
BABIES OPEN OUR MINDS TO THEIR MINDS: HOW “LISTENING” TO INFANT SIGNS COMPLEMENTS AND EXTENDS OUR KNOWLEDGE OF INFANTS AND THEIR DEVELOPMENT

CLAIRE VALLOTTON
Michigan State University

ABSTRACT: Preverbal children are capable of explicitly communicating their own desires, emotions, and thoughts through infant signs (i.e., symbolic gestures) that they have invented or learned from caregivers. In this article, I describe seven lines of child development research and show how attending to infants' use of signs can complement and extend this knowledge of development for both scientists and caregivers. The areas of developmental research include object permanence, categorization, shared meaning, mental state understanding and absent reference, emotion knowledge, identity, and self-regulation. I present qualitative data on infants' signing gathered through videos of caregiver–child interaction, student caregivers' systematic participant observations, my own observations in an infant classroom, and volunteered sign stories from parents who use signs with their infants. I also present quotes from interviews with parents and caregivers of signing children to show how infants' signing affects adults' perceptions of and feelings toward children. With infant signs, infants reveal their thoughts, feelings, interests, and personalities in their own contexts through everyday interactions. By “listening” to infant signs, parents, practitioners, and scientists gain insight into individual infants and respect for the often underestimated capacities of preverbal children.

Abstracts translated in Spanish, French, German, and Japanese can be found on the abstract page of each article on Wiley Online Library at <http://wileyonlinelibrary.com/journal/imhj>.

* * *

This article is based in part on the 2006 New Investigator Award presented at the 11th World Congress of the World Association for Infant Mental Health, Yokohama, Japan. Thank you to the children, parents, staff, and student caregivers of the Center for Child and Family Studies at the University of California, Davis for their time and patience in the studies involved in this report. Thank you to the families of Celia, Gemini, and River for their individual Sign Stories as well as to all of the parents who volunteered to tell me what they had learned from signing with their children. Thanks to friend and colleague Livna Grinbaum for the use of her data on toddler signing. Preparation of this article was supported in part by National Institute of Child Health and Human Development Grant 1 F32 HD050040–01. The content of this article is the responsibility of the author, and does not necessarily reflect the official views of the funding agency.

Direct correspondence to: Claire Vallotton, 2G Human Ecology, Michigan State University, East Lansing, MI 48824; e-mail: vallotto@msu.edu.

INFANT MENTAL HEALTH JOURNAL, Vol. 32(1), 115–133 (2011)

© 2011 Michigan Association for Infant Mental Health

View this article online at wileyonlinelibrary.com.

DOI: 10.1002/imhj.20286

HOW INFANTS TAUGHT ME ABOUT INFANT DEVELOPMENT

As a young graduate student, I faced the challenge of learning about infant development without having the intimate knowledge of an individual infant that comes with being a parent or primary caregiver; however, in addition to my books and classes, a job as a research assistant allowed me to sit on the floor in an infant laboratory classroom [the UC Davis Center for Child and Family Studies (CCFS)] and watch babies for hours at a time. I was there to videotape the infants' play behavior and to get to know them individually so that I could best test their cognitive development for the study I was helping to conduct. I knew to watch for behaviors indicating certain milestones of cognitive and social stages of development, but I also saw something I wasn't expecting: The infants were clearly and explicitly revealing the contents of their individual minds by using infant signs to communicate with their caregivers.

In the Infant and Toddler Program at the CCFS, the caregivers, who are typically undergraduate students of child development, are taught to systematically use infant signs (symbolic gestures) to communicate with the infants and toddlers in their care. Infant signs are gestures that communicate a specific concept, such as tapping fingers against the mouth to indicate "eat" or tracing a finger down a cheek to represent "sad." Children in the program are never explicitly taught or forced to sign, but learn the signs from their caregivers. The student caregivers at the CCFS are given explicit instruction on the use of signs with the infants, and are provided with a list and description of around 30 signs used most often in the infant and toddler classrooms. This same list is sent home with the parents of the infants and toddlers, but parents are not given any additional instruction on using signs. Student caregivers are reminded to use signs in the classroom by the Head Teacher, who used the signs consistently, and by small (i.e., 8" × 3") posters placed around the class in key areas; for example, a poster describing the sign for "outside" is placed near the door to the playground, and the posters describing "snack" and "more" are placed near the snack area. In addition, as in many classrooms, signs are incorporated into the songs that caregivers, parents, and children sign together at Circle Time when parents have returned to pick up their children. In the first academic quarter of each year, the caregivers model the signs for the children; in the subsequent academic quarters, when there is partial turnover among the student caregivers, it is the infants and toddlers who teach the signs to the new caregivers.

Infant signing was implemented at the CCFS as a caregiving practice based on the research of Acredolo and Goodwyn (1985, 1988), which showed that preverbal children could communicate intentionally and explicitly through gestures. The director of the CCFS believed that using infant signs would promote bidirectional communication between the infants and their caregivers, and would help caregivers get to know the babies in their care as individual people with their own needs, desires, thoughts, and personalities.

As a student and scientist of child development, I, too, came to respect these infants as individuals and to marvel at what they could teach me about development. I underwent a profound change in the way I saw infants, my perspective changing in small bursts of insight when I saw what they were capable of thinking and expressing through gestures—the intentional, communicative, and often symbolic actions they performed during everyday routines and interactions opened my mind to the infants' minds. It also made me more watchful of their nongesturing behavior as well. I began to look for other signs of intentionality, communication, and symbolic behavior, and to see those behaviors as indicative of infants' cognitive development, their abilities, and their social connectedness. Thus, much of what I learned during graduate school was

gained by sitting on the floor of the infant classroom, becoming a student of the infants. I learned not only by applying what I thought I knew about development to the behavior I saw but by learning to see from and respect the child's point of view.

I describe seven lines of research on infants' cognitive and social development and show how, through signs, infants reveal about themselves many of the same developmental capacities revealed in laboratory tests and experiments, and in addition, how they provide insight into their own unique personalities and perspectives. Following these sign stories, I describe parents' and professional caregivers' responses to infant gesturing, then discuss the implications of this work for developmental theory and research and infant mental health practice.

Throughout this article, I will use the word "gesture" to refer generally to many classes of gestures, including culturally conventional ones such as pointing or waving as well as symbolic gestures invented by children or modeled by caregivers. I will use the word sign or infant sign to refer specifically to those gestures that are modeled by caregivers or invented by infants and are considered to be symbolic; that is, they are capable of representing their referent in the absence of that referent (Werner & Kaplan, 1963).

SIGN STORY SOURCES

The qualitative data I present as sign stories were collected in a variety of ways and for several different purposes. For each sign story that I describe, I indicate the source of the story in the brackets following the title. Author Observations [AO] are my own observations made while interacting with signing children who were enrolled in the CCFS Infant and Toddler Program. These observations were made while I was either testing the children for a study or was in the classroom to collect data, but were not captured in my data. Research Video [RV] observations are episodes captured on videos that were collected for research purposes at the CCFS, then transcribed. These data come from two studies. One study followed one cohort of 10 infants over 8 months, filming 5-min episodes of infant-caregiver interaction during free play and snack times several times each week. The second study followed one cohort of 12 toddlers over a period of 3 months, filming them during episodes of naturally occurring distress, during separation, diapering, and conflict between peers; videos and the resulting transcripts from these episodes vary widely in length because filming did not stop until children's distress had resolved, as indicated by their resuming normal activity (for full details on the collection, coding, and transcription of these videos, see Vallotton, 2008b). Anecdotal Notes [AN] are systematic records of CCFS caregivers' observations of infants, written objectively and in careful detail. These were originally created as part of caregivers' training in child development and reflective early child education practice. Caregivers wrote two anecdotal notes each week describing a particular episode of child behavior that they had observed. They were not directed to write about signing but often chose to do so. Caregivers entered these notes directly into a software program on site, where they were then available in a dataset. Parents' Sign Stories [PS] are stories of infants' signing behavior that were volunteered by parents to me. These stories come from families at the CCFS, families enrolled in Early Head Start (EHS) who participated in an intervention study (Vallotton, 2005), or personal acquaintances who regularly and enthusiastically provide me with stories about their children's use of signs. In each sign story from all sources, the ages and genders of children are accurate; however, names have been changed in most cases, except for those stories coming from parents who preferred that I keep their child's name intact.

DEVELOPMENT REVEALED IN INFANTS' OWN WORDS

Object Permanence

Jean Piaget was the first to describe the development of object permanence—the knowledge that an object continues to exist even though you cannot see it. We typically test a young child's knowledge of object permanence with a series of tasks in which we hide an object, then wait to see whether the infant appears to notice that it is gone, whether the infant will look for it, whether the infant will look for it in the place in which we hid it or the place the infant last found it, whether the infant will continue to look for it if it alludes him or her at first, and whether the infant can correctly find it even if we have been very tricky at hiding it (e.g., Užgiris & Hunt, 1975).

Testing the infants' object permanence was one of my objectives during the years I spent at the CCFS, thus I was particularly sensitive to instances in which the infants spontaneously revealed this knowledge through their actions in the classroom as well as during testing.

Kenny asks, “Where did Randal go?” [AO]

I sat on the floor of the infant classroom observing the infants during free play time. Randal (11 months) stood inside the classroom, holding himself up with his hands pressed against the low window in the door that led to the infants' play yard outside. Kenny (12 months) was standing outside the door, looking in at Randal. The boys were looking and smiling at each other, tapping their hands against the door, one on either side of the glass. Upon tapping his hands against the glass, Randal lost his balance and sat down, suddenly out of Kenny's view. I saw Kenny's mouth take the shape of an “O” as he expressed surprise, then he put the palms of both hands up, near his shoulders, doing the “where?” gesture.

Dylan asks, “Where is the ball?” [RV, AO]

Dylan was 16 months old when he came into the laboratory with his Dad so that I could test his cognitive development, including his knowledge of object permanence. During the test, I hid a series of objects in increasingly tricky ways. After I finished hiding the object, I would ask Dylan to find them. The two objects I used were a small rubber ball and a toy car. After I hid the ball the first few times, Dylan began to actively participate in the test as if it were a game. I would hide the ball, then ask “Dylan, can you find the ball?” To which Dylan would immediately reply with two signs: “ball” (bouncing motion with palm of one hand flat and facing down) and “where?” (palms up near shoulders). Then he would search for and find the ball. When I switched to the car, he adapted his gestural question to: “car” (fingers of one hand together, rotating as if grasping and turning a key), and “where?”

The first sign story reveals Kenny's sense of permanence of another child and surprise at his disappearance in a real moment of interaction. It was one of the first instances of spontaneous infant signing that I had witnessed for myself, and an “aha” moment as I realized that watching infant signs could give me insight into a baby's thoughts *in vivo*.

In the second sign story, Dylan explicitly reveals a representation of the missing object (ball and car gestures), an awareness that it is gone, and an awareness that we are sharing this experience of the object being gone. Dylan showed a clear understanding of the permanence of the objects, not simply asking “Where did *it* go?” but identifying the specific object that had disappeared from view through a gestural representation. The information revealed to me by the infants themselves extended the information I was gathering through formal cognitive tests, both by providing more information about infants' abilities to represent objects no longer visible and by showing me their individual interests in the missing entities.

Categorization and Concepts

Early in development, infants begin to group objects or experiences that share similar features into categories (Quinn & Oates, 2004). This early categorization is a “bottom-up” process; that is, infants take their multiple experiences with a variety of objects and create categories based on features of objects that they do and do not share. The more similar one thing is to another, the easier it is for infants to group them. For example, experimental looking-time studies have shown that infants can group cats into a cat category which does not include dogs because cats are very similar to one another; however, at first, infants’ dog category includes cats because dogs can be so many different shapes and sizes (French, Mareschal, Mermillod, & Quinn, 2004). Infants group objects that share similar broad-level perceptual features such as shapes at 3 to 4 months (Quinn, Slater, Brown, & Hayes, 2001). This process quickly becomes more abstract and complex as infants begin to categorize similar relative locations such as “in” or “on” at about 6 months (Casasola, Cohen, & Chiarello, 2003) and objects that share similar functions by 11 or 12 months old (Träuble & Pauen, 2007).

As categories become more distinct and more abstract, children are able to generalize them to new instances of the objects that they encounter, and when they have a word to attach to the category, they learn it even faster. That is, language is a tool for developing categories in a “top-down” process in which an existing concept label is applied to a new experience or object, and the child fits the new thing into the existing concept. Though they are not yet using words to label objects, infants as young as 9 months do expect differently shaped objects to have different verbal labels (Dewer & Xu, 2007). By 18 months of age, hearing a word for a new concept helps children to learn that new concept, more quickly distinguishing it from others (Casasola & Bhagwat, 2007).

Built upon the skills of categorizing entities is the ability to relate a category to a verbal representation of it. Around 15 to 18 months of age, infants can generalize a label (i.e., a word) that they had learned in relation to a picture to the three-dimensional object represented in that picture (Ganea, Pickard, & DeLoache, 2008). For example, infants at this age may see a new object called a “drak” in a photo, and then if they encounter the actual drak in its three dimensional form, they will be able to indicate that they know it is called a “drak.” However, this skill is not fully formed and flexible until later in the second year or early third year of life, and is related to children’s vocabulary development (Younger & Johnson, 2006).

If having words, as verbal labels, facilitates this process of categorization and concept development, we may wonder whether a child who uses infant signs might use gestural labels to facilitate his or her own development of concepts. In the sign story below, a 15-month-old child uses a gestural label to relate a 2-D representation (a photo) of a concept to a 3-D representation (a doll) of the same concept.

Emma Finds Two Cows in Different Forms. [AN]

Emma (15.1 months) and I were sitting by the manipulatives shelf below the diaper-changing tables. She pointed to the picture of the cow and made the gesture for “cow” while looking at the picture. I mirrored her gesture and said, “Yes, that is a cow.” Emma smiled and walked over to the quiet area and brought back a stuffed cow. She again made the gesture for “cow” and then pointed at the cow picture. I said “They are both cows. You’re right.”

In this story, Emma applied a gestural label to a photo of a cow, then actively sought out another instance of the same category, the stuffed cow doll, and applied the same label to that object.

She demonstrated that she knew the concept of cow by joining together in an interaction three different representations of the concept: the picture, the doll, and the gesture. The caregiver, who narrates the story, may have witnessed Emma building her concept of cow or simply taking pleasure in sharing her existing knowledge. Either way, through Emma's gestures, we see her cognitive process of categorizing, labeling, and concept development.

Emma demonstrates representational behavior in the context of sharing her observation, or perhaps her knowledge, with her caregiver. The gesture for cow is one that she has learned in this classroom, and perhaps Emma knows, or maybe she is testing, whether they share a common understanding of that gesture and concept. Emma seems to be intentionally sharing meaning with her caregiver, and both of them take delight in this interaction.

Joint Attention and Shared Meaning

Joint attention—the experience of sharing an experience with someone and *knowing* you are sharing that experience with them—is a hallmark of social connectedness and a precursor to many social skills. Trevarthen (1998) described infants as born ready to connect in shared experience with others in intersubjectivity, or *primary joint attention*, even if the more conscious or explicit awareness of this shared experience comes more slowly over the next few years. Further, he described infants as highly motivated to share experiences with the important adults in their lives, particularly sharing the experience of simply being together and attending to one another in the rhythmic and reciprocal dialogue of facial and vocal cues that lets each dyad partner know that the other is attending and responding particularly to him or her (Trevarthen, 1998).

Trevarthen (1998) also described secondary joint attention—in which both parties are focused on an object or event—as the first experience of shared meaning and the catalyst for learning language. Sharing an experience with another provides children the context to create or learn symbols to further share meaning about the experience; this joy of shared meaning also provides children with the motivation to learn language (Trevarthen & Hubley, 1978).

We know that an infant and an adult are truly sharing joint attention when they monitor each others' attention to see if they are looking at the same thing, which begins in the few months before a child's first birthday (Tomasello, 1995). The action of monitoring another's attention implies some basic mental state understanding; that is, an infant must know at a rudimentary level that another person has a focus of attention (Tomasello, 1995). It is shortly after this that we can see infants become more aware of others' attention, intention, and emotions. Once infants understand that others have attention and intentions, they begin responding to others in ways that promote shared attention and engagement (Liszkowski, Carpenter, Henning, Striano, & Tomasello, 2004) and in ways that are helpful to the others' goals (Liszkowski, Carpenter, Striano, & Tomasello, 2006).

Between 12 and 14 months of age, infants begin to keep track of what they have experienced with another person and will use that information in subsequent interactions with that person. For example, if an adult and an infant share a particularly exciting experience of a specific object, then share less enthusiasm over other objects, a 14-month-old infant can use this joint emotional experience, or shared common ground, to accurately determine which object the adult wants when he or she excitedly, but ambiguously, asks the infant to hand "it" to him or her (Moll, Richter, Carpenter, & Tomasello, 2008; also see Tomasello & Haberland, 2003). Thus, beginning early in their second year of life, children remember and use information about the experiences

they have shared with another person, and even use the emotional information as cues to the meaning of a communication attempt.

We know that infants are capable of remembering the experiences they share with others, and can use that information in later interactions, at least in the short-term. We also know that infants are highly motivated to share experiences with others. In the sign story below, Dylan demonstrates this ability and motivation to me over a long period of time.

Dylan Reminds Me of the Game We Played Together. [AO]

Two hours after I had finished testing Dylan's cognitive development by playing the object permanence game (see the prior story: Dylan asks, "Where is the ball?"), I was in the play yard of the infant classroom videotaping infants' play behavior. I had just trained my camera on the specific child I was supposed to film for the next 20 min when Dylan walked up to me and signed "ball" and "where?" Holding the camera steady on the target child, I looked around the yard briefly for a ball, then replied, "I don't see the ball, Dylan." Dylan tried again, signing "ball, where?" This time I replied, "I'm sorry Dylan, I can't stop what I'm doing right now. Maybe your caregiver can help you find the ball." Dylan tried once more, this time gesturing "car, where?" At this point, I realized he was not actually looking for a ball or asking for my help to find one, but reminding me of the game we had played together a few hours before. I laughed (at myself) and replied, "Yes, that's right! We played a game this morning, 'ball, where is it' and 'car, where is it?'" I repeated the gestures with one hand as I held the camera steady in the other. Dylan smiled, once again signed "ball, where?" then walked away. For the next 6 weeks, until the end of the child development program for that year, Dylan greeted me by signing "ball, where?" every time I walked into the classroom.

Dylan used three signs to remind me of our shared experience—signs that we had used to share meaning in that experience—and was insistent in his communicative intention even though it took three times before I finally understood what he was trying to say. Dylan did this for the purpose of sharing the experience; he was not requesting anything of me other than confirmation of what we had shared. Dylan and I had known each other for more than 7 months at this point, as I had been a regular visitor to his classroom; but prior to our experience of sharing an hour together playing games, Dylan had not particularly taken note of my presence in the classroom. He continued to initiate this joint memory for more than 1 month, each time he saw me. From this series of interactions with Dylan, I learned about his capacity and motivation to remember and reshare an experience with me through reference to our shared experience.

Absent Reference

Symbols allow us to represent objects or concepts in their absence (Werner & Kaplan, 1963). As a baby's attentional and memory abilities grow to encompass things beyond the here and now, she or he becomes interested in communicating about things that are not perceived at that moment, whether it is a bird that just flew out of view, mom who dropped the child off in childcare 2 hr ago, or the train the baby heard and saw last week. However, to communicate about an absent object or concept, we must share a common experience or a common symbol system, and some would say that we must have at least a rudimentary awareness of others' mental states to know that we share these concepts and thus our symbols will be understood (Clark & Marshall, 1981).

It is the shared concept between the dyad, and the mutual knowledge that the concept *is* shared, that allows successful communication about an absent referent. Late in their second year of life, typical infants will begin to talk about objects that are not here at the moment (as reviewed by Ganea, Shutts, Spelke, & DeLoache, 2007). But before they can use language

to refer to out-of-sight concepts, infants can understand adults' references to absent referents (Huttenlocher, 1974). Infants as young as 14 months will keep track of the experiences they have shared with others (Moll et al., 2008), and can use that knowledge to interpret adults' references to absent objects (Saylor & Ganea, 2007). Further, infants will use the pointing gesture to refer to the previous location of a missing object when they have shared an experience of the object in that location with another person (Liszkowski, Carpenter, & Tomasello, 2007). Liszkowski, Schäfer, Carpenter, and Tomasello (2009) showed that preverbal 12-month-old infants will draw an adult's attention to an absent toy that they want by pointing to the location that recently held that toy. In these experiments, the adult whose attention the infant is directing with pointing gestures is the same person who had recently placed and removed the object the infant wants. Together, the work of Saylor and Ganea (2007) and Liszkowski and colleagues (2009) has revealed that infants know when they have sufficiently shared an experience with someone, such that that person will understand the concept to which the infant is referring. This indicates both representational ability and burgeoning awareness of others' minds.

The point gesture does not represent a specific concept but can be used to refer to many different things; thus, when infants use pointing to indicate an absent referent, they rely on their communication partner to share the same memory of the missing object. The communication strategy of pointing to a given location to share the idea of an absent referent is unlikely to work if the communication partner had not shared the experience of that referent in that location. However, if a preverbal infant had more concept-specific gestures, would he or she use these to share ideas about absent referents with communication partners with whom he or she *did not* share the relevant experience? That is, would the infant be able to rely on shared symbols, rather than shared experience, as the necessary common ground to facilitate communication? And would these additional communication tools allow the infant to refer to things even further away in time or space?

Angie Wants the Fish Crackers in the Fridge. [AN]

We were all playing in the infant yard when Angie [13 months old] starting doing the gesture for "fish" [lips slightly puckered, mouth opening and closing], then pointed to the door to the classroom. I asked if she wanted to go see the fish in the fish tank. We went inside the classroom, and I lifted her up so she could see the fish. Angie turned around in my arms and pointed back toward the other side of the room, gesturing "Fish." I pointed out the fish in the tank to her again, but Angie kept looking the other way. I told Jennifer [the Head Teacher] that Angie was gesturing "fish," but pointing to the other side of the room. Jennifer said "Angie's mom brought some fish crackers in with her this morning. They're in a plastic bag in the fridge. Maybe that's what she wants." I got the fish crackers out of the fridge, took Angie to the snack tables, and gave her the fish crackers. She smiled, then started to eat.

In this story, Angie and her caregiver do not actually share the common ground of knowing that there are fish crackers in the fridge. So Angie uses the specific fish gesture to indicate *what* in addition to pointing to communicate the location of the absent referent. Thus, Angie's gestures reveal her memory of what and where her snack is, and she is certain enough to persist in her communication attempt despite initial misunderstanding.

Glenna Tells About the Butterfly She Saw Last Week. [AO]

I was filming outside in the toddler's yard when Glenna, 16 months old, walked in front of me and looked up. I waved to her, and said "Hi Glenna." She walked over to a table that stood under a big tree. She pointed under the table, then gestured "butterfly," with hands together at the thumbs, flapping like wings. I commented that I did not see a butterfly, and asked "Where is the butterfly?" Glenna again pointed under

the table, and although I bent to look under the table, I did not see a butterfly. Glenna's caregiver, who had been watching our interaction, commented, "Glenna, are you talking about the butterfly you saw under that table last week?"

Glenna attempted to share the concept of an absent referent with me by both referring to its prior location and labeling it with a symbolic gesture. She may have even been referring to the location as a way to elaborate the concept of the butterfly she had seen, as in "the butterfly that was under the table," rather than using location as a reference to the object itself. Glenna did successfully communicate the concept of the absent referent to me—I understood the *butterfly* gesture—though her communication about her specific experience with it—that she had seen it there under the table—was less effective because it was an experience I had not shared with her, and the pointing gesture was not enough to communicate the full details of her experience.

There are two other noteworthy concepts relevant in this story. First, Glenna was not requesting an object but was referring to an absent referent simply for the purpose of sharing the experience. Second, Glenna demonstrated an episodic memory of something that happened several days previously.

Children's abilities to refer to an absent object or person are built upon their growing knowledge of object permanence, their developing abilities to store and retrieve long-term, episodic memories, and their growing knowledge about others' minds. Preverbal children who rely primarily on pointing to indicate the objects of their interest may not be able to communicate clearly when they are sharing a memory of an absent referent, particularly if they share it with a partner who did not share their experience. However, children who use a variety of object- or idea-specific signs can share their memories of past events and interests in absent referents.

Emotion Knowledge and the Beginning of Empathy

In their first year of life, infants begin to discriminate one emotion from another, then to differentiate the intensity of emotions (see Nelson, 1987), and by their first birthday, they can accurately interpret many of their mother's facial expressions in social referencing situations and respond accordingly (i.e., Sorce, Emde, Campos, & Klinnert, 1985). Most children begin to express emotion concepts verbally between 18 and 20 months of age, and shortly after their second birthday, toddlers begin to link experiences to emotions, showing a basic understanding of some causes of emotions (Bretherton & Beeghly, 1982). However, as many parents and other caregivers can attest, when very young children are themselves experiencing a strong emotion, they may have trouble articulating what it is, as recently verbal children tend to "lose their words" when they are upset.

Related to their ability to accurately perceive and eventually label their own or another's emotions, children begin to respond empathically to others' emotions. During their second year of life, children begin to respond to others' distress, even before they have the language to describe what the other is feeling. Around 13 to 15 months, about half of infants will show some kind of concern for their mother's distress. Until around 18 months, infants' dominant response to another's distress is to offer physical comfort such as a hug. In the second half of their second year, infants develop many more ways of expressing their concern and desire to make things better, including (but not limited to) verbal comfort, helping by bringing an object that may solve the problem (i.e., a Band-Aid), and distraction. By their second birthday, almost all typical infants will show concern for others, and engage in helping behavior, most often offering the

thing that would comfort him- or herself (Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992).

Before they can talk, infants can use signs to express emotion concepts such as sad, mad, scared, and happy, and feelings such as cold, hurt, and gentle (Vallotton, 2008b). Next are three sign stories that demonstrate infants' use of signs to describe their own and others' emotions, demonstrating basic emotion knowledge and concern for others.

Ellie Says She's Scared of the Dog. [AN]

Ellie (15.8 months) stared at the big dog with her eyebrows slanted inward. She gestured "dog" and pointed at the dog. Her caregiver said, "Yes, it's a big dog." Ellie took a couple of steps forward and stopped. She gestured "dog" and "scared." Her caregiver said, "The dog scares you? It's OK, this dog is gentle," and she stroked the dog. Ellie continued to stare at the dog. Her caregiver continued stroking the dog and saying, "gentle." Ellie walked slowly to the dog and poked it with her index finger. She waited, and poked it again. She waited, and tapped the dog twice. She waited again, and tapped the dog. She waited, and gave the dog a hug.

Ellie initiated a conversation about her feelings, and her caregiver was able to respond to Ellie's fear; first, she indicated that she understood what Ellie was feeling, and then provided reassurance both verbally and by touching the dog herself to show that the dog was gentle. Ellie was clearly curious about the dog, and once her caregiver had reassured her that it was safe, she approached the scary dog at her own pace and quickly became comfortable with it. Because it is harder to talk about emotions in the midst of feeling them, particularly for small children who are easily overwhelmed by their emotions, it is noteworthy that Ellie was able to use signs to describe her fear in the moment that she was feeling it. The caregivers and teachers at the CCFS have observed that once toddlers begin to use words, they use signs less and less; however, they go back to using signs in moments of intense emotion; when they cannot find their words, they can still find their signs.

Ellie Knows What Will Make Billy Feel Better. [RV] (This sign story was originally reported in Vallotton, 2008b, and is recorded here as it is in that article.)

Ellie (15.5 months) stopped as she was walking across the room, and made the gesture for hear. Her caregiver commented that she heard Billy crying. Ellie then made the gesture for sad. The caregiver said, "Yes, Ellie, I think Billy is sad. Emily is going to hold him and make him feel better." Ellie looked at her caregiver and made the signs for bottle and sleepy/nap. The caregiver said, "I think you are right. Maybe Billy needs a bottle and a nap" while repeating the gestures bottle and sleepy/nap. Ellie looked at the caregiver and pointed at Billy, as she again gestured sad, bottle, and sleepy/nap directly following one another (p. 248).

In this observation, Ellie (the same child as in the previous anecdote) shows concern for Billy's feelings by commenting on them to her caregiver. She further demonstrates an understanding of emotions and a burgeoning sense of empathy by commenting that perhaps Billy would feel better if he had a bottle and a nap. Consistent with Zahn-Waxler et al.'s (1992) observation that children often offer the type of comfort they themselves would like, Ellie probably knows that these are the things that make her feel better when she is upset.

Gemini Learns to Name Her Emotion. [PS]

When Gemini was 12 months old, she and Celia (14 months) were at the park, playing near each other in the sand. Their mothers sat nearby talking. A loud motorcycle went by. Gemini ran to her mother (Dawn) with lips quivering, crawled into her mother's lap, clinging to her and crying. Celia (who had been riding

motorcycles with her Papa for months and did not have a strong emotional reaction) followed Gemini over to where their mothers sat. Celia watched Gemini in her mothers' lap, then gestured "Scared," patting her chest rapidly with one hand. Celia's mother, Rebecca, commented without gesturing, "Is Gemini scared?" Celia repeated the "scared" gesture. Then Gemini, who had seen Celia gesture, repeated the "scared" gesture as well. Neither Gemini nor her mother had ever used the gesture for "scared" before. After this incident, Gemini began to use the "scared" gesture all the time to describe her feelings when she was frightened. Dawn and some of the other mothers in Gemini's play group began to wonder whether she used the sign so much because her personality is timid (and thus she is easily scared) or whether knowing the sign gave her an earlier awareness of fear, and that awareness made her more fearful.

This story is not only fascinating because Gemini learns to name her own emotion but also because the critical transaction that results in Gemini's new knowledge about her emotions takes place between two infants rather than between an infant and an adult. It is remarkable that Celia, at only 14 months, accurately recognizes and names Gemini's emotion. It is perhaps even more remarkable that Gemini recognizes the validity of the label Celia has given her emotion and immediately applies it to herself, then appropriately generalizes it to her feelings in other circumstances. This is a wonderful example of Vygotsky's (1978) idea about the cultural transmission of symbols within the Zone of Proximal Development. By participating in an emotionally salient social interaction with a slightly more advanced peer—in this case, just 2 months older—the younger child internalizes the meaning of the symbol (the sign for "scared") and begins to use it appropriately.

Identity Formation: Self-Reference and Self-Description

A young child's growing sense of self involves a set of skills including self-recognition, self-reference, self-description, pretend play, mental state understanding, knowledge of other, self-evaluation, and self-reflexive emotions (Anderson, 1984; Bertenthal & Fischer, 1978; Pipp, Fischer, & Jennings, 1987), which are related to one another (Lewis & Ramsay, 2004; Stipek, Galinski, & Kopp, 1990) and underpinned by brain development (Lewis & Carmody, 2008).

Stipek, Galinski, and Kopp (1990) described self-concept development between 14 and 40 months of age, based on maternal reports on 25 child behaviors indicating self-recognition, self-description and evaluation, and self-reflexive emotions (i.e., emotional responses to wrongdoing). Most 14- to 18-month-old children had the ability to recognize themselves, including recognizing self in a mirror, labeling themselves with their own name, showing or telling what he or she did, and expressing likes and dislikes; by 25 months, almost all children had self-recognition. Emotional responses to wrongdoing, including appearing upset or remorseful after doing something prohibited, hiding evidence of having done something prohibited, and calling attention to a prohibited action, is somewhat common among infants and toddlers. Children between 1 and 2 years begin to show self-reflexive emotions, with infants passing about 40% of self-reflexive items; this increases through 40 months old when toddlers show self-reflexive emotions about 60% of the time. Self-description and evaluation, which involved using terms to describe the self such as "good" or "pretty;" using the words "me," "mine," and "I," identifying own gender, and describing own physical characteristics, is much slower to develop; only one fourth of children between 14 and 18 months will self-describe, and even in the first half of their third year of life, only half of children will do it. These separate, but related, skills around self-knowledge show a clear increase during the infant and toddler years, with most 14- to 18-month-olds recognizing themselves physically, a little less than half of infants showing

self-reflexive emotions, and only a few describing or evaluating their own characteristics (Stipek et al., 1990).

Young children begin to use the word “me” and their own proper name—referring to themselves in the third person—prior to using the word “I,” a word that presents the self from the self’s perspective. Young children use “me,” “my,” “I,” and their own names as “subjects of utterances about the self” (Smiley & Johnson, 2006, p. 268). However, both Budwig (1995) and Brigaudiot, Morgenstern, and Nocolas (1996) observed that children only use “I,” rather than using “me” or their name, when referring to their internal states such as intentions, feelings, or perspectives. Perhaps this use of only the self-referential term “I” with internal states is because children who are old enough to use the subjective word “I” also are those who have words for their internal states. Would we see this same pattern if children had labels for their internal states at an earlier age?

Alana Describes Current State of Her Self. [RV] (This sign story was originally reported in Vallotton, 2008b, and is recorded here as it is in that article.)

Alana (15.33 months) was lying on the changing table and made the gesture for sleepy/nap [hands folded at side of cheek]. Her caregiver asked if she was tired; then Alana repeated the sleepy/nap gesture. Another child’s caregiver was setting up a diaper table nearby and oversaw Alana make the gesture for nap. The second caregiver asked, “Are you tired, Alana? It’s Monday, and I’m always tired on Mondays. Are you tired on Mondays?” Alana smiled and said, “Me?” in the tone of a question while pointing to herself. The second caregiver said, “Yes, that’s right. You’re pointing to yourself and saying, “Me.” Alana smiled and repeated “Me,” and pointed to herself, followed again by the gesture for sleepy/nap. (p. 247)

In this sign story, Alana describes her own internal state with the *sleepy* gesture and indicates that it is herself to which she is referring by adding the word “me” and pointing to herself. This is at an age (15 months) when most children recognize themselves, but few refer to themselves; while infants of this age commonly express their likes and dislikes, few describe themselves with a clear reference to the self. It is further noteworthy that Alana pairs an internal state sign (*sleepy*) with the word “me,” rather than “I,” indicating that the reference to self from the self’s perspective is not a prerequisite for having a sense of one’s own internal states.

Cathy Describes a Characteristic of Her Self. [RV] (This sign story was originally reported in Vallotton, 2008b, and is recorded here as it is in that article.)

Cathy (11.13 months) picked up a small spider stuffed animal on the floor and looked at it for a while. She looked at her caregiver and said, “Me!” “Yeah, you are holding a spider, Cathy,” her caregiver said. Cathy looked at the spider with her fist pounding on her chest (the gesture for scared). Then, she looked back at the caregiver. “It seems that you are telling me that you are scared of the spider,” the caregiver said. Cathy nodded without a smile. (Vallotton, 2008b, p. 247).

In this observation, Cathy coordinated three actions to represent a characteristic of her self. She used the word “me,” the holding up of the fake spider, and the sign for “scared.” Coordinating these three modes of representation is in itself noteworthy. But what Cathy communicated through this coordinated act is perhaps even more remarkable; she told her caregiver about a characteristic of her self—that she is scared of spiders. Cathy described an ongoing characteristic rather than a current passing state; if it were a current state and she were indeed scared of the spider she was holding up, she would almost certainly not be holding it.

Self-Regulation

In the first half of second year, infants gain an awareness of social expectations and begin to intentionally initiate and terminate their own actions to comply with expectations and achieve goals. It is during this time that infants begin to direct the word “no” toward themselves to prohibit their own actions—with varying success. Vygotsky (1978) talked about the use of symbols—usually words—as self-regulatory tools to inhibit, control, plan, and otherwise regulate behavior beginning around 3 years old when children are more fluent in their first language. That is, children use words to talk to themselves, first out loud, and then more quietly, and finally in their own heads as adults do, such that the external speech becomes the internal dialogue of executive function. But infants who sign have a set of symbols prior to words. Can they use these symbols to talk to themselves in service of self-regulation? Next, I describe two instances in which infants use signs to regulate their own behavior.

River Tells Himself to Focus. [PS]

River (14 months) was not a timid baby. He wanted to walk, run, and climb long before he could easily coordinate these actions. When learning to walk up or down stairs, River would often be distracted by other things going on or toys he was holding. To keep him from hurting himself, his Dad told River to “focus.” When his Dad would see River climbing stairs or doing other physically challenging tasks, he would say, “River, focus!” while pointing at his own forehead with his index finger. River picked up this unintentional sign, and began to point to his own forehead, reminding himself to focus when walking down stairs or along narrow walkways.

Celia Warns Herself to Be Nice to Her Mother. [PS]

Celia’s parents taught her the sign for “gentle,” (right hand gently stroking left arm) when Celia began playing with younger babies. Celia often used this “gentle” sign to talk to herself just prior to lightly touching a baby or when she would get upset with other children for taking her toys. By the time she was 14 months old, she learned to pair the “gentle” gesture with the word “nice.” Around this same time (14 months), Celia was often aggressive with her mother when the child was in a grouchy mood, pinching her mother or pulling her hair. After multiple warnings and requests for Celia to be gentle, Celia’s mother began putting her in her crib alone for 5 min if Celia would not stop her aggressive behavior. Celia hated this punishment and would cry the whole time. One day when she was 14.5 months old, Celia started to get irritable. She reached up to pull her mom’s hair, but then stopped, signing and saying “Nice, night night, no” with signs and words for each concept. This time, she did not pull her mother’s hair, and her aggressive behavior did not escalate.

At only 14 and a half months old, Celia successfully stopped herself from entering what was usually an escalating cycle of aggressive behavior. In this instance, she seemed to remember that the consequence for not being nice is to be put in her bed (“night night”), and she does not want this to happen. Thus, her words and gestures to her self seem to mean “Be nice because you don’t want to have to go night night.”

I have described the idea of infants’ use of signs in the service of self-regulation in greater detail in a previous article (see Vallotton, 2008a, for more sign stories showing that infants take comfort from caregivers’ use of signs when they are upset, use signs to engage in participatory regulation with caregivers, use signs to create, initiate, and modify comforting routines with caregivers, and sign to themselves in early self-regulatory self-“talk.”

ADULTS' RESPONSES TO INFANT SIGNS

Effects of Infant Signs on Parents' Minds

As part of their original study on infant signing, Linda Acredolo and Susan Goodwyn interviewed parents about their experiences signing with families. The results of a content analysis showed that parents felt they knew their babies better, that signs provided a window into their babies' minds (Acredolo & Goodwyn, 1992). In an effort to verify and elaborate on these reports of better relationships between signing parents and children, I conducted an experimental intervention study with 29 low-income families enrolled in EHS. I tested the effects of an infant sign intervention on the parent-child relationship, including whether signing with infants changed parents' perceptions of their children. Indeed, after the sign intervention, parents in the experimental group perceived their children as more acceptable and more reinforcing than did control group parents; that is, they were more satisfied with their children's behavior, particularly toward themselves (Vallotton, 2005).

Throughout my studies on infant signing, parents have spontaneously volunteered information on how signing affects their perceptions of and relationships with their children. Here are a few spontaneous quotes from parents:

I don't have to wonder what she needs anymore. She just tells me. (Julia, EHS mother of 11 month old Jasmine)

We have the smartest baby in the world, yes we do. (Matthew, father of Celia from sign story detailed earlier)

When I get home from work the first thing I do is have a conversation with my toddler about her day. (Roger, CCFS father of Glenna from sign story detailed earlier)

I asked a group of parents who use signs to tell me what they had learned from signing to their children. Here are some quotes representative of their responses:

I have learned how much a baby is watching and absorbing everything you do! (Jennifer, mother of Hayden, 30 months, and Tyson, 8 months)

I have learned that a child at a very young age has a strong emotional need to be understood. As a result of fulfilling this need early on with signing, my daughter is now more cooperative, less aggressive, well behaved, calmer and generally happier. (Juana, mother of Rhodelle, 29 months)

They were so much more aware and able to communicate, as babies, than society gives them credit for. (Karen, mother of four children who all use signs)

Jackson was playing little jokes on us at 11 months and we were able to see his light bulb moments and share in his excitement as we all realized he understood something for the first time. (Kathy, mother of Jackson and Lilly)

I truly feel that these little minds are able to accomplish so much, we're just scratching the surface. (Stephanie, mother of William, 4 months)

I've learned that babies are brighter than we believe. A baby is smart, they want to communicate with us and they can communicate with us, with baby signs, but even before they can do that, they're already communicating with body language. We as parents just need to learn what our smart baby wants to tell us. (Tina, mother of Hadewych, 4 months)

Signing helps both Jack and I to be less frustrated with each other. It is very easy for Jack to tell me he wants milk or food or his doggy. I am able to give him the things he wanted without him having to cry. I love being able to communicate with my son and each day he learns more signs. (Ashley, mother of Jack, 15 months)

I've learned how funny Kearah really is, and how easy is it to accommodate her needs. I love learning new signs with Kearah and I love watching her use the sign for the first time. (Tonia, mother of Kearah, 18 months)

Effects of Infant Signs on Early Childhood Professionals

A number of professional caregivers have shared with me what they have learned from signing with children. Here are some of the things they have said:

I pay more attention to infants when I expect them to respond to me. (CCFS caregiver)

When I sign to the babies, I have to be facing them, looking at them, so I'm watching them more, too. (professional caregiver in infant classroom)

Infant signs give us [professional caregivers] something specific to talk to parents about when they pick up their children, and we talk to each other. Using [infant signs] in our classroom makes us feel more professional. It has really improved teacher morale. (head teacher of an infant classroom)

Laura Nadeau, an Infant Master Teacher in the Ohio University's Child Development Center, has been using signs in her infant program for years. She described for me the multiple effects that infant signing has in her infant classrooms:

Caregiver training

Students who assist us in our classroom are blown away about how much an infant is capable of understanding! Sometimes even parents are amazed and begin to notice how much their preverbal child wants to and can communicate . . . Signing supports an awareness of all the ways infants try to communicate with us and with each other. It reminds us about how important it is to stop, observe, and listen to them.

Parent-teacher relationships

Parents often share signs that they have noticed at home. As a teacher and caregiver it is really important for me to learn these gestures that a child has invented or used at home before coming to the center. It really seems to help in their overall transition. In these instances I also see how signing with children can strengthen verbal communication between the parents and caregivers.

Teacher-child relationships

I believe that by using sign language, the infants are reassured that I want to understand and that I respect what they need or want. In turn they are able to develop a much more secure attachment with me and at the same time gain more independence . . . Using sign language with the children in my care has revealed so much to me about the cognitive ability of infants . . . Signing with preverbal children has allowed me to enter their world. I have been able to learn more about the individual child as they learn more about themselves and the world around them.

DISCUSSION

When we "listen" to infants' signs, we get a window into individual babies' personalities, interests, and fears as well as their immediate needs and wants. Further, if we take the time to consider the thoughts and feelings infants show us through their signs, we get insight into their development in many different domains. As seen in the sign stories presented earlier, signing children often reveal cognitive and social skills at a much earlier age than most developmental research leads us to expect. It is possible that signs allow us to see skills we would not otherwise see until children are using words; but it also is possible that signs *enhance* development of social and cognitive skills. While we know that signs do enhance language development (Goodwyn, Acredolo, & Brown, 2000), there has not yet been an experimental study to examine the effects of signing on other cognitive and social skills.

Although it is not known whether signing actually enhances cognitive and social development, it certainly provides the adults who study and care for preverbal children with insight into their internal worlds. The quotes from parents presented earlier contained several common themes that come through in their stories: (a) Babies are so smart, more than we know;

(b) babies learn fast, picking up lots of things from their environments; (c) when babies can tell us what they need, it is easy to give it to them, reducing frustration for both parent and child; and (d) babies have individual personalities and senses of humor. In addition, the quotes from professional caregivers reveal an enhanced attention to and respect for infants. Signing with infants' enhances both scientists' and caregivers' opportunities to learn *from* infants *about* infants.

Infant Signs as Intervention

As shown in the sign stories, infant signs are a tool for infants not only to make requests but also to initiate conversations about their thoughts and emotions. Infant signs enhance the ability of caregivers and preverbal children to share meaning. Signing also reduces the frustration that results in child–adult relationships from ineffective communication. Further, infant signs may actually help children build their knowledge of internal states as they elicit more elaborate talk of emotions and feelings from adults. Thus, infant signs may be a simple, yet effective, way to enhance relationships between preverbal children and the many adults who care for them.

Since the publication of the book *Baby Signs* (Acredolo & Goodwyn, 1992), infant signing has become increasingly popular among parents and in early child education classrooms serving infants and toddlers. It also has been implemented as part of early interventions with at-risk families in the United Kingdom, the United States, and Chile. Infant signing also has been recommended as a part of effective communication with toddlers to reduce frustration and tantrums by popular pediatrician Harvey Karp (2008). Though results from systematic studies of the effects of infant signing as an intervention are still forthcoming, initial reports on the effects of infant signs appear promising (Farkas, 2008; Hughes Wilhem & Lo, 2008; Pine & Kirk, 2008; Vallotton, 2009). That is, researchers reported positive effects of the signing interventions on parents' responsiveness to children's cues, parents' child-related stress and perceptions of children, and children's communicative behaviors and language development.

Future Research

Future research should investigate whether infant signs reveal the existing content and capacities of the preverbal mind or whether they are a toolset for building the infants' understanding of the internal and external world. Examining this question in the socioemotional domain, research should test whether using infant signing as an intervention increases children's socioemotional understanding, prosocial behavior, and self-regulation skills. Further, intervention studies should be used to test whether the reduction in parenting-related stress resulting from better infant–parent communication leads to parents having more empathy and insight for their young children as well as a sustained healthy parent–child relationship.

Conclusion

Through infant signing, babies reveal their minds to us; if we are watchful, we can see their worlds from their perspectives. We can see the minds of infants develop in their own everyday contexts. Infant signs can serve as a methodology for research, extending our knowledge of infant cognition and social skills by examining infants development revealed in their own words. Further, infant signs reveal in everyday life, for their parents and caregivers, the same developing abilities that lab experiments do for scientists. They can serve as a powerful learning tool for

parents and other caregivers to be co-learners with the infants in their care—learning *about* their children *from* their children by “listening” to what children have to say with signs.

REFERENCES

- Acredolo, L., & Goodwyn, S. (1985). Symbolic gesturing in language development: A case study. *Human Development*, 28, 40–49.
- Acredolo, L., & Goodwyn, S. (1988). Symbolic gesturing in normal infants. *Child Development*, 59, 450–466.
- Acredolo, L., & Goodwyn, S. (1992). *Baby signs: How to talk with your baby before your baby can talk*. Chicago, IL: Contemporary Books.
- Anderson, J.R. (1984). The development of self-recognition: A review. *Developmental Psychobiology*, 17, 35–49.
- Bertenthal, B.I., & Fischer, K.W. (1978). Development of self-recognition in the infant. *Developmental Psychology*, 14, 44–50.
- Bretherton, I., & Beeghly, M. (1982). Talking about internal states: The acquisition of an explicit theory of mind. *Developmental Psychology*, 18, 906–921.
- Brigaudiot, M., Morgenstern, A., & Nocolas, C. (1996). Guillaune I va pas gagner, c’est d’abord mamn: Genesis of the first-person pronoun. In C. Johnson & J. Gilbert (Eds.), *Children’s language* (Vol. 9, pp. 105–116). Mahwah, NJ: Erlbaum.
- Budwig, N. (1995). *A developmental–functionalist approach to child language*. Mahwah, NJ: Erlbaum.
- Casasola, M., & Bhagwat, J. (2007). Do novel words facilitate 18-month-olds’ spatial categorization? *Child Development*, 78, 1818–1829.
- Casasola, M., Cohen, L., & Chiarello, E. (2003). Six-month-old infants’ categorization of containment spatial relations. *Child Development*, 74, 679–693.
- Clark, H., & Marshall, CR. (1981). Definite reference and mutual knowledge. In A. Joshi, B. Webber, & I. Sag (Eds.), *Elements of discourse understanding*, pp. 10–63. Cambridge, England: Cambridge University Press.
- Dewer, K., & Xu, F. (2007). Do 9-month-old infants expect distinct words to refer to kinds? *Developmental Psychology*, 43, 1227–1238.
- Farkas, C. (2008, August). Effects of a gestural communication program with Chilean babies. In C. Vallotton (Chair), *Babies signing around the world*. Symposium presented at the 11th Congress of the World Association of Infant Mental Health, Yokohama, Japan.
- French, R., Mareschal, D., Mermillod, M., & Quinn, P. (2004). The role of bottom-up processing in perceptual categorization by 3- and 4-month old infants: Simulations and data. *Journal of Experimental Psychology: General*, 133, 382–397.
- Ganea, P.A., Pickard, M., & DeLoache, J. (2008). Transfer between picture books and the real world by very young children. *Journal of Cognition and Development*, 9, 46–66.
- Ganea, P., Shutts, K., Spelke, E., & DeLoache, J. (2007). Thinking of things unseen: Infants’ use of language to update mental representations. *Psychological Science*, 18, 734–739.
- Goodwyn, S., Acredolo, L., & Brown, C. (2000). Impact of symbolic gesturing on early language development. *Journal of Nonverbal Behavior*, 24, 81–103.
- Hughes Wilhelm, K., & Lo, L. (2008, August). Signing and language development of two-year-old twins: A case study conducted in Macau. In C. Vallotton (Chair), *Babies signing around the world*. Symposium

- presented at the 11th Congress of the World Association of Infant Mental Health, Yokohama, Japan.
- Huttenlocker, J. (1974). The origins of language comprehension. In R. Solsa (Ed.), *Theories of cognitive psychology* (pp. 331–368). Hillsdale, NJ: Erlbaum.
- Karp, H. (2008). *The happiest toddler on the block: How to eliminate tantrums and raise a patient, respectful, and cooperative one- to four-year old* (Rev. ed.). New York: Bantam Books.
- Lewis, M., & Carmody, D.P. (2008). Self-representation and brain development. *Developmental Psychology*, 44, 1329–1334.
- Lewis, M., & Ramsay, D. (2004). Development of self-recognition, personal pronoun use, and pretend play during the 2nd year. *Child Development*, 75, 1821–1831.
- Liszkowski, U., Carpenter, M., Henning, A., Striano, T., & Tomasello, M. (2004). Twelve-month-olds point to share attention and interest. *Developmental Science*, 7, 297–307.
- Liszkowski, U., Carpenter, M., Striano, T., & Tomasello, M. (2006). 12- and 18-month-olds point to provide information for others. *Journal of Cognition and Development*, 7, 173–187.
- Liszkowski, U., Carpenter, M., & Tomasello, M. (2007). Pointing out new news, old news, and absent referents at 12 months. *Developmental Science*, 10(2), F1–F7.
- Liszkowski, U., Schäfer, M., Carpenter, M., & Tomasello, M. (2009). Prelinguistic infants, but not chimpanzees, communicate about absent entities. *Psychological Science*, 20, 654–660.
- Moll, H., Richter, N., Carpenter, M., & Tomasello, M. (2008). Fourteen-month-olds know what “we” have shared in a special way. *Infancy*, 13, 90–101.
- Nelson, C.A. (1987). The recognition of facial expressions in the first two years of life: Mechanisms of development. *Child Development*, 58, 889–909.
- Pine, K., & Kirk, E. (2008, August). A longitudinal study investigating the early use of gestures with infants. In C. Vallotton (Chair), *Babies signing around the world*. Symposium presented at the 11th Congress of the World Association of Infant Mental Health, Yokohama, Japan.
- Pipp, S., Fischer, K.W., & Jennings, S. (1987). Acquisition of self- and mother knowledge in infancy. *Developmental Psychology*, 23, 86–96.
- Quinn, P., & Oates, J.M. (2004). Cognitive and language development in children. In J.M. Oates & A. Grayson (Eds.), *Cognitive and language development in children*. (pp. 21–60). Malden, MA: Blackwell.
- Quinn, P., Slater, A., Brown, E., & Hayes, R. (2001). Developmental change in form categorization in early infancy. *British Journal of Developmental Psychology*, 19, 207–218.
- Saylor, M.M., & Ganea, P. (2007). Infants interpret ambiguous requests for absent objects. *Developmental Psychology*, 43, 696–704.
- Smiley, P.A., & Johnson, R.S. (2006). Self-referring terms, event transitivity and development of self. *Cognitive Development*, 21, 266–284.
- Sorce, J.F., Emde, R.N., Campos, J.J., & Klinnert, M.D. (1985). Maternal emotional signaling: Its effects on the visual cliff behavior of 1-year-olds. *Developmental Psychology*, 21, 195–200.
- Stipek, D.J., Gralinski, H., & Kopp, C.B. (1990). Self-concept development in the toddler years. *Developmental Psychology*, 26, 972–977.
- Tomasello, M. (1995). Joint attention as social cognition. In C. Moore & P. Dunham (Eds.), *Joint attention: Its origins and role in development* (pp. 103–130). Mahwah, NJ: Erlbaum.
- Tomasello, M., & Haberl, K. (2003). Understanding attention: 12- and 18- month-olds know what is new for other persons. *Developmental Psychology*, 39, 906–912.

- Träuble, B., & Pauen, S. (2007). The role of functional information for infant categorization. *Cognition*, 105, 362–379.
- Trevarthen, C. (1998). The concept and foundations of infant intersubjectivity. In S. Braten (Ed.), *Intersubjective communication and emotion in early ontogeny* (pp. 15–46). Cambridge, England: Cambridge University Press.
- Trevarthen, C., & Hubley, P. (1978). Secondary intersubjectivity: Confidence, confiding and acts of meaning in the first year. In A. Lock (Ed.), *Action, gesture and symbol: The emergence of language* (pp. 183–229). London: Academic Press.
- Uzgiris, I.C., & Hunt, J.M. (1975). *Assessment in infancy: Ordinal scales of psychological development*. Urbana: University of Illinois Press.
- Vallotton, C.D. (2005). Effects of symbolic gestures as a caregiving tool: Children's social and language development and mothers' perceptions and behavior. *Dissertation Abstracts International: Section B: The Sciences and Engineering*, 65(9-B), 4877.
- Vallotton, C.D. (2008a). Infants take self-regulation into their own hands. *Zero To Three Journal*, 29, 29–34.
- Vallotton, C.D. (2008b). Signs of emotion: What can preverbal children “say” about internal states? *Infant Mental Health Journal*, 29, 234–258.
- Vallotton, C.D. (2009). Do infants influence their quality of care? Infants' communicative gestures predict caregivers' responsiveness. *Infant Behavior & Development*, 32, 351–365.
- Vygotsky, L.S. (1978). *Mind and society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Werner, H., & Kaplan, B. (1963). *Symbol formation*. Oxford, England: Wiley.
- Younger, B., & Johnson, K. (2006). Infants' developing appreciation of similarities between model objects and their real-world referents. *Child Development*, 77, 1680–1697.
- Zahn-Waxler, C., Radke-Yarrow, M., Wagner, E., & Chapman, M. (1992). Development of concern for others. *Developmental Psychology*, 28, 126–136.