INTERSUBJECTIVITY AND INTENTIONAL COMMUNICATION

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Abstract.
Taking the general definition of intersubjectivity in terms of a mutual sharing of experiences as its starting-point, the present inquiry aims to give an account of intersubjectivity that will detail its role for the development of intentional communication. This requires, however, an account of intentional communication that permits identifying those of its constitutive behaviours that are as well intersubjective; behaviours that do not involve intersubjectivity will not be vulnerable open to its influence. Section 2 provides such an account, and then establishes that types of referential behaviour and of such that indicates communicative intent are intersubjective. Section 3 brings up some data on pointing, visual attention contact, and gaze following – behaviours that in the preceding section have been identified as intersubjective. The data shows that these behaviours may appear well ahead of the time at which intentional communication normally is held to emerge. A few general suggestions as to why they nevertheless do not result in the onset of intentional communication are discussed and found wanting. Instead a search is launched for individual factors that might explain the contradictory data on intersubjective behaviour and intentional communication, while still being general enough to be useful for the inquiry concerning the global relation between intentional communication and intersubjectivity. In sections 4 and 5, three factors are discerned that fit the desired profile, pertaining to, respectively, the relation of intersubjectivity; the various forms that intersubjectivity may take in contexts of use as determined by the kind(s) of sharing between sender and observer which occurs in that context; and finally, the processing modes and processing levels of intersubjective behaviour. These factors all have varieties, making it possible to, by changing either the strength and form of individual factors or exchanging factors for each other, experimentally as well as conceptually (in theory construction) test the over-all relevance of each factor for specific elements of intentionally communicative behaviour. Finally, in section 6, a general perspective is taken on the relation between sender and observer, criticising attempts to model it in terms of, first, instrumental action, then, co-operation. The discussion pinpoints yet some intersubjective aspects of intentional communication, and ends in the claim that a primordial self-other equivalence constitutes the source of intersubjectivity.

1. Intersubjectivity

Few people would disagree with the statement that intersubjectivity plays a critical role for language acquisition and is central to intentional (preverbal) communication. Yet not many would agree about its exact significance. The concept of intersubjectivity has a number of uses, most of them not reducible, and the concept's inherent ambiguity makes the statement difficult to assess. The question that the present article sets out to answer springs from the numerous uses of the concept of intersubjectivity and the many behaviours to which these uses refer. It concerns *the nature of intersubjectivity* and how to describe *its precise role for the development of intentional communication*.

An example of intersubjective behaviour that is decisive for the development of intentional communication is active reciprocation, or 'proto-conversation', between infant and care-taker. It is a kind of *dyadic engagement*, consisting in vocalisations and episodes of repeated, rhythmic exchanges of gaze and facial expressions that reflect emotional states such as social smiling. Another example is *attention-reading*, by which an agent's goal-directed intentions, or intentions for action, can be recognised from

observations of the agent's bodily posture, behaviour, head and body turn, and other manifest attentional states.[1]

Active reciprocation and attention-reading exemplify the most frequently discussed types of intersubjectivity in contemporary research. The first type consists in mutual, first- and second-person engagement and joint activity, the second in a third-person understanding of other agents' actions as observed from an external perspective. The notion of a shared mind is crucial for both types, yet, as it presently will be argued, the ways in which the sharing of the mind supports them are several, and so are the ways in which minds can be shared.

In its most advanced form – as seen from an evolutionary and cognitive point of view, attention-reading is replaced by a so-called *theory of mind*, *i.e.*, the ability to 'mentalise', or mind-read, the mental states of others in order to explain and predict their behaviour (*cf*. Premack & Woodruff 1978). Being able to attribute beliefs and desires to other agents, and then generate higher-order beliefs allows for drawing propositional inferences about their mental states and counterfactual reasoning about their motives and preferences. However, having a theory of mind cannot be necessary for intentional communication, which characteristically occurs in infants who cannot conceive of the mind along those lines.[2] Theory of mind and dyadic interaction are two of several aspects of intersubjectivity, and attempting to account for its role for intentional communication by examining merely these aspects cannot possibly do justice to its complexity. This is not to deny that theory of mind and dyadic interaction in some form or other should constitute the cornerstones of a comprehensive explanation of intersubjectivity.

In developmental psychology, intersubjectivity usually is defined as a *deliberate sharing of experiences* about objects and events (*cf*. Trevarthen & Hubley 1978; Stern 1985). An innate desire to share experiences is held to be the driving force behind the young infant's engagement with others, assuming that subjective experiences are consciously aware, or self-conscious, in a qualitative and value-ladden manner. And indeed, sharing is implicated in intersubjectivity, and it does involve an experiential quality, or phenomenal feel. However, the sharing of experiences is not necessarily deliberate, but *can occur unintentionally* in the obeserver, *e.g.*, as resulting from dyadic engagement, which characteristically is highly emotionally laden. During the very first dyadic encounters between the young infant and its care-taker, the adult's expressive behaviour will provoke inadvertent emotional reactions in the infant (Gallese *et al*. 2004).[3]

An unintentional sharing of experiences can also arise by *attentional contagion*. Attentional contagion occurs when an agent's behaviourally manifest re-orientation towards a target causes an attention shift in the observer towards the same target. The

[1] States of mind ('mental' states) with both experiential, or phenomenal, and bodily correlates are publicly available, and may be indirectly accessed by way of their behavioural manifestations. Such behaviourally manifest states of mind convey information about an agent's current attention, goal-directedness, desire, and emotion. – For instance, a variety of emotions have characteristic bodily expressions that vary from type to type, each emotion type eliciting a similar range of responses in the agent across cultures and ages. By the same channels, information concerning an agent's attitude and interest is available, although in less specific form (Brinck 2004; Bühler 1990). Consequently, intentional agents can direct their actions not only at other agents' behaviourally manifest states of mind, but also at those states of mind that surface in behaviour while being intrinsically independent of specific behaviours, such as moods, desires, and concern.

[2] Whether a theory of mind is required for language acquisition and verbal communication is uncertain to say the least. See the discussion of the webconference *Issues in Co-evolution of Language and Theory of Mind*, arr. by the Institute of Cognitive Sciences, CNRS Lyon (2004) at http://www.interdisciplines.org/coevolution

[3] That the infant's sharing of emotions is undeliberate during its very first episodes of dyadic engagement does not, of course, exclude that at a somewhat later stage, a desire for sharing emotional experiences will motivate the infant to engage in proto-conversation.

attention can in this sense be automatically re-oriented, because the item that attracted the observer's attention will be causing the attention shift while it is still being processed on a subpersonal level of the brain (*cf*. Chawarska *et al*. 2003; Driver *et al*. 1999). Subpersonal processing of perceptual input occurs in the so-called pre-attention system of the brain and is not available to conscious awareness, which means that the observer cannot access the process and inhibit the attention shift before it occurs.

Although attentional contagion will provoke joint attention without engaging conscious awareness, nevertheless it can result in an experiential sharing of emotions around the target, because emotions too are contagious. Given that the target triggers emotional reactions in the agents, their bodies and behaviour will reveal the arousal that the emotions are causing in them and thus draw each other's attention. Focusing the attention on the bodily manifest emotional state of the other then will cause a corresponding emotional experience in the observer.

The thought that the intersubjectivity of infants is driven by an innate urge to share emotions and experiences loses some of its plausibility once it is made clear that bodily expressions of emotion automatically trigger similar experiences in observers as in the agent. Consequently, intersubjective behaviour may be driven by factors that are unrelated to intersubjectivity *per se*. Besides, even granting innate emotions, the existence of a desire that specifically would cause intersubjective engagement does not seem very probable. The reason is that although a rudimentary capacity for experiencing basic emotions is hard-wired in the limbic system, more nuanced and goal-related emotions develop in time through the infant's continual exploration of its environment. Hence, it is doubtful that the desire for mutual emotional experience might constitute the force behind the infant's very first dyadic engagements.

As illustrated by the present discussion, intersubjectivity proves to be a multifaceted phenomenon. Describing it as a sharing of experiences is correct, but does not reflect its complexity. Given that intersubjectivity is a relation of sharing between agents, a vital question concerns the *nature of sharing*.

Consider the following tentative definition: Intersubjectivity is *the mutual sharing of experiences between two (or more) agents*. That a relation is *mutual* in an unrestricted sense means that it is *common to both* agents. Mutual intersubjectivity permits sharing something that is external to the agents, say, an object of attention (a toy) or a ritualised activity (repeatedly giving and taking back a certain object). But it does not imply the involvement of the agents with each other, one that would be internal to and made explicit in the interaction, nor the sharing of experiences, since two agents can perform a series of actions in tandem without being consciously aware of interacting. Intentional communication will not be pursued in case one of the agents neglects active participation, because intentional communication is an open-ended process that cannot be run automatically, nor according to a given recipe. Yet the fact that reflexive behaviour may occur within the scope of a communicative act to scaffold or implement intersubjective behaviour must not be forgotten. To conclude, the first definition of intersubjectivity does not express the collective and interactive dimension of intersubjectivity that is essential for intentional communication, but still may characterise single elements in complex behaviour.

The word 'mutual' has another, more specific meaning, to the effect that an action, property, state, or object is done, possessed, or attended to by each agent with respect to the other. This stronger sense of the word underlines that the relation of intersubjectivity connects the agents jointly, as a unit, and further that their actions, properties, and states actually are related to each other, and hence interact. *Interactivity* is a property of agents that signifies mutually acting so as to directly affect the other, and that supports turn-

taking (the mutual co-ordination of actions in time), which is integral to intentional communication. Thus the second definition incorporates interactivity into mutuality, and in addition characterises intersubjectivity as *reciprocal*, or alternating.

The requirement that the agents' actions, properties, and states be *complementary* will further strengthen the concept of intersubjectivity. Complementary intersubjectivity consists in *matching* by either *imitation* of action, which promotes identification with the other agent, or *completion*, which makes possible role-switching. In complementary interaction each turn that is taken will achieve the previous one, and constitute either a prolongation of or a reaction to the other agent's behaviour. The third definition concerns the strongest kind of intersubjectivity that occurs in infant-adult interaction.[4]

Thus having completed the definition of intersubjectivity by describing the relation of sharing as of increasing strength and agent involvement, the next section will give an account of intentional communication that among other things uses the present definition to establish which of its constitutive behaviours are intersubjective.

2. Intentional communication

Intentional communication is the nonphysical and nonverbal, co-ordinated interaction between (typically) two agents relative to a distal object in common space, the primary goal of which is to establish principally visual joint attention. It is essentially triadic, and enables the agents to influence each other's behaviour indirectly, yet consistently, by way of the attention. Characteristically, the means of attaining the goal are flexible. The agents adapt them to their own needs and expectations and the contextual constraints. The paradigmatic example of intentional communication – nonverbal reference, or pointing[5] – is found in human infants and, arguably, the Great apes, and is used to direct the attention of the observer to a target (Brinck in press).[6]

Below, intentional communication is described from the sender's perspective by four types of behaviour, which subsume the varieties of communicative behaviour that may occur in acts of nonverbal reference. The behaviour types are identified by their respective functions, which they retain across contexts.[7]

(i) *preparatory*, or attention-getting, *behaviour*, *e.g.*, gesturing, vocalising, or other perspicuous sounds and behaviours, performed in order to draw the observer's attention to the sender

[4] This does not entail that complementary intersubjectivity is more advanced than reciprocal intersubjectivity; rather, the complexity of the processing is increased, while still occurring on the sensorimotor and perceptual levels.

[5] In the research on intentional communication, the pointing gesture usually is understood in a broad sense, typically as the extension of the arm and hand with or without the index finger outstretched towards a distal target. It can as well consist in a movement of the head and/or some other body part projecting a vector from the body towards the target. Likewise, ostensively performed reaching movements may acquire a function similar to pointing in case the agent is not persistently trying to decrease the distance between itself and the target, and the grip of the hand is not explicitly adjusted so as to fit the target.

[6] The term 'sender' (in the masculine) will be used to refer to the agent who is initiating the communication, and the term 'observer' (in the feminine) to the agent on whom the sender is acting, *i.e.*, the agent for the benefit of whom the sender performs his action.

[7] The present description of intentional communication globally agrees with Bard (1992), Bates *et al.* (1979), Leavens, Hopkins & Thomas (2004), and Leavens, Russell, & Hopkins (2005), and applies to human infants and Great apes alike. There is no *prima facie* difference between intentional communication in apes and infants, or any other species or group of agents for that matter, since the fundamental character of intentional communication is independent of by whom it is put to use. However, the use to which it is put might vary between different groups of agents.

Preparatory behaviour will – if recognised by the observer – *take control of the contingent circumstances* of the context of use, and set the scene for the ensuing interaction between sender and observer.

(ii) *communicative-intent indicating behaviour*, *e.g.*, gesturing, gazing, vocalising, touching, *et cetera*, performed relative to the attentional status of the observer, displaying the sender's intention to interact face to face with the observer, and sometimes terminating in attention contact

The communicative-intent indicators are *constitutive* of acts of intentional communication, and *initiate* the act in *making the sender's intention to communicate explicit*.

(iii) *referential behaviour*, *e.g.*, pointing, or visual orienting in the direction of the target, serving to guide the observer's attention to a distal target

The referential behaviour *fixes the content of the act* by primarily indexical means, although iconic gestures and bodily movements can be used to do so too.

(iv) *essentially intentional behaviour*, *i.e.*, persistent behaviour until reward, and elaboration of behaviour when repeated attempts to communicate fail.

Essentially intentional behaviour is distinctive of intentional communication, because it shows that the agent understands that "different means may be directed toward the same end and that the same means may be used for different ends" (Tomasello & Call 1997: 361). To wit, understanding the intentionality of action involves recognising not only that others are causal agents able to generate goal-directed behaviour spontaneously, but that they are intentional agents who can select their behaviour by choosing among alternative means to reach the goal.

Bates (1979) emphasises the central position of essentially intentional behaviour in the following definition of preverbal communication, which has been of great importance for later research:

> Intentional communication is a signalling behavior in which the sender is aware, a priori, of the effect that the signal will have on his listener, and he persists in that behavior until the effect is obtained or failure is clearly indicated. The behavioral evidence that permits us to infer the presence of communicative intentions includes (1) alternation in eye gaze contact between the goal and the intended listeners, (2) augmentations, additions, and substitution of signals until the goal has been obtained, and (3) changes in the form of the signal towards abbreviated and/or exaggerated patterns that are appropriate only for achieving a communicative goal (*ibid*.: 36).

Bates' second condition recapitulates the description of essentially intentional behaviour, focusing on the process of selection-for-action. The third condition concerns the fact that in intentional communication the means may, after having been selected for action, be adjusted to the end according to the constraints put up by the context of use. Except for the time, place, and object of the interaction, these constraints involve both sender and observer. Hence intentional communication requires a stronger kind of intentionality than a mere capacity for goal-directedness, which takes into account only constraints pertaining to the layout of the context as it is perceived by the agent.

Crucially, essentially intentional behaviour does not arise on the same level as the other behaviours, but plays a particular role for communication. It strengthens the sender's behaviour in a quantitative fashion. In spite of serving as a litmus test for intentional capacities in the sender, essentially intentional behaviour cannot be central to intentional communication as such, not having an individual communicative function in itself, and so not conveying a content of its own, nor inducing one in the observer.

Rather, it constitutes a *meta-operation* on those first-level actions that have been selected by the sender in the context of use, and hence functions as a *tool for improving and repairing* on-going communicative behaviour.

Of the four types of behaviour, only *the second and the third are intersubjective*. That communicative-intent indicators and referential behaviour are intersubjective is demonstrated by the fact that these behaviours will fail, or misfire, unless they cause the sender and observer to share as prescribed by the intersubjective relation. In the first case sharing concerns the intention to communicate, in the second it concerns the target or referent. The two behaviours can be intersubjective in either of the mutual, reciprocal, or complementary ways. Which strength the intersubjectivity relation in fact will have in the individual case depends on mainly three factors: The abilities of the agents; to which extent the context can scaffold the interaction; and the agents' individual motives for engaging in communication with each other.

Preparatory behaviour obviously is not intersubjective, neither depending on, nor directly issuing in a sharing of sorts. It functions as a signal with the purpose of eliciting a specific behaviour in the observer, *viz*. a re-orientation of the attention towards the sender. Attention-getters prepare for communication, which means that they make possible intersubjective behaviour. Finally, essentially intentional behaviour inherits its intersubjectivity from the behaviour it is invoked to enhance.

Determining at which points intersubjectivity occurs in intentional communication concludes the account. Now a discussion follows of the inception of intentional communication in development, which reveals that quite a few intersubjective skills appear several weeks before intentional communication normally emerges. Despite this, intersubjectivity is the most commonly cited triggering factor of intentional communication.

3. The onset of intentional communication

In human infants, the *pointing gesture* first emerges around 10 months of age. Referential pointing is produced reliably some time between 12 and 15 months, which is to say that intentional communication occurs around or shortly after one year. The fact that it occurs at this time is somewhat puzzling, because capacities that seem sufficient to enable intentionally communicative behaviour have been observed to be in place much earlier. For instance, 7-month-olds have been reported to follow pointing when it is initiated by eye contact and a subsequent head and gaze turn towards the object (Striano & Bertin 2005). That these capacities all pertain to the passive role of an observer does not in itself constitute a problem, because as a rule infants first learn to understand communicative acts and shortly after to perform them (Camaioni *et al.* 2004). One might think that once they have occurred, and the infant has been exposed to them for some time, they would become part of the infant's action repertoire.

As for *mutual attention*, an early preference for eye contact has been observed in 2–5-days-old newborns, who attend to direct, but not averted, gaze (Farroni *et al.* 2002). Experiments on slightly older infants indicate that eye contact in newborns may facilitate later face processing and perception of *gaze direction* (Farroni *et al.* 2004). Perceived lateral motion will cue spatial location in four-month-olds if preceded by eye contact (Farroni *et al.* 2003), an effect that is analogous to the one resulting from referential gaze-reading. – Young infants react differentially to perceived motion depending on the conditions (Farroni *et al.* 2000; Farroni *et al.* 2003). Cue-driven saccades, before the appearance of the target is recorded, are elicited when the model's pupils shift from a central position to either side. The pupils do not have to occur in the context of an upright face for this effect. Target-driven saccades, in the direction of the target, are elicited only

after a period of eye contact with an upright face. The infants will then react equally to directed movement of either head or eye gaze (pupil shift).

By 6 months, infants match direction of gaze as signalled by head turn within their own visual field (D'Entremont 2000; D'Entremont *et al.* 1997; Morales, Mundy, & Rojas 1998). This indicates that an initial eye contact is less important for the matching of direction at this age than for younger infants. Around 7 or 8 months of age, infants start *alternating gaze* during so-called social referencing (Campos & Steinberg 1981). In ambiguous or distressing situations, they look to the adult's face and then back at the object, seeking emotional information from the adult by looking at his or her face, and using it to evaluate the situation. A similar behaviour occurs in unpredictable situations, and also after infants' intentional actions (Reddy 2005), when emotional cues seem to be sought for confirmation of the infant's evaluation of the event.

Given that infants follow line of regard, alternate gaze, and engage in mutual attention several months before the onset of intentional communication, the view that all intersubjective skills emerge at a precise age must be incorrect (*cf.* the 9-month revolution in Tomasello 1995, 1999). Certainly, intersubjectivity develops gradually (Reddy 2005; Striano & Bertin 2005; Striano & Rochat 1999). In spite of this, the onset of intentional communication shows signs of a qualitative transition from one kind of interactive behaviour to another, from a dyadic to a triadic relation. How come intentional communication does not emerge earlier than by 12 months, if the capacity for intersubjectivity is in place much earlier?

One answer takes its starting-point in the research about autism. Human infants have a natural, or innate, inclination to interact with their caregivers by exchanging facial expressions of emotion (*cf.* Trevarthen 1979). However, autistic infants behave differently. For instance, they do not show a preference for visual attention contact, nor for pointing merely to share attention. Observations of this kind have been taken as evidence that social reciprocity and a recognition of psychological self-other equivalence (the matching of mental states), and even a capacity to identify with the other, are necessary for intentional communication (Hobson 2005; Meltzoff & Brooks 2001). All these capacities are held to emerge at about the same time, towards the end of the first year. Tomasello (1999; Tomasello & Rakoczy (2003: 125) assert that they are manifestations of a single social-cognitive skill: "the understanding of persons as intentional agents who have a perspective on the world that can be followed into, directed, and shared".

Another kind of evidence for this view is gathered from laboratory experiments on apes, testing for those cognitive capacities in human infants that are held to be intrinsically related to the development of intentional communication. The results of the experiments demonstrate behavioural differences between human infants and apes that remind of those between non-autistic and autistic infants (*cf.* Tomasello 1999; Tomasello *et al.* 2005), and have been interpreted as showing that intentional communication requires specifically human socio-cultural capacities.

A related answer relies on experimental evidence about skills for joint attention and the referential understanding of behaviour like instrumental action, emotional expressions, gaze, and pointing, which both are held to arise by 9 to 12 months (Brooks & Meltzoff 2005; Moses *et al.* 2001; Woodward 2005). It is claimed that taking an intersubjective and referential stance to other agents expresses an understanding of human beings as intentional agents that have reciprocal intentions towards each others' intentions and attentions (Tomasello 1998). This claim bolsters the view that the evolution and development of language involve a capacity for theory of mind.

A recent development of the second answer concerns shared ("we") intentionality (Tomasello *et al*. 2005). It is proposed that human beings have a species-typical, even unique, motivation for in a psychological sense sharing feelings, experiences, and activities with each other, irrespective of any other goal than that of sharing. This view emphasises the importance of collaborative as against competitive co-operation for achieving typically human ends (*cf*. Brinck & Gärdenfors 2003). Additionally, it singles out the emergence of dialogic, cognitive representations in infants around 14 months, supposed to integrate the first- and third-person perspectives *via* internalisation and allow for human collaborative, cultural practices.

Although these answers initially exploit different kinds of evidence, they end up with the same conclusion, citing intersubjectivity as the crucial factor for the onset of intentional communication. Besides, observations that might complicate the picture often are disregarded. For instance, some autistic children demonstrate a limited range of intersubjective behaviours, although these will not be sufficient to achieve fully-fleged intentional communication. Moreover, the primary intersubjectivity of ape infants appears strikingly similar to that of human infants (Bard 2005; Tomanoga *et al*. 2004), yet it does not result in the same adult abilities in apes as for human beings.

Instead, explaining how the onset of intentional communication can appear so abrupt, although an impetus for intersubjectivity is present in the infant already at birth, requires identifying the factors that lie behind the complexity of intersubjectivity and establishing how they contribute to it. A *first factor* already has been identified, *viz*. the relation of sharing, the strength of which varies with the conditions of the context of communication (*cf*. section 1). It can be illustrated by reference to various joint-attention skills. Thus mutual intersubjectivity is exemplified by the co-ordination of actions in space and time relative to a shared, perceivable target, using contextual, perceptual cues and on-line information about the other agent's behaviour and physical action. This does not involve direct interaction between the agents. Reciprocal intersubjectivity will occur when the agents co-ordinate their actions relative to a target in common space by acting so as to affect each other's attention and actions. Finally, complementary intersubjectivity sustains acts of declarative pointing, combining mutual and joint attention with referential pointing, during which the agents use their attention to mutually and intentionally affect each other's attention and intentions.

The next section will identify a second factor, pertaining to how intersubjectivity manifests itself in individual behaviour. The form that intersubjectivity will take relative to a certain behaviour issues from the nature of the sharing in which the behaviour is based, and determines how and by which means the agents may interact. Because sharing may be implicit to the agents, they will not necessarily be consciously aware of doing it, nor of its object, but nevertheless will adjust their actions to the context on a pragmatic level, which situates action in contexts that are explicitly oriented towards a concrete goal and can be readily recognised, and moreover occur in a sociocultural setting that the agent is familiar with.

4. Three forms of intersubjective behaviour

Consider some of the behaviours that commonly are referred to as intersubjective: mutual attention (attention contact), showing, showing off and teasing, emotional engagement, joint attention, social referencing, and pointing. These behaviours instantiate the relation of intersubjectivity in different ways, depending on whether they concern the sharing of affect, attention, or intention in the agents.

The three categories of emotion, attention, and intention roughly reproduce the traditional, psychological categorisation of mental acts as having either affective,

cognitive, or conative functions. *Affect* concerns the emotional experience of perception, information, and knowledge, and is associated with positive or negative attachment and evaluation. *Cognition* concerns knowledge and understanding of information about the world, self, and other subjects, including their perspectives of the world. *Conation* concerns the agent's current interest (in terms of the agent's focus of attention) and action-readiness. It relates affect and cognition to active and goal-related behavior, and thereby moves the agent to action. Its main instrument is the attention system in the brain that controls the inhibition and production of behaviour as well as the selection of attentional objects.

Consequently, intersubjective behaviour will be either interaffective, interattentional, or interintentional. Stern (1985) defines these categories as follows (italics added). Interaffectivity consists in the infant's matching its own "*feeling* state as *experienced within*" with the feeling state "seen 'on' or '*in*' another" (1985: 132), and still by 12 months affective exchange is "the predominant mode and substance of communications" (*ibid*.: 133). Interattentionality means that the infant has "some *sense* that" persons, including the infant itself, can have individual, different, attentional foci, which can be "brought into alignment and shared" (*ibid*.: 130). Interintentionality "impl[ies] that the infant attributes an *internal*, *mental* state" to the adult, namely, "comprehension of the infant's intention and the capacity to intend to satisfy that intention". Intention is a shareable, but not necessarily self-aware, experience (*ibid*.: 131).

As indicated by the italicised words in the quotations, Stern uses mentalistic terms in his definitions. But a pure mentalism about the mind, which separates processes of the mind from sensorimotor processes and bodily experience, disagrees with the biological and ecological outlook of the present article.[8] According to the view advocated here, states of mind have both mental and bodily correlates, which are of equal importance for the self- and co-regulation of behaviour. Because emotion, perception, and cognition have evolved primarily for the purpose of physical action, physical and functional properties automatically ground mental processes (Dewey 1916; Gibson 1979; James 1900; Johnson 1987; Merleau-Ponty 1945). This is how information about the 'mental' realm can be behaviourally manifest, and physical behaviour can have immediate repercussions on the mind. The mind is embodied in being functionally and constitutively dependent on sensorimotor activity and perception. Furthermore, embodiment implies embeddedness, which means that any type of cognitive process is adapted to and depends on the shared environment in which it occurs. Conceiving of the mind as embodied sidesteps the dilemma whether intersubjectivity is a property of the mind or body; to conclude, intersubjectivity springs from a sharing of embodied states of the mind.

To avoid mentalising, Stern's concepts will be redefined as follows.

- *Interaffectivity* consists in the infant's simultaneous matching of its affects and emotions to those currently displayed by another subject in overt behaviour, by posture, facial expression, *et cetera*.
- *Interattentionality* involves behaviours such as mutual attention-reading, directing gaze, and intention movements that may spread by contagion much like the emotions, but also are deliberately used for the purpose of, *e.g*., attention-reading and directing gaze.
- *Interintentionality* is based in the agents' exchange of information about their respective intentional and referential states as these are made externally accessible in behaviour, *e.g*., as in declarative pointing. At a more complex level, it involves

[8] Note that the disagreement with Stern does not concern his phenomenological, experientially based approach to the mind. An opposing objective, third-person approach is not to be preferred to Stern's.

having higher-order attentions and intentions about one's own and others' attentions or intentions.

The three forms of intersubjectivity can be known from behaviour or direct experience. Each rely on a distinct capacity of the embodied mind, the functional properties of which will individuate the behaviour and thereby also contribute to the content expressed by it, as illustrated by the following examples. *Interaffectivity* supports the sharing and exchange of affects between sender and observer and consequently underlies behaviour such as social referencing that is performed for evaluative purposes, and dyadic engagement that promotes the exchange of positive emotions. *Interattentionality* concerns sharing with regard to action-readiness, focus of attention, and interest as made perceivable in behaviour. *Interintentionality* drives triadic interaction, such as the process of joint attention and acts of nonverbal reference, and underlies complex attention-reading that requires having higher-order attentions about first-order intentions and attentions.

Much communicative behaviour is complex, combining several 'simple' behaviours that do not have a communicative function if taken out of context. Complex behaviours as well combine basic actions that rely on different kinds of sharing, and thus on different forms of intersubjectivity, but nevertheless can occur within the scope of a single communicative act. A case in point is nonverbal reference (section 2) that, if the contextual scaffolding is poor, will exploit a wide range of behaviours to get the message across.

Also consider how an infant's communicative behaviour is affected by the conditions during which gaze following will be triggered at different stages of development and that systematically relate to the different forms of intersubjectivity. The interaction between the infant's reactive behaviour and gaze following as elicited by either eye contact or perceived motion (pupil shift or head turn) was described in section 3. To recapitulate, eye contact facilitates the perception of gaze-direction in young infants, producing target-driven saccades. Having engaged in visual attention contact with the sender, the infant then will react to either of head turn and gaze shift in the direction of the target. In contrast, the perception of mere gaze generates cue-driven saccades. While it is significant that the eyes occur in the context of an upright face for eliciting target-driven saccades, this is without importance for cue-driven ones.

By 6 months, there is a change in the behaviour, and the infant starts to interpret gaze as directed also in the absence of eye contact. This might appear to show that attention contact by then has lost its central position for communication. On the other hand, only slightly later eye contact will make the infant follow pointing. How should these seemingly contradictory observations be understood?

The data indicate that the young infant from very early on intuitively takes gaze to have a communicative function in case the gaze shift or directing gaze was preceded by eye contact. In other cases it follows gaze automatically and parsimoniously, without individuating the gaze, nor contextualising it. The infant reacts similarly to gaze as to an unexpected event (a sudden noise), with the crucial difference that the other's gaze tells the infant to actively start searching the context for salient targets.[9] Both gaze-related abilities probably are innate (or at least prepared for), and therefore the perception of

[9] Early 'automatic' gaze-following roughly corresponds to Butterworth's (1991, 2003) ecological notion that might be characterised as a biologically based propensity to orient to the sender, check the sender's attention, and then search the surroundings for salient targets of attention. This is followed by a geometrical capacity for gaze following, in agreement with the view expressed above, except for that according to Butterworth, this second stage does not start developing until by 12 months of age, while here it is claimed to develop soon after 6 months.

others' gaze can directly afford action to the infant, something that seen from an evolutionary point of view must have proved very efficient in the distant times of our ancestors.

However, by 6 months the infant seems to have learnt something about the general function of gaze, and now can apply a referential reading to any kind of gaze, whether deliberate or not, as signalling the other agents' interest (or focus of attention) and imminent goal-directed action. The referential reading replaces the earlier cue-driven reaction to directed gaze, which still remains operative, but is less prevailing.

The observation that 7-month-olds can follow point when the gesture is preceded by eye contact hints at another generalisation, this time of the function of visual attention contact that is extended to new contexts. The infant will now use eye contact to enhance and disambiguate behaviour in novel contexts. The infant seems to take it as a vocative-imperative signal ('You!'), which is of immediate concern to the addressee (infant), in contrast to communicative intentions that do not address the recipient in a specific manner.

All in all, this means that shortly after 6 months the infant can distinguish between at least the referential and the communicative uses of gaze, and takes both to be informative as to the other agent's future behaviour. The referential and communicative functions can each be related to other kinds of behaviour – the understanding of referential gaze to the capacity to perceive action-readiness and goal-direction in others, and the understanding of eye contact to early dyadic angagement and mutual attention.

Nadel *et al.* (2004: 69) stress the importance of taking seriously the difference between interaction that is merely socially embedded and such that constitutes an interindividual exchange and sharing, the latter preparing the infant for taking part in episodes of intentional communication. A similar conclusion can be reached by relating the young infant's gaze-related behaviour to intersubjectivity; eye contact being a form of interaffectivity, exploiting the experience of self-other equivalence and aiming for interaction, while reflexive gaze-following as well as referential gaze are interattentional and depend on sharing fundamental processes of the perception-action system that allow for detecting interest and action readiness in other agents. Differences in the processing mode make the latter two afford sharing of different strenghts, and also have slightly different functions. Attention contact signals mutuality between self and other to the infant; directed gaze signals the other's interest and readiness to act without implicating the infant in the activity. Consequently they produce different starting-points for responsive action in the infant-observer.

Finally, it should be stressed that the definitions of the present forms of intersubjectivity avoid commitments such as to whether intersubjectivity is, say, purposive, deliberate, subjectively experienced, or self- or consciously aware; neither do they presuppose the existence of any particular mechanisms or capacities that might cause intersubjectivity. Consequently, the corresponding concepts can be used to from a fairly unprejudiced point of view analyse the nature of concrete instances of intersubjectivity in episodes of intentional communication, and for constructing models of intersubjectivity in different domains. They might also be used to conceptualise models concerning selective impairments in the capacity for intersubjectivity as reflected by the presence of, e.g., only one or two of the forms of intersubjectivity available to the agent. [10] In the following section a third factor that contributes to the complex nature of intersubjectivity is presented, pertaining to the processing of intersubjective behaviour.

[10] The three concepts of intersubjectivity can, perhaps in combination with some other distinctions, be used to characterise and compare syndroms that cause impairments or weaknesses in the capacity for intentional communication (and later in linguistic abilities) that are linked to peculiarities in the capacity for

5. Varieties of processing and access

The complexity of intersubjectivity stems from the interaction of a few of its different aspects, each variable in itself. Two factors reflecting have been introduced so far. The first one pertains to the nature of the interrelation between the agents, being either mutual, reciprocal, or complementary, where the last kind is the strongest and most demanding one seen from a cognitive and developmental point of view. The second factor was dealt with in the last section and concerns the way in which the interrelation materialises in the individual case, that is to say, from which kind of sharing it will emerge in the context of communication, and which specific function it as a consequence will have.

A *third factor* concerns the *processing level and processing mode* of the intersubjective behaviour, which belong to the brain. The processing mode unambiguously will limit how, or by what resources or means, the agents will be able to interact in the context of use. Hence its influence on the interaction will be both quantitative and qualitative. The most important consequence the processing mode will have for agents engaged in intentional communication (as opposed to in verbal communication that uses a more complex system and a richer vocabulary) concerns the kind of access they are granted to currently processed information about their on-poing interaction.[11]

Again a threefold distinction will be made, this time between sensorimotor, perceptual, and conceptual processes and corresponding processing. Given the topic of preverbal communication, conceptual processing will be of less relevance than the other kinds, not having the same kind of cognitive significance to infants as to older children and adults. Yet it appears that some time after 6 months of age, the infant starts constructing (proto-)conceptual categories by abstracting from perceptual input, and to which she eventually will have more or less conscious access. The role of conceptual processing for the development of cognition must not be neglected as it in time will provide the child with the means for performing meta-operations on concepts such as inductive generalisation and inferential reasoning.

Sensory-motor processes afford motor patterns, and are *impenetrable* on a personal level which is to say that they are unavailable to conscious awareness. The agent's reactions to them will be produced on a subpersonal level and be caused by functional units, the 'subsystems' of the agent, which take care of most of the on-going processes in the agent. Because the processing is impenetrable, the agent will not be able to voluntarily inhibit behaviour that issues from it. The results of the processing will be only indirectly available to the agent, which means that the agent may access the information by focusing on her own behaviour.

That a process in contrast is *penetrable* means that it, *while it is going on*, it is available to the agent on a personal level, in order that the agent can monitor and respond to, or "comment on" it (Weiskrantz 1997), either behaviourally or by communicative means. If the agent has been able to access the information properly, she should thereby be able to produce a response to it that acknowledges her actual awareness of it, resulting

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intersubjectivity. Further, they can be used to model the specific way in which each insufficiency might relate to intersubjectivity. To illustrate, while autism would cause a strong weakness in interaffectivity and a less important one in interintentionality, Williams syndrome would entail impairments in interaffectivity and interattentionality.

[11] A terminological remark: *Availability* concerns information that is out in the open, and is in principle obtainable for the agent, whether or not she actually will obtain it. *Accessibility* concerns whether the agent is in fact in the position to get it.

from a multimodal comparison (multimodality being a property that indicates that the information is explicit and available to conscious awareness) of it with information acquired previously, – or the agent has failed to categorise the input.

Perceptual processes cue perceptual categories, and are *experientially penetrable*, *i.e.*, available to the agent in conscious awareness as phenomenal percepts, and consequently the agent may influence them purposively and voluntarily. *Conceptual processes* are *cognitively penetrable*, which means that they are sensitive in a rational or semantic (truth-preservative) way to the agent's beliefs and goals (Pylyshyn 1999).

The level of the processing of the interaction and the manner of accessability to the processed information will determine how the agents can react to and monitor their interaction. Crucially, the forms of intersubjectivity and the processing modes vary along different axes, which means that in a given context of communication there will be one selection for form of intersubjectivity and another selection for level of processing.

For instance, gaze following can be caused by a reaction to either head-turn, gaze shift, gaze shift as initiated by eye contact, gaze shift as perceived together with the upper part of the face, and more. To each of these types of interaction corresponds a certain sort of processing and certain processes, the general character of which will be principally perceptual or sensorimotoric. It should be emphasised that the differences arising from selection of form of intersubjectivity will be greater than those that depend on processing, because the former categories are more inclusive. Considering that for every individual behaviour or act in the context of use, there will be a selection for three factors, intentional communication affords a large number of ways to get the message across.

Having thus looked into some of the factors that determine the final output of intersubjective communicative behaviour, it is time to broaden the perspective on intentional communication. The next section examines how the relation between sender and observer might be modelled from a general point of view, with the purpose of revealing the *source* of intersubjectivity in individual contexts of communication.

Towards the end of the section, it will be claimed that concrete instances of the intersubjective relation, as in attention contact, gaze-following, and joint attention, have their origin in the perceivable self-other equivalence of sender and observer. This claim issues in the conclusion that particular intersubjective behaviours, exemplifying either one of the three forms of intersubjectivity, spring from the sender's and observer's mutual experiences of their equivalence in the context of communication.

6. From social tool-use to self-other equivalence

Intentional communication sometimes is characterised as a form of social tool-use, *i.e.*, as an "ability to coordinate sequences of behavior involving objects with sequences of behavior involving social agents" in goal-directed activities that are characterised by persistance until the goal is achieved (Bard 1992: 1187).[12] Intentional communication is

[12] Bard (1992) furthermore maintains that the ability to use a communicative gesture as an intermediate means is vital for intentional communication. This is true, but not the whole truth. The crucial issue that finally will determine whether the use of a gesture belongs to intentional communication or not concerns whether (a) the agent understands the gesture as an instrumental action or a sign, and (b) the gesture will constitute an instrumental action or a sign in the eyes of the observer (*cf.* Brinck in press). While instrumental action is made to fit the external context, communicative action is tailored to the sender's intention to communicate and the observer's needs and expectations concering the sender's behaviour to the extent that these are publicly available in the context of use, and as such accessible to the individual. Finally, that this complex of states of mind targets behaviour, and merely indirectly states of mind.

social because it is performed for the benefit of others[13], and a form of *tool-use* because the sender uses other agents as a means to reach a personal goal. In using the observer as a tool, the sender relies on the expectancy that the observer will act as a self-propelling causal agent whose actions are goal-directed (*cf.* Tomasello & Camaioni 1997).

The Social Tool-use Hypothesis (henceforth, STH) describes intentional communication in predominantly instrumental terms as a manipulative form of behaviour, placing actions on objects and agents on a par. Doing so implies, first, that intentional action exploits one and the same kind of operational mechanism and similar input irrespective of whether it involves objects or agents, and, second, that the behaviour of agents is as predictable as that of objects. However, there are significant differences between acting on objects and on social agents, which suggest that their respective behaviour cannot be controlled by a similar mechanism.

In contrast to objects, an agent's behaviour normally cannot be anticipated merely from information about the agent's previous behaviour. In spite of occuring in a similiar context again and again, the behaviour may nevertheless be novel each time, because it does not merely depend on the context and the preceding action, but crucially also on the agent's current *dynamic internal state*. Consider the flexible behaviour of a causal agent who uses only perceptual information as input and produces instrumental actions as output. The flow of contextual input causes the internal state to change continually. Input and internal state together make the agent gradually adjust his or her behaviour to the similarly dynamic context. The agent's behaviour in turn affects the contextual state, and thereby indirectly contributes to determine the next input. In this manner, input, output, and internal state create a progressive perception-action loop that guarantees that the agent will not be in the same internal state twice. The dynamic properties of states of the mind obstructs the chances for producing correct explanations and predictions of the agent's behaviour from an external point of view.

As mentioned in section 2, being able to select among alternative means for reaching the goal distinguishes intentional from causal agents. Intentional communication requires intentional agents. Suppose that our causal agent is upgraded to an intentional level, and so is endowed with a mechanism for selection-for-action. As a consequence the agent's set of possible courses of action would grow exponentially, making accurate prediction and explanation of behaviour from a third-person perspective almost impossible. Because of the great differences between acting on objects and agents that arise in the case of intentional communication, it seems safe to conclude that the analogy drawn by STH between co-ordinating behaviour on agents and on objects will fail.

A second objection to STH concerns the fact that it implies that sender and observer manage to adjust their behaviour in accordance with the contextual constraints while monitoring only their own individual perspective of the shared context. In instrumental contexts the course of action can be adjusted to the goal in this way, but the case is another regarding intentional communication. In such contexts, the agents' mutual awareness of their respective communicative intentions is guiding the interaction, allowing the agents to efficiently block accidental circumstances that might influence the interaction.

Had sender and observer not been attending to their respective perspectives, they would not have been able to control the interaction. Ignoring perspective-taking, already the initial attempt to make attention contact might fail, and turn-taking would suffer. An example of preverbal communication that functions along the lines of social tool-use is

[13] That a behaviour is performed for the benefit of others does not imply that the over-all action to which the behaviour belongs, nor its goal, will benefit somebody else besides the agent who is performing it. Social behaviour is directed at other agents and performed in the presence of other agents.

the young infant's first uses of imperative pointing, without initially turning to the adult to check where the adult is looking. If the adult happens not to be looking in the direction of the infant, the gesture will not have its intended effect. This illustrates how attempts to interact can fail due to a lack of control of the context of communication, and furthermore underlines the importance of preparatory behaviour for intentional communication.

The central position of *perspective-taking* in intentional communication arises from its essentially traidic nature, which materialises in the triangulation process that leads to joint attention (Brinck 2004). The sender's and observer's points of view will necessarily be distinct, simply because it is physically impossible for two agents to be at exactly the same place at the same time. This fact introduces a difference in their respective input that in turn will create a need for perspective-taking, and therefore make attention-reading essential to intentional communication.[14] From the observer's perspective, manifest attentional states are more discriminative than mere bodily behaviour. Moreover, because the attention signals an agent's intention to act, it can give the observer access to information about the sender's future behaviour. Consequently, manifest attentional states permit sender and observer to track each other's perspectives by attention-reading in a broad sense, as indirectly involving internal states, and thereby to continuously enhance the quality of their interaction.

In its present form, the Social Tool-use Hypothesis is seriously flawed. To summarise, it models intentional communication on instrumental action, and does not acknowledge the difference between acting on objects and agents, nor the central position of perspective-taking in communication and, importantly, the increased complexity this introduces into the interaction.

A more promising approach compares preverbal communication to co-operation on the grounds that sender and observer play similar roles and contribute to an equal extent to episodes of intentional communication. While the focus of STH is on simpler forms of interaction, this approach highlights complicated forms that require turn-taking and sometimes role switching too, and involve agents who have mutual expectations regarding the ways in which they should adjust their respective behaviours to each other. This particular reciprocity is strongly intersubjective, or complementary. In line with this view, Reddy (1999: 39) describes intentional communication as a "continual elaboration of actions and intentions in response to the other's action".

Comparisons of complementary communication to co-operation are quite common. However, because the word 'co-operation' is ambiguous, the significance of co-operative behaviour for intentional communication cannot be taken at face value. Consider the fact that co-operation admits of degrees (Brinck & Gärdenfors 2003). The baseline definition of *co-operation* is that two (or more) agents are involved in a common goal-directed activity. To reflect different forms of co-operation, the definition can be strengthened stepwise by adding the following conditions in their order of appearance.[15] First, that the actions are *synchronous, i.e.*, performed at the same time and place; this roughly reflects intersubjectivity in the weak sense of mutual interaction (*cf.* section 1). Second, that the actions are mutually *co-ordinated* in space and time, and the agents *take turns*, – corresponding to reciprocal intersubjectivity. Third, that the actions are *adjusted* or *matched* to each other, and that the agents *switch roles* during the activity, – similarly to in complementary intersubjectivity.

[14] Note that the different spatial locations of two agents sharing attention to an object in common space will only produce a corresponding difference in input if the agents are able to (i) register contrastive information (in this case springing from the difference in location), and (ii) the information can be of use by functioning as a basis for action.

[15] The classification is inspired by Boesch & Boesch-Achermann four-tiered analysis (2000: 186).

Since it turns out that the various forms of co-operation and intersubjectivity globally agree, characterising intentional communication as co-operation in an unrestricted sense of the word will not add to the present account. However, the hypothesis of communication *cum* co-operation aims to limit the scope of the concept of intentional communication to include complementary behaviour only. But it is hard to find a rationale for this move, which appears arbitrary given the analysis of intentional communication in section 2. That analysis showed that referential behaviour and communicative-intent indicators equally well can be reciprocal as complementary.

Nevertheless, as an object of comparison co-operation can illuminate the nature of intersubjectivity. For instance, the goal is of equal importance to all three forms of co-operation, while in contrast the stronger the intersubjectivity relation, and the more involved the agents are with each other, the lesser the importance of the goal. Further, the relation between the agents may in co-operation be unbalanced as well as balanced, while intersubjectivity requires that it be balanced. Another difference is pointed out by Nadel (2002; Nadel *et al.* 2004): Although co-operation is socially embedded, it does not imply interindividual engagement, while intersubjectivity promotes the exchange of turns and roles and sharing of tempo and rhythm.

The fact that the comparison of preverbal communication to co-operation takes mutual involvement as its starting-point, makes it likely that the comparison rather aims for *self-other equivalence* than for co-operation, Self-other equivalence promotes an implicit recognition of the similarity between self and other, and grounds intersubjectivity in concrete contexts. The equivalence is based in an innate cross-modal mapping of felt and observed actions, and prepares the agents for adjusting their individual behaviour to the needs and demands of the other agent, as in later, more complex forms of interaction (Meltzoff & Brooks 2001).[16]

As regards intentional communication, self-other equivalence specifically provides for the ability to produce and understand shared communicative gestures, and to do so on similar grounds as the other agents (Brinck in press). This ability that has its foundation in early imitation (Meltzoff & Brooks 2001; Nadel 2002), and is implemented by the mirror neuron system (Meltzoff & Decety 2003; Rizzolatti & Craighero 2004). The sender will try to determine whether the observer has understood his gesture by tracking the observer's reactions to it in real time. If the observer's reactions are similar enough to those that the sender was expecting, this will indicate that she has understood. The sender's expectations about the observer's behaviour originates from previous experiences of engaging in intentional communication (with other agents), and so does not have to involve counterfactual reasoning. Thus, self-other equivalence, which on a higher level of analysis supports intentional communication, will reduce to shared behaviour, yet without losing its initial appeal. The matter is not as simplistic as it sounds, since behaviour can express internal states, and moreover deliberately is made to do so in intentional communication. The skills that enable the comprehension, production, and prediction of acts of intentional communication all rely on a capacity for

[16] Similarly to early imitation, dyadic engagement can be understood in terms of spreading neural activation in the motor representations of the brain (Decety & Ingvar 1990; Jeannerod 1997). Research on the so-called mirror neurons have revealed that manual actions are recognised by a mapping of the observed action onto a motor representation of it in the observer's brain. When an observer is watching somebody else perform an action, there is a concurrent activation of those motor circuits that would have been recruited had the observer performed the action herself (Gallese *et al*. 2004: 397). Analogously, noticing others' facial expressions of emotion will activate similar areas of the observer's brain as of the agent whose face it is, and gives rise to similar sensations and negative or positive experiences (Gallese *et al*. 2004; Rizolatti *et al.* 2002; Wicker *et al*. 2003).

reading and controlling one's own as well as others' external manifestations of states of mind.

Self-other equivalence of the present kind does not presuppose an explicit, conceptual, and doxastic recognition of the equivalence, which would have involved representing self and other from a disengaged third-person perspective. On the contrary, it presents itself directly to the senses of the agent who successfully is participating in a dyadic interaction that requires continuous monitoring to an equal degree from both agents. Controlling the interaction requires attending to both self and other, while recognising and anticipating the progression and timing of the turns to be taken. In episodes of mutual attention, the equivalence and difference between self and other are both perceivable, recognised either explicitly as experienced in conscious awareness, or implicitly as in observable, responsive behaviour.

Maintaining that intersubjectivity is fundamental to cognition constitutes a manner of avoiding the epistemological gap that inevitably will present itself if instead cognition is grounded either in the first- or third-person perspective. The double nature of self-other equivalence that makes the former strategy viable is brought out by Reddy (2003, 2005) in arguing that an understanding of attention is implicit in early dyadic interaction. Reddy maintains that the infant's original identification with the other is a prerequisite for self-other equivalence, as is the experience of being different from the agent with whom the infant is engaged.

The perceivable properties of self-other equivalence makes it possible for the infant to grasp the bi-directional relationship of self and other without initially experiencing the breach between the first and third-person points of view. In contrast to models that take this gap as a starting-point, and then present a theory of how it might be bridged, Reddy's strategy has much to recommend it. It can hardly be denied that the infant's early experiences with others and the environment (by which the infant and its kin are surrounded as a *group*) are social and interactive. Given this, it is reasonable to assume that these experiences form the basis for eventually developing a detached perspective of the world. Taking identification as the starting-point (or rather the negligence of any particular perspectives) and, crucially, awareness of the other as its given counterpart seems intuitively correct, and also very natural considering that the infant in the beginning of life gets to know the world through others, not being able to move around on its own during the first months in life.

7. Concluding remarks

Intersubjectivity has been shown to interact with intentional communication in several ways, which accounts for the complexity that was highlighted in the beginning of the article. The contribution of intersubjectivity to intentional communication can be summarised as follows: the *relation* determines *how* the agents will share (mutually, reciprocally, or by complementarity), the *mode what* they will share (affect, attention, or intention), and the *processing* their *access* to and *monitoring* of the mutual interaction (sensorimotor processes on a subpersonal level, perceptual and conceptual processes on a personal level, each granting the agents different access to the processes, thereby constraining the interaction in different ways).

Moreover, during the successive stages of development different elements in the relation between intersubjectivity and intentional communication will be prominent, explaining why the progress of intersubjective behaviour in ontogeny is anything but linear. The reason why the presence of individual intersubjective behaviours in the infant during the first year do not coalesce to produce intentionally communicative behaviour is that they have not yet matured to an equal degree and therefore cannot combine in the

flexible ways required for intentional communication. As the brain matures, the various aspects are gradually brought together, and shortly after the first year start to take the form that allows for intentional communication.

To conclude, intersubjectivity is a deep-rooted and very flexible capacity that constitutes an excellent platform for intentional communication, because it leaves the agents plenty of room for tinkering during the interaction.

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