Modality (F (1, 34) = 7.83, p = .008; partial eta^2 = .19) reached significance, as did the interaction between response type and sample, and the triple interaction between sample, response style and modality.

The main effect modality F (1, 34) = 7.83, p = .008; partial eta^2 0.19) indicates that mothers responded to their children's orientation more frequently with bodily that gestural reactions. The interaction between response type and sample indicates that rural mothers reacted to their children more frequently by redirecting them than urban mothers; urban mothers followed their infants' bodily orientations more frequently than rural mothers (F (1, 34) = 6.99, p = .012; partial eta^2 = .17). Moreover the samples differed in terms of which modality they show which response in (sample * response type * modality interaction: F (1, 34) = 7.74, p = .009; partial eta^2 = .19; cf. figure 1). Urban mothers use gestures more than their body to redirect the child, but they use their body more frequently to follow their child's orientation. Rural mothers on the other hand use both modalities more frequently to redirect than to follow their child's orientation and use the bodily modality more frequently than gestures for both response types.

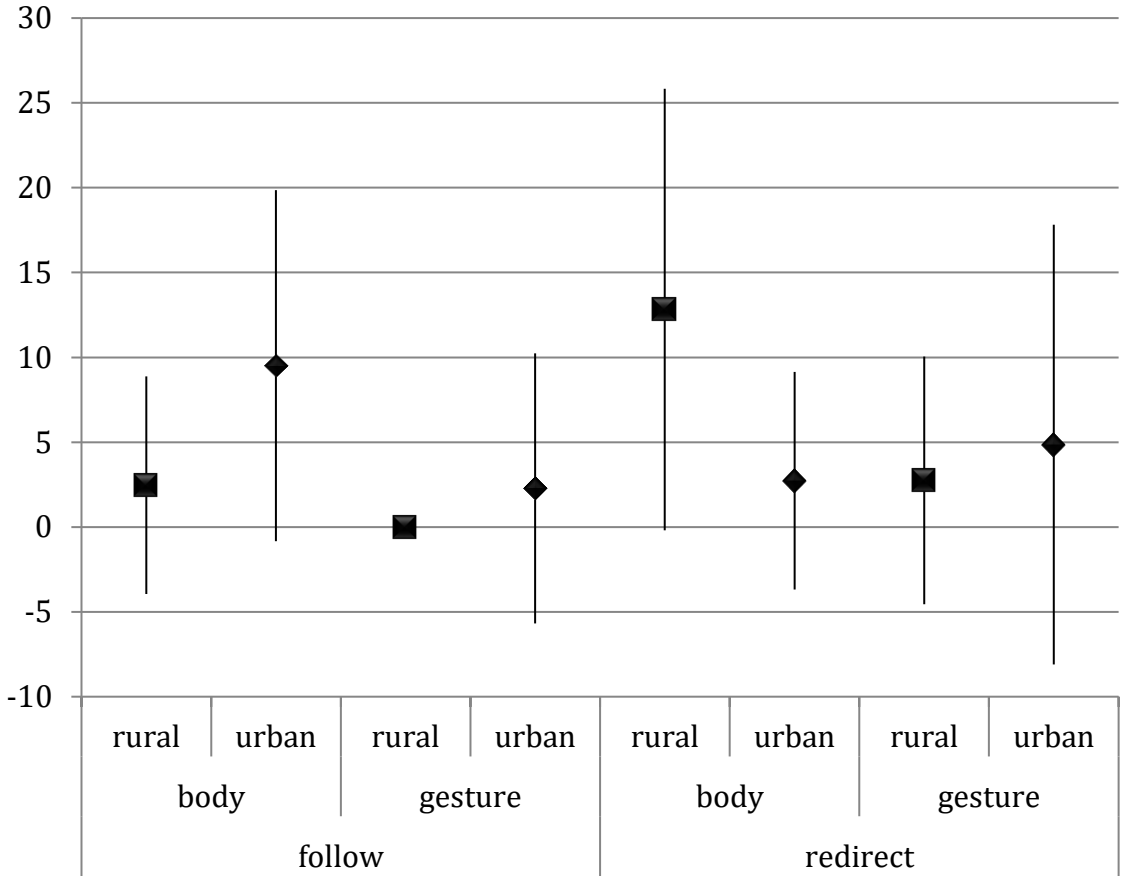

Figure 1: rural and urban mothers' response types and modalities (bars indicate +/- 1 *SD*)

Correlations with Child Variables, Socio-economic Factors and Family Structure

To explore how other factors besides sample were related to the assessed measures, correlation were calculated (cf. table 8). To increase the readability of the table a ratio was calculated for the socialization goals (individuality/hierarchy) and only key behavioral measures were included. These correlations show that child's gender and family structure did not seem to be related significantly to any of the assessed measures (they are not displayed in table 8). While parents' occupation

and education played a role for the socialization goals, they were less relevant for the observable behaviors. The most pervasive effects were found for number of children in the household and to a lesser extent the infants' birth rank. Additionally, these variables seemed to be reflected mainly in infants' daily experiences, less in the video-recorded interaction with their mother.

Table 8: Correlations between Families' Background Variables and Triadic Behaviors

	Birth rank (0 = first born)	Household members		Father's occupation			mother's years of education
		adults	children	farming	job	business	
Socialization goals: Indivuality/hierarchy	-0,21 (43)	-,36* (41)	-,43** (42)	-,44** (41)	,38* (41)	0,01 (41)	,44** (43)
Triadic interaction/hr	-0,29+ (46)	-,35* (41)	-,48** (44)	0,06 (41)	0,03 (41)	-0,04 (41)	0,06 (43)
Caregiver gestures/hr	-,38** (46)	-,38* (41)	-,55** (44)	-0,01 (41)	-0,01 (41)	0,04 (41)	-0,11 (43)
Infant gestures/hr	0,06 (46)	-0,23 (41)	0,05 (44)	-0,01 (41)	0,10 (41)	-0,05 (41)	0,03 (43)
Mother gestures/min	-0,03 (41)	-0,05 (41)	-0,02 (41)	0,16 (41)	0,14 (41)	-0,25 (41)	-0,17 (41)
Child gestures/min	,32* (41)	0,24 (41)	0,21 (41)	0,03 (41)	-0,09 (41)	0,09 (41)	-0,01 (41)
Mother body/min	-0,19 (41)	0,00 (41)	0,15 (41)	-0,10 (41)	0,22 (41)	-0,11 (41)	0,11 (41)
Child body/min	0,12 (41)	0,02 (41)	0,00 (41)	0,13 (41)	0,15 (41)	-0,28+ (41)	0,14 (41)

*Correlation is significant at the **0.01; * 0.05, + 0.01 level (2-tailed); Ns in brackets*

Discussion

This study set out to explore how rural and urban living environments relate to nine month old infants' triadic interactions and gestural communication in Gujarat, India. Hypotheses were related to the frequency of triadic interactions, who initiates and who follows in these interactions and to the modality in which the communication takes place.

The hypotheses were that urban infants would experience more triadic interactions than rural ones (H1) and that the urban caregivers would follow the infants' initiatives more frequently than the rural ones (H2a) as an expression of a child-centered interaction style. Rural infants' caregivers were expected to be more directive in triadic interactions (H2b) and infants were expected to observe others' activities more frequently (H2c) related to a hierarchical interactional style.. Overall, these hypotheses have been confirmed by the results. Urban infants experienced more triadic interactions. These triadic interactions were often the result of a caregiver following the infant's interest. This could be confirmed both in daily observations and in video-recordings. Rural mothers were more directive in the video-recorded interactions. They manipulated their infants' body more than orienting their own body, and they also redirected their infants more frequently than following them. However, rural infants did not experience more caregiver initiated triadic interactions or observe others more frequently than urban ones.

The results confirm that there are differences in interactional style with Gujarati nine-month-old infants with regard to who initiates and who follows in an interaction. The behaviors urban Gujarati caregivers show, particularly in following their infants behaviors, seem to confirm that they indeed follow a more child-centered approach to

child rearing than their rural counterparts. This is also reflected in their socialization goals in which urban mothers emphasize the infants' individuality more than rural mothers. Rural mothers value hierarchy more than urban mothers and are more directive when showing their child something, which strengthens the hypothesis that their view of their infants is more hierarchical. However, this does not seem to be reflected in the expected way in the everyday observations of triadic behaviors. The observational data could be interpreted as rural caregivers providing less input to their infants in general. This could be due to a perception of children being responsible for their own learning more than having to be taught (Lancy, 2010). If this was the case, rural infants should be found observing their social environment more, but this is also not the case. It may be that this is an effect of age, as the expected difference has been found previously with infants who were a few months older (Mastin, 2013).

Additionally, urban families were expected to communicate more in a distal modality - that is by gestures - than rural families (H3). Rural families were expected to communicate more proximally, that is through body movements (H3). This hypothesis could only be partially confirmed. Urban infants and caregivers used more gestures during everyday observations, though this was not true for the video-recorded situation in which the mothers were asked to show the child something distant. In the video-recorded interactions rural mothers were not more likely to use bodily communication more than urban mothers overall but they preferred using their body rather than gestures for both following and redirecting (cf. figure 1). Bodily communication was not coded for the observations, because the observation notes were not fine-grained enough to analyze the details available from the video-recordings. It is therefore possible, that some

interactional patterns specific to rural families might not have become apparent. Previous research has also shown that results concerning bodily behaviors comparing rural and urban Gujarati families are incoherent (Abels et al., 2005). What might be interesting to note is that using the body to communicate was fairly frequent in both mothers and infants (cf. table 7) which highlights the necessity to include this interactional modality in future studies.

Rural and urban environments in non-Western communities typically differ in terms of household size, family livelihood and educational options. It was therefore not assumed that these would be independent of sample. In future it would be interesting to try to untangle these factors by systematically sampling for exceptional cases. Because of the relations between sample and these factors, the correlations found between them and infants' experiences do not come as a surprise. It seems mainly that the number of children in a household is related to what experiences the children make. Similar differences can be expected between rural and urban families in other parts of the world (cf. Keller, 2007; Mastin, 2013). This is an important addition to the literature as cross-cultural studies on triadic interactions and gestures often compare families in different countries (e.g. Calaghan et al., 2011; Liszkowski et al., 2012; Salomo & Liszkowski, 2013) that differ in many more ways that rural and urban samples in the same region. Studies focusing on comparisons of different socio-economic groups were often conducted in North American communities (e.g. Abels & Hutman, 2015; Rowe & Goldin-Meadow, 2009) which may not be representative of infants throughout the world (cf. Henrich et al., 2010).

A result which may be specific to India is that the number of adults in a household are related negatively to such aspects as how many caregiver initiated triadic interactions the child experiences. This is counter-intuitive as more adults should be able to spend more time with the infant. However, a large household could also mean that a child's primary caregiver, particularly in rural India, has more chores and therefore actually has less time for the infant which may not be compensated by other caregivers. That Gujarati infants receive less attention in larger households is in line with earlier results that for Indian infants the "household size infant indulgence hypothesis"- that is that infants in larger households receive more indulgence (Munroe & Munroe, 1971; Whiting, 1961) - does not seem to be true (Seymour, 2001).

Both the frequency of gestures used (Rowe & Goldin-Meadow, 2009) and the following of child initiates (Tomasello & Farrar, 1986) have been linked to more favorable language acquisition in the past. However, it is questionable whether this is universally true. There are reports of children who experience little child directed verbal input (cf. Brown, 1998; Schieffelin & Ochs, 1986) and also few triadic interactions (Salomo & Liszkowski, 2013), not to mention child-initiated ones. Children in these communities learn language, nevertheless and there may be different pathways to language development here (cf. Mastin & Vogt, 2016). Specifically, it is possible that the role of bodily communication for language acquisition has been underestimated. It would therefore be interesting to study Gujarati infants' further development to see whether these different interaction patterns represent different developmental pathways, too.

The current study illustrates that infants' experiences seem to differ between routine and video-recorded situations (cf. also Abels et al., 2017). Although rural infants experience fewer triadic interactions and fewer gestures produced by their caregivers in daily interactions, when asked to show their infants something out of reach, rural and urban mothers use comparable numbers of gestures and bodily actions. Possibly, they follow a shared script on which actions to use to create a triadic situation with an infant. This hypothesis may be strengthened by the fact that rural and urban caregivers do not differ in the frequency with which they use attention directing gestures in the everyday observations (cf. table 5). Whether this script is common to the local population or universal as some have suggested (Liszkowski et al., 2012; O'Neill et al, 2014) needs to be studied in further detail. What is interesting however, is that on a micro level different strategies that are in line with a child-centered or hierarchical child rearing model become apparent. Mothers might thus consciously increase the behaviors they show but how they use these behavior may be unaffected by this increase.

Infants participating in this study were nine months of age, which was chosen as a starting point for many socio-cognitive behaviors described in infants. It was assumed that the interactions during these early stages of development would lay a foundation for infants' later attention directing style. However, it may have been too early to observe some behaviors shown more frequently by infants in later stages of their development. For example, gestures during the video-recorded interactions were quite rare in both samples. The everyday observations with their much longer timely extension could buffer this effect to some extent. Differences between rural and urban infants in observing

others' activities have been described for the first part of the second year (Mastin, 2013) but may not be present at nine months of age, yet. It is all the more encouraging that many of the hypothesis seem to be supported by the current study, making it a valuable approach for future studies.

While this study provides data only on Gujarati families, for theoretical reasons, discussed in the section on cultural differences, it can be assumed that these differences can be found in other communities that show similar ecocultural differences as well. The results indicate that hierarchical and child-centered interactional patterns can be observed in situations relevant to infants' social cognition and may help explain cultural differences found in social communication (e.g. Callaghan et al., 2011; Salomo & Liszkowski, 2013). Whether the developmental consequences of these experiences are universal (for example universally improving language acquisition if the child's triadic impulses are followed; Tomasello & Farrar, 1986) or constitute different developmental pathways specific to the families' context (see Mastin & Vogt, 2016) remains to be seen in the future. However, the results suggest that it could be important to include a wider spectrum of behaviors, such as bodily communication, in future studies on communication development.

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