

Chapter 2

The Origin of Indexical Species

Two primary characteristics of Index in ontogeny are intentionality of use, and the emergence of visual representation in memory. Demonstration of intentionality in indexical gestures requires the apprehension of source, path, and goal according to Piaget's model, upon which Lakoff and Johnson's model is constructed. Johnson (1997), Lakoff and Johnson (1999: 33), and Johnson (2007: 134) indicate that source, path, and goal are primary universal spatial skills which have their inception in embodied, or lived, cognition schemas. As Lakoff and Johnson argue, "Our most fundamental knowledge of motion is characterized by the source-path-goal schema, and this logic is implicit in its structure" (1999: 34).¹ Their claims clearly emanate from the Piagetian assumption that spatial concepts have their foundation in sensorimotor schemes, since embodied cognitions are constructed from daily perception-based interactions with objects. Lakoff and Johnson's model of development serves the present model in that embodied experiences are by their very nature subjective, permitting individualized uses of index in their purely pragmatic sense to derive from lived experience in the here and now—applying prelinguistic and linguistic indexes to gradually more differentiated locations and objects.

The present model goes beyond subjective experience to embrace more objective semantic invariant meanings of differentiated space. The present model further recognizes the later import of subjective experience in that embodied experience and the range of others' embodied objective experiences culminate in a subjective construction of space which does not ignore cultural determinants. This more-informed subjective experience can give rise to systems of spatial concepts which are imaginative, but are constructed from the course of both subjective and objective experience. This present approach has its genesis in Piaget and Inhelder's assertion that, "...sensorimotor structures constitute the source of the later operations of thought" (1966/1969: 28). Spatial awareness has its origin, then, in sensorimotor intelligence, indicating increasingly differentiated spaces via Index. In infancy and early childhood, index, as Piaget and

¹ Cf. Lakoff and Johnson (1999: 32–34) for a more extended discussion of the source-path-goal schema.

Inhelder intimate (1948/1967: 42), does not yet delimit ground (in other words, spatial limitations are not invariant); rather, index, given its foundationally visual nature, serves as the basis for the inception of images in memory, since its use underlies the emergence of Visual Working Memory (VWM) (Oakes et al. 2007: 78).²

The specific claim here is that index underlies the most basic of concepts—spatial, as well as those which build on spatial concepts; and that deictic indexes in particular drive higher-level spatial thought. Lakoff and Johnson's (1999) claim that space is a universal scheme expressed as source, path, and goal demonstrates the primacy of index as an elemental tool directing movement through space. Embodied subjective experience constitutes the framework within which early indexes are used: "The same neural and cognitive mechanisms that allow us to perceive and move around also create our conceptual systems and modes of reason" (Lakoff and Johnson 1999: 4).

Index constitutes the first sign tool in development; and as Kapitan asserts: "Indexical meanings are instrumental in guiding thought even when no tokens are uttered. Indexical thinking is prior to linguistic processing" (2006: 385). Indexes form the unifying construct in the sensorimotor stage to connect visual perception to action in the form of eye gaze and reach; and shortly thereafter, networks of visual pathways are forged in memory.

2.1 Gesture as Index

Let us examine which spatial indexes qualify as pre-index, proto-index, or full-fledged index in the course of development. Production of tongue movement, seemingly in response to that of another, has been documented at 0;1 (Meltzoff and Moore 1977), but it may not qualify as proto-index since it is not imitative—it does not demonstrate voluntary, but involuntary, behavior (Mandler 2004: 31). Non-imitative behaviors, although directional, are at best pre-indexical. Extending the tongue at this early stage does not demonstrate or reproduce a scheme of directed behavior.

Following the path of another's eye gaze at 0;2 (Scaife and Bruner 1975: 265), however, supersedes the pre-indexical in that it is imitative, but only directionally.³ The index qualifies as proto-index, not full-fledged index, given the nearly simultaneous

² Working Memory has replaced and extended reference to Short Term Memory (STM) in the fields of cognition and psycholinguistics. Baddeley and Logie (1999: 32) posit the existence of "visual cache" in the WM system, which stores visual representations of objects, their contexts, and their identities.

³ Nevertheless, the quality of Firstness does characterize gaze pattern. But for apprehension of the signified (demonstrated in gaze following), the indexical nature of gaze trajectory is unlikely to materialize, underscoring the pivotal role of Firstness in the ontogeny of index and in its interpretants. The effect at this early developmental period is primarily emotional in that the impetus for the effect is based in idiosyncratic affect, i.e. notice of others' change in gaze direction. "But no sign can have any significant effect beyond the emotional unless mediated by an emotional interpretant. After all, we must *feel* that we *recognize* the sign if it is to have any further effects on us" (Almeder 1980: 30).

reproduction of the other's visual path; this simultaneity demonstrates spontaneity and lack of targeted planning from Point A to Point B. Gaze trajectory reproduction here considers neither source nor goal according to Lakoff and Johnson's (1999) model.⁴ Following the movement of an object, as opposed to gaze trajectory, is likewise proto-indexical at this stage (approximately three months). Although visual tracking in either case may be imitative, it appears not to involve even an unconscious notice of a beginning or end point; and for this reason, it cannot be considered a full-fledged index.

Gaze following qualifies as full-fledged index at 4 months of age (West 2011c: 92) when gaze and reach coordinate in prehensile activity (Piaget and Inhelder 1966/1969: 9). According to Piaget and Inhelder (1966/1969: 10) this targeted reach represents intentional guided grasping such that the grasp is not a consequence of accidental attainment, but of purposive, measured extension of the arm toward the sought after object with the appropriate hand shape to orchestrate procuring it. Although the prehensile gesture graduates to indexical status, it nonetheless exceeds pure Secondness. Although Secondness is obviously illustrated by virtue of action on concrete co-existent objects, Firstness is present given initial notice of the object, for without Firstness in the form of perception and preference, notice of the object would be unlikely. Thirdness is likewise illustrated in the child's use of a particular hand shape to receive/acquire the object; and recognition of kinds of hand shape toward successful attainment of different types of objects constitutes a general behavior type or habit.

Once infants use index to target particular objects/places, its use is more full-fledged, although without the reciprocal nature of the deictic component. Eye gaze becomes a more full-fledged index when the source of the index and/or its goal are ascertained such that objects or places are singled out as noteworthy. In fact, early recognition of objects is dependent on recognition of their location via a landmark, which provides an anchor and/or a context. Quinn (1994: 66–67) reports that at three months, infants recognize that objects have been displaced from their previous location, e.g., remembering whether objects were above or below a particular point of orientation, indicating that exposure to a place of orientation (or landmark), in the spatial context, hastens object recognition.⁵ This finding underscores the primary influence of Index to enhance object recognition. Together with vision, the landmark is a more full-fledged index (expressed as *origo*), in that it provides a point of reference for the object; consequently, even before source and target are apprehended in events where movement is at issue, points of orientation help ground an object and appear to facilitate object constancy (that objects have substance). Eye gaze, then, together with landmarks as *origo*, constitute the first full-fledged indexes in ontogeny, but what it is indexing is not always clear.

⁴ In Piagetian terms, the source is unrecognized ego, or, where ego "is" in the spatial array—hence, the *origo* is also unrecognized. The goal, then, is the purpose or endpoint.

⁵ Quinn's design is representative of others in that it uses looking time as an indication that infants recognize that a change in location has taken place. In this case, recognition of a new location with respect to the landmark is indicated by more extended looking time, whereas shorter looking time is associated with recognition of an unchanged location.

Given their undifferentiated non-deictic character, early indexical uses are particularly ambiguous, in that they can refer to the object contained within the space, or the place itself. For this reason, prelinguistic indexes are often ambiguous, since they directionalize simultaneously to the object and the place. In any case, early indexes such as imitation of expression, movement, or gaze trajectories implicitly draw an attentional pathway from the producer to a relatively proximate point in space, which is not always linear. Although primitive imitations require some awareness of movement through space, such awareness appears to be passive and without intentionality or realization of endpoint or causation—they regularly surface without realization of point of origin or termination. Clapping hands or wagging of the tongue at 0;4 in response to the same behavior on the part of another (Piaget 1936/1952: 24) constitutes a behavioral transition to more full-fledged indexical use, in that it demonstrates some coordination of visual and tactile indexes (gaze and hand), and some deliberate attempt to reproduce the behavior scheme of another, albeit imitative (Piaget 1945/1951: 14), and not purely intentional. Moreover, clapping in response to another's clap does not indicate that the infant is holding the adult's clapping scheme in WM or LTM.

Full-fledged indexical use is unequivocal at the point in development when infants engage in prehensile reaching. This form of reach requires coordinating the use of two indexes, eye gaze and hand/arm extension. According to Piaget and Inhelder (1966/1969: 9), this coordination (at four to five months) entails the simultaneous regulation of vision and manual grasp, and indicates that the reach is intentional (Piaget 1936/1952: 88), given the preparation required to successfully reach distinctive objects in different locations. One index, eye gaze, determines the distance, shape, pliability, et cetera, of the object to be grasped by the second index, extension of the arm and hand shape. The utility of one index to fashion another clearly demonstrates the presence of intentionality in indexical use, qualifying prehension to be the initial full-fledged index, although it is still unclear that infants can hold in WM representations of planned reaching schemes at this age.⁶ In other words, spontaneity of reach indicates that the index is intentional, but perhaps not a consequence of planning. Furthermore, the use of the arm and hand as index are not nearly as ambiguous as is eye gaze, in that eye gaze encompasses a wider spatial array, namely, both the object and the space where it is situated. Mental indexes can similarly refer ambiguously.

The influence of the first mental index—Visual Working Memory (VWM), in determining Index's role in facilitating object recognition is just beginning to be uncovered. This is a difficult endeavor, since measures of VWM during early infancy can vary or be unreliable, in that they can consist of neurophysiological imaging methods, or behavioral ones (looking time or sucking patterns). In spite of early pre- and proto-indexical uses, Index is nonetheless a primary tool undergirding the formation of object concept (the identity or substance of an object). According to Leslie and Káldy (2007: 117), recognition of the location of objects

⁶ Intentionality is but one aspect of deixis in the present theory, and is supported by Levinson's (2004) analysis of indexical terms. Levinson's second component of deixis will be taken up in the following section.

often precedes awareness of the object's salient features. This early recognition of location constitutes the inception of an object file, which Leslie, Xu, Tremoulet and Scholl (1998) refer to as "object index." This representational form of Index emerges at approximately 5–6 months of age (Leslie et al. 1998; Leslie and Káldy 2007). In fact, object index causes the creation of an object file, in that it constitutes the mechanism through which infants "attend to an object in the visual field" (Leslie et al. 1998: 13). Eye gaze and "inner gaze," i.e., recognition of particular locations associated with objects, are early indexes which facilitate representation of objects, including their perceptual and functional properties. As Leslie and Káldy indicate, "An object file⁷ may or may not contain a feature bundle,⁸ but it must minimally contain an index.... The first and in many ways most important part of the object file is a continuously updated spatiotemporal code that locates the object corresponding to the object file. This is the indexing function of the object file; the file points at the object it refers to" (2007: 117).⁹ Leslie et al. (1998: 11) further describe the object index as possessing properties, half of which are remarkably akin to those of Peirce's Index: a mental token that functions as a pointer, does not inherently represent the features of the object pointed at, is attentionally resource-limited, and is location-specific. The conception of the object file, within which the object index is operational, assumes memory skills beyond the limitations of STM into WM, in which LTM representations can be updated and synthesized with current sensorimotor experience.¹⁰

The emergence of the object file in VWM, along with its synthesis in LTM, represents a growing body of literature. According to Oakes et al. (2007: 78), "Although infants' memory for visually presented objects has been studied for decades, their memory [has] generally been assessed using procedures that recruit LTM systems, and therefore conclusions about VSTM are difficult to draw". It is evident from more current accounts (Leslie et al. 1998; Leslie and Káldy 2007) that indexical information is represented early on in memory, approximately five months, simultaneously with the use of more full-fledged behavioral indexes, such as eye gaze and intentional reach. According to Leslie et al., "At five months,

⁷ "Object files are temporary object representations that interface between sensory information and long-term semantic information" (Leslie and Káldy 2007, p.117). In addition to spatiotemporal information, they include perceptual and functional features of an object held in WM.

⁸ Object files eventually include inextricably bound perceptual and functional characteristics of an object which are held together in WM. Such features may include color, shape, size, et cetera (Leslie and Káldy 2007).

⁹ In perceptual motor schemes, the physical attributes are not distinct from the action-based exchange with the object. Hence, an interesting (and as yet unresearched) question is: If one were to lose the index, would one be able to retrieve the object file?

¹⁰ WM extends STM in that limits on the amount of information to be remembered and its duration have been extended from seven units to approximately fifteen (Naiman 1974: 22; Erlam 2005: 153–154, 2009: 78) over three seconds (Eysenck, 2001: 163). WM, likewise, provides for the integration of information from slave systems (the phonological loop and the visuospatial sketchpad) with information from Long Term Memory (LTM) (Baddeley and Hitch 1974: 80–81; Baddeley 2000:418, 2007: 7–13).

infants will index-by-location without binding features [of the object]...” (1998: 17). Oakes et al. (2007: 89) indicate that color can be bound to location with a single object by 0;8; and at 0;10, color can be bound to and representative of multiple objects (Oakes et al. 2007: 85). Nonetheless, it is not until 1;1 that color, as a feature of an object file, is bound to the object index of that file. The association of identifying features of an object to a location is somewhat protracted, compared to the association of features within an object file—object index emerging approximately seven to eight months earlier, before its association with features. This relatively lengthy interval of associating location to object attributes may result from a reliance on visual indexes, such as targeted gaze, which often mediates the use of other indexes, such as reach, pointing, and the like. Visual indexes, especially gaze, lend themselves to less-differentiated locations and to the ambiguity of whether place or object is the intended referent.

The import of VWM (the first mental index) in sensorimotor applications can be measured through examination of the length of time intervening between the observed action scheme, and the infant’s reproduction thereof. Building enduring representations minimally requires the means to represent visual copies in LTM, and later, to access them from LTM and integrate them with current contextual information in WM, in order to reproduce a similar behavior scheme.

Imitative behavior schemes demonstrate that by 0;7, infants can use mental indexes as representations in VWM; but the character of these mental representations early on may be limited to exact perceptual copies from LTM, i.e., calling up the behavior scheme to be imitated without altering it. Moreover, limitations in WM appear to include conformity of the imitation (propelled by mental indexes) to the original spatial context, and the presence of a physical stimulus which cues the infant to enact the particular imitative behavior. These behaviors are attached to particular contexts in LTM and in WM, which strongly suggests the dependence on sensorimotor embodied experience in early visual representation, and consequently, in the use of the first mental indexes—the infant’s imitation is performed in a particular place at a particular time, with the same persons/objects present to trigger the recapitulation of the behavior scheme. Imitative behavior schemes of this type are produced between 0;7 and 0;11, whereupon some anticipatory imitation (imitation absent a physical cue) emerges (Piaget 1945/1951: 25–45).

At 0;7, infants imitate behavior schemes based on direct perceptual observation, e.g., hitting, which typically illustrates directionality away from *origo* (Piaget 1945/1951: 25). At 0;8, infants begin to imitate behavior schemes which they have observed several hours beforehand, such as biting the lips (Piaget 1945/1951: 30–31); and at 0;9, imitation of eye-blinking and opening and closing the mouth and hands after a similar interval of time has elapsed is documented (Piaget 1945/1951: 40). These forms of imitation may not reveal the state of the child’s conceptual representations, but may merely constitute a perceptual analogy on the mental plane (Mandler 2004: 30); and it is just this conceptual representation that clearly indicates index’s primacy. Factors responsible for the transition between visual memories which are perceptual only, and those which carry some

conceptual meaning appear to be duration of memory to permit anticipatory imitative responses, and application of the scheme to new contexts. This VWM competence begins with simple schemes, e.g., anticipating the swish of a donkey's tail by moving a rattle (in the presence of a motionless donkey) (Piaget 1936/1952: 299). The competence becomes more refined at 1;0 when infants employ more elaborated schemes, i.e., imitating the means to physically access a desired object with a tool—accessing a cork with a stick upon seeing the cork (Piaget 1936/1952: 299). All of these VWM representations qualify as early mental indexes foundational to the development of higher mental processes, in that they are directional in nature, drawing on the source, path, goal trajectory.

Deferred imitation demonstrates a still more elaborated VWM system, in that the imitation takes place days and weeks after the observation; and the observation consists of a series of connected sensorimotor behaviors, such as an iteration of another child's tantrum observed several days beforehand. According to Piaget (1945/1951: 63), deferred imitation has been documented at 1;4. More developed VWM skills are required to defer the imitation. Infants must hold more than one image in the VWM system for a lengthier interval. These increased VWM competencies underlie the interiorization of index, which lays the groundwork for increased independence between index, and the place and time of its referent.

In spite of the critical role of intentionality and VWM in the development of full-fledged indexical use, Index, at this stage, lacks the semantic and symbolic qualities which could characterize it as deictic. Before acquiring deictic meaning/use, Index's reciprocal and social functions must be recognized. This novel line of inquiry suggests that mentally-represented indexes may surface simultaneously with behavioral ones, showcasing the interdependence of sensorimotor indexical systems with representational ones.

2.1.1 Pre-Deictic Gestures

Until this point, infants have not unequivocally differentiated place from object features, perhaps consequent to an undifferentiated relationship between figure and ground. Since the ground is often the location, and the object together with its features is typically the figure, recognition of figure-ground relations is foundational to the development of early uses of Index. Furthermore, discerning whether the use of Index refers to place, or object within that place, is dependent on some recognition that the two are distinct, yet they form the same spatial context. Apprehension that the ground (location) can contain objects different from a particular object or may contain numerous objects arises from lived cognitions of spatial boundaries. Nonetheless, an overdependence on experienced Secondness can account for the protracted differentiation of figure from ground, consonant with the initial limited use of Index as a pointer of lived spatial scenarios—conforming to what has been seen/perceived.

To bring Index to a higher vocation (to differentiate reciprocal actions of reciprocal partners in a social milieu), certain pragmatic and cognitive skills must be present, namely, increased spatial differentiations. Mental operations, such as reversibility, first materialize as lived experiences, such as reciprocity of action within a dyadic interchange.¹¹ Similarly, pragmatic considerations such as turn-taking (elemental to perspective-taking) have their basis in embodied experience, e.g., giving and receiving. These cognitive and pragmatic skills enlist the infant to participate in turn-taking exchanges, and thus contribute to the directional alterations that are inherent to such interplays. Unidirectional Indexes become bidirectional with the realization that self-agency in pushing or grasping toward or away from ego can graduate to modifications of hand shape and direction of arm when receiving.

Although unidirectional indexical gestures begin with prehension at four to five months of age, they continue to be further refined in hand shape and in extent of reach. Modified hand shape is expressed in pointing with the index finger at 8 months of age (Bates 1976: 61; West 2011c: 92) and extending the arm in giving and receiving exchanges at 9 months and thereafter (Carpenter et al. 1998: 681; Volterra et al. 2005: 9). When extending the arm, infants often need to alter their hand shape to accommodate the object to be received—taking the form of an open hand, cupped hand, et cetera; and the co-occurrence of eye gaze to facilitate and coordinate the motor index (hand and arm) is still indispensable. Nonetheless, indexical gestures at this stage are for ego alone (ego as the only *origo*), such that they are not concurrent with eye gaze toward another, nor mutual eye gaze exchange (Carpenter et al. 1998: 153). This lack of mutual eye gaze demonstrates the absence of bidirectionality in indexical use, and thus does not qualify as deictic at this stage.

Visually-directed pointing at 0;8 is unidirectional, thus it permits only one *origo*, namely, ego. In the face of relatively undeveloped cognitive and pragmatic systems which, if developed, would permit logic to guide action sequences, infants rely on affect to drive behavior schemes, such as using an index to single out a referent. To illustrate, feelings/preferences of ego are affective components which motivate the use of early indexes. Directional gaze and gaze coordinated with reach and/or pointing, are elicited by a Firstness-based agent, namely, affect. Recognition of similar attributes, e.g., size and shape, illustrates a component of Thirdness in the development of index in that objects of similar shapes/colors are classified together, and observation of others using hand shape as indexes demonstrates a recognition of a practice rooted in convention. Moreover, pointing indicates present objects only at this age; it does not yet refer to hidden/absent

¹¹ Full-fledged reversibility takes place in Piaget's Concrete Operational Stage, between the ages of 5;0 and 7;0. It entails the means to recognize and reason that a current perceptual state of an object, e.g., shape, can be returned to its previous perceptual state without changing any substantial characteristics of the object. Conservation of mass, for example, requires a child to hold the current shape of clay (a pancake) in memory and call up the previous shape of the clay (a round ball), using the rationale that the mass of clay is the same in the pancake as in the ball, since it can be reformed into the ball once more. (Cf. Sect. 4.3 for further discussion.).

referents. Between 1;0 and 1;2 search (gaze as index) for hidden referents upon other's request materializes, although gaze toward another in the process of an indexical event does not rise to the level of joint attention (Baldwin and Saylor 2005). In fact, children's gaze at this point in development is still unidirectional, and is claimed to be more frequent toward the speaker when speaker is referring to absent, rather than present, objects (Saylor 2004: 608).¹² The presence of Secondness is obviated by a concurrent search for present objects. Likewise at this age, eye gaze unites with arm extension to serve as index toward a coexistent referent. These early social skills of showing and giving appear to lay the groundwork for developing relational competencies not merely those inherent to spatial orientations and contrasts but those necessary for pragmatic competence—conversational turn taking.

Indexical gestures facilitate social interchange as a necessary bridge to deictic uses, in that they begin to uncover a cognitive foundation for role-taking. In an exchange, the agent initiates conduct toward a non-agent participant, who receives the directional token. The receiver then becomes an agent, and the initial agent receives. Inherent in these giving and receiving indexical exchanges is lived experience of participating in an interchange, in which the index needs to be altered to accommodate the nature of the participation, especially given the frequency with which shifts arise in many common scenarios. Rolling a ball from one partner to another, or passing a plate at the dinner table demonstrate the reciprocal and social nature of these indexicals; nevertheless, the child's apprehension of different roles (giver/receiver) is not yet convincing. The child may merely be engaging in turn-taking exchanges, which are in spontaneous compliance with expectations of who should act, and may be employing indexes automatically.

2.1.2 Deictic Gesture

Until the symbolic meaning of Index is ascertained, at least on an unconscious level, each gestural use, is devoid of a shifting character. In other words, unidirectional or bidirectional gestural indexes, such as eye gaze, reaching, or pointing, even if they are intentional (fixing deliberately on a particular referent) and reciprocal, are non-deictic absent their semantic meaning, even after their shifting pragmatic use and idiosyncratic semantic use have been apprehended. Recognition of the pragmatic use of index affords infants the awareness of the context of the referent, i.e., that indexes often refer to different locations and objects. This awareness of context, however, does not necessarily culminate in deictic use if it is uninformed by a system of *origo* encoded in invariant meanings—a semantic and symbolic enterprise. Gestural indexes can be used non-deictically if their uses are devoid of symbolic (at the least conventional) meaning. If eye gaze, prehension,

¹² Further discussion of index and absent objects will be provided in 2.4.2.

pointing, and the like, fail to include the general meaning together with orientational reference to social roles of potential *origos*, index has but a single purpose (joint attention) and shifting attention to distinctive objects with respect to diverse *origos* is unrecognized. The means to shift from a single orientation or from a single participant's notice is but a rudimentary illustration of what deictic use entails. Merely gesturing toward an object/person does not constitute deictic use. The gesture must, at very least, be iteratively imitative of a recognizable convention, drawing on symbolic/conventional meaning. Indexical gestures are directional only (until approximately 1;4) without reference to semantic meaning; and even some deictic gestures or terms which have the potential to draw upon symbolic meaning may be used indexically only, especially by children.

Independent of social uses, gestures can express a culmination of embodied experiences with objects, emanating from sensorimotor experience. Their indexical function is primary for two reasons: the pivotal role of vision in this exophoric¹³ indexical gestural use, and the fact that they represent foundational spatial functions which have their origin in perceptual experience. Even after the onset of demonstratives, infants produce index-based gestural schemes unaccompanied by language such as: finger movement to represent a spider to elicit the “itsy-bitsy spider” song.¹⁴ The indexical function of finger movement is obviated when infants follow the movement trajectory of the spider: up the water spout; afterward, upon the arrival of the rain, down the spout; and with the arrival of the sun, up the spout once again. Infants express other indexical gestures, reproducing sensorimotor schemes, such as ball-throwing: “...a throwing motion for ‘ball’ would be an indexical sign because throwing is an action frequently associated with a ball” (Acredolo and Goodwyn 1985: 44). The ball-throwing gesture is likewise characterized as indexical consequent to the directionality of its path. Moreover, these gestural schemes are virtually always exophoric—dependent on a physical cue in the environment (cf. 2.2.2). Furthermore, gestural schemes such as ball-throwing derive from a wish to express function, rather than form-based embodied experience, supported by gestural reproduction of more verb-based constructions: throwing, sniffing, flapping, and the like, rather than noun-based constructions with their emphasis on identity and description. In fact, the nature of gestures appears to require production of motion- or direction-based scenarios, as opposed to the representation of static perceptual attributes.

Although the pragmatic use of gestures is primary (especially at early ages) in view of its indexical function and visual nature, some semantic meaning can likewise

¹³ Cf. 2.2.2 for further discussion of exophora and its function(s).

¹⁴ This children's folk song is used widely in the United States and the United Kingdom in pre-schools and with care-takers (cf. Seeger 1948: 126), and is as follows: “The itsy-bitsy spider climbed up the water spout/Down came the rain, and washed the spider out/Out came the sun, and dried up all the rain/And the itsy-bitsy spider went up the spout again.” Alternate versions include: “The Incy Wincy Spider” in Fraser (1975: 28) and “The Blooming Bloody Spider” in North (1910: 279–280).

be accorded to certain early gestural uses.¹⁵ Spontaneous gestures which are obviously intentional, surface at approximately 1;4; and their meanings virtually always include schemes based in sensorimotor embodied constructs. Many of these schemes are comprised of two gestures, beginning at about 1;5. What follows is an illustration of gestures in combination: sniffing twice (meaning “flower”) followed by a shrug (meaning “I don’t know where”) (Acredolo and Goodwyn 1985: 47–48). From Acredolo and Goodwyn’s account, it appears that the syntax of these two-gesture representations reflect an exact replica of the sequence of events in lived experience, which is analogous to the process in language development when words/morphemes begin to be connected.

Nonetheless, the claim here is that to qualify as a deictic gesture, children must go beyond understanding the pragmatic nature of shifting referents and beyond idiosyncratically derived semantic meanings, to discern (however unconsciously) the symbolic/classificatory meaning accorded to the sign-referent association. To reiterate, even though intentionality and attentionality (joint attention skills) are necessary for deictic use (to ascertain the individuating and pragmatic orientational shifts), it is recognition of distinctive *origos*, and that *origos* have social/conversational roles which completes the deictic equation.

Deictic gestures (gestures used more symbolically) typically consist in the use of chains of gesture, not merely a single holophrastic-like unit. Although meaning (conceptual/semantic knowledge) can be expressed by means of a single gesture, the meanings accorded thereto are not reliably accurate, and have little history to recommend them. Early gestures are often spontaneous idiosyncratic communication devices (apart from sign language) whose meaning is often interpreted by contextual features alone, since an established code (written or unwritten) does not precede them; the gestures may not be intentional or conscious. The syntax of gestural communication without linguistic accompaniment has not systematically been investigated; consequently, how gestures express role-based orientations on a semantic plane is founded, in large part, on conjecture, or on the behavior of a single subject only (Goldin-Meadow 2003: 232; Acredolo and Goodwyn 1985).

Some indexical gestures which express lexical-like meaning comprise a larger part than do linguistic holophrases in communicative processes at the onset of language; but, fall out of use once syntax and morphology advance. These lexical gestures can include flapping of the arms (indicating “bird”), or opening and closing the mouth (indicating “fish”) (Acredolo and Goodwyn 1985: 43). Although they include directed, intentional, and perhaps, reciprocal movement in space, the

¹⁵ The particular pragmatic skills ascertained in indexical, leading to deictic use is the likelihood of behavioral pointers to refer to different referents on each occasion of use. In the field of linguistics, “pragmatics” pertains to the context, both linguistic and extralinguistic; the spatial context includes the participants apart from their roles, other foregrounded or backgrounded objects, and the “scene.” In the field of linguistics, “semantics” refers to specific and general meanings which adhere to a particular term, namely, invariant meanings (in the case of the latter) which do not focus on the particular referent person/object, e.g., the invariant meaning of “here” is placed near the speaker, whereas a pragmatic approach simply attaches “here” to the particular location referred to at any one point in time.

consideration of source, path and goal is not clearly present. Source is unrecognized, since (at best) ego is the only *origo*. When the child produces the spider movement scheme or when she indicates a lack of knowledge of the whereabouts of the flower, the perspective is the child's alone, not that of another observer/intrinsically-sided object (e.g., the water spout).

2.2 Demonstratives as Index

Demonstratives, unlike virtually every other linguistic category, appear not to derive from lexical items; rather, they are underivable and constitute their own class. Diessel (1999: 160) claims that: "...demonstratives might not derive from lexical items, as commonly assumed, but rather from a class of genuine deictics that belong to the basic vocabulary of every language." Diessel's latter assertion establishes the universality of demonstratives across languages at early stages in development (cf. Sect. 1.1). Still, demonstratives (like lexical items) constitute one of the building blocks for grammatical items, and perhaps have a more influential role in the development of grammatical morphemes, than do lexical items such as: inflections and other potentially deictic expressions (pronouns and articles). "...Grammatical items develop from lexical expressions and demonstratives, but never vice versa" (Diessel 1999: 152). Moreover, in English definite articles have evolved directly from demonstrative pronouns, which is the case in many additional languages (Lyons 1968: 279; Lyons 1999: 110, 116, 331–334; Diessel 2006: 476).¹⁶ It is well established then that demonstratives are primary linguistic indexes which have a significant influence both diachronically and ontogenetically.

2.2.1 Pre-Deictic Demonstratives

Ontogenetically, demonstratives function initially as the most exophoric linguistic structure; *ergo*, they are devoid of semantic meaning, conveying pragmatic meaning only—other demonstrative uses develop thereafter which do not rely on the physical presence of their respective referents. According to Halliday and Hasan (1976: 31–33), demonstratives consist in three distinct classes: exophoric, endophoric and shared knowledge; but, each use can overlap with other uses later in

¹⁶ In short, C. Lyons describes the diachronic process of demonstrative to definite article as follows: "The semantic weakening or 'bleaching' taken to be involved in the shift from demonstrative to article reflects a very general diachronic process of devaluation of lexical content. This process can be described in terms of loss of lexico-semantic features, and in the case we are concerned with it is essentially the feature [+Dem] which is affected.... It is much more common, however, for articles to have no deictic content, so that their creation involves loss of deictic features as well as [+Dem]" (1999: 331–332).

ontogeny. Exophoric demonstrative use materializes when the referent is present, e.g., “That’s what I ran into” (referring to a toy train in the physical environment). Endophoric demonstrative use is called upon when both demonstrative and referent are within the same linguistic context, e.g., “I want to play with my friend’s train; wow, that goes fast.” Demonstrative use constitutes shared knowledge when the referent is absent from the context, appearing only in the joint memory of the interlocutors, e.g., “My friend didn’t like that when I was playing with that at his party.”

The function of the exophoric use is to *show* what is in the environment, rather than to tell or to classify what is there—a linguistic pointer with little, if any, lexical information. The showing function of exophoric demonstrative use is a result of its indexical primacy, coupled with the consequent lack of semantic meaning residing therein—a characteristic of pure indexes (cf. 5.1). In their early exophoric uses demonstratives refer in a noncontrastive sense, without notice of differentiated near and far space; and they refer to an object, person or to qualities of an object.

The earliest uses of demonstrative pronouns are exophoric non-contrastive, and are accompanied by indexical gestures, primarily pointing (Clark 2009: 94). In fact, the gesture precedes initial demonstrative productions and serves a “boot-strapping function” (Goldin-Meadow 2003: 210). These earliest indexical expressions are one-word utterances belonging to the class of demonstratives, specifically demonstrative pronouns (Clark 2009: 94). Moreover, these early non-contrastive indexes are pre-deictic, since differentiated locations and shifting roles are yet to be apprehended. As long as gestures, such as pointing, accompany early demonstrative use their non-contrastive, non-shifting, pre-deictic character persists. According to Bates (1976: 55, 61) and Clark (2009: 94) exophoric demonstratives derive from pointing gestures and serve as precursors to early space deictic use in English; and afterward, pointing accompanies demonstrative use disambiguating which referent is the focus (Clark 1978: 96–97; Diessel 1999: 110; 2006: 466). The very need for disambiguation in early exophoric use highlights the pre-deictic character of early demonstratives. Reliance on visual indexes, such as pointing, accentuates indexical meaning, obscuring symbolic meaning. With little dependence on the semantic content of the linguistic expression to determine the utterances’ meaning/referent, what is left for the speech partners is the visual/directional indicator whose function is to single out an object in the context within an attention scheme (uni- or bi-directional).

Accompaniment of initial demonstrative production with gestural indexes is likely to be a consequence of two factors: early exophoric demonstrative use (Diessel 2006: 470) and the nature of demonstratives as expressing definiteness. Definiteness characterizes the function of demonstratives to identify a specific referent, or to include referents in a particular class of referents (Lyons 1999: 274; Lyons 1968: 279). With respect to the (exophoric demonstrative use) referents of “this” or “that” are typically present in the extra-linguistic context (Halliday and Hasan 1976: 58–59). Even when the referent is not present at the time that the demonstrative pronoun is produced with a gesture, its use is still arguably exophoric since according to Bühler (1934/1990: 156) and Fricke (2002: 221–222) a contextual analogy based on its original use is reproduced in the present context. This reference to absent objects is still arguably exophoric because it is “anchored... to the current *origo*, to

the here and now of the interlocutors” (Haviland 2000: 19). As long as the *origo* of the exophoric reference is in the here and now, the referent need not be present to qualify as exophoric (West 2011a: 159, 2011c: 94; cf. 2.4.2).

In English, as in many Indo-European languages, demonstratives are later used contrastively in their full fledged sense, indicating a distinction in distance of a referent with respect to the distance of another similar referent from the speaker’s location and orientation.¹⁷ Non-contrastive uses, obviously, do not make such spatial distinctions—they refer to objects in an undifferentiated manner, without demarcating near from far spaces, and objects within those spaces.

The earliest exophoric non-contrastive demonstrative uses are unmarked, and are restricted to the demonstrative “that” (West 1986: 32). “That” is considered to be unmarked in its undifferentiated use, given its conformity to three criteria (recognized widely among linguists): appearing frequently in language input, produced early in development, and consisting of fewer morphemes. Such unmarked, spatially undifferentiated uses emerge at approximately 1;6 and continue to 2;8 (West 1986: 115), appearing without a proximal counterpart. This age frame for the unmarked use of “that” is likewise supported by Clark (2009: 166–167; 1978: 96–97).

Still other factors indicate the continued unmarked, non-contrastive use of the exophoric “that,” until 2;8: accompanying gestures, absence of recognition of *origo*, and social/conversational role taking. If “that” refers to any object of focus without implicitly alluding to speaker as *origo* (or *origo*’s possible orientations to the objects in question) or to contrastive near/far locations, demonstratives (particularly “that”) are used non-deictically.¹⁸ At this juncture in development, indexical gestures need to compensate for the lack of linguistic specificity. The meaning of the linguistic cues in the form of demonstrative pronouns is so vague as to be an ineffectual indexical device when used unaccompanied by other indexes, obviating the need for inclusion of gesture. The function of gestural indexes to supply a scaffold for linguistic ones, especially demonstratives, in early development is the ease and commonality of relying on visual cues in joint attention schemes. In fact, Goldin-Meadow (2003: 80) claims that the purpose of gesture in exophoric deictic use is to disambiguate which referent is the object of focus, even in contrastive contexts when at least two similar objects are potential referents.

At 2;1, “that” is still pre-deictic, characterized by its limitation to exophoric uses (Lyons 1995: 56–57; Deissel 2006: 469), dependence on gestural indexes (Clark 2009: 95), together with incomplete social and conversational reciprocity and failure to recognize points of orientation (Tanz 2009: 52–60; West 1986: 68).

Even after 3;0 when children begin to envision themselves in other orientations and a different object of focus might result, the *origo* (self as point of orientation) remains static (West 1986: 115; 2010: 7; Tanz 2009: 87, 125; cf. 2.2.2). Further

¹⁷ While in English, the speaker is the only *origo* for demonstrative use, other linguistic systems encode additional *origos* such as proximal/distal objects from the addressee’s perspective or from the addressee and speaker’s perspective, should they share spatial orientations (Diessel 1999: 36; Burenholt 2008: 101).

¹⁸ Cf. 2.1 and 2.1.1 for a more extended discussion of non versus pre-deictic use.

evidence of pre-deictic use is that the child applies the same demonstrative to refer to objects whose distance is either more or less proximate.

2.2.2 *Deictic Demonstratives*

The unmarked¹⁹ “that” is prevalent in exophoric uses, when the demonstratives are used non-contrastively, that is non-deictically.²⁰ The point at which exophoric uses become contrastive is the point at which demonstrative pronouns become deictic. Contrastive use requires the appearance (in children’s repertoires) of two different demonstratives differentiating near and far space. Consequently, the emergence of “this” demonstrates the onset of deictic use in its exophoric sense. “This” is more often marked and is virtually always restricted to contrastive contexts and its use is more often exophoric with respect to its other uses (Lyons 1977: 311; Tanz 2009: 79–81). If there is but one referent of focus and one spatial orientation “that” is the demonstrative selected for use, be it exophoric, endophoric or shared knowledge based; and “that” is unmarked since it refers to any object beyond proximate space in its contrastive use, and in its non-contrastive use, to any object under focus independent of proximity to any one *origo*. It is clear that “that” is the unmarked member of the demonstrative paradigm in that it has a wider incidence of use and is produced earlier on in ontogeny when compared to “this” (West 1986: 115; Tanz 2009: 87, 125). In contrast, “this” appears in restricted contexts (proximate, contrastive use from speaker’s perspective), and is less frequent in the input and in children’s output.

Findings which support the ontogeny of exophoric use from the unmarked demonstrative pronoun “that” only to the more marked demonstrative pronoun uses of “this” and “that” are derived from two sources: data from earlier ages (from 1;6 to 3;4) from the author’s 1986 longitudinal study and data from Tanz’s (1980; 2009) longitudinal study in which subjects range in age from 3;4–4;9. The design of the former study (West 1986) consisted of a natural speech sample and a cognitive task intended to determine the onset of contrastive demonstrative use, together with elemental contrasts which may be precursors to demonstrative contrasts. Determining that points of orientation exist and are legitimate beyond the child’s own ego-based system is paramount to drawing further contrasts of location and orientation to each *origo* (West 2010a: 6). A viable indicator of children’s apprehension of other points of view is their onset and productive use²¹ of

¹⁹ Although linguistic complexity is an additional factor in determining degree of markedness, it is immaterial in the case of the English demonstratives, consequent to their similar phonetic forms.

²⁰ Like exophoric uses, endophoric uses are non-deictic if they are accompanied early on by pointing/eye gaze, and/or are used noncontrastively.

²¹ Productive use entails both semantic and syntactic variability—employing each pronoun with distinctive verb lexicons and distinctive object NPs, as well as employing them in cases other than nominative, e.g., “me,” “my,” “you,” and/or “your.”

person pronouns, and their apprehension that objects must be oriented differently to account for different *origos* and orientations of those *origos*. Results from the natural speech sample indicate that although subject pronouns were used at 2;0 and beyond, productive use of person pronouns (deictic use) was not operational until approximately 3;1–3;4 (West 1986: 142, 158; 2011c: 95). The onset of person deictic use was determined to surface when children used different verbs with both “I” and “you”—to ensure that each use was not formulaic (i.e., not used in stock phrases). Additionally, first person and second person forms were not productive until each was used as subject, object, possessive pronouns, and the like, such that semantic and syntactic variability was apparent (at approximately 2;10: cf. West 1986: 142, 158, 2010b: 197).

The objective of the cognitive task relative to person-pronoun shifting was to measure at what ages children could make simple social/conversational and cognitive contrasts, requiring person orientation shifts which underlie contrastive demonstrative use. Children were asked to orient moderately novel objects with intrinsic fronts and backs to themselves and to the experimenter. Three trials for each *origo* (child, experimenter) were administered, half of which represented both *origos* facing the same direction, and half facing opposite directions. The children were shown a familiar teddy/doll and were asked individually to “make the doll/teddy so you can see/kiss it,” and “make the doll/teddy so I [the experimenter] can see/kiss it.” Correct responses entailed manipulation of the representational object so that it and the respective human were facing each other (West 1986: 155). During three trials, the experimenter faced the child, but did not face the doll/teddy; while during the other trials, the experimenter faced a similar direction with respect to the child, which still required some orientational shift of the representational object. Systematic and/or correct person deictic use was ascertained if the child oriented the representational object accurately for the respective person form.

Demonstrative use was measured by means of another cognitive task (a simple form of “hide and seek”) in which children were asked individually to find a piece of candy hidden under one of two cups arranged at different distances from the child/experimenter. Eight trials were administered: four featuring “this” and four featuring “that”; in half of the trials the child and experimenter sat adjacent to one another such that they shared the same orientation to the objects, whereas in the other four trials, orientation to the objects was distinct (child and experimenter facing one another across a table). Instruments consisted of two identical cups, each placed face down on opposite sides of a rectangular table. Beforehand, each child covered his/her eyes; then, the experimenter instructed the child to find the candy based on the verbal cue: “The candy is under this/that cup.” The experimenter deliberately refrained from using gestural indexes to single out the appropriate cup. The child was then instructed to select one of the two cups. It was expected that the child’s responses would be more accurate in the “this” condition than in the “that” condition, given its presumably greater salience as a proximal object and more restricted object set. Further, the child’s responses

were expected to be more accurate for both demonstrative pronouns when orientation of the partners was shared, because ego determined *origo* for both humans, and hence, orientation to the object. Systematic use of each demonstrative was achieved when performance in three of the four trials was accurate. Findings indicate that demonstratives were used unsystematically from 1;6–2;7; and systematic use of “this” and “that” to ego alone emerged at approximately 2;8 (West 1986: 156). Performance on the this task demonstrates that the simple perspective-taking shift from ego only as *origo* was on par with performance on the doll/teddy task, and that recognition of ego as *origo* preceded productive deictic use of the person pronouns.

“This” and “that” begin being used partially contrastively thereafter; between 2;8 and 3;4, the demonstrative is used to refer to proximate objects from only a single, static contrast. With contrastive demonstrative use comes first instances of the marked demonstrative “this” and uses of “that” to refer to less proximate objects. Demonstrative contrastive use becomes somewhat systematic only after socially based conversational roles are apprehended, beginning at 3;0, when person pronouns are used deictically (Tanz 2009: 87, 125; West 1986: 115; 2010a: 12). Certain social competencies appear to precede more systematic deictic performance; and full-fledged systematic deictic use may materialize somewhat later in development than the social and psychological skills necessary for their extended use. This underscores the fact that competence for a skill can precede performance; and full-fledged accurate performance may indicate a graduated consciousness of shifting conversational roles. Onset of the indexical use of conversational deictics “I” and “you” takes place from its earliest productions in the second year until the productive use of the symbolic functions of “I” at approximately 3;0 and precedes deictic uses of demonstrative pronouns (West 1986: 51; 2010a: 12; Tanz 2009: 51–52). In fact, in the natural speech sample, none of West’s participants produced “this” until 3;4 and the contrastive “that” was soon to follow (1986: 51). Furthermore, none of West’s subjects reached systematic contrastive demonstrative use, employing another as *origo* even at 3;5, whereas person deictic use appeared to be systematic at 3;0. It is obvious that contrastive demonstrative use depends substantially on recognition of speaker *origo*, but upon the further competence of *origo* and orientational shifts.

Although some systematic demonstrative use is evident at 3;4 (contrasts in location for ego as *origo*), further refinements are needed to advance a full space deictic contrast—additional *origo* shifts and the additional orientation alterations with respect to the objects in question, initially dependent upon joint attention and social reciprocity. Tanz’s (2009: 87, 125) findings based on a similar experimental design (substituting plates for cups, and pennies for candy) indicate that full contrastive demonstrative use is not ascertained until 4;9. Tanz’s subjects ranged in age from 3;6 to 5;0; and even at 4;1 only two thirds of her subjects were able systematically to select the appropriate plate under which a penny was hidden when the experimenter was *origo*, especially when the experimenter’s perspective was reversed with respect to that of the child. Virtually all of her younger subjects

systematically selected the appropriate plate to uncover the penny when the child was *origo* and especially when the child and the experimenter shared orientation to the plates. Children's use of the marked "this" in its contrastive sense with the unmarked counterpart "that," then, appears not to be fully deictic until 4;9. This protracted acquisitional interval is likely to be a result of integration between pragmatic uses of demonstratives and what Nunberg (1993: 20) terms "classificatory" components (tantamount to Peirce's category of legisign; cf. 5.3). The latter entails unconscious knowledge that near and far objects/places are established not by ego, but by the location and orientation of a semantic, conversational classification, that of speaker.

2.3 McNeill's Account: The Non-Redundancy of Gestural and Linguistic Index

The issue of whether gesture and language have an identical/similar function is addressed both in McNeill (1992 and 2005). Relying on Trevarthen's (1977) findings, McNeill makes the case that although their origins are unquestionably linked during the first month (raising the hand and simultaneously moving the tongue and lips), their functions later diverge. Gestural and linguistic representations are alike, in that both are subject to the process of "symbolicization"; but, McNeill determines that the two have distinct functions. McNeill (2005) describes their distinctive, but complementary, uses, such that the use of one serves as a scaffold for the use of the other. More particularly, features of gesture include: globality, simultaneity, and idiosyncraticity; whereas primary language properties are more likely to encompass: analysis, sequentiality, and conventionality. "...The synchrony of gestures and speech puts different semiotic modes together at the same moment... {reflecting} the speaker's cognitive experience...The modes are opposites in multiple ways—global meaning with analytic meaning; idiosyncratic and created on the fly with prespecified for-meaning pairings; imagery with forms regulated by conventions" (McNeill 2005: 91).

These specific functions for language and gesture poignantly coalesce when both gesture and language together use an indexical sign to express a largely directional purpose. Despite their complementary use, language (particularly demonstratives) serves a distinctive role with respect to gesture in the communicative act. "Pointing and demonstratives are not redundant, i.e., they do not wholly overlap in function. Language does not (as a later development) supplant earlier gesture" (McNeill 2005: 38–39). Kendon (1980) and McNeill (1992) claim that indexical gestures accompanied by demonstrative pronouns constitute "co-speech gestures." (Kendon and Versante (2003: 133) recognize the import of gesture accompanying the demonstrative use even into adulthood). The pointing gesture (during adulthood but especially during childhood) appears to take on a more primary location index, while the demonstrative indicates the cognitive focus of the speaker to the referent selected. Pointing here may serve a deontic function, and demonstratives a

more epistemic one.²² In this regard, the pointing gesture impels another to attend (as in imperative use), while the demonstrative labels the speaker's own mental focus (mentally selecting a particular object from among others)—the former affecting another's conduct, the latter identifying speaker's mental notice. Although gestural and linguistic indexes (pointing vs. demonstratives) serve as indexes in their own right, they likewise serve as indexes for the other, emphasizing the other's unique utility. Given that gestures themselves have different functions (more or less abstract/symbolic), and because language is by nature a symbolic phenomenon, one cannot replace the other—rather, they complement one another, fostering mutual indexical effectiveness.

The distinctive function of gestural and linguistic indexes is implicitly taken up in McNeill's account of the ontogeny of gesture. McNeill (1992: 302) proposes that three types of gesture emerge in a rather particular sequence (based on their respective degree of abstractness): pointing (1;0), whole body enactments (1;2), and manual iconics (2;6). Among others, early pointing constitutes a protogesture for McNeill 1992: 300, in that it has "the raw materials with which such communication {intersubjective} is effected..." Early pointing is not yet abstract, since it fails to express a contrast, spatially or otherwise, and is limited in its flexibility not to extend beyond the infant's immediate context (McNeill 1992: 300). Both whole-body gestures and manual iconics are initially protogestures only, but later, between 2;6 and 6;0, become "true gestures," (McNeill 1992: 302–303).²³ McNeill's "true gesture" status requires increased "symbolicization," (McNeill 1992: 296–297). McNeill (1992: 297) characterizes this coalescence/symbolicization as: "a gradual, greater arbitrariness, flexibility and increased contrastiveness...During development there is a gradual process of symbolicization in terms of arbitrariness, flexibility, and contrastiveness."

McNeill (1992: 296; 2005: 101–102) further ascribes both the development of early gesture and its elaborated uses ("symbolicization") to embodied experience, such that later whole body or manual iconic schemes derive from sensorimotor experience, e.g., the whole body gesture for "hot" is the hand waved at midline, as if enacting the experiencer's movement (McNeill 1992: 302). Eventually, physical gestures become arbitrary, flexible and contrastive, especially noteworthy when memory representations take precedence over physical ones. This representational shift from physical to mental representation can be equated with Peirce's concept of the sign–Object connection, since Peirce likewise acknowledges the import of how physical signs evolve into memory representations via decreased dependence

²² "Epistemic" modality refers to the degree of responsibility which speaker assumes for the content of the message—its veracity and source. "Deontic" modality is concerned with the actualization of acts performed by morally responsible agents—a more discourse-oriented phenomenon, given its propositional nature. The latter implies a resultative state or behavior, while the former expresses the speaker's mental state of affairs/cognitions. Cf. Leiss (2008) for a more extended discussion of these modalities.

²³ Morford and Goldin-Meadow (1992) observe that manual iconics are never used concurrently with speech, whereas pointing is commonly paired with speech, namely, demonstratives.

on the co-occurrence of sign and object in the same time and place (cf. 5.2 and 5.3). According to McNeill: “All of the gestures clearly are used to refer to objects or events that are present in memory {at 1;0 and thereafter}, not in the physical environment” (McNeill 1992: 303).

McNeill’s “arbitrariness” requirement for “symbolicization” is tantamount to a primary characteristic of Peirce’s symbol, requiring that the relationship between signifier and signified may not be motivated by likeness or directionality. Arbitrariness between that which represents, and that which is represented necessitates a greater cognitive leap to connect the two than that which is required by association based on likeness or similarity. In other words, a relationship between sign and object which is based on perceptual similarity (as is the case with indexical or iconic sign relations) relies initially upon less complex conceptual skills, since there exists a perceptual trace to formulate an analogy. Absent a motivation to connect the two, as is the case with analogy, children must ascertain that two unlike substances (sign/object) can culminate in a legitimate and reliable connection. Arbitrariness constitutes a more advanced competence in the acquisition of deictic thinking, in that it permits the association of an abstract representation (gestural or linguistic) to a host of applications. Arbitrariness facilitates the application of a sign to a class or host of objects which share one or more abstract qualities or functions. McNeill’s rendition of arbitrariness supports the claim of this author—that recognition of semantic meaning is paramount to more advanced uses of index, viz., the need to classify social and conversational roles underlies full-fledged deictic use. In the case of contrastive demonstratives, semantic meaning is speaker’s as the vantage point to determine near versus far space, defining the locations of objects within each space.

Flexibility, McNeill’s second component of “symbolicization,” entails the means to assimilate new conceptual knowledge into existing schemes and to alter them accordingly. This flexibility lends diversity to previously developed schemes, hence, facilitating the recognition of *origos* and orientational shifts necessary to deictic use.

Together with flexibility, McNeill’s third component characterizing higher mental processing, depends primarily upon pragmatic skills, facilitating the application of a gestural or linguistic index to differing referents in distinct spatial contexts. “Discursive” skills (which constitute the very essence of pragmatic competence) are responsible for higher mental representation necessary to “symbolicization” (McNeill 2005: 116–117).

The third component of “symbolicization” is contrastiveness. Determining contrasts entails an exploration of similarity, as well as difference across objects, events, and orientations within events. Contrastiveness is paramount to deictic use of index, in that near and far locations (and changing locations) of *origo* to those locations are essential to differentiation of spatial limitations.

Once gesture undergoes “symbolicization as whole body enactments or manual iconics,” it, like language, can serve as a “material carrier,” as Vygotsky terms this process. “Becoming a material carrier” according to McNeill (2005: 98) entails the process on the part of gesture and language (separately and together) to be the embodiment of an individual’s image or mental representation. “A material carrier appears to enhance the symbolization’s representational power. The concept implies

that the gesture, *the actual motion of the gesture itself*, is a dimension of meaning. Such is possible if the gesture *is* the very image; not an 'expression' or 'representation' of it, but *is* it. From this viewpoint, a gesture is an image in its most developed—that is, most materially, naturally embodied—form” (McNeill 2005: 98). When this process of materialization depicts more metaphoric meanings, it increases the gesture's/language's means to bring about metaphoric representations. Moreover, materialization permits the uniqueness of pointing as a deontic gesture to coalesce with the epistemic nature of demonstrative use in an embodied single meaning. It is this culminating meaning which supports the social basis of joint attentional schemes.

McNeill's semiotic account of the ontogeny of gesture and language can be likened to Peirce's notion of index, from the purely physically coexistent relationship of index and referent to the coexistence of index and its mental yet coexistent referent, namely, the subjectively created memory/image. This extension demonstrates a transition between a more factual use of index and a more learned/symbolic one. Furthermore, although McNeill constructs the mechanism by which signifiers enhance the use of other signifiers, he fails to identify the social/communicative process to which these mechanisms give rise. More specifically, he ignores the role of joint attention schemes in the development of signification. Such analysis could more clearly define the role of gestural and linguistic indexes in the course of development. Additionally, McNeill fails to capitalize on the distinct role of meaning in the signifier-signified relation, a primary tenet of Peirce's model (cf. 5.2, 5.3).

2.4 The Role of Joint Attention

Much investigation has been directed to the role of joint attention in the early use of demonstratives; but in so doing, investigators have often ignored the classification of joint eye gaze as index. First, we shall explore how pointing is a gestural precursor and bridge to the emergence of demonstrative use, followed by an analysis of social and conversational factors, and finally to mention the semantic, classificatory element necessary to deictic use.

The social component typically requires unconscious linguistic and cognitive skills which rest upon particular pragmatic competencies. Pragmatic competencies include the means for at least one individual to secure a focus for him/her self first and thereafter to attempt to influence another to focus on the same object. The communicative element of joint eye gaze or gaze accompanied by social pointing is to index the object of focus with one index, while employing the other to single out the involved other. Thus, joint attention (impelling the use of two gestural indexes and often accompanied by a demonstrative pronoun) singles out a referent with the notice and/or approval of the other partner. This pragmatic or communicative function of index is but the inception of deictic competence. Later, deictics (especially demonstratives) serve to augment indexical use toward extended inter and intrapsychological thought processes.

2.4.1 *Joint Attention as Social Index*

The function of gesture evolves from a pre-social (exclusively intentional) one in which children unidirectionally focus their attention toward a referent to a social one (Bates 1976: 61). Illustrating the need for the shift from competencies beyond intentional use (to meet muster as more full-fledged gestural indexes) is Levinson's (2004: 101) claim that, "indexicality [is] both an intentional and attentional phenomenon," (cf. 2.1.1 and 2.1.2 for further discussion of the ontogeny of "intentional" gestures). Certain indexical schemes demonstrate intentionality (but not attentionality) in that they constitute a non-ballistic, directed, purposive object attainment for the infant alone, from the inception of the gesture throughout its enactment. Some internal, cognitive and perhaps affective volition regulate the gesture toward obtaining an intended object, underscoring the directional nature of prehension. Infants' earliest use of eye gaze and pointing (gestures employed together) do satisfy Levinson's intentional component, when these gestures are employed in the act of prehension (cf. 2.1). The early absence of the attentional component demonstrates that these gestures do not meet muster to qualify as index under Levinson's requirements. Furthermore, a reliable interpretation of Levinson's attentional component is not forthcoming, since he fails to indicate whether attention must be solitary or joint. Under Levinson's account, gestures could meet muster as indexes if they merely serve to direct the infant's attention alone.

Other investigators require that attention be joint or bidirectional, between infant and another to qualify as indexical. Unidirectional gestural use (such as simply pointing or looking at an object), although attentional, still lacks the bidirectional, social exchange which Bates and others insist is critical to indexical use, especially as a bridge to deictic indexing. When eye gaze becomes joint it ultimately unites spatial and temporal components of the environment, both physically and socially. But unity of spatial and temporal components is not obvious without "an object directed process" (Carpenter et al. 1998: 152) such as intentional reaching. Eye gaze, for example, is still a proto-index at the point at which prehensile reach is developed, since it lacks the joint/social gaze component. Nonetheless, prehension, even though it is a unidirectional gesture, hastens object recognition and discovery which Carpenter et al. (1998, 153) consider to be foundational to the onset of joint attentional schemes. Other unidirectional schemes likewise facilitate the emergence of bidirectional, joint attention exchanges (Crais, Douglas, and Campbell 2004; Thal and Tobias 1992; Volterra et al. 2005; and Pizzuto and Capobianco 2008).²⁴ Reaching with the open hand toward another, giving, showing, and pushing a person/object away from the child for example, are considered to be foundational to developing joint attentional gestures, and hence to social uses of gestural indexes.

²⁴ Crais et al. (2004: 681) extend deictic use even to such behaviors as Bruner's joint attention function, indicating that socially motivated eye gaze is sufficient to qualify as deictic.

When used as a single indexical aggregate, eye gaze and pointing likewise underlie social/communicative competence in that together the indexes secure the attention of another. According to Butterworth (1995: 37) and Carpenter et al. (1998: 147), between nine and twelve months of age, eye gaze and pointing become coordinated as simultaneous directional indexes, both toward the same purpose. Between nine and eleven months, extending the arm and hand for social purposes in taking and giving exchanges, represents an additional index which hastens joint attention and communicative competence (Carpenter et al. 1998: 681; Volterra et al. 2005: 9). But in view of the absence of invariant meanings despite the potentiality of participant shifts, these gestures fail to qualify as deictic; they are merely auxiliary indexes. It is not until eighteen months of age that an adult's eye gaze and head movement alone (as the only index) result in successful joint gaze with the child toward the intended object: "This new ability to isolate the referent of the mother's gaze, as plotted from the infant's position... is definitely present at 18 months" (Butterworth and Jarrett 1991: 63). This indicates that joint eye gaze, when employed without concomitant indexes does not serve as a social index until eighteen months of age when it appears apart from other accompanying gestural indexes, such as prehensile reaching, pointing, and giving exchanges. Prior to their social use, these indexical gestures enhance the use of other indexical gestures; and it appears that only when each is employed independently, as an attention securing device to another, can they serve a social, reciprocal function. Using gestures reciprocally (shifting social roles) constitutes the underlying competence for social gestures.

Giving gestures eventually become social; but, at the outset, they merely express a single direction—they do not initially incorporate a reciprocal role taking component. In fact, before nine months of age giving exchanges consist of a more static unidirectional object transfer in which the child remains as giver only or receiver only (Volterra et al. 2005: 9). Later, shared eye gaze, social pointing, giving, showing and the like, represent quintessential, socially driven, gestural indexes (Bates 1976: 50; Carpenter et al. 1998: 681; Clark 2009: 94). In these gestural exchanges the child has a participatory role and experiences reciprocity inherent in deictic exchanges.

Measures of the onset of reciprocity supersede joint eye gaze and giving-receiving scenarios encompassing infant's use of gestural and linguistic performatives.²⁵ Many investigators claim that until gestures are used as performatives (either declaratively or imperatively), they cannot be deictic, which presumes their status as indexes. Rationale for this claim rests upon the fact that social skills underlie the use of performatives—affecting another to conform to the infant's desire implies the recognition of the potential effect of one party upon the other. This claim supports the primary role of social exchanges in the evolving character of index, and of deixis in particular. Most uses of imperative performatives

²⁵ Performatives can be gestural and/or linguistic. They indicate the intent of one party toward an event in which another party is participating, and in so doing, performatives often influence the behavior of non-agents in the event to satisfy the wishes of the agent.

(as opposed to declarative performatives) express social competencies, in that they induce another party to comply with the implicit command of the speaker.

Nonetheless, declarative performatives may not qualify as deictic, if they identify an object for the child's use alone without securing the attention of the addressee. Looking at, or saying, "milk" without gazing toward the interlocutor and without command-like intonation or stress represents a declarative performative which may be devoid of social reciprocity. Bates is one of the first to claim that early (fourteen months of age) primitive indexically based social actions without linguistic accompaniment (performatives), such as pointing, constitute social, and perhaps deictic use: "This series of steps—point at object, point at adult, point at object—put together in a chain form the components that eventually form the smooth deictic act of simultaneously pointing at an object while turning to the other for confirmation" (Bates 1976: 303). Bates appears to indicate that the presence of social exchange is sufficient to constitute deictic use. But, social exchange, although necessary to deictic use in the form of performatives, is still insufficient to qualify as deictic.

Using a similar rationale that indexical/directional gesture is sufficient for deictic use without social reciprocity, Volterra et al. (2005: 9–10) consider gesturally directional performatives, e.g., giving, showing, pointing, and ritualized requests likewise to be deictic gestures. Their rationale entails the claim that giving illustrates the trajectory of object transfer and the intent/purpose of each agent in the dyad to elicit a response from the partner. Yet, these investigators assume all exchanges to consist in semantic role templates, and hence are deictic (Volterra et al. 2005: 9): those which are declarative (statements which contain a claim) as well as imperative (those which more explicitly demonstrate to the receiver how the agent of the performative wishes them to proceed). These investigators assume without careful analysis that a simple indexical/directional exchange (how one member of the dyad affects another) is sufficient for deictic use. Their analysis merely considers pragmatic shifts and not the underlying semantic role, assumable by any party. Absent from their analysis is whether these early social, directional gestural schemes qualify as symbolic.

Such interactive focus (although necessary to the development of deictic use) is purely pragmatic—dependent only on shifts within a dyad. These pragmatic considerations merely reflect shifts from infant to another and the reverse, enacted without acknowledging the semantic nature of social role-taking. While certain components of object exchange and securing dual focus are cognitive in nature, they unquestionably depict communicative, pragmatic (but not social semantic) competencies. Gestural schemes acquire a pragmatic turn when a communicative (but not socially conventional) function motivates their enactment. This communicative turn-taking begins after eight months of age when children secure the cooperation/attention/focus of another.

The social/interpsychological function of gestural indexes (such as eye gaze, pointing and the like) assumes that the producer of the gesture (the child) at early stages of indexical use intends to direct the attention of another toward the producer's object of focus. Directing the focus of another is a deontic enterprise, in that it

involves children's attempts to influence the perspective/focus of another—to make it conform to their own. This communication-based gestural performative expresses a wish to secure the attention of another, such that it reflects the child's focus only.²⁶ In large part, performatives appear not to constitute epistemic revelations, since their function as performatives is not to disclose/identify a concept or fleeting cognition of the child. Performatives appear to fall short of deictic use, even though their character is communicative, because they often do not acknowledge the full reciprocity inherent in turn-taking exchanges, hence performatives constitute indexes which support pragmatic (not semantic) competencies necessary, but not sufficient for deictic use. Performatives are indexes which evolve into social embodied experiences via pragmatically driven components, namely, turn-taking scenarios, characterized by participant shifts.

Nevertheless, pragmatic turn taking needs semantic classifiers to ascertain deictic uses of index. Integration of semantic meaning with pragmatic meaning impels deictic advances, i.e., recognition of the legitimacy of several *origos* whose slot is filled by innumerable potential participants assuming the same role; these participants need to be perceived as having several potential orientations to objects. In this way, index becomes the agent for coalescence of semantic and pragmatic meaning, such that they inform one another to arrive at the particular intended reference. This developmental course is supported by Werner and Kaplan (1963) and Karmiloff-Smith (1979). Werner and Kaplan underscore the fact that symbolic functioning is a primary benchmark toward the emergence of increased gestural and linguistic functioning; but they do not adequately define "symbolic functioning." Karmiloff-Smith asserts that between 2+ and 5 years of age, children develop the means to express relations between persons, objects and events. Her assertion capitalizes on the essence of symbolic functioning. The development of deictics then follows a similar path—from non-contrastive uses to relational, symbolic, contrastive ones. Use of symbolic meaning together with apprehension of the shifting orientation of distinctive *origos* (e.g., "this," "that" designating an object of focus) are paramount to full fledged deictic use. What qualifies as deictic must involve apprehension of indexical shifts together with application of invariant meaning of a functional role (symbolic meaning) and later designating the object's distinctive places and their *origos* as in "this" versus "that."

Despite the critical place of social index in the ontology of deictics, additional augmentation of spatial and orientational skills are still vital if index is to be deictic. Early indexical gestures and emergent demonstratives consist in either a context driven use, or in a socially motivated use only, apart from their symbolic use as having a general meaning in the code. To extend indexes to their deictic use, children must apprehend a general/symbolic meaning which goes beyond the primacy of assuming social, reciprocal roles. In sum, early indexical gestures (pointing, arm extension, eye gaze, performatives, and the like) are insufficient

²⁶ This deontic purpose may not consist in turn-taking if the performative expresses the child's wishes only, and not those of the other partner.

in themselves to qualify as deictic, in view of children's lack of apprehension of semantic meaning—discernment of invariant roles within which participants fit. In other words, these early indexical uses fall short of deictic use in that their pragmatic and perhaps their social import is recognized to the exclusion of their semantic import.

2.4.2 Reference to Absent Objects

The development of index plays a primary role in hastening the onset of absent representations, in that it constitutes the most basic of signs in ontogeny—its meaning derives entirely from the object in Secondness (cf. 5.2). In other words, invariant/conventional meaning does not need to be ascertained early on; rather, infants can have the object suggest the meaning as a consequence of the directionality of the index. Emerging cognitive and social skills which rely on index, such as object representations, and joint attention together underlie infants' competency to think about and/or refer to absent objects and events. Social indexes necessary to the representation of absent objects include: tracking others' experience, differentiating their own from other's experience, establishing mutual knowledge, and social pointing. Indexes enlisted in developing these competencies are: gaze-following, pointing, arm extension, social pointing, and social gaze. Particular cognitive skills foundational to absent object related competencies include: recognition of familiar objects/episodes, object permanence, associating and disassociating objects from places, holding information in WM for at least two minutes (Ganea et al. 2007: 736), and making modifications to LTM representations of prior objects in context. Involved indexes largely consist in: gaze coordinated with intentional hand and arm reach, memory of particular locations associated with certain objects, altering in LTM the original correspondence between certain indexes and their locations, and the like.

While some of these cognitive and social skills overlap (both within and across skill groups), and while they are not meant to be exhaustive of those which contribute to absent object representation/reference, they directly influence infants' readiness to determine that an object typically present is not so. All of the more elementary cognitive competencies depend upon WM and LTM systems which become sufficiently developed to handle sustained records of integrated events (cf. 2.1 for a discussion of early ontogeny of WM).

Mental records of events gradually become more sophisticated between one month of age (when objects and faces can be tracked) (Meltzoff and Moore 1977: 75) to engaging in joint attention exchanges wherein an object becomes the focus of a dyad, at fourteen months of age and beyond (Bates 1976: 61), (cf. 2.4.1).

Prior to the onset of language, measuring enduring mental representations of non-present objects requires careful and inventive planning, since, without language, inferring from implicit behaviors presents challenges of validity and reliability. Measures consist of: neural imaging methods (event-related potential, ERP),

gestural indexes, such as length of eye gaze toward an attribute of a previously presented object, or search for a hidden object previously observed. According to Leslie and Kálldy (2007: 112), ERP findings demonstrate that prior to use of gestural indexes, infants encode and perhaps store objects together with their locations as young as 0;6—activity in the temporal lobe increased upon disappearance of an object, and still more increases were recorded upon its occlusion. ERP findings provide evidence of early onset of mental representations which include encoded indexical information, such as the object's location. Such suggests that mental indexing is underway concurrently with the onset of object files (cf. 2.1), and well after production of the first indexes—intentional reach. Nonetheless, infants at 0;6 do not employ intentional gestures toward an occluded object (Reznick et al. 2004: 146).

Measures and design paradigms reflect infants' age, and hence length of time that the previous presented object can endure in memory, i.e., temporal capacity to hold absent object in WM/LTM. Accessing remembered, non-present objects appears to begin at 0;5–0;6 (Baillargeon 1993: 274)²⁷ and develops such that the representation is maintained in WM for increasingly greater intervals—seventy seconds by 0;8 (Baillargeon, DeVos and Graber 1989: 349; Baillargeon and Graber 1988: 509). Their “hide-find” procedure elicits the use of longer visual attention (eye gaze) toward the previously presented object emerging from a different hiding place. The assumption is that infants look longer when they perceive a difference between where they remember the object to have been and where they later observe it to reappear (Reznick 2007: 7). The mental representation of the previous place characterizes an index which is held in WM (and constitutes a memory of an absent object) to be compared with the object in an unexpected place. Gaze-as-index here serves as an invaluable measure of a mental index—the object's initial location.

The developmental advance—apprehending that hidden objects likewise have substance, and that directional, intentional extended reach can access hidden objects—indicates the extension of index from coexistent sign with its referent to include some physical or spatial displacement between the two. This hide-find competency enhanced by gaze and reach indexes develops over a rather lengthy course, a ten month period (Mandler 2004: 33; Saylor and Ganea 2007: 700). The protracted nature of the acquisition of hide-find skills is to be expected, given the reliance on indexical and cognitive competencies—coordination of visual and tactual indexes, and gradual attenuation between sought-after object and its place(s). This latter competence requires the means to recognize the identity of the same object upon observation of its transfer from an initial hiding place to others. Although this recognition appears to be in place by 0;9 (Leslie and Kálldy

²⁷ While both groups of infants (4.5 and 5.5 months) looked “reliably longer” at the object being occluded, it is unclear (at Baillargeon's admission) what the younger infants were attending to: the rotating screen occluding the object, or the occluded object itself (1993: 271). Consequently, additional investigations need to more firmly establish when these competencies emerge.

2007: 116), searching in other hiding places (with gestural indexes) does not surface until 1;3–1;4 (Piaget 1936/1952: 337–338; Saylor 2004: 600; Saylor and Ganea 2007: 700). Reliably searching in the last hiding place indicates attenuation between object and location, necessary to determine index's referential intent (to the place or the object). Rationale for the delay between onset of mental indexes (locations of objects/people) and the use of gestural indexes to single out objects appear to lie in the interference in WM brought about by the use of gestures as auxiliaries. Their implementation draws upon limited WM temporal and spatial resources (cf. 2.1). In particular, visual fixation (gaze), “negates the use of working memory” (Bell and Morasch 2007: 32). While Bell and Morasch's claim may overstate the case, the attention required to use and coordinate gestural indexes appears to, at least, nearly expend the small number of WM chunks at infants' disposal. When these indexes are used unconsciously, fewer WM resources are required for that task, permitting remaining resources to be used for other types of processes.

At the outset, gestural indexes are less coordinated (use of a single index); but, after 0;8 coordination of gaze and reach, and pointing thereafter materialize. This is so as a consequence of the sustained spatial cohesiveness afforded by gaze, permitting simultaneous visual encoding of several objects, together with their respective locations. Conversely, other indexes (pointing, reach) have the capacity to distinguish a single object; hence, their means to serve unambiguously as indexes emerges later, and perhaps assumes the place of gaze prior to its social function.

Necessary to a more amplified hide-find competence is a social skill, namely to engage another by means of joint eye gaze, emerging at 1;0 and continuing to develop until 1;4 (Saylor 2004: 608). Index here is pivotal to the advancement of hide-find competencies, in that it is the vehicle by which each partner looks at the other for confirmation of success. Likewise at this age (1;0) infants demonstrate sustained gaze of a salient attribute of an absent object, e.g., color, shape (Saylor 2004: 602–603; Saylor and Ganea 2007: 698), which can be held in WM for as long as two minutes (Ganea and Saylor 2007: 498). It is at this point (when gaze and reach are united as joint indexes) that chains of events, such as hide-find scenarios become fully operational. These two coordinated indexes facilitate synthesis (in VWM) of the object's previous hiding place(s) with the last location where it was observed to have been hidden. Success at the hide-find task draws upon coordinated mental indexes representing two or more locations, requiring further organization of cause-and-effect temporal coordinates.

Use of coordinated gesture to refer to unfamiliar absent objects (upon introduction during the experiment) is only sporadic at best at 0;11 (Gallerani et al. 2009: 290); but, coordinated gestural use in the form of crawling/gazing toward an absent unfamiliar object becomes more frequent thereafter (Saylor and Baldwin 2004: 258; Baldwin and Saylor 2005: 136). At approximately 1;3, coordinated reach for hidden objects (in opaque containers) surfaces (upon request); nonetheless, a present anchor (a physical cue in the environment) is necessary to elicit deployment of this index (Saylor 2004: 600; Saylor and Ganea 2007: 700). It is

evident that the use of indexes to refer to absent objects relies upon sustained visual memories and upon facilitated uses of index to differentiate the possible locations from the actual one (last placement). At 1;4, recognition of absent referents (those hidden in the environment and/or beyond) is restricted to familiar objects/people. In fact, it is familiar people whom infants first recognize upon their reappearance via gestural indexes (Gallerani et al. 2009: 291). Afterward, at 1;6, infants begin recognizing familiar absent objects upon their reinstatement into the environment; and still later unfamiliar persons are recognized (Saylor and Baldwin 2004: 548; Baldwin and Saylor 2005: 136).

In the course of acquiring the means to recognize and later refer to absent objects, index graduates from a purely unidirectional ego-oriented instrument to a bidirectional, socially-based tool with which children initiate, receive and validate their attention to a non-present entity, whose physical and functional attributes are not immediately observable. Recognition of absent objects is the index which precedes reference to same, thus employing index to connect with a referent without existential contiguity.²⁸ This stage represents the transition between purely physical coexistence of sign and referent (Peirce's primary requirement for degenerate index) and a more attenuated (spatially and perhaps temporally) relationship between index and object (Peirce's requirement for genuine index: cf. 5.3).

At 1;8 children begin using language to refer to absent objects by means of coordinated gestural and linguistic indexes, gesture in the form of pointing/gaze and single words (Capirci et al. 1996: 652–653; Clark 2009: 166; West 2010a: 3, 2010c: 373, 2011c: 92; Moulin-Frier et al. 2011: 198), which is a rather protracted process (Sachs 1983: 5). When multiword utterances are in place, children apply a formulaic pattern to a new context (e.g., “all gone” water, “all gone” sticky). “All gone” refers to an object/state which has been recently consumed/removed (Capirci et al. 1996: 652–653). Neither gestural nor linguistic indexes assume the function of the other. In fact, one serves as a scaffold for implementation of the other (McNeill and Duncan 2000: 157–158). Semiotically, one of these indexes can serve as a more primary index to direct attention toward the use of the other, e.g., pointing may precede the linguistic utterance, as well as unequivocally establishing which object from among many is the intended referent. This graduation from ego only as *origo* to other legitimate *origos* is but one illustration of the transcendence from ego-centered and unitarily ego-driven events and effects of events to an inter-psychological perspective in which events can have any number of agents and can be experienced by multiple participants and non-participants alike.

Requiring that indexical signs spatially and temporally co-occur with their referents precludes the use of physical indexes to refer to displaced objects (hidden, absent and the like). This requirement for physical contiguity relegates mental signs (memories of objects not visually apparent) to a more iconic function. Despite the

²⁸ Interlocutors' use of indexes likewise serves as a precursor to infants' own gestural and linguistic indexes. Gallerani et al. (2009: 284) indicate that caregivers' use of past and future syntax, where questions, and epistemic mental state terms facilitate infants' reference to absent objects.

symbolic function of mental signs e.g., envisioning an experience with non-present objects, such signs can operate to invoke a gesture/deictic term, indicating the conspicuous absence of an object/person ordinarily present. The recognition of and/or reference to an absent object (expected to be present) in the spatio-temporal milieu appears to serve as the catalyst for the use of demonstratives and gestural indicators to point toward the place of the non-present object; consequently, the use of indexical signs toward places where conspicuously absent objects are typically located appears to characterize a transition in indexical use beyond that which is purely existential, extending Peirce's basic characteristics of index. Recognition of, and reference to, absent objects develops in conjunction with joint attentional gaze, validating the supreme influence of social interaction in semiosis.



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