Chapter 1

THEORY OF MIND: AN OVERVIEW

"An individual has a theory of mind if he imputes mental states to himself and others. A system of inferences of this kind is properly viewed as a theory because such states are not directly observable and can be used to make predictions about the behavior of others", wrote in 1978 David Premack and Guy Woodruff (p. 516), two primatologists interesting in the possibility that chimpanzees are implicitly aware that different individuals can have different mental states, such as intentions and thoughts, and can use this ability to predict behavior.

From then on the concept of Theory of Mind (ToM) has been adopted by developmental psychologist (e.g. Bretherton, McNew & Beeghly-Smith, 1981; Wimmer & Perner, 1983; Baron-Cohen, Leslie & Frith, 1985; Perner & Wimmer, 1985) producing probably the fastest growing body of empirical research in psychology and giving rise to a wide range of different theoretical positions (Leudar, Costall & Francis, 2004). About thirty years after the research on children's ToM began, this field of study continues to be a leading influence in the investigation of developmental psychology and psychopathology (Hughes & Leekam, 2004).

This chapter is aimed to answer to some questions about ToM. In particular, the chapter begins with the definition of ToM, that is strictly related to theoretical approaches assumed (*what* is ToM?); next comes a summary of the key reasons for the interest in ToM (*why* to study ToM?); then I synthesize the main research findings

about ToM (understood as a comprehension of both epistemic and emotional mental states) development from infancy to childhood (*when* ToM develops?); finally the chapter concludes with some consideration about the instruments used to assess this ability (*how* to study ToM?).

1.1.   What is Theory of Mind?

Theory of Mind is the ability to impute mental states to the self e to the others as a way of making sense and predicting behavior.

Over the years alternatives for the term "Theory of Mind" or "ToM" have also come into use (Whiten, 1994), such as "folk psychology" (Harris, 1992; Goldman, 1993; Stich & Ravenscroft, 1994), "intentional stance" (Dennet, 1987; Gergely et al., 1995; Griffin & Baron-Cohen, 2002), "mentalization" (Fonagy, 1991; Fonagy et al., 2002; Allen & Fonagy, 2006), "mentalizing" (Frith & Frith, 1999, 2003, 2006; Allen, 2003), "representation of subjectivity" (Battistelli, 1992, 1995) and "mindreading" (Baron-Cohen, 1994, 1995, 2005; Nichols & Stich, 2003; Coricelli, 2004; Tirassa, Bosco & Colle, 2006a). In psychology these terms are often used interchangeably (and the present work does so), but they have subtle differences.

Briefly, referring to Griffin and Baron-Cohen (2002), Frith and Frith (2006) and Sharp, Fonagy and Godyer (2006), the terms can be defined as follows, even if different theoretical approaches adopt quite different (i.e. restricted or wide) definitions (see the next section).

"Theory of Mind" or ToM (Premack & Wooduff, 1978) is the individual's ability to represent themselves or others as having intentional and representational states (to desire, to believe, to know, to think…); this term refers specifically to the assumption that behavior is caused by mental states and often it is applied to the operationalization of the process we use to impute mental states.

"Folk psychology" (Harris, 1992; Goldman, 1993), that is called also belief-desire psychology or naïve/commonsense psychology, includes epistemic and emotional representational states and qualitative/phenomenal states, traits, disposition and empirical generalizations about behavior, too.

"Intentional stance" refers to how we predict behavior using intentional constructs and what intentional states really are; the term was introduce by Dennet (1987), who considered beliefs and desires as logical constructs not reducible to brain-states.

"Mentalization" (Fonagy, 1991) and "mentalizing" (Frith & Frith, 1999; Allen, 2003) refer to the process by which we make inferences about mental states (mentalistic insight); this process is supposed to be link to the mother-child attachment relationship and to the development of the self (with this meaning it is also adopted the term "reflective function", used by Fonagy and Target, 1997, 2001; Fonagy et al., 2002).

The word "mindreading" (Baron-Cohen, 1995) is considered more theoretically neutral than other terms (Whiten, 1994), it has the same meaning of ToM, mentalization and mentalizing: it is the ability to understand that mental states, that are not observable, can be the cause of behaviors.

Finally, "representation of subjectivity" (Battistelli, 1992) underlines the role of subjective factors (e.g., epistemic and emotional states, moral judgment, meta-knowledge) and it could be referred to the different cognitive levels at stake when we understand humans' actions.

The present work uses the terms "ToM", "mentalization" and "mindreading" as synonymous, adopting a wide definition of this mental process, considered as a multicomponential ability (Bruner & Feldman, 1993).

Much ToM research has focused on a single children's ability, that is the understanding of false belief. However, as Wellman and Liu (2004, p. 523) underlined, "many researchers believe that developing a Theory of Mind includes understanding multiple concepts acquired in an extended series of developmental accomplishments". For example children can develop the understanding of desires, knowledge, beliefs, also those that are discrepant from reality (e.g., different desires, false beliefs) or across individuals (e.g., persons can have different beliefs about a situation); they also can develop the comprehension of emotions (real and apparent emotions) (e.g., Wellman & Liu, 2004); more sophisticated development are the understanding of metaphor, irony, double deceptions and complex narratives (e.g. Happè, 1994). Nevertheless, as Astington (2003) noted, even if researches follow the idea that ToM regards the comprehension of a wide range of mental states, they tend to focus on epistemic states, often omitting motivational states (intention and desire) and emotions[1] (see also the paragraph 1.1.2.).

1.1.1. Theories of ToM

How do children come to understand themselves and other people as psychological beings? In other words, how they develop the ability to understand their own and

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[1] In the present work when I write "ToM" I always refer to the various mental states, including emotions, unless I specify that it is referred to epistemic mental states (e.g., false beliefs). When I write specifically about "emotions" I say if I refer to the scientific literature on emotions, out of the field of study of ToM.

others' mental states? Several theories have been offered explanations to ToM development and nature.

The so called classical approaches are characterized by a piagetian (Piaget, 1975) conception of development (Astington, 1996), focused on individual factors rather than social ones. While contextualistic approaches are interested in the interpersonal relationships, underlining the interaction between cognition and social context.

Classical approaches

Classical ToM approaches are: theory-theory, simulation and modular theories (Astington, 1996).

Theory-theory approach (Wellman, 1990; Perner, 1991; Gopnik & Wellman, 1992; Gopnik & Meltzoff, 1997) suggests that humans have a theory used to reason about others' mind. This theory, regarding persons' mental states, is developed automatically and innately; it is like a scientific theory: mental states are theoretical notions that explain and predict behavior in the same way a scientist interprets data. So children develop a theory, a conceptual framework, and through it they can analyse other persons' behaviors.

Simulation theory (Johnson, 1988; Harris, 1991, 1992) is based on the idea that children are aware of their own mental states through the introspection process and are able to simulate being in another's shoes (a sort of role-taking), extrapolating from their own mental experiences. In other words, we understand others' mental states not because we have a theory, but because we are able to simulate another person's perspective from our own perspective.

Modular approach (Baron-Cohen, Leslie & Frith, 1985; Fodor, 1987; Leslie, 1987, 1994) postulates that ToM develops thanks to a neurological maturation of domain-

specific and modular mechanisms, that have an automatic functioning. These mechanisms are innate, although the experience is involved in their expression. For example, Baron-Cohen (1995; Baron-Cohen et al., 1995), according to Dennet's (1987) intentional stance and to the evolutionary psychology, has adopted a phylogenetic perspective. He has hypothesized four modular mechanisms: the intentional detector (ID) and the eye direction detector (EDD), that developed in the first 9 months, regarding the ability to grasp volitional mental states of goal and desire and eye directions through visual, auditory and tactile perceptions; the shared attention mechanism (SAM) (9-18 months of life), that built triadic representations, through which the child can share attention with others on an external object; finally, the theory of mind mechanism (ToMM), activated around 3-4 years, that incorporated the previous mechanisms, using them in order to represent epistemic mental states[2].

Contextualistic approaches

The importance gave to interpersonal interactions for the psychological functioning (the "second wave" of studies; Bosacki & Astington, 1999) allowed ToM researchers to point out the role of the context in the mental states understanding development. For example, the socio-cultural approach (Bruner, 1990; Hobson, 1991; Feldman, 1992) theorized that ToM development is a social construction: the child is able to interpret himself and reality thanks to the cultural instruments and the narrative thinking (Bruner & Feldman, 1993). So the comprehension of how mental states guide self and others'

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[2] Leslie's (1987) view is quite different from Baron-Cohen theorization; he hypothesized three modules: the theory of body mechanism (ToBy), developed around 3-4 months, regarding physical objects; the theory of mind mechanism (ToMM) regarding human mental states (8 months-2 years), and the selection processor (SP), developed around 4 years, that select information used by ToMM.

behaviors arises from the relationships, that develop in a specific cultural context (see also Olson & Astington, 1993; Astington, 1996).

The attention on interpersonal processes is underlined also by Fonagy and Target (2001), from a psychodynamic point of view, and by Meins, from a socio-constructivist perspective. In particular they focused on the mother-child attachment relationship (Bowlby, 1969, 1973, 1980). Fonagy and colleagues (Fonagy, Redfern & Charman, 1997; Fonagy & Target, 1997) suggested that mentalizing is a key determinant of children self-organization and found that the quality of attachment relationship, as well mothers' reflective function (her ability to reflect on what is going on in her own and children's mind), affect children ToM development[3]. Also Meins and colleagues (Meins, 1997; Meins et al., 1998, 2001, 2002, 2003) showed the caregivers' important role for ToM development[4]. They found that in a secure attachment relationship, the mother is able to correctly identify child's competences and to guide her child within the zone of proximal development[5] (Vygotskij, 1978), moreover she is able to focus on her child's mentalistic attributes (rather than physical or behavioral ones) when she describes her child (this ability is called "mindmindedness"; Meins et al., 1998)[6].

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[3] Fonagy and colleagues (Fonagy, Redfern & Charman, 1997; Fonagy & Target, 2001) identified two different explanations about ToM development. One postulates that attachment relationship affects indirectly mentalizing development: the secure attachment allows children to engage in important social processes (symbolic play, language and social interaction with peers), that in its turn influences ToM. The second model hypothesizes a direct influence of mother-child attachment relationship on reflective function.

[4] Meins (1997) theorizes that a secure attachment relationship influences ToM, through symbolic play and language.

[5] The zone of proximal development is "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" (Vygotsky, 1978, p. 86).

[6] About ToM socio-cultural, psychodynamic and socio-constructivist point of views see also Liverta Sempio & Marchetti, 2001a; Marchetti, 2002; Marchetti & Massaro, 2002; Lecciso, 2005.

Finally, Liverta Sempio and Marchetti (Liverta Sempio & Marchetti, 2001a, 2006; Liverta Sempio, 2002; Marchetti, 2002), from a socio-relational perspective, underlined that ToM, considered both a cognitive and affective ability, rises from a joint work between primary caregiver and infant, in which the dialogue between minds takes place through meaningful affective communication (i.e., the intersubjective exchange)[7]. So in this view it does not make sense to set beliefs against other mental states (such as emotions): all mental states are co-created within the affective relationships, that are socially and culturally situated.

The next paragraph deals with this question regarding how emotion understanding can or cannot be considered part of the mentalization ability.

1.1.2.   What about emotions in ToM theories?

For a long time researches about ToM considered only epistemic mental states, especially false belief (Wimmer & Perner, 1983; for a critic: Bloom & German, 2000), but in these last years they subscribe to much broader definitions that encompass a wide range of mental states (Hughes & Leekam, 2004), including emotions. But what role have emotion in ToM theories? The answer obviously refers to "what ToM is" for each approach.

Briefly, following Liverta Sempio and Marchetti (2006), it can be noted that in the theory-theory approach (Gopnick & Wellman, 1992; Perner, 1991) emotions are considered as mental states among others; in the simulation approach, Harris (1989;

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[7] The socio-relational approach agreed with other perspectives, within the field both of psychoanalysis (e.g., Stern, 1985, 1998; Lyons-Ruth, 1998; Tronick, 1998; Sander, 2007) and the cognitive psychology (e.g., Liotti, 2005; Tirassa, Bosco & Colle, 2006a, 2006b), pointing out the importance of family relationships, without over- or underestimating infant's abilities: intrapersonal and interpersonal processes are jointly responsible for ToM development.

1992) was one of the earliest researchers that linked ToM and emotions; while the modular approach referred only to epistemic mental states.

Inside cultural vision (Bruner, 1990; 1996; Bruner & Feldman, 1993) emotions could be considered integrated into the narrative frame: the narrative thinking, culturally deep-rooted, is on the basis of the "folk psychology". In the vygotskian view of authors like Olson and Astington (1993; Astington, 1996), emotions are not considered or are merely part of contextual factors.

In Fonagy (2002; Fonagy et al., 2002) and Meins' (Meins et al., 1998) perspectives, focused on the attachment relationship, ToM and emotions are linked inextricably. Also the socio-relational approach, as I explained at the end of the previous paragraph, considered emotions, as well the other mental state, growing within the affective relationships.

These different perspectives about the link between emotions and ToM influence the methodological choices, as I explain in the paragraph 1.4.

1.1.3. ToM and neuroscience

In this paragraph I summarize the recent findings regarding the neural basis of ToM; investigations on this matter only recently became feasible and in future they will be more and more sophisticated, giving us new data that could be used to build a wide and complex picture about ToM, its development, its link with other cognitive, emotional and social processes (e.g., language, executive function, metacognition, decision making, social and emotional functioning) and the links among the understanding of different mental states (such as emotional and epistemic).

A wide range of technique are used in order to study the neural structure of ToM, for example EEG, TMS, fMRI and psychophysiological techniques[8] (Saxe & Baron-Cohen, 2006). Current researches (e.g., Fletcher et al., 1995; Gallagher et al., 2000; Adolphs, 2001; Stuss, Gallup & Alexander, 2001; Castelli et al., 2002; Walter et al., 2004; Frith & Frith, 2006; Saxe & Baron-Cohen, 2006; Singer, 2006) suggested the activation of the orbifrontal cortex (with the superior temporal sulcus and the amygdala) and cortical frontal regions, in particular the medial frontal and prefrontal cortex, when persons are asked to infer mental states of others.

Results in the neuroscientific studies are not totally univocal, probably because they used different ToM tasks, consisting of narrative or perceptual stimuli, that require an implicit or an explicit mental state recognition, and investigated various mental states (depending on the definition of ToM adopted).

Recently a particular class of neurons, placed in the frontal cortex, called mirror neurons, discovered by Gallese, Fadiga, Fogassi and Rizzolatti (1996), researchers at the University of Parma, seems to be involved in imitation, intention understanding, empathy and language learning.

Mirror neurons are considered the neural correlate of mindreading (Gallese & Goldman, 1998; Gallese, 2003; 2006; Gallese, Keysers & Rizzolatti, 2004; Rizzolatti & Craighero, 2004; Rizzolatti & Sinigaglia, 2006). They are activated in relation to intentional behaviors performed both by self and by others, "providing a potential bridge between minds" (Williams et al., 2001). The damages in these structures could be responsible for ToM deficits of persons with autism, that show a defective "intentional attunement" (that is a direct form of experiential understanding of others), caused by a

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[8] EEG is the electro-encephalography; TMS is the transcranial magnetic stimulation; fMRI is the functional magnetic resonance imaging (see Castelli, 2005); examples of psychophysiological techniques are the electrodermal activity and cardiovascular measures.

lack of embodied simulation, based on mirror neurons (Gallese, 2006; critical remarks: Hamilton, Brindley & Frith, 2007).

The discovery of this special neurons provides some evidence for the simulation theory, even if it constitutes an open issues (Borg, 2007). However it can be said that mirror neuron system seems to confirm the link between emotion and ToM, because it can be on the basis of cognitions and emotions within the relationships.

1.2.   Why to study Theory of Mind?

Recent hypothesis suggest that ToM represents an evolved psychological capacity which evolutionary emergence occurred after the hominid-line split off; so it is most highly developed in humans than non-human primates (even if apes seem to be able to imitate, to self-recognize, maybe to deceive, to perspective-taking; Heyes, 1998; Tomasello, 1999; Call, 2007). As Brune and Brune-Cohrs (2006, p. 438) suggested, ToM "probably emerged as an adaptive response to increasingly complex primate social interaction". So an answer to the question "why to study ToM?" deals with the social functioning, as also developmental researchers suggested (I explain this subject below, within this paragraph, and more in detail in chapter 3).

But adopting a wide definition of ToM, that includes also emotions, leads us to give another answer, that is interlaced with the first one, regarding the role of ToM in emotional functioning.

1.2.1. Social functioning

Since ToM is the ability to understand one's own and others' mental states, assuming they are on the basis of human behavior, it is evident its relevance for social and relational life: the understanding of and coordination with other peoples' behavior is achieved through the connection between behavior and mind and thanks to this ability persons are able to give meaning to interpersonal behaviors. A good social adaptation (i.e., to be social competent) is possible, for example, if we can recognize epistemic and emotional mental states, especially those in contrast with reality (e.g., to distinguish appearance from reality, to realize the existence of diverse emotions, desires and beliefs, to understand false beliefs) (Moore & Frye, 1991; Baron-Cohen, 1995; Slaughter, Dennis & Pritchard, 2002; Astington, 2003; Cassidy et al., 2003).

Taking into account the mental states in order to interpret actions allows us to make sense of past behaviors, to affect present behaviors and to predict future behaviors. In this sense ToM has an important adaptive function. As Fonagy & Target (2001) suggested, children – giving meaning to social experiences – can create internal models or representations of the self and the others and can use these models to act appropriately during relationships.

The relationship between ToM and social functioning is complex and bidirectional: the development of ToM affects social competence and social relationships affects ToM development.

About the social implication of mindreading (usually operazionalized using the false belief task), it was found that a good ToM is related and predicts good relational competences (e.g., cooperative behaviors, positive relationships with peers) (Hughes & Leekam, 2004; Symons, 2004).

For example, children who are more able to understand others as intentional agents at nine months of age (see paragraph 1.3.1.), are more able to cooperate with peers at 24 months (Brownell, Ramani & Zervas, 2006); preschool children that understand the first order false belief have good communicative ability within peer relationships (Slomlowski & Dunn, 1996; Watson et al, 1999) and a good ToM seems also facilitate children's transition to school and their ability to act in the school context (Astington & Pelletier, 1996; 2005). During the school-age period, children who can understand the first and second order false beliefs experienced more satisfaction for school life and are assessed as social competent by teachers (Astington, 2003); moreover ToM can help children to learn, not only through imitation and by instruction, but also collaboratively (Tomasello, Kruger & Ratner, 1993; Kruger & Tomasello, 1996; Tomasello, 2001). Nevertheless the role of ToM in the social competence development is not so clear (Liverta Sempio, 2002; Repacholi & Slaughter, 2003; see also paragraph 3.1.1.).

The researches on the role of social relationships in ToM development came most of all from studies regarding the mother-child relationship (Carpendale & Lewis, 2004), showing how this affective interaction can influence children's understanding of mental states, as previously discussed from a theoretical point of view.

In particular, studies on family context underlined the role of some variables in children's increasing mentalization ability, such as family structures (number of brothers/sisters) (Jenkins & Astington, 1996; Perner, Ruffman & Leekam, 1994; Arranz et al. 2002; Pears & Moses, 2003) and mother's mental language and communicative style during mother-child interactions (Brown & Dunn, 1991; Meins et al., 2001; Hughes & Dunn, 2002; Ruffman, Slade & Crowe, 2002; Peterson & Slaughter, 2003; Symons, 2004; Taumoepeau & Ruffman, 2006; Lecce & Pagnin, 2007; review: de Rosnay & Hughes, 2006). Moreover, following Fonagy and colleagues (Fonagy,

Redfern & Charman, 1997; Fonagy & Target, 1997, 2001; Sharp, Fonagy, Goodyer, 2006; Fonagy, Gergely & Target, 2007) and Meins's (1997; Meins et al., 2003) views, also the quality of the attachment relationship and the mother's ability to mentalize influence the child's ToM development.

1.2.2. Emotional functioning

ToM is important not only for the social functioning (Moore, Frye, 1991; Slaughter, Dennis, Pritchard, 2002; Astington, 2003; Cassidy et al., 2003), but also for the development of the self, in particular of the self-organization (Fonagy & Target, 1997) and self-awareness (Howlin, Baron-Cohen, Hadwin, 1999; Allen, Bleiberg & Haslam-Hopwood, 2003) (see also Lecciso, 2005): when children assign mental states to the self and to others, they also give meaning to psychological experience, first of all their own experience.

Allen, Bleiberg and Haslam-Hopwood (2003), adopting a psychoanalytic point of view, summarized some of the abilities connected to mentalizing, suggesting that it is crucial to our well being: mentalizing is the basis of a sense of identity, thanks to it we have a feeling of self-agency (that affects the experience of mastery and the sense of responsibility of our own behavior) and it allows us to have a sense of coherency and continuity; it is the basis of meaningful, sustaining relationships, in fact through the meeting of minds (Aron, 1996), that presupposes and affects mentalizing, we can feel connected to others and we can give and receive support (i.e. engagement in reciprocal relationships). Finally, they suggested that mentalizing is the key to self-regulation and it promotes the capacity to open emotional expression and sharing a full range of feelings.

Also Fonagy, Gergely, Jurist & Target (2002) suggested that mentalization has a regulation function. A self-regulation basic experience is the emotion regulation (Fonagy et al., 2002; Diamond & Aspinwell, 2003), that in general is the ability to think about one's own emotions and to regulate them (Morris et al., 2007). They suggested (Fonagy et al., 2002; Jurist, 2005), connecting mentalization to the attachment theory frameworks (Bowlby, 1969, 1973, 1980), that the affect[9] regulation arises from the attachment relationship, in which plays an important role the contingent and marked mirroring of child's emotion (Gergely & Watson, 1996; Fonagy et al., 2002).

They coined the word "mentalized affectivity" to indicate the mature capacity for regulation of one's own feelings and the capacity to discover the subjective meaning states of one's own affects. It is a mature capacity for affect regulation, it includes the ability for appreciating difference between self and other and self-awareness.

While affect regulation, that is present from birth, is the ability to modulate emotions, mentalized affectivity not only modulates them, but also implies the comprehension of the impact of our representational world on affective experiences. Thus mentalized affectivity is a qualitatively different affect regulation and it can develop thanks to mentalization, that allows us to understand our and others' mental states and to use this comprehension to self-reflect and regulate emotions.

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[9] In Fonagy and colleagues' (2002) psychodynamic view the emotional experience within the mother-child attachment relationship is called "affect".

1.3.   The development of mental states understanding

"The chronological order in which cognitive novelties emerge during childhood is a datum of central importance for the study of human cognitive growth"; following this Flavell's (1972, p. 281) suggestion, in this paragraph I briefly review the main findings regarding ToM development, from infancy to childhood, trying to answer to the questions: what behaviors do children of different ages show that seem relevant to the development of knowledge about people?

1.3.1. Infants

Infants have many of the rudimentary skills needed for a more mature, fully functional ToM. They are precocious mentalization abilities, known as precursors of ToM, that show infants' ability to grasp important aspects of the mind which guide their behaviors and influence others' behaviors. Obviously, considering precursors implies a multi-componential view of ToM, beyond the false-belief comprehension, that comprises a wide range of inners states, not only cognitions, but also emotions and motivational states (intentions, desires) (Astington, 2001; Liverta Sempio & Marchetti, 2006).

The root of precursors is the babies' sensitivity to social cues (e.g. eye contact and voice; especially those of mothers), that is present even hours after birth (Eisenberg, 1975; Haith, Bergman & Moore, 1977; De Casper & Fifer, 1980; Wolff, 1987; Slater & Butterworth, 1997; Bushnell, 2001); in the earliest phase of infancy children are also sensitive to contingent mother's affective response, are able to discriminate her emotions and develop expectations about communicative interactions with her (e.g.,

Tronick et al., 1978; Stern, 1985; Haviland & Lelwica, 1987; Caron, Caron & Mac Lean, 1988; Fogel, 1993; Legerstee, 1997; Reddy et al., 1997; Beebe & Lachmann, 1998; Jaffe et al., 2001; Legerstee & Varghese, 2001; Trevarthen & Aitken, 2001; Lavelli & Fogel, 2002; Yale et al., 2003; Markova & Legerstee, 2006).

Moreover they are able to imitate, that is to convert an action plan originating from the other's perspective into one's own (Meltzoff & Moore, 1977, 1989, 1997, 1998; Legerstee, 1991; Kugiumutzakis, 1998; Meltzoff & Prinz, 2002; Nagy, 2006; Meltzoff, 2007) (see also Braten, 1998; Legerstee, 2005; Lavelli, 2007)

In the present brief review of the main ToM precursors, that develop during the first 24 months of life (reviews: Battistelli, 1997; Astington & Berriault, 2001; Flavell, 2004), I focus my attention particularly on those that are studied both in normal and clinical population (e.g. autistic children), often producing interesting debates not solved yet (Legerstee, 2005): joint attention, pointing, social referencing and symbolic play. They could be considered as cornerstones for socio-communicative development, pointing out that adaptive and interpersonal strategies are already present in infant's mind. They grow in the parent-child affective relationship and they could be seen as intersubjective intentions, based on and aimed to build, moment by moment, intersubjective understanding of joint experience (Liverta Sempio & Marchetti, 2007).

During the first year children begin to learn how people differ from objects, understanding that animate agents are self-propelled and can move unpredictably (Legerstee, 1992, 2001; Woodward, 1998; Reddy, 2003). By around 9 months (but this ability seems to be already present at 5-7 months; Legerstee, Barba & DiAdamo, 2000; Legerstee & Barillas, 2003), they demonstrate the ability to understand intention, that is the understanding of other beings as intentional agents, that act in order to attain their aims (Phillips, Baron-Cohen & Rutter, 1992; Gergely et al., 1995; Meltzoff, 1995;

Carpenter, Nagell & Tomasello, 1998; Tomasello, 1999; Bellagamba & Colonnesi, 2005; Legerstee & Markova, 2007).

The ability to parse actions as intentional is evident when children begin to engage in joint attention, a triadic activity that involves the child, the adult and an external object/event toward which they both direct their attention: they have a shared goal and coordinate their actions for pursuing it. For example an infant can look at an object, in his line of vision (some months later also out of it, e.g. behind the child), that the mother is looking at: they achieve a common cognitive focus. During this period of life children can also use their understanding of intention when imitate others' intentional actions, even if these actions don't reach their goal (Bakeman & Adamson, 1984; Carpenter, Nagell & Tomasello, 1998; Phillips, Baron-Cohen & Rutter, 1998; Striano & Bertin, 2005; Tomasello et al., 2005; Bellagamba, Camaioni & Colonnesi, 2006; Frischen, Bayliss & Tipper, 2007). These researches' data testify the appearance in infants of a basic comprehension of others as intentional and mental agents, driven by internally represented goals (Legerstee, 2005).

Around the first birthday children actively establish joint attention through gesture, such as pointing (Bates, Camaioni & Volterra, 1975; Camaioni, Perucchini, Bellagamba & Colonnesi, 2004; Liszkowski, 2005; Liszkowski, Carpenter & Tomasello, 2007). Infants point in order to draw other's attention to an object in the environment.

There are two modes of pointing: imperative and declarative. The first one is merely an instrumental action and appears generally around 10 months: the child requests an object or an action (e.g. to obtain an unreachable toy or to be picked up by the mother) and the adult is an instrumental agent (a means) who collaborates with him at a behavioral level. The declarative pointing is developed some months later (around 13 months) and serves to co-orient the child's and the caregiver's visual attention toward

the same object or event, so the dyad comes to share attention on something/somebody. The main difference between these two acts is that the imperative gestures are aimed to manipulate others' behaviors or to manipulate the world through others' behaviors (in this sense they don't need a real mentalistic ability), whereas declarative ones seem to demonstrate that children are able to manipulate others' minds or states of knowledge and imply an idea of others not as means but as subjects with a mind, that contains mental states (such as attention) that one can share and influence (Camaioni, 1993; Liszkwoski et al., 2004, 2006; Tomasello et al., 2005).

By the end of the first year of life, infants become also able to use the emotional expression of a familiar adult to regulate their behavior in unfamiliar and ambiguous situations (Sorce et al., 1985; Walden & Ogan, 1988; Moses et al., 2001; Stenberg, 2003; Walden & Kim, 2005; Striano, Vaish & Benigno, 2006). This ability, called social referencing, requires the previous acquisitions and the coordination of some important socio-communicative variables: the recognition and understanding of others' emotional expression, the joint attention (sharing attention with adult on the novel situation) and, finally, the ability to modify one's own behavior in response to the parent's emotional expression (Desrochers et al., 1994; Moses et al., 2001; Carver & Vaccaro, 2007). For example, if a child is uncertain about how react (to approach or not) to an ambiguous stimulus (e.g. an unfamiliar toy or animal or a strange adult), he looks at his mother's face and/or pays attention to his mother's tone of voice (Vaish & Striano, 2004) not only to make sure that she is there, but also to use her expression in order to acquire information (i.e. to understand parent's mental states) about the situation, to interpret it and to react appropriately to the stimulus.

Before the social referencing development, the infant is already able, around 9-10 months, to predict others' behaviors from their emotions (Walden & Ogan, 1988);

then, during the second year, they begin to grasp others' "emotional point of view", for example they understand, from expressions and actions, if a person likes and desires an object that they doesn't like (Denham, 1986; Wellman, Phillips & Rodriguez, 2000).

Another important change in infants mentalization ability occurs at about 18-24 months of age, when symbolic activities develop. In this period of life, children think not only about the world as it is, but also as it could be: they can imagine hypothetical situations, alternatives to reality (Leslie, 1987; Lewis & Ramsay, 2004). This ability is clearly evident in children's pretend play, that consolidates during the third year. It is traditionally considered a meta-representational skill, because it requires the ability to transform symbolically objects and actions. For example children pretend when they use an object to represent a different absent object (e.g. a pencil could be used as a telephone, even if the child at the same time knows that it is really a pencil) or they treat an inanimate object as if it would be real (e.g. a child feed a doll, pretending it is a real baby).

In conclusion, precursors show a raising infants' Theory of Mind, in fact these children's behaviours seem to imply a primitive comprehension of one's own and others' minds and it has been observed that when this comprehension failed, such as in autistic children, later Theory of Mind development is impaired (e.g., Baron-Cohen, 1989, 1991, 1993, 1995, 2001).

All precursors involve relations with others: they grow and develop in the family relationship and, at the same time, influence it. Liverta Sempio and Marchetti (2007) suggested that they are a sort of "thinking with" the caregiver (a meeting of minds) and of "thinking about" one's own and others' mental states, built in child-caregiver relationship, even before the false belief understanding develops.

1.3.2. Toddlers

Preschool age is a developmental period in which there are many changes in mental states understanding, that progresses from an understanding of desire to an understanding of false belief (Wellman & Liu, 2004). During this period, from two years of age, the children's ability to comprehend mental states is testified by the growing use of the mental state talk (i.e., children's talk about inner states, using emotional, motivational and cognitive mental terms, such as "think", "know", "pretend", "get angry", "like") (e.g., Bretherton & Beeghly, 1982; Dunn, Brown & Beardsall, 1991; Wellman & Bartsch, 1994; Dunn & Brown, 1993; Wellman et al., 1995; Hughes & Dunn, 1998; Ruffman, Slade & Crowe, 2002; Hughes, Lecce & Wilson, 2007; see also Lecce & Pagnin, 2007).

Around the end of the second years of life children understand that desires cause behaviors (Wellman & Bartsch, 1994), they can reasoning about desires and recognize that people can have different ones, for example they understand that if a person likes broccolis more than biscuits, when the person wants something to eat he will take broccolis and not biscuits, even if children's desire is diverse (Repacholi & Gopnik, 1997). They also seem to grasp simple causal relations among desires and emotions, for example they understand that people will feel good if they get what they want and feel bad if they do not (Bartsch & Wellman, 1995; Flavell, 1999; this ability becomes more explicit around 3-5 years: Pons, Harris & de Rosnay, 2004).

During this early preschool period children can already realize that a person will see an object not only if the person's eyes are aimed in the direction of the object, but also if there are not vision-blocking obstacles (Flavell et al., 1981; Flavell, 1988; Gopnik, Slaughter, Meltzoff, 1994), so they are able visual perspective-taking.

When children are three years old, they can understand the true belief, referred to reality (Wellman, 1991; Lohmann, Carpenter & Call, 2005), and engage in belief-desire reasoning (Wellman & Bartsch, 1994). They can also judge that they and someone else can have differing beliefs about the same situation (when the child does not know which belief is true and which is false) (Wellman & Liu, 2004).

Regarding the development of emotion understanding, Izard (1971) found that by the preschool years, most children can discriminate the facial expressions for happiness, sadness, anger, and fear. Thus they start to be able to recognize and name emotions on the basis of expressive cues and, around 3 years, they begin to understand how external causes affect the emotions of other children (Pons, Harris & de Rosnay, 2004).

At the age of four years, children are able to understand the false belief (Wellman, Cross & Watson, 2001; Flynn, 2006): they judge that a person can have a false belief about a situation, while at the same time they know that what they belief is true (they handle two different mental representation of reality). This ability is usually assessed with a verbal task, the first-order false belief task (Wimmer & Perner, 1983; Castelli, Lecciso & Pezzotta, 2001; Liverta Sempio et al., 2005; see also the paragraph 1.4.), but Onishi and Baillargeon (2005), using a non-verbal task, showed that 15-month-old infants can predict an actor's behavior on the basis of her true or false belief about a toy's hiding place.

Traditionally this ability is considered an important developmental stage, but – as I underlined before (paragraph 1.1.) – it represents only one aspect, among others, of people's understanding of others' mind, "nothing more, nothing less" and currently it is controversial how well standard false-belief tasks actually measure this concept (Bloom & German, 2000, p. B30).

At 4-5 years old, children also start to understand that a person's beliefs (true or false) will determine his emotional reaction to the situation and are able to judge that a person can feel one emotion but display a different emotion (real-apparent emotion) (Harris, 1989; de Rosnay et al., 2004; Pons, Harris & de Rosnay, 2004; Wellman, Liu, 2004; Pons, Harris, 2005).

During the preschool period children develop not only the knowledge on the belief about physical objects (e.g., about an object's identity or location, as operazionalized in the false belief tasks), but also the knowledge about how to do things (such as to complete an homework). It requires not simply the understanding of perceptual access for recognizing how the knowledge is acquired (e.g., looking; Wimmer, Hogrefe & Perner, 1988; Pratt & Bryant, 1990), but also the understanding of other forms of knowledge sources, such as the activity of teaching (Ziv & Frye, 2004). Briefly, teaching implies two components: the awareness of a difference of knowledge (between teacher and learner) and the intentional activity (to increase others' knowledge) (Olson & Bruner, 1996; Tomasello, Kruger & Ratner, 1993; Ziv & Frye, 2004). Researchers found that children's teaching strategies (Wood et al., 1995; Astington & Pelletier, 1996; Ashley & Tomasello, 1998; Strauss, Ziv & Stein, 2002), as well learning ability (Tomasello, Kruger & Ratner, 1993; Kruger & Tomasello, 1996; Tomasello, 2001; Astington & Pelletier, 2005), are related to change in mental state understanding.

1.3.3. School age children

ToM development continues during the school age, but there are few researches on this period (studies are most of all on children with psychological difficulties or pathologies;

e.g., Buitelaar et al., 1999; Peterson, Wellman & Liu, 2005; Sobel, Capps & Gopnik, 2005; Kaland, Smith & Mortensen, 2007; see also paragraph 2.1.).

When children begin the primary school, they are able to interpret ambiguous situation using the reasoning on expectation (Pillow & Henrichon, 1996), to distinguish jokes from lies (Sullivan, Wimmer & Hopfield,1995) and to understand the second order false belief (Perner & Wimmer, 1985), that requires making inferences about someone's false attribution of belief. In the early school years children were found to understand the situational determinants of happy and scared and, some month later, also of sad and angry feelings (Harris et al., 1987) and become more able to predict emotions from beliefs (Pons & Harris, 2005).

Around 8 years, they understand mixed emotions or more sophisticated mental states, such as irony and metaphor (that imply the ability to go beyond the literal meaning of an utterance) (Ackerman, 1981; Marchetti, Massaro & Valle, 2007) and refer much more to mental states in their discourse (for example when they explain emotional reactions; Rieffe, Meerum Terwogt & Cowan, 2005), as well they better understand the polysemous meanings of the mental-state verb "know" (Booth & Hall, 1995).

In this period of life children's developed ToM is also evident in their ability to lie consistently (Talwar, Gordon & Lee, 2007), to understand that a person may have multiple or even contradictory emotional responses to a situation and that morally reprehensible actions (e.g., to lie, to steal) cause negative feelings, while morally praiseworthy actions (e.g., to make a sacrifice, to resist a temptation) cause positive emotions (Pons, Harris & de Rosnay, 2004). So older children have knowledge of situations that evoke more complex emotions, such as pride, shame, guilt, gratitude, jealousy and worry (Harris et al., 1987).

As Pons, Harris and de Rosnay (2004) pointed out, children invoke different strategies for emotional control as they get older, for example at age 6-7 they refer mostly to behavioral strategies, while from 8 years old they start to acknowledge that psychological strategies can be more effective (e.g., denial, distraction).

During the last years of primary school (9-11 years old) children can comprehend "faux pas" situation (Baron-Cohen et al., 1999), that requires the simultaneous mental representation of the perspective of the person who says something he should not have said, without grasping his mistake (the "faux pas"), and of the other person involved that can be hurt/irritated.

The growing mental states understanding is assessed with advanced tasks (described in chapter 2), focused for example on metaphor, irony and double deception (e.g., Happè, 1994), that are supposed to be acquired later in development than the understanding of desire, emotion, knowledge and belief (Brune & Brune-Cohrs, 2006).

1.4. How to study Theory of Mind?

In this paragraph I introduce the topic of ToM assessment, that is in-depth analyzed in the second chapter.

The classical instrument used to assess the first order false belief understanding is the "*Sally-Ann task*" (Wimmer & Perner, 1983; modified versions: Baron-Cohen, Leslie & Frith, 1985; Siegal & Beattie, 1991; Italian version: Liverta Sempio & Marchetti, 2001b). The child is shown a scenario illustrated, which can be enacted by puppets or real people.

There are two characters: Sally and Ann; Sally has a basket; Anne has a box. Sally puts a marble in her basket and then leaves the scene. While Sally is away and cannot watch, Anne takes the marble out of Sally's basket and puts it into her box. Sally then returns and the child is asked "Where will Sally look for her ball?". To answer this question the child must realize that Sally has not seen the marble being moved and, therefore, that Sally has the false belief that the marble is still in the basket.

As I explained in the previous paragraph, normal children pass this task around the age of four. It seems that the difficulties of younger preschool children to understand the false belief in this task are not due to problems in the mnestic or language domain (Lewis & Osborne, 1990; Perner, Leekam & Wimmer, 1987; Wellman, Cross & Watson, 2001), even if language is strongly related to ToM development (Malle, 2002; Antonietti, Liverta Sempio & Marchetti, 2006; Milligan, Astington & Dack, 2007).

Another first order false belief task is "*The deceptive box*" (Perner, Leekam & Wimmer, 1987; Italian adaptation: Liverta Sempio & Marchetti, 2001c), that assesses the understanding of both one's own and other's false belief. This task, as the second order false belief task "*Look prediction*" (Sullivan, Zaitchik & Tager-Flusberg, 1994; Italian adaptation: Antonietti et al., 1999), are illustrated in the second chapter.

Most of ToM studies used these classical tests, but they are focused only on the false belief epistemic mental state. Other tasks assess basic or mixed emotions understanding (e.g., Steele et al., 1999; Ruffman, Slade & Crowe, 2002), some other studies both beliefs and emotions together (e.g., Symons et al., 1997; De Rosnay & Harris, 2002) o separately (Cutting, Dunn, 1999; Repacholi, Trapolini, 2004; Pears, Fisher, 2005). In the next chapter I review tasks that assess complex epistemic and emotional mental states (e.g., Happè, 1994; Baron-Cohen et al., 2001a, 2001b; Golan et al., 2007a).

This variety of tasks reflects the different ToM theories, described in the first paragraph of this chapter, that operazionalized their definition of mindreading in different ways, performing different methodological choices. As Liverta Sempio and Marchetti (2006) showed, the more ToM definition is individualistic and decontextualized, the more researches have a correlational nature and use instruments referred to single areas (for example, false belief task and emotion recognition task separately).

Vice versa the more ToM definition links cognition and emotions, the more researches use instruments that point out this connection between different aspects of mental functioning (e.g., Fonagy & Target, 1997). Thus some researchers, as I have showed before, include emotions into the set of mental states that constitutes ToM, some others conceived ToM quite exclusively as false belief understanding, putting emotions "outside" the set of mental states studied by the ToM paradigm.

A future promising direction of research should try to propose a more emotionally charged view of theory of mind, including all basic emotions, as well as mixed and complex emotions, within its objects of investigation.

Moreover it can be noted that most of ToM instruments assess the understanding of others' mental states, not considering one's own mental stated comprehension. Future researches should investigate also this matter and it could be interesting to better understand the relationship between one's own and others' epistemic and emotional states understanding, also in order to throw light upon children social and emotional functioning, that could be linked with the ability to understand mental states both of others and oneself.