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# What are the Links Between Theory of Mind and Social Relations? Review, Reflections and New Directions for Studies of Typical and Atypical Development

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## Abstract

*Twenty years after research on children's 'theory of mind' began, this field continues to be a leading influence in the study of developmental psychology and psychopathology. In this review we examine the contribution of research on children's theories of mind to our understanding of children's developing social relationships. Evidence shows that for both typical and atypical populations this relationship is neither uniform nor unidirectional. Theory-of-mind skills are multifaceted and the nature of the developmental relationship between different aspects is not yet known, and there is evidence that theory-of-mind skills both transform and are transformed by interpersonal and family relationships and by language communities. To understand the multifaceted and complex nature of development in this area, we need clearer definitions of the skills under investigation, as well as research designs that capture the transactional nature of the relationship between theory of mind and social relations. Addressing these issues should help to clarify (i) the processes by which children's developing understanding of others is influenced by the social environment, and (ii) issues concerning the specificity of theory-of-mind impairments in atypical populations and the processes by which these impairments develop.*

*Keywords:* theory of mind; social relationships; autism; language skills; disability

After more than 20 years of pre-eminence, investigations into children's developing theories of mind continue to lead current research in developmental psychology. A key reason for the intense academic interest in this topic is a general acceptance that theory-of-mind skills transform and/or are transformed by children's close relationships. Before reviewing the evidence for this proposal we first address two issues that become recurring themes in this paper, namely the problems of defining 'theory of mind' and of disentangling environmental and genetic influences on children's theory of mind. Next we consider how developments of theory of mind transform children's social relations, and here our main objective is to complement the recent excellent

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reviews (Flavell, 1999; Wellman & Lagattuta, 2000) and meta-analysis (Wellman, Cross & Watson, 2001) of age-related changes in children's theories of mind by focusing on the social implications of these normative developmental milestones in children's understanding of others. In the third section of this paper we consider aspects of social relations that may influence theory-of-mind development; here we review findings from the growing number of studies that investigate influences of culture, family and inter-individual relationships. Finally, we consider the relation between theory-of-mind performance and social competence in atypical groups; specifically children with autism and children with sensory impairments, before offering some general reflections on emerging issues within contemporary theory-of-mind research.

## Conceptualising the Link Between Theory of Mind and Social Relations

### *Defining 'Theory of Mind'*

Originally, the term 'theory of mind' was coined to refer to the ability to impute mental states to the self and to others (Premack & Woodruff, 1978). Very quickly however, a task involving the attribution of a mistaken belief—the false-belief task (Baron-Cohen, Leslie & Frith, 1985; Wimmer & Perner, 1983)—became the litmus test for crediting a child with a 'theory of mind'. Two consequences of this operational but narrow definition were (i) a heavy research focus upon 3- to 5-year olds, since it is in this age period that most children begin to succeed false-belief tasks; and (ii) an emphasis upon representational mental states of belief and knowledge (rather than upon intentions, perceptions, emotions, desires and so on). Although only a single index of a capacity that develops across the life-span, false-belief comprehension is associated with diverse socially relevant domains, including shared pretense (Hughes & Dunn, 1997; Youngblade & Dunn, 1995), communication (Słomkowski & Dunn, 1996) and sensitivity to criticism (Cutting & Dunn, 2002; Dunn, 1995). These findings suggest that false-belief comprehension is central to young children's ability to adapt to their social worlds.

At the same time, there is a paradoxical contrast between 3-year-olds' failure on false-belief tasks and their evident success in negotiating everyday social interactions. This contrast leads to the question of whether, under this formal definition, 'theory of mind' has any fundamental significance for children's social competencies (Astington, 2001). As a result, many researchers now subscribe to much broader definitions of 'theory of mind' that encompass a wide range of mental states (from perception to intention, cognition and emotion), expanding considerably the scope of theory-of-mind research (for reviews, see Flavell, 1999; Hughes, 2001b; Tager-Flusberg, 2001).

Within its broader framework, two contrasting kinds of definition for 'theory of mind' can be offered (Tager-Flusberg, 2001). These emphasise either formal propositional knowledge (of a set of interconnected principles that state how the mental world works) *or* socio-perceptual skills (that provide an implicit social 'know-how' that allows us to negotiate the mental domain). The developmental course of 'theory of mind' is very different under these two alternative definitions. This point is pertinent to the current debate surrounding precursor or 'fledgling' theory-of-mind skills in late infancy (e.g., joint visual attention, social referencing, imitation, communicative vocalisations and gestures), which are interpreted generously by some (e.g., Baldwin & Moses, 1994; Dunn, 1999b; Meltzoff, Gopnik & Repacholi, 1999; Tomasello, 1999)

and cautiously by others (e.g., Butterworth & Jarrett, 1991; Moore, 1999). Similarly, these two definitions lead to contrasting interpretations of the relationship between theory of mind and children's emerging social competencies; a point that needs to be held in mind when assessing the evidence for this relationship.

### *Disentangling Social Environmental Influences*

Early theory-of-mind research emphasised dramatic and universal age-related changes in children's concepts of mind, and so development was seen as essentially a maturational process, with children's social environments having no more than a triggering role (Leslie, 1994) (but see Astington (1996) and Dunn (1996) for early exceptions to this view). Then, in a landmark study Perner, Ruffman and Leekam (1994) documented a striking effect of family size, equivalent to an acceleration of approximately six months per sibling in understanding false-belief.

The positive effect of larger families on theory-of-mind development, confirmed in several subsequent studies (e.g., Astington & Jenkins, 1995; Lewis, Freeman, Kyriakidou, Maridaki-Kassotaki & Berridge, 1996; Peterson, 2001; Ruffman, Perner, Naito, Parkin & Clements, 1998) sparked a growing interest in the nature and extent of individual differences in theory of mind, and in social environmental influences on this individual variation. For example, recent studies have demonstrated clear associations between theory-of-mind performance and both family background (Cutting & Dunn, 1999) and cultural background (Vinden, 1999). However, these studies of effects of culture and family often overlook the fact that many environmental influences on child characteristics covary with genetic effects. Thus what appears to be an environmental factor (e.g., socio-economic status) may in fact have a substantial heritable component (e.g., IQ). This point is highlighted by the findings from the only theory-of-mind study to date to adopt a genetically sensitive design. In this study, Hughes and Cutting (1999) tested 120 pairs of 40-month-old twins and found that theory-of-mind scores showed much stronger between-twin correlations for identical twin pairs ( $r = .66$ ) than for fraternal twin pairs ( $r = .32$ ). Model-fitting analyses indicated an estimated heritability of 67% for this sample; the remaining 33% of the variance in theory-of-mind performance was accounted for by non-shared environmental influences (i.e., environmental factors that have child-specific effects).

Although Hughes and Cutting's (1999) findings require replication in a much larger sample (especially since shared environmental effects are difficult to detect in small samples—Martin, Eaves, Kearsy & Davies, 1978), they do provide a fresh perspective upon the results of phenotypic studies. For example, the results both confirm that sibling effects are unlikely to be symmetrical (Ruffman *et al.*, 1998), and highlight the active role played by children in shaping their own social environments (Dunn & Plomin, 1990). Studies of this kind help us to focus on the processes by which child–environment interactions come to have specific effects.

### **Do Developments in 'Theory of Mind' Transform Children's Social Relations?**

How do developmental changes in theory of mind influence children's social interactions with close others? In this section, we attempt to trace the social implications of theory of mind for each stage of development.

### Infancy

Newborn infants appear not only impelled to interact with other people, but also to impel others to interact with them. Thus infants are very much active social partners, but to what extent does this stem from developments in ‘theory of mind’? Obviously, answering this question requires a more general definition of ‘theory of mind’ than false-belief comprehension, and here the term ‘mentalizing’ has proved useful (Frith & Frith, in press) in that it encompasses awareness of a wide range of inner states (i.e., not only cognition, but also intention, desire, emotion). This broader definition increases the scope of theory-of-mind research both substantively and developmentally. In particular, the recent shift in focus from beliefs to intentions has led to an emphasis on action (rather than representation), that enables key changes across infancy to be included in accounts of theory-of-mind development (Hughes, 2001b).

For example, recent research shows that from 6 months of age infants recognize that animate agents are self-propelled (Spelke, Phillips & Woodward, 1995) and can distinguish between biological and mechanical movement (Woodward, 1998). These competencies enhance infants’ abilities to attend selectively to human behaviour and to view events from an agent’s perspective. Indeed, from about 10 months of age, infants begin to parse actions according to the actors’ underlying intentions (Baldwin, Baird, Saylor & Clark, 2001), and by 12 months infants expect agents to approach a goal in the most economical way (Gergely, Nadasdy, Csibra & Biro, 1995). Of course, parsing action on the basis of intention is not the same as knowing the *content* of an intention; nor does it allow us to conclude that 10-month-old infants *intend* to parse actions in this way. Nevertheless, recognizing actions as intentional is an important foundation for children’s social and communicative development.

Joint visual attention is a prime illustration of how the ability to parse actions as intentional might provide a cornerstone for socio-communicative development. This new form of sensori-motor action also emerges between 9 to 12 months of age, appears unique to humans (Tomasello, 1999), and is significantly associated with later language development (Baldwin & Moses, 1994; Mundy & Sigman, 1989; Tomasello & Barton, 1994). Although it is debated whether infants engaged in joint attention actually make inferences about another’s person’s mental states (Corkum & Moore, 1998; Perner, 1991; Reddy, 1991), accompanying gaze checking is often treated as an indication that the child is aware of the other’s mental state (Tomasello, 1999). A second example that also emerges around 9 to 10 months of age is ‘social referencing’—infants’ ability to use others’ emotional reactions to guide their own actions in novel or potentially threatening situations (Baldwin & Moses, 1994; Moses, Baldwin, Rosicky & Tidball, 2001). However, as noted by Flavell (1999), while these infant behaviours are interpreted generously by some and cautiously by others, all agree that what is really needed is better empirical evidence as to what infants actually impute to themselves and others in the way of mental states and subjective experiences.

### Toddlerhood

To highlight the dearth of theory-of-mind research in this age group, Meltzoff and colleagues (Meltzoff *et al.*, 1999) refer to toddler-hood as the ‘dark ages’ between infancy and pre-school. One exception to this paucity of research is the substantial body of work on pretend play in toddler-hood. How might pretend play influence

toddlers' social relationships? Most obviously, shared imaginative play is enjoyable and exciting for toddlers, and so acts as a powerful motivator for these very young children to initiate and sustain social contact. Indirect effects may also be important. For example, one consequence of developing pretend play skills is the facilitation of co-operative interactions between siblings (Brown, Donelan-McCall & Dunn, 1996; Dunn, Brown, Slomkowski, Tesla & Youngblade, 1991). By fostering co-operative sibling interactions, fledgling pretend play skills may have widespread positive effects on children's social lives, since sibling relationships are known to have a powerful influence upon children's socio-emotional adjustment (Dunn, 2000; Garcia, Shaw, Winslow & Yaggi, 2000; Patterson, 1986).

A second area that has received much less attention from a 'theory-of-mind' perspective is toddlers' developing capacities for emotional *regulation*. Studies involving a variety of frustration tasks (e.g., waiting for a reward) have demonstrated striking individual differences in toddlers' emotional lability that are significantly related not only to individual differences in maternal style, but also to later problems in peer relationships (e.g., Calkins, Gill, Johnson & Smith, 1999; Calkins & Johnson, 1998). Other studies indicate that deficits in emotional regulation underpin many of the problems shown by children with disruptive behaviour disorders (e.g., Cole, Zahn-Waxler, Fox, Usher & Welsh, 1996; Eisenberg *et al.*, 2000). These are good grounds for positing strong bi-directional links between successful relationship experiences and the skills needed for regulating emotions—what has yet to be discovered is whether these skills are moderated by children's *understanding* of emotion.

However, perhaps the most important milestone in toddler-hood is language development. Here, the acquisition of internal state language (Bartsch & Wellman, 1995; Bretherton & Beeghly, 1982; Shatz, Wellman & Silber, 1983), and the ability to reason non-egocentrically about other people's feelings and desires (Repacholi & Gopnik, 1997) enable toddlers to display their awareness of the subjectivity of feelings, preferences, desires, and perceptions. This transforms toddlers' social interactions in several ways: by opening up new horizons in communication, and by enabling not only empathic exchanges (e.g., comforting a younger sibling with a hug or a kiss) (Zahn-Waxler, Radke-Yarrow, Wagner & Chapman, 1992) and joint goal-directed activity but also teasing and provocation (Dunn, 1988).

### *Pre-school*

By pre-school, most children have quite a sophisticated understanding of mental states, and especially emotions. For example older pre-schoolers can identify a range of emotions, and generally understand that people: (i) do not always really feel what they appear to feel; (ii) show emotional reactions to an event that are influenced by their current mood, or even by earlier emotional experiences associated with similar events; and (iii) can experience two conflicting emotions more or less simultaneously (Flavell & Miller, 1998). These developments in emotional understanding make children much more skilled 'mindreaders', and so transform their social interactions. Consistent with this view, emotion understanding in pre-schoolers is significantly associated with empathy (Zahn-Waxler *et al.*, 1992), positive peer relations (Dunn & Cutting, 1999), and the use of socially prescribed rules for controlling emotional displays (Harris, 1989, 1994).

Preschoolers also understand some of the most basic facts about thinking: namely, that it is an internal human activity that refers to or represents real or imaginary things.

They can also appreciate that human behaviour is influenced not only by transient mental states (e.g., thoughts, beliefs, emotions, precepts) but also by more stable characteristics such as ability and personality (Flavell, 1999). It seems likely that this new and relatively complex 'folk psychology' underpins the development of children's self-concepts, which in turn are likely to influence how children interact and engage with social partners (Eder, 1990).

By 4 years of age, most children can attribute mistaken beliefs to themselves and to others, and so begin to show new and advanced forms of social interaction, including tricks, jokes and deception. Four-year-olds can also appreciate that the word 'know' expresses more speaker certainty than 'think' or 'guess' (Flavell & Miller, 1998; Montgomery, 1992; Perner, 1991; Taylor, 1996). It seems reasonable to suppose that these improvements in understanding knowledge and belief make 4-year-olds more sophisticated social partners; and indeed false-belief performance is correlated with connectedness of conversation (Slomkowski & Dunn, 1996), teacher ratings of social competence (Lalonde & Chandler, 1995) and elaborate joint pretend play (Hughes & Dunn, 1997; Taylor & Carlson, 1997; Youngblade & Dunn, 1995).

Interestingly, children's play across the pre-school years is characterized by a shift in preferred social partners, from adult caregiver to sibling or friend, suggesting that as they become less reliant on adult conversational 'scaffolding', children are more able to sustain connected conversations with other children, who also have the appeal of shared interests and humour (Dunn, 1994). As noted earlier, then, developments in theory of mind show associations not only with *how* children interact socially, but also with *whom* they engage in social interactions.

### *School Age*

Children's knowledge about mental representations continues to increase after the age of 4. Later developments include understanding (i) mistaken beliefs about beliefs (Perner & Wimmer, 1985); (ii) the role of pre-existing biases and expectations in influencing both personal tastes (Carpendale & Chandler, 1996) and how people interpret either ambiguous events (Pillow & Henrichon, 1996) or moral dilemmas of truth and rightness (Chandler, Sokol & Hallett, 2001); (iii) subtle forms of social deception such as bluffs and white lies (Happé, 1994); (iv) mixed and ambivalent emotions (Harris, Johnson, Hutton, Andrews & Cooke, 1989).

On the one hand these late-developing theory-of-mind skills should lead to increased social harmony, as conflicts arising from misunderstanding become less frequent, and as children develop a new repertoire of skills for avoiding distressing or embarrassing situations. On the other hand, these later developments also enable children to conceal or clarify their motives as needed, in order to manipulate social situations. Thus while physical aggression peaks in early childhood (Tremblay *et al.*, 1999), relational aggression is most evident in middle childhood (Crick & Grotpeter, 1996), but see also (Crick, Casas & Mosher, 1997), and continues into adulthood (Werner & Crick, 1999). In addition, 'ring-leader' bullies have been shown to display intact or even superior theory-of-mind skills (Sutton, Smith & Swettenham, 1999a, 1999b). In addition, pre-school developments in theory of mind may, by school-age, lead to heightened sensitivity to criticism (Cutting & Dunn, 2002; Dunn, 1995), which in turn is likely to lead to problems of low self-esteem and anxiety. Here, the message is that the social implications of developments in children's understanding in mind are far from being uniformly positive.



Taken together, the above findings support our opening claim that developments in theory of mind transform children's close relationships, but also highlight both the complexity of these socio-cognitive influences, and the need for more research in this area. In section three we turn the association on its head, to consider how relationships affect children's understanding of mind.

### **Do Social Relations Transform Children's Theories of Mind?**

Despite the remarkable consensus regarding the main features and developmental milestones within children's acquisition of a 'theory of mind', there is considerable controversy about how these empirical findings should be interpreted theoretically. In particular, different theoretical perspectives provide contrasting views on the nature and extent of social environmental influences upon theory-of-mind development.

For example, from a strictly nativistic position (e.g., Baron-Cohen, 1995; Leslie, 1994), young children's social environments may trigger but cannot determine theory-of-mind development. By this account, theory-of-mind development is essentially a maturational process, such that individual differences are much less significant than age-related changes. In support of this claim, nativists can point to at least one study (Avis & Harris, 1991) that suggests a universal pattern of age-related changes in theory-of-mind development. However, more recent work involving larger and more diverse samples also highlights significant cultural differences in both the rate and pattern of theory-of-mind development (Vinden, 1999; Wellman *et al.*, 2001).

Another prominent account of developments in children's understanding of mind is the 'theory theory' (Gopnik & Wellman, 1994; Wellman, 1990), in which children's conceptual development is compared with the refining and reformulation of scientific theories. At the heart of this account is the notion of a 'conceptual revolution' (Kuhn, 1962) somewhere between the ages of 3 to 5 years. Social experiences are thought to play a formative role in this dramatic shift in children's conceptions of others, since they provide young children with information that cannot be accounted for by their present theory of mind, information that will eventually cause them to revise and improve that theory.

According to the 'theory theory', the richness of social environments will influence the rate with which children acquire a theory of mind, while cultural differences in the nature of children's social environments may lead to substantive differences in how specific mental states are understood. Nevertheless, the child is still portrayed as an individual thinker who interprets social experiences according to the constraints of his or her current conceptions of the mind, and reformulates these conceptions if they provide inadequate explanations of specific salient experiences. However, the mechanisms by which children's concepts of mind are changed and reformulated remains to be elucidated.

A third prominent account of theory-of-mind development is 'simulation theory'. In one version of this theory (Harris, 1991), acquiring an understanding of mind depends on self-awareness and the imaginative capacity for pretence. This suggests that contrasting opportunities for pretend play in children's social environments should lead to significant individual differences in understanding mind. Consistent with this view, it is known that siblings are often children's preferred partners for pretend play (Dunn, 1992, 2000), and children's performance on formal tests of theory of mind is significantly related to both the quality of children's sibling relationships (Dunn *et al.*, 1991), and to the number of siblings (Perner *et al.*, 1994), especially older siblings

(Ruffman *et al.*, 1998) in the child's family. Taken together, these findings suggest that siblings' pretend play may be a key facilitator for theory-of-mind development (see Howe, Petrakos & Rinaldi, 1998; Lillard, 1993 for a similar view).

A fourth theoretical account of theory-of-mind development is the executive function hypothesis (Carlson & Moses, 2001; Hughes, 1998b, 2001a; Russell, 1997), in which both developmental change and individual differences in theory of mind are seen as closely related to the functions underlying flexible goal-directed behaviour (e.g., self-monitoring, working memory, planning, cognitive flexibility). To some extent the executive-function account overlaps with simulation theory, since these executive functions are critical for self-awareness and the capacity for pretence (Harris & Leivers, 2000). However, as noted by several researchers (Bishop & Adams, 1989; Dennis, 1991; Hughes, 2001a; Ylvisaker & DeBonis, 2000), executive functions are also important for communication skills (e.g., online adaptive responses to changes in conversational topic, planning a coherent narrative, and monitoring the consequences of particular speech acts). Thus although many accounts highlight intrinsic and direct relationships between executive function and theory of mind (Hughes, 1998a, 1998b; Mitchell & Riggs, 2000; Perner, 1997; Perner & Lang, 2000; Russell, 1997), the relationship may also be socially mediated. For example, executive dysfunction may impoverish social interactions and so affect children's developing understanding of mind. Conversely, social interactions provide a fertile arena for practising and improving executive skills. As a result, executive functions may show relations with theory of mind that are at least partially underpinned by links with the quality and quantity of children's social interactions (Hughes, 2001a; Hughes, White, Sharpen & Dunn, 2000).

Looking across these four theoretical perspectives it may be seen that there are contrasts in (i) the *extent* to which children's social environments are thought to play a role in development (the modularists' account being much more conservative than the other three); (ii) the specific *form* of social interactions that are highlighted (e.g., observational learning, pretence, sustained conversation); and (iii) the key *processes* underlying these social interactions; these processes may be either cognitive (e.g., self-awareness, imagination, cognitive flexibility, verbal ability) or social (e.g., opportunities for direct engagement or third-person observations). To what extent do these contrasting emphases fit with the available empirical findings? This question, together with the points raised by a gene-environment perspective, is considered at three different levels: (i) culture, (ii) family, and (iii) inter-individual relations.

### *Culture*

As noted above, early research (Avis & Harris, 1991) highlighted cross-cultural similarities in children's acquisition of a theory of mind (defined in its narrow sense as false-belief comprehension). However, more recent and larger scale studies have demonstrated cultural variation in both the rate (Wellman *et al.*, 2001) and course (Vinden, 1999) of false-belief comprehension. This variation appears closely linked with contrasting linguistic frameworks (Astington, 1996; Vinden, 1996, 1999; Vinden & Astington, 2000). This is interesting, since both between-species comparisons and at least two types of within-group investigation into individual differences also highlight language as a key influence on theory-of-mind development.

Initial comparisons of theory-of-mind skills across different species suggested that chimpanzees (but not monkeys) could engage in tactical deception; but more recent



reviews (e.g., Heyes, 1998; Povinelli & Eddy, 1996) have been more sceptical. 'Enculturation' studies (in which chimpanzees are reared by humans and trained in a simple sign language) show that enculturated chimpanzees display more frequent rates of mutual gaze, deferred imitation, and simple pretence but do not show any clear evidence for first-order theory-of-mind abilities (Call & Tomasello, 1996). Taken together, these results suggest that language may be necessary, but not sufficient for theory-of-mind development; we will return to this proposal in the third section of this paper, in which we review theory-of-mind development in atypical populations.

With regard to investigations of individual differences in children, a large set of studies has shown significant correlations between language ability and false-belief performance, both concurrently (Happé, 1995; Hughes, 1998a) and across time (Astington & Jenkins, 1995); this relationship may be especially close for specific aspects of language development, such as mastery of the syntax of complementation (de Villiers, 2000; Tager-Flusberg, 2000). Another set of studies has documented significant correlations between family socio-economic status (SES) and individual differences in false-belief performance (e.g., Cole & Mitchell, 2000; Cutting & Dunn, 1999; Holmes, Black & Miller, 1996), and SES contrasts in language use are widely recognized (e.g., Bradley & Corwyn, 2002; Burt, Holm & Dodd, 1999). Of course, as noted earlier, it is possible that the relationship between language and theory of mind reflects common genetic influence on each of these cognitive domains. Against this view are the preliminary findings from Hughes and Cutting's (1999) twin study, indicating that the genetic influence on theory of mind was largely independent from the genes involved in language ability. However, the language index used in this study (the verbal subtests from the Stanford Binet Intelligence Scales (Thorndike, Hagen & Sattler, 1986) did not focus on the communicative aspects of language use). A functional account of the relationship between language and theory of mind is therefore plausible, although the exact nature of this functional relationship remains a matter of controversy (Astington, 2001).

### *Family*

As noted above, children from larger families typically show accelerated false-belief comprehension. Although this finding initiated a flurry of research into individual differences in theory of mind, its interpretation remains a matter of controversy. Interestingly, this effect appears stronger for *younger* siblings (Ruffman *et al.*, 1998); a pattern that runs against the usual advantage shown by first-borns in their language skills and general cognitive development (Hoff-Ginsberg, 1998). This finding is consistent with Hughes and Cutting's (1999) demonstration that environmental influences on theory of mind were primarily non-shared (i.e., child-specific), and is open to two different interpretations. One possibility is that *interactions* with older siblings provide children with the benefits of a skilled partner (e.g., in games of pretend play), who can operate within the child's 'zone of proximal development' (Vygotsky, 1978). Alternatively, it may be that children benefit from *observing* older siblings interacting with others, and especially caregivers. In particular, witnessing salient emotional interactions between other family members may facilitate children's developing theories of mind (Dunn & Brown, 1991; Lagattuta, Wellman & Flavell, 1997). Assessing the relative importance of direct participation vs. bystander witnessing of emotion exchanges would require diary-based studies, such as those conducted to examine direct and indirect effects of marital conflict on children's socio-emotional adjustment (Cummings,

1994; Cummings, Ballard, El-Sheikh & Lake, 1991; Jaffe, Wolfe, Wilson & Zak, 1986; Jenkins & Smith, 1991).

Dunn and colleagues' detailed longitudinal studies (e.g., Dunn *et al.*, 1991) provide some evidence for both of these interactional and observational explanations, since their findings suggest that false-belief comprehension at 40 months is significantly and independently predicted not only by co-operative interactions between siblings at 33 months but also by observations of mother–sibling conflict interactions. In addition, the 'observational learning' account is also supported by results from Lewis *et al.*'s (1996) Mediterranean-based study in which false-belief comprehension was associated with overall family size (including adult relatives living at home) rather than with number of siblings *per se*. On the basis of their findings, Lewis *et al.* (1996) proposed a 'general apprenticeship' model in which theory-of-mind development is improved through contact with a variety of family members (rather than through interactions with siblings in particular).

Family-wide influences are also highlighted by studies that use natural language samples. These studies point to talk about negative emotions as the foundation stone for children's developing psychological knowledge, and suggest three themes in this work: (1) family talk about feelings is often precipitated by children's own negative emotions; (2) children muster their most sophisticated linguistic skills when they report on events involving negative emotion (Dunn & Brown, 2001; Hudson, Gebelt, Haviland & Bentivegna, 1992); (3) the frequency of early conversations within the family about negative emotions predicts later success on tests of emotion understanding.

What mechanism might link early exposure to emotional exchanges and later understanding of mind? One possibility is that the salience of emotional displays alerts children to differences in points of view, so that children appreciate subjectivity in the context of emotions (especially negative emotions) before they can engage in cognitive perspective taking (Dunn & Brown, 1991). Support for this view comes from the association found between the diversity (i.e., relationship-specificity) of children's emotion accounts and their performance on false-belief tasks noted above. Alternatively, the facilitative effect of emotions on children's understanding of mind may be linguistically mediated, since there is evidence that children are especially articulate when talking about events involving fear, anger or distress (Dunn & Brown, 2001). Studies using model-fitting methods are needed to test whether the increase in explained variance justifies support for this linguistic mediation model rather than the more parsimonious direct effects model.

Bringing a new twist to the story, recent interview studies have shown that pre-school-aged children's understanding of the causes of anger and sadness appears to be relationship-specific. For example, maternal anger is better understood than friends' anger, while maternal sadness is less well understood than friends' sadness. Similarly, accounts of anger and sadness show contrasting themes for mothers vs. friends (Dunn & Hughes, 1998). To add further complexities, findings from a longitudinal study of children's real-life accounts of negative emotions suggest several developmental changes between the ages of 4 and 7 (Hughes & Dunn, 2002). These include increases in: (i) references to specific agents, especially peers and siblings; (ii) differentiation of the agents and situations that elicit anger vs. sadness; (iii) diversity (i.e., relationship-specificity) of responses; and (iv) reference to thoughts and beliefs (especially for sadness). Early false-belief performance was significantly correlated with these last two aspects of children's accounts, highlighting the need to integrate research into

children's understanding of affective and cognitive mental states, and suggesting reciprocal influence across a developmentally extended period, making a simple additive model of conceptual development unlikely.

### *Inter-individual Relations*

Young children's first and almost universally most important relationship is with their primary caregiver (or attachment figure). The importance of this attachment relationship for children's developing theory of mind has been stressed by a number of researchers who have demonstrated significant longitudinal associations between attachment security in infancy and false-belief comprehension in the pre-school years (e.g., Fonagy, Redfern & Charman, 1997; Meins, Fernyhough, Russell & Clarke-Carter, 1998; Symons & Clark, 2000). At first glance the direction of this association seems clear, since secure attachment typically precedes false-belief comprehension by some years. However, this account only holds up if we adopt (i) the narrow definition of theory of mind as false-belief comprehension, and (ii) the orthodox view of attachment as primarily determined by maternal sensitivity (Ainsworth, Blehar, Waters & Wall, 1978; Isabella, 1993).

As noted earlier, several theorists have argued for a broader definition of theory of mind to include skills such as joint attention and communicative gestures that appear as early as infancy. Within attachment research also, the orthodox view has been challenged (Lamb, Thompson, Gardner & Charnov, 1985; Lewis, 1997) and is only partially supported by meta-analytic findings (De Wolff & van IJzendoorn, 1997; Goldsmith & Alansky, 1987). Moreover, studies have shown that attachment security is closely related to child characteristics such as temperament (Mayseless & Scher, 2000; Seifer, Schiller, Sameroff, Resnick & Riordan, 1996; Susman-Stillman, Kalkose, Egeland & Waldman, 1996). From each of these perspectives, the association between early attachment security and later false-belief performance could simply reflect stable individual differences between children (e.g., in sociability or in maturity).

A new generation of attachment research has recently provided a more precise formulation of constructs such as maternal sensitivity (Meins, Fernyhough, Fradley & Tuckey, 2001) and an elaboration of mechanisms that may underpin the association between attachment security and theory-of-mind development (Fonagy & Target, 1997; Meins *et al.*, 2001). While early attachment research focused on maternal sensitivity to infant signals of hunger or distress, this new research focuses upon maternal sensitivity to the infants' *mental* activity. Specifically, Meins *et al.* (2001) have shown that individual differences in maternal 'mind-mindedness' predict unique variance in attachment security, while others have shown that parents whose disciplinary strategies (e.g., Ruffman, Perner & Parkin, 1999; Vinden, 2001) focus on mental states (e.g., a victim's feelings or the non-intentional nature of a transgression) have children who succeed in false-belief tasks at an earlier age than others (see also Charman, Ruffman & Clements, 2002; Sabbagh & Callanan, 1998). Moreover, Reznick (1999) has reported a systematic relationship between maternal willingness to attribute mental states to infants and maternal education and cultural background. One interesting avenue for future research would therefore be to explore whether contrasts in parental perceptions of infant intentionality can explain the differences mentioned earlier in age and rate of theory-of-mind development across cultures and across different SES groups within a particular culture. By taking a broad definition of theory of mind and following children longitudinally, it should be possible to examine the

interrelationship between mind–mindedness and the earliest forms of joint attention in addition to later outcomes in the form of representational theory of mind. Ideally, such research should adopt a two-generation genetically sensitive design (e.g., involving adoptive or step families), to examine the extent to which associations between parental ‘mind–mindedness’ and children’s theory of mind development simply reflect genetic relatedness between parents and children.

### **Theory of Mind and Social Competence in Atypical Populations**

In this section we look at the relationship between theory of mind and social functioning in atypical populations. Some of the most significant and influential research on theory of mind in the past twenty years has been carried out in the field of autism. In recent years this research has been joined by a body of work investigating theory of mind in children with visual and hearing impairments. What does the evidence from these atypical groups tell us about the way that theory of mind affects and is affected by social relationships? To answer this question we return to the two issues raised at the beginning of this review, concerning definitions for theory of mind and the nature and strength of environmental influences. The issue of definition is relevant to the question of whether impairment in theory of mind is specific to children with autism, while the issue of environmental versus genetic influences is relevant to the issue of directionality in the relationship between theory-of-mind impairment and social competence. We look at both of these issues as we examine the research in autism and in children with visual and hearing impairments.

#### *Theory of Mind in Children with Autism*

The ‘theory of mind’ hypothesis of autism began in the mid-1980s with the now classic discovery that children with autism fail to infer another person’s false belief—an ability shown to be easily within the reach of typically developing 4-year-olds and children with Down’s syndrome of equivalent mental age (Baron-Cohen *et al.*, 1985). This research led to the proposal that the cardinal features of autism (impairment in social and communicative functioning) could be explained by a specific cognitive deficit in the capacity for meta-representation (Leslie, 1987). This proposal and the evidence that supported it changed the future of autism research for the next two decades.

In the beginning, the picture of the theory-of-mind impairment in autism seemed clear. Children with autism, a clinical group defined diagnostically on the basis of social-communication impairments, were proposed to have a cognitive impairment that prevented them from ‘decoupling’ the primary representation of an object (a thought about an object or event) from a secondary representation of that object (a representation of the thought). Hence children with autism failed to form propositional attitudes (propositional constructions of the form ‘A thinks that (. . .)’; Leslie, 1987). This ‘meta-representational’ problem was proposed to explain not only the social-communication impairments of children with autism but also another key diagnostic feature, their lack of imaginative play.

In support of this position, other evidence demonstrated that children with autism had difficulty in understanding, not only false belief but also understanding of knowledge (Leslie & Frith, 1988), intention (Phillips, Baron-Cohen & Rutter, 1998) and complex emotion (Baron-Cohen, Spitz & Cross, 1993). Furthermore, research also

showed links between theory of mind and social understanding. Significant associations were found between theory-of-mind impairments and autistic deficits in understanding deception (Sodian, 1991), jokes and lies (Leekam & Prior, 1994), irony, white lies and double bluff (Happé, 1994). Associations were also found between theory of mind and overall pragmatic language competence (Eisenmajer & Prior, 1991); and between theory-of-mind impairments and autistic 'real-life' social impairments, as rated by parents, teachers and health-professionals (Fombonne, Siddons, Archard, Frith & Happé, 1994; Frith, Happé & Siddons, 1994; Hughes, Soares-Boucaud, Hochmann & Frith, 1997; Tager-Flusberg, 2000).

However, further tests of the theory-of-mind account of autism also raised a number of questions. Research on pretend play in autism, for example, indicated that while lack of spontaneous imaginative activity was associated with poor performance on tests of false-belief comprehension, this problem with pretend play could not be attributed to a failure to decouple representations. Evidence showed that children with autism were able to engage in pretence when prompted (Jarrod, Boucher & Smith, 1996; Lewis & Boucher, 1988), and that children with higher verbal mental age showed spontaneous pretend activity albeit of a stereotyped nature (Wing & Gould, 1979). This evidence challenged Leslie's proposal for a decoupling or meta-representational deficit.

In addition, research on children's understanding of non-mentalistic representations challenged the original claims about the cognitive mechanisms underlying theory of mind. This research, based on evidence from 3-year-old typically developing children (Zaitchik, 1990), predicted that if children with autism are impaired in forming meta-representations, they should also perform poorly on a non-mentalistic version of the false-belief test. In contrast to the performance of typically developing children, however, results showed *intact* performance for children with autism in understanding non-mental representations (Leekam & Perner, 1991; Leslie & Thaiss, 1992). This led to the conclusion that the impairment in autism was not a blanket failure to 'decouple' primary from secondary representations as originally suggested, but rather a more specific problem with forming propositional attitudes such as 'He thinks that . . .'" (Leslie & Thaiss, 1992).

The proposed impairment in forming propositional attitudes raised a further question of how one could account for the more basic non-propositional social interaction impairments in autism. Since impairments in joint attention emerge long before the onset of theory-of-mind skills, the origins of theory of mind remained unexplained (Mundy & Sigman, 1989). To address this gap, others have proposed theoretical frameworks that highlight deficits in either affective contact (Hobson, 1989, 2002) or executive functioning (Rogers & Pennington, 1991) as underpinning these basic social interaction deficits.

In response, Baron-Cohen (1995) extended the theoretical proposal of a 'theory-of-mind' impairment to include other precursor states. This widened the definition of 'theory-of-mind' impairment to include not only understanding of a range of mental states such as 'think', 'know', but also perception of social stimuli and coordination of attention in joint attention activities. However, this more broadly defined theory-of-mind ability was still seen as modular, and unidirectional. Specifically, Baron-Cohen proposed that (i) damage to a specific mechanism, a 'shared attention module' within the mind-reading system, was responsible for impairment in the operation of another mechanism, a 'theory-of-mind module', and (ii) damage to



either or both of these modules would have an adverse impact on the child's social relationships.

To understand the link between theory of mind and social relations within this reformulated account we need to return to the issue of how theory of mind should be defined. When defined in its broad sense to include social interaction skills such as joint attention or social referencing, we have a circularity in which autism symptoms (i.e., social and communication impairments) equate with theory-of-mind impairments (e.g., joint attention, social referencing). It is therefore helpful to adopt the narrow definition (false-belief comprehension) as a measure of theory of mind that is independent of autism symptoms, and to consider evidence from two different populations: children with autistic spectrum disorders who pass false-belief tests of theory of mind, and children who fail false-belief tasks and yet do not show symptoms of autism (e.g., late-signing deaf children).

Children with autistic spectrum disorders who pass tests of false-belief comprehension also have milder diagnostic symptoms of autism (Frith *et al.*, 1994; Hughes *et al.*, 1997; Prior *et al.*, 1998). This evidence indicates that (i) theory-of-mind difficulties are intrinsically related to the clinical pattern of autism diagnosis of which failure in social relationships is a key feature; and (ii) the specific relationship between social competence and theory-of-mind impairment is dimensional rather than categorical. Of the high functioning individuals in these studies, those who passed false-belief tasks had fewer and milder social interaction impairments. However, social interaction impairments in this group were not qualitatively different from those in other children with autistic spectrum disorders and still met criteria for a diagnosis of autism or Asperger syndrome.

What does this evidence from children with autism who succeed false-belief tasks tell us about the direction of the relationship between theory of mind and social competence? Do these children have milder symptoms of autism because of competence in theory of mind as the modular account would suggest? Or is their theory of mind ability the result of these children's greater social competence? Indeed, as an interesting alternative to both of these proposals, it is worth considering whether the relationship between theory of mind and social skills in children with autism might be mediated by individual differences in language ability.

Language appears to be a powerful mechanism for the acquisition of representational theory-of-mind skills in children with autism. Several studies show that performance on theory-of-mind tasks in children with autism is significantly related to both lexical knowledge (Dahlgren & Trillingsgaard, 1996; Happé, 1995; Leekam & Perner, 1991; Sparrevohn & Howie, 1995) and syntactic knowledge (Tager-Flusberg, 2000; Tager-Flusberg & Sullivan, 1994). Advanced language ability therefore seems to give some children with autism an advantage in their ability to pass false-belief tasks. However, the threshold of language ability sufficient for passing such tasks is much higher in children with autism than in typically developing children. As Happé (1995) has argued, children with autism may rely more on language than other children in order to 'hack out' a solution in the absence of the usual cognitive routes. The specifics of the route that children with autism might take from language to theory of mind are not yet known. Given Hughes and Cutting's (1999) findings discussed earlier, it is possible that the dependence between language and theory of mind might be quite different for children with autism than for other children. Research evidence from children with visual and hearing impairments offers further light on this issue.



*Theory of Mind in Children with Visual and Hearing Impairments*

In recent years numerous studies have shown that theory-of-mind impairments are not restricted to children with autism, and may be found in other atypical populations. Because the diagnosis of these populations is not characterized by social and communication deficits as it is for children with autism, such studies challenge conventional explanations of theory-of-mind impairments in autism.

Several researchers have reported theory-of-mind impairments in children who are blind or severely visually impaired (McAlpine & Moore, 1995; Minter, Hobson & Bishop, 1998; Peterson, Peterson & Webb, 2000). Specifically, these studies show that when compared with children matched for chronological and/or mental age, children who are blind and severely visually impaired perform poorly on false-belief tasks until about the age of 12, and show particular difficulties in understanding mental (rather than perceptual) states.

Similar findings emerge for children with severe hearing impairments. In particular, a consistent finding in several studies is that 'late signers' (typically deaf children with hearing parents) but not 'native signers' (deaf children with deaf parents) are also delayed in their understanding of false belief (Courtin & Melot, 1998; de Villiers & de Villiers, 2000; Figueras Costa & Harris, 2001; Peterson & Siegal, 1997, 1998, 2000; Hosie *et al.*, 2000). Note that the intact false belief comprehension shown by native signing deaf children is consistent with earlier reports that native signers are as likely as typically developing children to engage with their parents in conversations about non-present objects, events and ideas (Meadow, Greenberg, Erting & Carmichael, 1981).

Also of note is the finding that, for both late-signing deaf children and typically developing children, syntactic complexity (specifically, use of complement clauses) is the strongest predictor of false-belief understanding; this effect is separable from the effects of general language, non-verbal IQ and hearing loss (de Villiers & de Villiers, 2000). In contrast, unlike typically developing children, late-signing deaf children do not appear to show improved performance when the pragmatic demands of the task question are simplified (Peterson & Siegal, 1995) or when 'thought pictures' that minimize verbal demands of the task are used (Woolfe, Want & Siegal, 2002). Below, we consider the implications of these findings for our understanding of the role of language in theory-of-mind development.

*How is Theory of Mind Mediated by Language?*

Research on children with perceptual impairments highlights not only the importance of communicative experiences for a representational theory of mind, but also the multiplicity of elements within communication that can contribute to false-belief comprehension. These include syntactic ability, pragmatic understanding of task questions, and discourse skills such as the awareness of mutual beliefs, knowledge and assumptions involved in conversational exchanges. As a result, contrasting proposals have been offered regarding how language influences the development of a theory of mind.

One view is that concepts of mental states arise out of conversational exchanges with others (Peterson *et al.*, 2000; Woolfe *et al.*, 2002). From this view, children with autism, late-signing deaf children and blind children all have, for different reasons, a common impairment in forming and maintaining conversational exchanges with

others that delays their acquisition of a theory of mind. What is not yet clear in this account however is whether it is conversation itself that it is the critical linguistic mediator or whether non-verbal interactions play a crucial prior role.

Some suggestion that early non-verbal interactions may be critical for theory-of-mind development comes from studies which indicate that the evidence on language impairments in blind children is much more mixed than was traditionally thought. In particular, although initial word learning does appear delayed, the first words of blind children are similar to those of sighted children (Landau & Gleitman, 1985), and once initial word learning is underway, pragmatic speech functions and imitations, repetitions and routines are also intact in blind children (Perez-Pereira & Castro, 1997). Thus in blind children, delays in the acquisition of a theory of mind appear to reflect not language impairment *per se*, but rather the effects of a relatively late onset of initial word learning and the limited access to non-verbal conversational cues. If so, the question of how language mediates theory of mind needs revisiting since what are considered to be the earliest forms of social-perceptual theory of mind, joint attention and non-verbal forms of communication are also the earliest forms of language.

In an alternative view of linguistic influences on theory of mind, Tager-Flusberg (2000) and de Villiers (2000) argue for contrasting effects for children with autism and children with sensory impairments. Specifically, for children with sensory impairments, the acquisition of explicit, representational theory of mind is argued to depend critically on linguistic experiences and skills (in particular mastery of the syntax of sentential complements). In contrast, according to Tager-Flusberg (2000), children with autism have an additional difficulty with constructions involving cognitive verbs ('he *thinks* that . . .') rather than communication verbs ('he *says* that . . .'). This additional difficulty might originate much earlier in development as a consequence of autism-specific impairments in implicit social-perceptual theory of mind and social interactional competencies. Since these early competencies are also central to language acquisition, such impairments also carry consequences for later aspects of syntactic language development and the formation of complement constructions.

Given the prediction that only the broader socio-perceptual and social interactional impairments are specific to autism, longitudinal research is needed to establish that the impairments in representational theory of mind found in deaf and blind children are *not* preceded by impairments in the broader aspects of theory of mind, gaze following, pointing, empathy or comfort giving. To date, there has been little systematic research on how children with sensory impairments differ from children with autism in the broader aspects of 'theory of mind'. Recent findings from de Villiers' group suggest that deaf children are, as predicted, *unimpaired* on implicit theory-of-mind skills (e.g., as tapped by games of deception such as the penny-hiding task; de Villiers, *in press*). However, we lack systematic evidence on broader aspects of theory of mind such as joint attention and emotion perception and on the relationship between these abilities and language skills in very young children with sensory impairments. There is some evidence that blind children show early (and age-limited) difficulties in the broader aspects of theory of mind. Brown, Hobson, Lee and Stevenson (1997) reported many similarities between blind children and children with autism when they tested them using autism diagnostic measures. Nearly half of the blind sample satisfied the DSM-IV (American Psychiatric Association, 1994) diagnostic criteria for autism that include impairment in social interaction, communication and behaviour. These children might therefore share diagnostic features of autism such as impaired joint attention and pretend play.

If it turns out that children with sensory impairments have representational theory-of-mind impairment *and* some of the broader social-perceptual impairments associated with joint attention and emotion recognition, then the specificity of the autism impairment in terms of broad or implicit theory-of-mind skills would be challenged. Such findings would also challenge the linguistic account of theory of mind presented by de Villiers, but do not necessarily contradict the cultural or conversational account of theory of mind. This approach predicts that impairments in theory of mind should, for all groups, relate to the specifics of the conversational and/or social experiences that are missing. For blind children this includes non-verbal cues in joint attention episodes that provide crucial information about other people's intentions. For deaf children this includes auditory cues such as the prosodic contour of speech utterances. For children with autism who, despite intact vision and hearing, show a profound lack of social experiences, the problem would extend across modalities. Insofar as joint attention skills are important for early word learning, initial difficulties in joint attention will lead to delays in lexical and semantic development that may accompany the reported delays in syntactic ability.

### *Social Relations in Children with Autism/Sensory Impairments*

What conclusions may be drawn about the link between theory of mind and social relations for children with autism and children with sensory impairments? Is the connection between theory of mind and social relationships to be interpreted in the same way for deaf and blind children as it is for children with autism, whose condition is actually defined by their impoverished social relationships and communicative impairments?

To answer these questions we have to decide what kind of definition of theory of mind we want. If we define theory of mind in its narrow sense, then the argument might go as de Villiers suggests: children fail false-belief tests because of a difficulty in forming syntactic complement constructions. Whatever the source of the problem with complement constructions, there is no reason why this should affect more basic aspects of theory of mind that do not rely on forming these complement constructions. Thus for non-autistic children, the more basic theory of mind and the social relationships that rely on it should be intact, even if there is difficulty in the more subtle aspects of theory of mind and social strategy that relies on these complex representations. The extent to which the nature of this syntactic problem is similar for children with autism and children with sensory impairments is not clear. Tager-Flusberg's (2001) research suggests a possible difference. Presumably a difference between the groups would also be indicated if deaf children who failed the false-belief test also failed the non-mental representation task that presents problems for typically developing 3-year-olds but not for children with autism (Leekam & Perner, 1991).

If we define theory of mind in its broader sense, it may turn out that impairments at this level are specific to autism or that delays or difficulties also apply to other groups albeit to a lesser extent. Whether or not this 'broader' theory of mind is specific to autism, its origin is explained quite differently by the modular account and the conversational/cultural account. According to the modular account, mechanisms responsible for eye detection and shared attention are innate, and although these modules may need some minimal threshold of experience to function, the existence or maintenance of each module is not considered to be dependent on social interactions with others. Social relationships are affected as a consequence of impaired theory

of mind. According to the conversational/cultural account, social relationships are impoverished for reasons that vary according to the clinical condition of the child. As a consequence, understanding of others' minds is impaired at either the broader or narrower level depending on the nature of experience (linguistic, social) that has been limited. For example, according to Hobson (2002), children with autism lack the innate emotional sense of others as like themselves, and so are unable to enter into the 'triangle of relatedness' that provides typically developing infants with alternative perspectives on the world (that, according to Hobson, form the foundations for symbolic thinking).

One way forward might be for modularity theorists to distinguish their views from the conversational/cultural account by specifying the threshold of experience necessary for a module to function. Recent social-orienting explanations of the joint attention impairment in autism provide another approach to clarifying the ways in which very early perceptual-cognitive capacities and social-emotional capacities might interact with each other (Dawson, Meltzoff, Osterling, Rinaldi & Brown, 1998; Leekam & Moore, 2001; Mundy & Neal, 2000). These transactional models represent an attempt to specify some of the ways in which perceptual-cognitive abilities are both triggered and changed by social experience. For example, new developments in psycholinguistic research (for a review, see Altmann, 2001) have begun to advance our understanding of how early syntax development is bootstrapped by infants' use of thematics (e.g., who does what to whom) and by other environmental cues.

### **Conclusions and a Caveat**

The first clear conclusion from this review is that broad and unqualified claims for a link between theory of mind and social relations are not justified. Instead, the evidence suggests (i) a contrast between acquisition and application of theory-of-mind skills; (ii) the variety of social life (rather than any single social factor) is what matters for theory-of-mind development; and (iii) the importance of other less intensively researched developments (e.g., in emotion understanding).

Taking each of these points in turn, one interesting and unexpected finding in the literature is that developments in theory of mind may have positive, neutral or even negative implications for social relations (e.g., both empathy and malicious teasing are associated with age-related increases in toddlers' awareness of internal states; while later advances in children's understanding of mind are associated not only with improved connectedness of communication, but also with negative outcomes such as increased sensitivity to criticism or even ringleader bullying). Future research should therefore adopt a more differentiated view of theory of mind in order to identify specific links between distinct aspects and positive (or negative) social outcomes.

With regard to point (ii) an analogy with the social risk factors for behavioural problems may be useful. That is, just as behavioural problems are best predicted by the extensiveness and multiplicity of risk factors rather than by any single factor (Ackerman, Izard, Schoff, Youngstrom & Kogos, 2000; Campbell, Shaw & Gilliom, 2000), so a variety of positive social influences may have a cumulative impact in fostering young children's developing understanding of mind. As Dunn (1999a) has argued, four types of social interaction are particularly revealing of young children's mind-reading abilities: conversations about inner states; shared pretend play; narratives; and deception. In this review we outlined how different theoretical perspectives on theory-of-mind development highlight different forms of social interaction—but if

it is the variety of forms of social interaction that matter, then hybrid theoretical accounts which integrate distinct perspectives are needed.

In addition, many other aspects of social interaction could be added to this list (e.g., jokes, talk about shared memories, negotiation of conflict). However, the real take-home message here is that these interactions do not form mutually exclusive categories. For example, in a study of pre-schoolers' conversations with friends, Hughes and Dunn (1997) reported that children are twice as likely to refer to inner states in the context of pretend vs. non-pretend play. More work is needed to illuminate other ways in which distinct elements of social interaction act in concert; this should be helpful for creating effective multi-pronged interventions (Lohmann & Tomasello, in press).

One vital element of social interaction that deserves much more research attention is emotion. The central importance of emotions in early social exchanges can be seen from how parental interpretations of their baby's intentions depend upon the baby's expression of emotion. The same attention to emotion is evident in children too; for instance, it is the emotional dramas that prompt children to tell coherent stories about the past (Brown, 1995). Emotions also appear to have a powerful contextual influence upon fledgling theory-of-mind skills. For instance, Newton, Reddy and Bull (2000) found that children were most likely to engage in deception in emotionally charged conflict situations, and so highlight the importance of pragmatic need and situational exigencies as motivational influences upon the development of deceptive skills (cf. our earlier point regarding emotion as a cue to subjectivity). Conversely, Dunn and colleagues (see Dunn, 1999a) have found that causal talk about feelings best predicted success on false-belief tasks when it occurred in the positive emotional contexts of shared play or joking rather than the negative context of conflict. Here it is worth noting that the children were most likely to be reflecting on *others'* inner states in the context of positive cooperative play. So both positive and negative emotions can fuel developments in children's understanding of mind: more work is needed to establish whether positive and negative emotions have contrasting salience for distinct aspects of theory of mind. Other questions raised in this review concern the relative importance of direct participation vs. witness-roles in emotional exchanges, and whether language developments mediate the positive effect of emotional exchange on theory-of-mind development.

This brings us to the second main conclusion from this review, namely that distinct components (e.g., socio-perceptual versus socio-cognitive) of children's theories of mind are thought to emerge at different stages of development and to show contrasting relations with children's real-life social experiences and competencies. However, the relationships between separate facets of theory of mind have yet to be resolved; though findings from atypical groups (e.g., the dissociation between intact implicit theory-of-mind skills and impaired false-belief comprehension in deaf children) have indicated a few leads. In particular, there is growing recognition that theory of mind may be defined at several levels—from the explicit, formal structure of propositional understanding, to the implicit 'procedural' knowledge that guides us in our moment-to-moment social interactions. The nature of any link with children's social relationships will depend upon the level at which theory of mind is defined. In particular, we know as yet next to nothing about the functional relationship between 'broader' aspects of theory of mind and the understanding of propositional attitudes required for a representational theory of mind. What is the process by which the structures of complementation are built up from these more basic aspects of theory of mind—or are these two independent developments? Once we know more about the associations between



these skills for typically developing children, we can establish how pathways of development differ for children in different clinical groups.

These issues arising from complexities within 'theory of mind' and in the mutually transforming relationship between theory of mind and social relations should help to guide future research directions in the study of both typical and atypical development. For example, with respect to the complexity of the relationship between theory of mind and social relations, language has been proposed to have a mediating role. Yet the evidence to date indicates that the influence of language is neither uniform nor unidirectional. On the one hand, young children use language to communicate needs, wishes, emotions, intentions and ideas, as well as to influence others and establish or clarify social ties and by this view, language is the medium through which social relationships foster early developments in understanding of mind. On the other hand, other research suggests that theory of mind in its broader sense is centrally important for the acquisition of language, and from this perspective language is the tool that makes early developments in understanding mind socially meaningful. In addition, links between language and theory of mind may be drawn at many different levels—from the possibility of common genetic influence (not supported by existing twin data)—through to distinct aspects of language (vocabulary, syntax, pragmatics). Future research needs to consider not only what parts of language are related to what parts of theory of mind but also how these relationships might differ for typically developing children and children within different atypical groups.

A recurring theme in this review is that to answer the above questions future research will require more complex and sophisticated methodological designs than those typically seen in theory-of-mind research. In particular, longitudinal studies are needed to examine whether individual differences in theory of mind at different ages show heterotypic continuity across time (i.e., individual differences are stable, but manifest in different ways at different ages). In many ways skills such as joint visual attention and false-belief understanding have little resemblance to each other. While the development of these skills does not appear to show homotypic continuity (i.e., stability in both magnitude and form), therefore the question of whether there is evidence for heterotypic continuity is not yet established. Hay and Angold (1993) suggest three such types of evidence: stability of individual differences across time, evidence that the first state is a prerequisite for the second, and evidence that experimental manipulation of the first state has consequences for the second. In addition to longitudinal designs, the development of future research programmes, genetically sensitive designs are needed to (i) tease apart genetic versus environmental influences on these individual differences, and (ii) elucidate the 'nature of nurture' (Plomin & Daniels, 1987) by distinguishing child-specific (non-shared) from shared environmental influences, coupled with a transactional exploration of interactions between genes and environment. Finally, while the range of experimental paradigms used to investigate both developments and individual differences in theory of mind have increased significantly over the past twenty years, issues of reliability and validity continue to be overlooked, and this needs to be remedied before the real significance of theory of mind for social relationships (and vice versa) can be properly explored.

A caveat is also needed in this conclusion, regarding issues that we have not addressed in this review. One such gap is the issue of gender differences in the rate of theory-of-mind acquisition (Charman *et al.*, 2002) and in real-life applications of theory-of-mind skills (Hughes, Deater-Deckard & Cutting, 1999; Hughes & Dunn, 1998). A second gap concerns the relation between theory-of-mind performance and



real-life social interactions among older children and adults (Ames *et al.*, 2001; Malle & Knobe, 2001). A third gap concerns aspects of social interactions that do *not* show any clear relationship with performance on theory-of-mind tasks. Interestingly, these aspects are predominantly in the realm of *antisocial* (Blair, 1995, 1997; Hughes *et al.*, 2000) or *machiavellian* behaviour (McIlwain, in preparation; Repacholi & Slaughter, in preparation). Each of these areas is a fascinating arena for future investigations; however, current research is still in its very early stages, and much more needs to be known before any useful review can be made. The scene is set for research into children's theories of mind to continue apace!

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