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Enactive intersubjectivity: Participatory sense-making and mutual incorporation

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Abstract Current theories of social cognition are mainly based on a representationalist view. Moreover, they focus on a rather sophisticated and limited aspect of understanding others, i.e. on how we predict and explain others' behaviours through representing their mental states. Research into the 'social brain' has also favoured a third-person paradigm of social cognition as a passive observation of others' behaviour, attributing it to an inferential, simulative or projective process in the individual brain. In this paper, we present a concept of social understanding as an ongoing, dynamical process of participatory sense-making and mutual incorporation. This process may be described (1) from a dynamical agentive systems point of view as an *interaction and coordination of two embodied agents*; (2) from a phenomenological approach as a *mutual incorporation*, i.e. a process in which the lived bodies of both participants extend and form a common intercorporality. Intersubjectivity, it is argued, is not a solitary task of deciphering or simulating the movements of others but means entering a process of embodied interaction and generating common meaning through it. This approach will be further illustrated by an analysis of primary dyadic interaction in early childhood.

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Introduction

Current theories of intersubjectivity remain focused on social cognition understood in a representationalist sense: Concepts such as theory of mind, simulation, or mentalisation all have in common that they conceive of social understanding as putting into operation a 'theory' or 'model' of how people act. Research into the so-called 'social brain', particularly into the mirror neuron system, has also favoured a third-person paradigm of social cognition as a passive observation of others' behaviour, based upon an inner modelling process in the individual brain. One could say that the person who perceives another does not actually interact with him or her but deals with internal models or simulations of her actions.

This may sound like a caricature, but it reveals something of the problem. Clearly, no-one would deny that we interact and that interacting is of importance to our social capacities, but in the readiness to accept this 'obvious' fact, there is a danger that the interaction itself is ignored. This is due to the fact that traditional approaches see interacting as that which we do on the basis of inferential or simulative models. We run these models in order to be able to explain and/or predict other people's behaviours. Once our model provides us with an explanation or a prediction, we can bring it into the interaction. How could these activities, the one internal and hidden away and the other engaged in the outside world, work together? Internalist approaches do not seem up to the task of taking the real interaction into account.

In contrast, in this paper, we propose to look at the problem of intersubjectivity from the angle of the interaction process. Rather than considering it a straightforward end stage of the social cognitive machinery, we view it itself as the source of intersubjectivity. Instead of postulating a collaboration of interacting and reasoning, we present a non-representational, enactive and embodied concept of intersubjectivity. On this approach, social understanding is not realised by 'snapshot' activities of one individual's theorising or simulating but *arises in the moment-to-moment interaction of two subjects*.

The interaction process includes several components such as bodily resonance, affect attunement, coordination of gestures, facial and vocal expression and others. Social cognition is not a solitary task of deciphering or simulating the actions of others but emerges from the dynamical process of skilfully interacting with them. Such a view on social cognition has recently been described as 'participatory sense-making'—the process of generating and transforming meaning in the interplay between interacting individuals and the interaction process itself (De Jaegher and Di Paolo 2007, 2008; De Jaegher 2009). We could call this a 'dynamical agentive systems' approach to intersubjectivity. In the present paper, we elaborate on the phenomenological aspect of this process by introducing the notion of *mutual incorporation*.

Combining a dynamical agentive systems perspective with a phenomenological perspective will allow us to link two sides of the same process—the interaction. The *dynamical agentive systems approach* observes and describes the interaction as a

coordination process between intentional and embodied agents. It regards their actions as exhibiting an inherent and 'visible' intentionality and as being related to each other in a meaningful way, although so far, it has disregarded the subjective experience of the process. The *phenomenological approach* takes an immersive perspective, starting from a first- and second-person take on the same process and describing the experience of the mutual engagement in phenomenological terms. Although these perspectives may seem different at first sight, they intertwine quite naturally in order to give a more comprehensive account of social understanding than each could do separately. They combine a scientific and an experiential approach to the interaction and as such allow a better grasp of the second-person constitution of intersubjectivity.[1]

In what follows, we first give a brief overview of the criticisms of current concepts of intersubjectivity. The main section of the paper develops our alternative concept, which, in the last section, we also apply to the development of social understanding in early infancy.

How have current concepts of social cognition been criticised?

The aim of this section is not to give an exhaustive criticism of current concepts of social cognition. Rather, we summarise some of the important critiques already provided by other researchers in order to open up a space for our positive proposal that takes these criticisms seriously.

The main concepts of social cognition today seem to be 'theory of mind' theory and simulation theory. *Theory theory* (TT) claims that we explain and predict another person's behaviour by relying on an innate or acquired theory of how people generally behave and of the mental states such as beliefs or desires that cause their behaviour (Premack and Woodruff 1978; Baron-Cohen et al. 1986; Antonietti et al. 2006). On the basis of our theory of mind, we make inferences about others' mental states. *Simulation theory* (ST), on the other hand, claims that we have no need for a theory like this because we have an inner model that we can use for simulating another person's mental states, and this model is our own mind. Thus, we model the beliefs and intentions of others whom we deal with *as if* we were in their situation, or *as if* we were them (Dokic and Proust 2002; Gordon 1996; Goldman 2006).

Different as these two concepts are, there are several critical points that may be raised against both of them:

1. *'Inner world' hypothesis*: Both TT and ST conceive of the mental as an inner realm separated from others by an epistemic gulf that can only be crossed by inference or projection. We are hidden from each other in principle; therefore, we must infer or simulate the other's inner states in order to understand him. But "...do you look into yourself in order to recognise the fury in his face?" Wittgenstein asks (1967, §220, p. 40). In most everyday situations, we do not use any imaginative, introspective simulation or inference when we interact with

[1] The combination of these perspectives fits well with the enactive approach as envisaged by Varela and Thompson (see for instance Thompson 2005, 2007).

another person. Instead, we just immediately perceive the other's intentions and emotions in his expressive behaviour as related to a meaningful context (Scheler 1954; Gallagher 2001, 2008; Merleau-Ponty 1962, pp 215ff).

2. *Missing interaction*: Both TT and ST assume that we primarily observe others from a third-person stance. Their research paradigms focus on one-way, removed social situations and are biased towards localising social cognition in one participant or in his brain. However, our primary and everyday encounters with others are not solitary observations but interactions in the second-person perspective (Reddy 1996; Gallagher 2001; Hobson 2002; Hutto 2004; Ratcliffe 2007; Stawarska 2007, 2009). It is only in situations where we observe another person and their behaviour is ambiguous, i.e. not immediately understandable in the context of the situation, that one way to make sense of it could be to reason about it.
3. *Missing embodiment*: Social cognitive science largely assumes a disembodied sender–receiver relation between two Cartesian minds; the body usually functions only as a transmission device (Gallagher 2001; Lindblom and Ziemke 2008). Even though simulation theories increasingly include the body in the modelling of others, they still do not take into account the *reciprocity* of embodied agents. After all, there are no interacting minds or brains but only interacting living bodies or persons.
4. *Missing development*: Traditional approaches to social cognition have been criticised for being overly concerned with which capacity follows which in time, without attention for how the different capacities follow *from* each other (and therefore also remain connected to each other throughout the lifespan) (Fogel 1993; Hendriks-Jansen 1997; Gallagher 2001). Moreover, the explanation of social cognition by brain modules or mirror systems remains static and unidirectional in that they assume that the brain mechanisms guide development. But there is increasing evidence that these neuronal systems develop and are continuously modified *only through social interaction*, particularly in early childhood. The capacity of infants to tease and engage in humour also suggests that they are able to grasp others' perspectives well before a so-called mind-reading mechanism 'comes online'.[2]

In view of these and other problems, proponents of TT and ST have often shifted their concepts to the *subpersonal sphere*. Then, the inferences or simulations that should steer our social interactions are claimed to be brain processes of which we are not explicitly aware. This version is mainly put forward for simulation theory. However, as Gallagher (2007) has pointed out, simulation is a personal-level concept that cannot be legitimately applied to subpersonal processes. ST postulates the use of a first-person model to form third-person 'as if' or 'pretend' mental states. Attributing this procedure to the brain raises a number of objections:

1. If we are not aware of the simulation, it makes no sense to say that the brain or a part of it is using a model in order to generate an understanding of someone else. A model is only a model for a subject who *takes it as* similar to the original.

[2] This is beautifully illustrated in, for instance, Reddy's studies of humour and teasing in infancy (Reddy 2001, 2008; Reddy et al. 2002).

Mirror neurons, however, are equally activated by one's own or by another's movement; they are neutral with respect to who the agent is. Therefore, they cannot simulate or pretend *as if* my intentions are your intentions. Neither neurons nor neural networks know any 'as if'; "there is no neuronal subjunctive" (Gallagher 2007, p. 361).

2. The same applies to the concept of 'mirror neurons' itself. Mirrors certainly do not exist in physical nature. A mirror on the wall does not mirror anything except *for a subject* who is able to take its reflections *as* a mirror image. Unless we want to house a homunculus in the brain, the similarity relation between one's own and another's movements cannot be established by a neural system, much less by single 'mirror neurons'. It is persons who simulate, model or infer, not brains.

These objections may suffice to point out that there are serious problems with a subpersonal account of simulation. In sum, there is a strong tendency in present social cognitive science to rely on brain mechanisms such as mirror neurons or other special modules to explain social cognition (see e.g. Decety and Sommerville 2003; Frith and Frith 2001, 2007). As a result, intersubjectivity is taken as an inferential or projective process encapsulated in the brain. However, such explanations single out *one section only* of the whole circle of organism–environment interaction. They fail to address social interaction as a structured and structuring process which in turn influences brain functions. This is not to say that the link between action and perception found in mirror neuron research does not play an important role for social understanding. However, an approach like ours would predict that the mirror neuron system can only function when embedded in a context of embodied and meaningful interactions.

In general, representationalist approaches assume that the social world or the social other is something pregiven, i.e. they are fully determined in the way they appear to me. Social cognition, then, consists in the internal mapping or modelling of the other's characteristics and actions and, from there, interpreting and giving explanations for their behaviour. However, if intersubjectivity is regarded as a circular process in which the cogniser constantly influences the other by his actions and vice versa, then cognising and acting are interdependent, and there is no pregiven other. On this condition, the concept of inner mapping or representation is too static to be an adequate description of the process.

An alternative view: enactive intersubjectivity

Our alternative concept of intersubjectivity is based on the following assumptions:

1. Social understanding is as much an interactional as an individual affair.
2. Intersubjectivity relies heavily on embodiment in a rich sense of the word, i.e. on dynamical and embedded whole-body actions.
3. Intentions are not opaque and hidden but are expressed in action and can be perceptible to others.
4. Intentions are not pregiven and static but can be generated and transformed in the process of interacting.

Thus, we conceive of social understanding as an interactional and intercorporal process in which both partners are immersed and in which the process of interacting itself plays a leading role for the understanding (De Jaegher 2009). In short: Social cognition emerges from embodied social interaction or, in Merleau-Ponty's term, from *intercorporality.* In elaborating this concept, we will describe it first from an enactive approach, namely as a *dynamical coupling and coordination of embodied agents*. Then we go on to analyse the same process from a phenomenological point of view as *mutual incorporation*.[3]

(a) Enactive approach: dynamical coupling and coordination

From an enactive point of view, organisms do not passively receive information from their environment which they then translate into internal representations; rather, they actively participate in the generation of meaning. Thus, a cognitive being's world is not a pregiven external realm represented by the brain. Rather, it is the result of a 'dialogue' between the sense-making activity of an agent and the responses from its environment (Varela et al. 1991; Varela 1991, 1997; Torrance 2005; Thompson 2005, 2007; Di Paolo et al. 2008).

On this basis, social cognition is regarded as the result of a special form of action, namely *social interaction*. Instead of linear processes, the enactive approach looks at the circular dynamics within a dyad of embodied agents. Analyses of social interactions and conversations show that participants unconsciously coordinate their movements and utterances (Condon 1979; Scollon 1981; Davis 1982; Kendon 1990; Grammer et al. 1998; Issartel et al. 2007). For instance, listeners coordinate their movements, however tiny, with the changes in speed, direction and intonation of the movement and utterances of the speaker. Studies on the way musicians work together while playing also show this (see for instance Maduell and Wing 2007). These findings suggest that interactors' perception–action loops are coupled and interlaced with each other. This includes processes of synchronisation and resonance, in-phase or phase-delayed behaviour, rhythmic co-variation of gestures, facial or vocal expression, etc. Through this, social agents are able to coordinate their sense-making in social encounters—that is: they can *participate in each other's sense-making* (De Jaegher and Di Paolo 2007). Hence, social understanding emerges from a dynamical process of interaction and coordination of two embodied subjects coupled to each other.

De Jaegher and Di Paolo define coordination as "the non-accidental correlation between the behaviours of two or more systems that are in sustained coupling [...] or have been coupled to another, common system" (2007, p. 490). A distinction (though not a very strict one) can be made when studying social interactions between different aspects of coordination. The distinction we are interested in here is that between coordination *to* and coordination *with*. The first is a one-sided coordination, i.e. where one of the coupled systems follows the lead of the other (think of Charlie

[3] Approaches to intersubjectivity have linked scientific and phenomenological stances before but have not used dynamical systems theory. Stawarska, in her forthcoming book, for instance, combines the dialogical, developmental and sociolinguistic stances (Stawarska 2009). Like Stawarska, we do not subscribe to the project of "naturalising phenomenology" when understood literally because this seems to presume that phenomenological terms could be *redescribed* in terms of natural science. Instead, we believe that both approaches can mutually enlighten each other (see also Gallagher 1997).

Chaplin's assembly line work in *Modern Times*).[4] Coordination *with*, in contrast, entails co-regulation (Fogel 1993), i.e. it is *interactionally achieved* (for instance, sawing a tree with a two-man saw).

Such interactional coordination does not necessarily imply perfect synchronisation. On the contrary, it is the continuous fluctuation between synchronised, desynchronised and in-between states that drives the process forward. The to-and-fro between attunement and alienation is even necessary in order to understand each other without melting into each other. Perfect synchronisation would lead to an undifferentiated, homogeneous feeling state. Therefore, misunderstandings and irritations are necessary as the dialectical counterparts of understanding. They are like questions that lead to answers in the subsequent course of the interaction.

Now since in normal interaction none of the participants is able to completely steer the process deliberately but is drawn into the feedback and feed-forward cycles of the interaction, the process itself can become leading over the two interactors. Patterns and rhythms of coordination make them act and react in ways that they could not foresee. In other words: The interaction process gains a 'life of its own'; it acquires a kind of autonomy (De Jaegher and Di Paolo 2007). Moreover, the history of coordination demarcates the interaction as an identifiable pattern with its own internal structure. This is due to the fact that the interactors are highly plastic systems that are susceptible to being affected by the history of the coordination. "Sustained interactions can be expected to have undergone several instances of loss and regain of coordinating structures, each of them leaving the interactors slightly better able to remain in such interaction or reinitiate it" (De Jaegher and Di Paolo 2007, p. 496). This interactional experience continually increases the skilfulness of the participants. They acquire what developmental psychologists have called *implicit relational knowing* (we will come back to this later on). Skilful interactions are usually characterised by greater fluency and skilful interactors by greater flexibility.[5]

It should be clear that, by focusing on the coordination dynamics of the process of interacting, we are not assuming a purely physical process. It is embodied subjects who coordinate, which means that in these couplings there is also a coordination of *meaning*. In fact, meanings emerge, become aligned, change and so on through the interpersonal coordinations of movements. And vice versa, movements also become interpersonally coordinated through attempts at understanding each other, which is an effort to create and align understandings. This is based on the 'visibility' of intentions-in-action: Grasping, pointing, handing over, moving towards, etc., are inherently meaningful and goal-directed actions. They are perceived as such and understood within the context of the common situation, without the need to explicitly represent the other's mental state. Moreover, as intentional movements, they also invite a certain range of meaningful reactions (e.g. pointing to → gaze-

[4] In such situations of a coordination *to*, it may happen that two people are coordinated to a third event (e.g. another worker to the assembly line). From a certain perspective (e.g. when the assembly line is out of view), it may look like Charlie and his colleague are coordinating with each other, whereas actually they are each coordinated through a third element. This can be called *external* coordination. Sharing a train journey, then, also is not an interactional coordination, but an external one. External coordination alone does not make an interaction social.

[5] This is not to deny that patterns of interaction can also have a restrictive effect on the degrees of freedom of the participants.

following, handing over → accepting, moving forward → moving backward, etc.), thus creating a common space of co-varying intentional movements. The resulting patterns of interaction acquire a meaningfulness over and above the meaning of the individual actions. Social understanding then, comes about in the way that each of the partners, while interacting, implicitly experiences or explicitly realises the commonly generated meaning patterns of the interaction.

We are talking here about primary social situations, i.e. social interactions. From these, third-person observational situations may be derived which constitute, as it were, a deprived form of social understanding, in that there is no bi-directional engagement. However, there is still a structural coupling between observer and observed, as is also shown by enactive theories of perception in general: In order to perceive, the subject is in continuous sensorimotor interaction with the object, e.g. through moving his eyes, focussing, adjusting posture and so on (O'Regan and Noë 2001; Noë 2004). In social situations, such observations may also include imaginary transpositions, reasoning or inferences about the other person's possible experiences or intentions, in particular when their behaviour is ambiguous. This is the place for the aspect of social cognition that is commonly explained by theory of mind or simulation theories.

Having carried the enactive account up to this point, we will now take a phenomenological approach in order to describe the subjective experience of the process in more detail.

(b) Phenomenological approach: mutual incorporation

As we said above, the comprehensive system that arises through coupling of two interactors is not a coordination of two mind or brain states but of two embodied subjects. Through the mutual coupling of their lived bodies—mediated through eye contact, facial expressions, voice, touch, gesture and other kinds of intentional action—they enter into a dyadic bodily state. Their body schemas and body experiences expand and, in a certain way, incorporate the perceived body of the other. This creates a dynamical interplay which forms a particular phenomenal basis of social understanding and which we will describe as "*mutual incorporation*" (see also Leder 1990, p. 94).

Incorporation is a pervasive characteristic of the lived body, which always transcends itself and partly merges with the environment. It may be unidirectional or mutual.

Unidirectional incorporation is most obvious in skilful handling of instruments, as when driving a car and feeling the road surface under the tyres; when playing piano and letting the fingers find the keys by themselves; or when a blind man probes his environment with a stick and feels the surface at its end:

> The blind man's stick has ceased to be an object for him, and is no longer perceived for itself; its point has become an area of sensitivity, extending the scope and active radius of touch, and providing a parallel to sight (Merleau-Ponty 1962, p.143).

In these cases, the instrument is integrated into the motor schema like an additional limb or an extension of the body, subjectively felt as 'melting' or being at one with the instrument. However, it is only in moving that the stick becomes an

extension of the blind man's senses. As long as he does not move, he does not feel anything with it. Thus, incorporation presupposes what von Weizsäcker (1940) called the "gestalt cycle", referring to the inseparable interconnection of perception and movement: What an organism senses is a function of how it moves, and how it moves is a function of what it senses. Thus, the touching hand anticipates and selects what it feels by its movements, whereas the shape of the object reciprocally guides the hand's touchings. Through this, organism and environment co-constitute each other.

Incorporation is not restricted to that which is near the skin, however—the lived body extends to whatever object it is interacting with. Imagine jumping over a creek: it only works if you direct your gaze and whole-body intention to the other bank. If you remain focused on the side you are standing on or only have eyes for the gap, you fall in. What enables you to get across is your incorporation of the bank and, by this, your anticipation of the trajectory you will take. This anticipation is not a mental feat but the lived experience of the sensorimotor gestalt cycle that unfolds as you prepare your leap.[6] Through this, the distance to the other side and the leap are brought into correspondence with each other, co-determined in the same embodied action. Incorporation therefore does not imply that the incorporated object be near or on the body. Rather, we incorporate by forming a sensorimotor gestalt cycle towards it, any object we interact with. In this, our lived body is ambiguous: It is at the same time here and there, preparing for a move while also already extended towards its goal and outcome.

Take also the example of a tennis return: In order to hit the incoming ball properly, the player incorporates its trajectory—he actually moves with the ball from where it starts and *feels* it approaching—and thereby adjusts his return to it from the very beginning (see also Dreyfus 2002). By its "operative intentionality" (to use Merleau-Ponty's term), his body *coordinates to* the ball, both forming a unified field of sensorimotor coherence. Instead of generating an independent representation of the moving ball, the player, in following it, lets his arm be drawn to the appropriate position: "... to move one's body is to aim at things through it; it is to allow oneself to respond to their call, which is made upon it independently of any representation" (Merleau-Ponty 1962, p. 139). Thus, the approaching ball as an incorporated target immediately evokes the corresponding movement of the arm.[7]

Similar incorporation also occurs when watching other people. For instance, when looking at characters in a film, we sense their expressions and actions with our own body. Our perception of others always includes a proprioceptive component that connects their bodies to our own. In more marked cases, unidirectional incorporation may even reach the degree of *fascination*. Thus, we may listen to a spellbinder, literally hanging on his every word—or on his lips, in the German expression—and

[6] Von Weizsäcker (1940) called this 'prolepsis', by which he meant the capacity of living beings to anticipate the goal and outcome of their action and, what is more, to take into account the *effect* of their own behaviour *on the object or event* they are interacting with. Thus, the snake does not catch the mouse by spotting where the mouse sits but by anticipating where the mouse will move as a reaction to its presence and pushing there. To put it more generally: Through its embedding in the sensorimotor gestalt cycle, living movement anticipates and adjusts to its own outcome.

[7] This way of thinking has meanwhile been empirically corroborated in sports research; see e.g. Michaels and Oudejans (1992), McLeod and Dienes (1993) and Kistemaker et al. (2009).

feel being drawn towards him. Or we may watch the *salto mortale* of an areal acrobat with a mixture of fascination, tension and anxiety. Our lived body reaches toward and 'conjoins' with the acrobat's swinging movements—we may even be prompted to co-movements.[8] For a moment, we might not even distinguish his movements from our own any more, and the ambiguity of incorporation gets lost. Different from incorporating instruments and from observing others in everyday situations, the incorporation in fascination is passive or *decentered:* The object or person by whom we are fascinated becomes the external source of the vectors or field forces that command our body. In other words, the centre of the 'operative intentionality' of our body shifts towards that of the other. This reaches an extreme in *hypnosis* where the subject is entirely coordinated to the hypnotist. His gaze is fixed, he is captivated by the hypnotist's appearance or performance, unable to move, or only moving in the ways the hypnotist suggests. However, a mismatch in the coordination could break the captivation and bring the subject's separateness and autonomy back to his awareness.

This brings us to *mutual incorporation,* referring to the reciprocal interaction of two agents in which each lived body reaches out to embody the other. Depending on the kind of interaction, there may again be different degrees of coordination and synchronisation. In unidirectional incorporation, we dealt with *coordination to*, while mutual incorporation implies *coordination with* (It has to be noted, however, that this distinction is conceptual rather than reflecting a strong division in reality).

For instance, as a skilled tennis player, I not only incorporate the ball and its trajectory but also my opponent's position, posture and movements. I feel the thrust and direction of his stroke as well as the momentum the ball receives, and with this, my own body's reaction is already being prepared. Here, my lived body is also in an ambiguous state, fluctuating between the incorporated body of the other and my own embodied position. In a fluent phase of the game, even before one player strikes the ball, the other's reaction unfolds, and this already influences the first player's initial action. As this goes on reciprocally, both players are connected in a feedback/feed-forward cycle, and there are no gaps of reaction time (Buytendijk 1956, 152f). Thus, they both experience the holistic development of the situation which is co-constituted by their bodily movements. However, if one of the players makes a surprising or feinting move, the coordination breaks. Here, the mutual incorporation does not match up the partners exactly, but each meets an autonomous response. So the game consists of an oscillation between matches and mismatches, of in-phase and phase-delayed states.

A similar phenomenon is found in eye contact where the gazes of both partners enter into an often intensive dialogue, or even a 'fight of gazes'. Just like limbs, the gazes act as extensions of the subjective bodies and form a system of mutual incorporation. I may feel the other's gaze as a pull, a suction, or also as an arrow that hits me and causes a bodily tension; I may feel his gaze right on my face (e.g. when blushing with shame); I may be fascinated by the gaze or withstand it, 'cast it back'

[8] Although there may be an element of imitation, fascination does not imply simulation. We certainly do not create a pretend state of the swinging acrobat and then project it onto him. Rather, we are immediately tied to him, out of ourselves, so to speak. We therefore do not agree with Theodor Lipps who used the example of watching an acrobat as evidence for his theory of empathy as being based on analogy or simulation (Lipps 1903, p. 122).

etc. My reaction to the other's gaze already influences his next action. No inner representation or simulation is necessary for this process—we certainly do not simulate e.g. another's angry gaze towards us, even less his anger, but rather feel tense or threatened by the impact of the gaze. And yet, the contact of gazes is certainly one of the most intense forms of social interaction and understanding. Also, if anything in a particular encounter was different, the whole meaning of the interaction could change (we could e.g. take a gaze of anger as a gaze of surprise).

Mutual incorporation implies a component of autonomy and otherness that is absent in unidirectional incorporation. The experience of even slight mismatches or unforeseen reactions suffices to establish a difference between self and other. Nevertheless, in mutual incorporation, the other's body becomes a source of impact on our own body as well. When e.g. seeing a smiling face, we often automatically and non-consciously mimic the smile, at least in terms of a specific muscle activation (Schilbach et al. 2008). The other's body influences our own bodily movements and sensations, and vice versa. Thus, face-to-face contact elicits a process of empathic perception which Merleau-Ponty attributed to the prereflective sphere of "intercorporality" and which he regarded as the basis of social understanding:

> The communication or comprehension of gestures comes about through the reciprocity of my intentions and the gestures of others, of my gestures and the intentions discernible in the conduct of other people. It is as if the other person's intentions inhabited my body and mine his (Merleau-Ponty 1962, p. 215).

As we can see, the concept of mutual incorporation leads to the opposite of the representationalist account: Interactional social understanding is not an inner modelling in a detached observer, but on the contrary, the other's body reaches out to my own, and my own reaches out to the other. This is the phenomenological equivalent to the dynamical interaction of embodied agents that we have described on the system level.

(c) Upshot: a systemic agentive-phenomenological approach to intersubjectivity

In order to further clarify the link between our systemic agentive and phenomenological considerations so far, let us define the term "operative intentionality". Merleau-Ponty uses it to denote the prereflective meaningful connection that the body establishes with its environment, based on the inherent connection of perception and action (Merleau-Ponty 1962, pp. xvii, 137, 243). The environment as a whole as well as particular objects are always already perceived with a tone of 'what I can do with it' or, to use Gibson's term, as *affording* a range of possible actions. This also includes the prereflective, implicit skills that the body applies in interacting with the environment.

Operative intentionality has a spatial as well as a temporal aspect:

1. It originates from the body, or in other words, the body is the source or 'centre of gravity' of operative intentionality. To illustrate, reaching for an object is a centrifugal action; in being hit by a gush of strong wind, there is a centripetal vector which you experience as an impact towards yourself; taking a piece of

food and ingesting it is a centripetal action, whereas pushing against something which puts up resistance has both centrifugal and centripetal qualities.

2. Through its habits and skills, the body *anticipates or implies* potential actions or events: It is prone to act in a way that is determined both by its acquired dispositions and by the affordances of the present situation. Thus, operative intentionality is directed towards the future, namely through implicit expectations or *protentions* that may or may not be fulfilled. This temporal aspect is also connected to particular affects such as interest, curiosity, suspense, fear, surprise, joy or disappointment.

In social interactions, which we have characterised in phenomenological terms as *mutual incorporation*, our body's operational intentionality is partially decentred. There are now two 'centres of gravity' which both continuously oscillate between activity and receptivity, or 'dominance' and 'submission' in the course of the interaction, as the examples above have shown. This unity of centering and decentering is the presupposition for embodied intersubjectivity: In order to understand the other *as other*, empathy has to be balanced by alterity. Both partners bring in their dispositions that are based on acquired intercorporal micro-practices (see below). They also bring in their retentions and protentions of the process that are partly fulfilled by interactive matches, but also partly disappointed by mismatches. In dynamical systems terms, this means that we *coordinate with* the other—both our behaviours regulate each other. The coordination here is both bi-directional and interactive, as opposed to the unidirectional 'coordination to' of fascination.

When two individuals interact in this way, the coordination of their body movements, utterances, gestures, gazes, etc. can gain such momentum that it overrides the individual intentions, and common sense-making emerges. This process has been described at the systems level as the social interaction gaining an autonomy of its own (De Jaegher and Di Paolo 2007). Phenomenologically speaking, this may be experienced as the process gaining its own 'centre of gravity': The 'in-between' becomes the source of the operative intentionality of both partners. Each of them behaves and experiences differently from how they would do outside of the process, and meaning is co-created in a way not necessarily attributable to either of them. We could even say: Who each is within the interaction is already affected by the other.

Let us expand on these last considerations.

1. *The 'in-between' becomes the source of the operative intentionality of both partners.* This means that we enter into and participate in an interaction process that itself exerts a certain influence. We both have only little control over it. Hence, in engaging in a social encounter, there is an extent to which I surrender to the other and to the process of interacting. It is like entering into uncharted terrain, not just spatially but temporally, personally and affectively as well. At the outset, the course of our encounter is more or less unpredictable. At the same time, however, each participant brings implicit expectations and protentions to the encounter that may or may not be fulfilled. Our shared humanity, history, skills and know-how and more specific shared elements such as interests and current goals ensure that we do intuit at least something of how the interaction

may unfold. On the other hand, the 'pull' of the in-between can also manifest precisely in those situations where the course or outcome of an interaction is very predictable (e.g. "we always end up fighting, even if we both come with the best of intentions," see also Granic 2000).

2. *Meaning is co-created in a way not necessarily attributable to either of the interaction partners*. Mutual incorporation opens up potential new domains of sense-making, i.e. domains of sense-making that were not available to me as an individual. In terms of participatory sense-making, in these situations we speak of truly *joint* sense-making. A good example is the spontaneous emergence of humour which often arises from a counter-intentional event in the interaction, for example a mishap or mismatch. Think of a child handing over an object to her father and, because of his hesitation, quickly taking it back. In this way, a game of teasing may emerge. Examples like these are described by Reddy in a paper on humour in infants aged between 7 and 11 months. She found that "the affective responses of others form a constitutive part of humorous incongruity and thus shape both the form and the content of humour" (Reddy 2001 p. 255). We would like to go further and say that the pattern of interacting itself can shape the form and content of the joke.
3. *Who each is within the interaction is already affected by the other.* Mutual incorporation also means mutual affection. As we enter into an interaction and are each already engaged in the activity of sense-making, we are perceivers as well as perceived. In contrast to interactions with objects, which are only reactive—that is, they can change me but never because they intend to—in social interactions there is a certain way in which I am not in control. It is not just that I cannot make the other do what I want (this can happen in interactions with objects too, as e.g. with a computer), it is also that the other, to an extent, *makes* me (see for instance the research on the effect of teacher expectations on student performance, e.g. Braun 1976). The other, while perceiving me and engaging with me, co-determines me in his gaze, touch, attitude, etc. I not only have limited control over the other, but also over myself in my encounter with him.

In terms of an enactive approach to social cognition, we have now phenomenologically illuminated interactional coordination in social encounters. The concept of mutual incorporation gives flesh to the notion of coordination by capturing the way in which the interactors' operative intentionalities can overlap and intertwine. On the other hand, the notion of interactional coordination can answer questions like: What could be the processes by which our lived bodies extend to include the other? What interacts and how, in order for there to be a phenomenon such as mutual incorporation? Whereas perception–action cycles are traditionally seen as individual processes, we propose that they can extend beyond one individual to include the other, resulting in a two-way process of perceiving and being perceived, acting and being acted upon. Thus, the process implies a unity of interiority and exteriority that lends itself to both a phenomenological and a dynamical agentive systems account.

In the following section, we will further illustrate and apply this view using examples from infancy research.

An enactive approach to early intersubjectivity

Enactive social cognition, as we have seen, is based on the processes of coordination and mutual incorporation in which both partners are immersed. Having outlined essential features of the approach, we will now apply it to the example of early intersubjectivity. The interactive approach already has a strong foothold in this field, which can therefore provide both an illustration of the ideas presented here, as well as a testbed for them. For reasons of space, we will restrict our focus to imitation and mutual regulation in the mother–child dyad.

(a) The early mother–infant dialogue as a mutual incorporation

From birth on, the infant's body is ready to connect with the body of others. Infant research has shown that even newborn babies are able to imitate the facial expressions of caregivers. They apparently transpose the seen gestures and facial expressions of others into their own proprioception and movement. Meltzoff and Moore (1977, 1989) have proposed that observation and execution of human acts are integrated within a common sensorimotor space, also termed "supramodal act space". Thus, the infant does not need to carry out any process of inner simulation or inference. Its body schema is characterised by a transmodal openness that immediately allows it to incorporate and imitate others.[9]

Reddy (2008) suggests that the best framework for understanding the phenomenon of neonate imitation is to pose the question of its significance for the infant. She points to the glaring fact that imitative activity happens within the framework of an engaged interaction. According to her, the best approach to take in order to account for the fragility and situation dependence of imitation in neonates (the fact that imitation is affected by a variety of factors and that not all gestures are imitated with the same ease for instance) is to take an interactional perspective. She sees imitation as "bi-directional" and as "relevant to the interaction rather than involving arbitrary acts, as directing the interaction down specific routes" (Reddy 2008, p. 60). In other words, imitation is relevant to the neonate because of its role in promoting an interpersonal dialogue.

In imitation, both the model and the imitator are influenced by one another, leading to an emotional shared activity. Since bodily mimesis evokes corresponding feelings, a mutual *affective resonance* gradually develops within the dyad. This is increased by the emergence of proto-conversations (*primary intersubjectivity* according to Trevarthen 1979, 1993). Six- to eight-week olds already engage in these conversations with their mothers by smiling and vocalising. The dyad exhibits a finely tuned coordination of movements, rhythmic synchrony and mirroring of affective expressions that has often been compared to a couple dance (Gopnik and Meltzoff 1997, p. 131). Infant and caregiver also follow a turn-taking pattern, shifting the roles of agent and recipient in a non-random sequence (Jasnow and Feldstein 1986). Stern has emphasised the temporal flow patterns and "vitality contours" of the dialogue (Stern 1985/98). They enable infant and caregiver to share their emotional states, which they experience as the intermodal extract of rhythmic, melodic, vocal, facial and gestural characteristics. These intermodal characters and

[9] We do not endorse Meltzoff and Moore's representationalist approach here.

contours are among the main bridges of mutual incorporation and, with it, of primary empathic understanding. Thus, affects are not enclosed in an inner mental sphere to be deciphered from outside but come into existence, change and circulate between self and other in the intercorporeal dialogue.

(b) The mutual regulation model

The same process may also be described on the system level, namely as a coordination and interaction between two agents. As an open system, the infant's physiological state, in particular its brain organisation, is expandable with input from an external source—the caregiver. When infant and mother mutually create a coordinated state, i.e. when they become components of a dyadic system, this system gains greater complexity and coherence. This does not mean that mother and infant are perfectly attuned to each other. According to the *Mutual Regulation Model* put forward by Tronick (1998, 2007), the interaction is rather a "messy" process in which there are affective "matches" and "mismatches" ("interactive errors"), with quick reparations leading from the latter back to the former. This means an improvisational, self-finding and self-correcting process in which shared states and meanings are co-created (see below).

In normal playing interactions, infants and mothers match their affects only 30% of the time (Tronick and Cohn 1989; Tronick and Weinberg 1997). Thus, miscommunications are normal events; they occur when one of the partners fails to appreciate the meaning of the other's emotional display and in turn reacts inappropriately. Reparation becomes a key process, as it conveys the experience that a miscommunication ends up in understanding and dyadic states again. The repeated experience of successful repair will have profound effects on the infant's sense of agency, trust in others and bonding capacity. Mismatches may thus be regarded as perturbations of the dyadic system which move the system to a renewed and, even when adapted in a positive way, increased coherence.

However, coordination is not only a systemic phenomenon. It is driven forward by the subjective experience of both partners who share their affective states, which will often be intense, whether positive, as in pleasure or joy, or negative, as in rejection or anger. Affect attunement and mutual incorporation create *dyadic states of awareness* (Tronick 1998): The emerging affect during a joyful playing situation between mother and infant may not be divided and distributed among them. It arises from the 'between' or from the over-arching process in which both are immersed. The understanding achieved by this moment-to-moment interaction is part and parcel of the process, and no independent inner states are transmitted to the other that he would first have to figure out and interpret in order to go on.

(c) Emergence of meanings and intentions in the dyadic system

The dynamical coupling of two agents also leads to emerging properties and meanings that would not occur in one of the partners alone. The sharing of intentions is most obvious in preverbal requests for help which are answered by the caregiver, starting at the end of the first year of life (Acredolo and Goodwyn 1988). Such requests suggest that the infant apprehends the other as someone who can understand and satisfy its own intentions. Similarly, in what Reddy calls infants' 'teasing'—i.e. the deliberate violation of shared expectations, understandings and conventions, by

which infants create "interpersonally appropriate humorous situations" (Reddy 2001, p. 252)—the understanding of an action as teasing depends on several factors but crucially on the response it gets from others. This response makes the meaning of teasing actions rather fragile and hard to carry over into future acts of teasing, as the corresponding response will very likely change. The novelty of the meanings generated in these acts eventually gets sedimented into routines and games, but its first emergence is spontaneous and interactive.

The development of *pointing* at about 9 months of age illustrates the emergence of intentions in the further course of social interaction (cf. Vygotsky 1978, p. 56). Originally, pointing is only a simple but incomplete grasping movement directed towards a desired object. The child's failed reaching may provoke a helping reaction from the caregiver, when she interprets the reaching movement as a kind of pointing gesture. In the 'thwarting' of a goal, a gap opens up for potential new meaning. The individual reaching movement can then turn into a 'gesture for others'. The meaning of reaching changes and develops into a new possibility for interacting with the (social) world: pointing. Gradually, the child learns to use this new meaning-in-movement, which is also shown by his looking back towards the mother to make sure that she has seen the object as well. As we can see, the intention of pointing does not reside within the child's individual mind but emerges as an outcome of their ongoing social interactions. Meanings and intentions may be formed not only individually but arise through participatory sense-making. They are emergent products of interaction, and in many situations, they can be viewed as distributed phenomena rather than as individual, private mental acts or properties.

A behaviouristic refutation of our interpretation would be Perner's argument that infant pointing follows an associative schema established between their own actions and their mother's reactions (Perner 1991). The infant could have learned by conditioning how to successfully control their mother's gaze. We agree with Reddy and Morris (2004) that this kind of argument establishes a dualistic opposition of an exclusively behavioural exterior and an unobservable interior mind, where the mentalistic abilities develop on a separate track unconnected to a meaningful interaction. This is indeed an undisprovable position, since "any pointing, however complex, and even if performed by adults, could always be seen to have prior associations with people's reactions and reinforcements" (Reddy and Morris 2004, p. 657).

The only way to solve this problem is to take behaviour as intentional from the very beginning, in line with what phenomenologists and enactivists have argued in detail.[10] Even though this approach cannot be 'proved' either, it is both phenomenologically more justified (experience as explanandum is taken seriously) and more parsimonious. A behaviouristic or mind-reading account has to construct a potentially endless number of 'epicycles' in order to account for, in the first place, the 'labelling problem': How to know which external events to apply the results of the internal mentalisation to? How to connect these results with certain observable behaviours? In order to solve this problem, the cognitivist account needs to postulate extra modules, such as an 'eye-direction-detector' for understanding gazes, or even

[10] See for instance Gurwitsch (1977: 77), Scheler (1954: 23), Merleau-Ponty (1962), Sheets-Johnstone (1999), Varela (1991, 1997), Thompson (2007) and Di Paolo (2005).

an 'intentionality detector' (Baron-Cohen 1995). In sum, if actions were not meaningful in themselves and perceived as embodied, animate and agentive, social understanding would either require an inordinately complicated mechanism, or the capacity would be much more fragile than it is in real life. The dynamic-phenomenological approach we put forward here is close to the experience of social interactions and parsimonious in that meaning is created in the lived experience of connection and disconnection, which is inextricably bound up with the dynamic physicality of interaction.

(d) Implicit relational knowledge

As pointed out before, the history of coordination of two highly plastic systems continuously changes their dispositions. The patterns of interaction are sedimented in their implicit memories and result in what Lyons-Ruth et al. (1998) has called *implicit relational knowing*. This means a prereflective knowledge of how to deal with others—how to share pleasure, elicit attention, avoid rejection, re-establish contact etc. The infant acquires specific interactive schemes ("*schemes of being-with*", Stern 1998) and body micro-practices (Downing 2004) that are needed for keeping up the respective interaction. Implicit relational knowing is a temporally organised, 'musical' ability to engage with the rhythm, dynamics and affects that are present in the interaction with others (see also Trevarthen 1999; Malloch 1999). It implies an interaffective memory for the specific 'feel' of the vitality contours (crescendos or decrescendos, flowing or explosive dynamics, etcetera) and for the emotions that they carry. It may also be regarded as an intercorporeal memory which shapes the actual relationship as a procedural field that encompasses both partners.

This account of intersubjectivity is quite different from concepts of mentalisation and mind reading. To illustrate this, let us take the example of an infant of a borderline mother which has learnt to withhold its impulses to approach the mother because of her repeatedly aggressive behaviour (cf. Boston Change Process Study Group (BCPSG) 2007). According to Fonagy's mentalisation concept, the infant would inhibit its ability to reflect on the mother's affect because of the unbearable content of the representation of her aggressive affects (Bateman and Fonagy 2004). The alternative view is that the mother's hate is expressed through the quality and dynamics of the embodied interaction, e.g. repeatedly rejecting the infant's approach or overriding its initiative. As a result, these interaction sequences are taken up in the infant's implicit memory in their *process* form, not their *content* form, e.g. as a bodily tension and resistance which the child builds up against his own impulses to approach the mother. He does not need to create a representation of the mother's inner state but enacts his implicit knowledge in the situational context, as an avoidant coping style. Instead of being caused by an intrapsychic process of representation, the child's behaviour emerges from the present interactive matrix of the two-body system that is informed by his implicit knowledge or by the history of the system.

This interactional-embodied knowledge, however, is not replaced when verbal interaction becomes possible later on; rather, it remains the basis of our social interactions and even continues to grow with age. This is analogous to the pragmatic claim made by Gallagher (2001): the "embodied practice of mind" remains, throughout life, the basis of our social engagements.

One implication of our approach for infancy research is that mutual incorporation and participatory sense-making can provide insight into another's experience, even if the other has no verbal abilities. If intentions, meanings, affects and understandings can be created in the in-between and each interactor participates in this, it should be possible to grasp (to a certain extent) the experience of a non-verbal partner by interacting with him. This is possible because what happens in the in-between affects each of the interactors. The autonomy of the interaction process affects that of the individuals involved (see also De Jaegher and Froese 2009). This makes a phenomenology of infants' experience conceivable. Our approach contradicts the idea that intentions are hidden and inner, or static, ready-made, and waiting to pop out of us for another to pick up (see also Torrance 2009). Rather, we participate with the other in the emergence and transformation of intentions, affects and understandings. We thus agree with Sheets-Johnstone (1999) when she suggests that a constructive phenomenology of infant experience is possible and that this requires a transdisciplinary effort.

Summary and conclusion

We have outlined a concept of enactive intersubjectivity based on the coordinated moment-to-moment interaction of embodied agents and the agents' experience of this process. According to our concept, social understanding is primarily based on intercorporality; it emerges from the interactive practice and coordination of the persons involved. We do not need to form internal models or representations of others in order to understand and communicate with them. Social cognition rather develops as a practical sense, a musicality for the rhythms and patterns of the early dialogue. In a non-mentalising way, children are already able to see the intentions and emotions in the actions of others, in their postures, gestures and facial expressions, as related to the context of the common situation. This provides a primary understanding without recourse to a concept of mental states.

In particular, we have described the process of mutual incorporation as a reciprocal expansion of the lived bodies of the participants. It can easily be experienced in intensive encounters with others but, in a more subtle way, plays a role in any social interaction. Mutual incorporation is not a subjective illusion based on a virtual body model that is projected onto the other. On the contrary, it corresponds exactly to the coupling and coordination of embodied agents that can be observed on the system level. In the early mother–infant interaction, mutual incorporation creates dyadic states of awareness but also includes mismatches and subsequent repairs of the coordination. These sequences are essential for the formation of the child's implicit relational knowledge.

Certainly, enactive social understanding does not stop here. We would suggest that even more sophisticated forms of intersubjectivity (for instance those that have until now remained the exclusive focus of theory of mind concepts) might be explained within an interactive perspective. They can be conceived as developing (1) from increasingly complex interactions such as joint attention and completion of goal-directed actions (Meltzoff and Brooks 2001), (2) from games that involve objects or interaction partners that disappear from view and reappear during

interaction (peek-a-boo, hide and seek), i.e. games in which the child gradually learns about different perspectives and (3) from infants' growing familiarity with stories that include intentions and personal relations (Gallagher and Hutto 2008). By these interactive and communicative practices, children gradually extend their understanding to hidden or longer-term intentions of others as well. Approaches to social cognition based on individual simulation or mentalisation are derived from special forms of intersubjectivity which rather arise from states of detached observation or disturbed interaction—states that create the need to explain another's behaviour and to infer his intentions from a third-person perspective. However, these situations should not be taken as the core of social cognition. Despite those later developments, enactive intersubjectivity remains the basis of our everyday social understanding.

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