Advanced Review

Theory of mind

Stephanie M. Carlson,* Melissa A. Koenig and Madeline B. Harms

Theory of mind and its development has been a significantly important—and challenging—topic of research in cognitive science for three decades. This review summarizes our knowledge of when and how children come to understand their own and others' minds, including the developmental timetable, old and new measures, and foundational skills in infancy. We review recent research on theory-of-mind (ToM) and learning, that is, ways in which children's understanding of other minds informs how they learn about the world, as well as evidence for an important role of domain-general cognitive skills (executive function) in the development of ToM, and the neural networks that are most strongly implicated. Finally, we propose future directions for research in this vast and growing field. © 2013 John Wiley & Sons, Ltd.

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INTRODUCTION

Children's understanding of their own and others' minds, often referred to as theory-of-mind (ToM), is a foundational social cognitive skill, with implications for many aspects of children's functioning, such as social competence, peer acceptance, and early success in school.[1,2] In addition, deficits in ToM have been found in a variety of atypical populations including autism spectrum disorder (ASD) and schizophrenia.[3,4] Hence, it is vital to determine what governs the emergence and expression of mental-state understanding, how it changes with development, and what disrupts its functioning. This brief article is designed to provide a state-of-the-science summary of current research and thinking on development and measurement of ToM, ToM in infancy, ToM and learning, relations to executive function, the neural correlates of ToM, and future directions.

DEVELOPMENT AND MEASUREMENT

Striking changes occur between the ages of 2 and 5 years in children's appreciation of mental states.[5] Throughout this period, ToM develops in a stable, predictable sequence.[6] By 2 years of age, children's ToM includes a basic understanding of emotion, intention, desire, and perception.[7] However, children of this age reveal very little understanding of knowledge and belief. They have difficulty appreciating that people can differ in their beliefs and knowledge states and that someone could believe something that is false.[8] For example, when 3-year-olds know the truth about what is inside a box (e.g., crayons), they typically misjudge that someone else will know what is inside the box even when it is mislabeled (e.g., Band-Aids).[9] In addition, they have difficulty realizing that appearances may differ from reality,[10] and that people can have different visual perspectives on the same scene or event.[11] By the time they are 4 or 5, however, children have a more adult-like understanding of these matters,[5] although, as will be described later, newer methods have revealed early forms of false-belief reasoning even in infancy.

Children's ToM is typically assessed with a range of standard laboratory paradigms, such as the classic location false-belief task pioneered by Wimmer and Perner.[8] These paradigms have produced a wealth of data concerning developmental changes in mental-state understanding. In addition, they are heavily relied upon individual differences in research assessing relations to factors that may affect the development of ToM such as executive function,[12] pretend play,[13] language,[14] maternal mind-mindedness and mental-state language,[15,16] family parenting styles,[17] and culture,[18] as well as possible sequelae of ToM such as peer relations[2] and academic achievement.[1] In their influential meta-analysis of the false-belief

*Correspondence to: smc@umn.edu

Institute of Child Development, University of Minnesota, Minneapolis, MN, USA

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task, Wellman et al.[19] concluded that age-related changes in performance from 3 to 5 years are extremely robust across several task manipulations and study populations. Wellman and Liu's Theory of Mind Scale[6] has been a major contribution enabling researchers to assess ToM across the preschool period more broadly, tracking a developmental progression from intention to desire, knowledge, belief, and finally discrepant emotion, although interestingly the order of passing desire and knowledge tasks is reversed in Chinese[20] as well as Iranian preschoolers.[21]

A common interpretation of these marked advances in ToM in the preschool period is that children undergo a significant conceptual change in their views about the mind, or a series of such changes as indicated by the ToM Scale, moving from a mechanistic-behavioral understanding to one that fully appreciates the mind as a representational device that sometimes gets things wrong.[22] Such change is believed to be brought about by children continually testing their nascent theories against reality, and revising them accordingly, like 'little scientists'.[23] As we will see in the section on *Relations to Executive Function*, however, this is not likely to be the whole story. There are also further developments beyond the preschool period that are more difficult to explain on the conceptual change account. For example, second-order false-belief tasks, in which one person falsely believes that another person thinks something to be true, are used to measure ToM in slightly older children, although they appear to assess age-related increases in working memory rather than reflecting a conceptual shift in ToM ability.[24]

A recent advance in this field is to consider ToM over the lifespan, with concomitant innovation of computerized measures that include reaction time as well as accuracy of mental-state reasoning in adults. For example, Dumontheil et al.[25] asked participants aged 7–27 to move objects on a shelf (in a computer display) according to the instructions of a 'director' who could only see some of the objects. To succeed, they had to take the perspective of the director, which differed from their own, and only move objects the director could see. Performance improved even between late adolescence and adulthood on this task. As with the second-order false-belief task, neurocognitive changes apart from any new conceptual shift would need to be understood to help account for these later developments (see *Neural Correlates* section).

INFANCY

Despite the interest in a lifespan approach to ToM, several researchers have looked for the earliest signs of children's awareness of mental life. At a basic level of social understanding, infants interpret others' actions in ways that are sensitive to evidence of intentionality and agency. In the beginning half of the first year of life, infants track and imitate the facial and hand gestures of humans, not inanimate objects.[26,27] Three-month-olds prefer faces with open eyes[28] and orient toward the direction of gaze of a previously viewed face.[29] Infants also attend to the relations between agents and objects: 5-month-olds interpret human reaches as goal-directed when such actions are performed by a human hand.[30] By the end of the first year, infants prove sensitive to a moving actor's behavioral adjustments and physical constraints when analyzing action in pursuit of goals[31] and will follow the gaze of entities who show evidence of contingent interaction with the infant herself or with others.[32] As communicators, they produce gestures such as points, requests, and displays for other people, successfully track others' gaze across distances, and they monitor the success of their bids for attention.[33] Many researchers currently see these and other behaviors as reflections of infants' intentional attributions toward others, that is, attributions of mental states with content.

It is important to distinguish the attribution of mental states from mere sensitivity to the associated physical cues (i.e., 'rich' vs 'lean' interpretations). As mentioned earlier, infants may understand that when others attend to, act upon or emote toward an object, they attribute it to a mental state that is *about* something. However, echoing the debates found among primatologists, some have argued that such behavior could also be the product of an automatic orienting procedure, innate or learned, that is sparked by exposure to certain stimuli like moving eyes and faces (with no attribution of intentional states).[34] Others propose that extensive interactions with caregivers condition infants to anticipate interesting events in the direction of the caregivers' head-turns.[35] In infancy research, while it is difficult to propose a gold standard or litmus test that would decide in favor of a single view, it is important to underscore the fact that infants are indeed selective in their attributions of goals. That is, infants attribute goals in ways that uniquely depend on the presence of certain cues and not others.[36,37] For example, when 7-month-olds see an actor reach toward one of two toys, they subsequently select that toy for themselves. However, if the actor indicated one of the toys in a more ambiguous fashion (i.e., back-of-hand contact), infants choose randomly.[38] This makes it difficult to explain infants' responses with appeal to strictly lower level factors, such as heightened attention to interactions between people and objects and to actions that draw attention to objects. Although all kinds of actions lead infants to attend more to the objects they are associated with, only certain actions (e.g., an open-handed reach) are interpreted by infants as goal-directed.

Recent cross-cultural evidence suggests that the explanatory role to be played by early experiences with caregivers differs depending on the social-cognitive skill in question. Callaghan et al.[39] examined the emergence of the early social-cognitive skills of children from three cultural contexts using eight experimental manipulations of imitation, gaze following, pointing, helping, collaboration, and joint attention, as well as later-developing skills such as pretend play and symbolic competence. One of the cultural settings, Canada, was Western and middle class—characteristic of children tested in most current developmental research. Two settings, India and Peru, were different small-scale, traditional societies with non-Western parenting, socialization, and educational practices. For tasks that measured infants' intention and attentional understanding, the findings indicated general similarity across cultures. At 9 months, infants imitated adults' action demonstrations at similar levels and at around 10–13 months, they spontaneously produced declarative points and successfully tracked an adults' gaze beyond barriers. Similarly, in tasks that measured infants' ability to share goals and attention with others, the picture that emerged was one of cross-cultural universality: infants between 9 and 13 months engaged in joint attention with an experimenter who called attention to a series of photos and toddlers between 18 and 27 months made attempts to re-engage a reticent experimenter in collaborative games. In contrast, for tasks that involved pretense or graphic symbols, robust cultural differences were found. Canadian children were generally quicker than their Indian and Peruvian counterparts to develop such skills. This pattern makes sense given the different rates at which children in these cultures engage in such culturally laden practices [e.g., all Canadian mothers reported pretending with their children, whereas fewer Peruvian (42%) and Indian (24%) mothers reported ever pretending with their children]. This pattern of results points to an important distinction between the basic, early-emerging socio-cognitive skills that develop at around the same age in different kinds of societies and the culturally constructed skills that are influenced by the varying amounts and types of exposure that are present in any given cultural group.

As we alluded to earlier, in contrast to a fairly rich and universal understanding of intentional action in infancy, it seems that explicit reasoning about beliefs and other mental states has a more protracted developmental course, one that may depend in important ways on cognitive flexibility and a syntactic system for handling belief-world contrasts.[40] Indeed, recent evidence confirmed that preschoolers' abilities in explicit false-belief reasoning were uniquely tied to developments in complement mastery and executive function.[41] As we noted earlier, children typically succeed on standard, verbal false-belief tasks at around 4 years of age[8,19] and further developments in children's belief reasoning occur later still.[42–44] These developments can be facilitated by explicit training and environmental influences, such as sibling or maternal talk,[16,45–47] and may vary by cultural background to some degree.[48]

However, there is evidence that younger children may be aware of certain aspects of false beliefs. For example, 3-year-old children appear to have some awareness of the content of a protagonist's false belief as indicated by their looks toward the corrected location.[49,50] Recent research has found further evidence of belief-based anticipatory looking in 24- and 18-month-old infants.[51,52] There is also evidence that 13- and 15-month-old infants expect agents to act in accord with both true and false beliefs about an object's location.[53,54] There is ongoing debate about whether such findings reflect true mentalistic reasoning or whether they are better explained by leaner, associationist accounts that posit attention to certain behavioral contingencies.[55]

Evidence of very early sensitivity to false beliefs juxtaposed with later, slower developments have led researchers to propose two systems: infants and young children possess a fast, implicit, and inflexible understanding of false beliefs (system 1) that precedes and contributes to a slower, explicit, and flexible understanding (system 2).[41,56] Early knowledge may be preconceptual, responsive to cues, formatted 'in a rudimentary and implicit form' (Ref 53, p. 257), and developments in language and executive function may underlie advances in later, explicit mentalistic reasoning. One important strength of this approach is that it supports the differentiation of different aspects of ToM and helps to disentangle domain-specific processes from the domain-general support for these developments. Furthermore, evidence consistent with this approach comes from recent longitudinal work by Thoermer et al.[52] who administered a set of implicit and explicit ToM measures at five time points between 15 and 48 months of age. The authors found a predictive relation between individual differences in anticipatory looking at 18 months and performance on an unexpected-location false-belief task at 48 months, controlling for verbal IQ.

Importantly, this predictive relation did not generalize beyond those two specific tasks: no relations were found between infants' anticipatory looking and the content version of false belief at age 4 nor performance in ToM Scale tasks at age 3, nor implicit perspective taking at 30 months, and no relations were found between implicit perspective taking at 15 months and later ToM abilities. This pattern of results suggests that the system that supports our initial ability to reason about others' actions and perspectives might be separate from a conceptual, coherent, later-developing ToM. Nevertheless, important questions remain: How does implicit knowledge underpin and transition to explicit understanding? If there are two systems, how do they interact and what factors make explicit knowledge accessible?

THEORY OF MIND AND LEARNING FROM OTHERS

Other social-cognitive research has focused less on the developmental milestones and more on the ways in which children *use* their ToM abilities in the service of other developmental tasks, such as learning from others. Because much of what we learn about the world derives from what others claim to know, the ability to make inferences about the status of a particular informant's knowledge proves critical to evaluations of testimony. On those occasions, when they can check an informant's claims against known facts or prior assertions, children are in a position to form an assessment of the trustworthiness of their informant. Not only do children prefer to learn from reliable over less reliable individuals,[57–60] but also they form enduring profiles of an informant's prior accuracy and continue to use this information when evaluating new testimony after a week has passed.[61] The ability to use an individual's reliability to guide learning and imitation appears to be an early emerging competence: children as young as 24 months of age are sensitive to the risk of being misinformed and can make judgments about the worthiness of a particular social source to guide their learning.[62–64] Several recent studies show that preschoolers prefer to learn from knowledgeable rather than ignorant speakers,[59,60] experts over novices,[65,66] benevolent over malevolent people,[67,68] rational over less rational agents,[69] or even native over foreign speakers.[70,71]

However, when evaluating an informant's testimony, considering another person's competence or knowledge is not enough. Children must also take into account a speaker's motives given that someone might intend to lie or deceive. Mascaro and Sperber[67] observed that 3-year-olds did not differentiate between benevolent and malevolent informants, but by 4 years of age, children trusted benevolent informants specifically. Another recent study presented 3- to 5-year-old children with two informants: one who gave advice with good or helpful intentions and another who harbored bad or malicious intentions (i.e., was happy to mislead other people). When given the opportunity to decide whether to trust these informants, 3- and 4-year-olds failed to differentiate between the previously helpful and malevolent informants. Only 5-year-olds were significantly more likely to trust the information provided by the helpful source.[68] Furthermore, the difference in selective trusting was associated with children's ToM understanding (as measured via the ToM scale), suggesting that children's developing understanding of mind facilitates their ability to reason about the underlying intentions and future actions of others. In research with older children, individual differences in the ability to tell effective lies were associated with individual differences in second-order ToM ability.[72] Thus, as children become increasingly expert in the psychological world, they become increasingly able to both detect harmful intentions in others and to use this knowledge to their advantage (for their own devious purposes).

Just as children's growing ToM is believed to help them become more selective *learners* with age, becoming an effective *teacher* (e.g., to a younger sibling) would seem to involve appropriate estimations of others' states of knowledge. After all, the motivation to teach stems from (1) a recognition that the other person lacks knowledge and (2) an intention to close the knowledge gap between self and other.[73] Consistent with this notion, there is some evidence that children's teaching ability is related to their understanding of false belief.[74–77] For example, Davis-Unger and Carlson[74] asked 3- to 5-year-old children to teach a board game to a confederate adult learner. Teaching improved with age (e.g., explaining more rules and providing corrective feedback) and moreover, it was correlated with performance on a ToM task battery, even after controlling for age and verbal ability. Conceptual understanding of knowledge states is not the only requirement for effective teaching, however, as teachers must also be able to remember all the rules and resist the temptation to step in and do the task for the learner—skills that call upon executive function. Indeed, when children's executive functioning was assessed as well, it accounted for unique variance in children's teaching ability over and above their ToM performance.[75]

RELATIONS TO EXECUTIVE FUNCTION

Although conceptual changes fit neatly with descriptions of development of ToM from infancy to age 6,[6] executive function has also been suspected to account for the striking developmental changes in ToM. Executive function refers to the conscious, goal-directed control of thought and action, and includes domain-general processes of working memory, inhibition/impulse control, and set-shifting/cognitive flexibility.[78] Executive function skills are closely linked with prefrontal cortex development, which shows a protracted period of progressive and regressive changes (e.g., myelination and pruning) and performance improvements well into adolescence[79,80]; however, dramatic behavioral changes in executive function occur in the preschool period on measures including delay of gratification, working memory, Stroop-like tasks, and set-shifting tasks such as the Dimensional Change Card Sort.[81,82]

It is now well established that children's ToM development is functionally dependent on their developing executive function skills.[83] The correlations typically persist when age, verbal ability, and other factors are controlled.[12,84–89] Even later developments and individual differences in ToM performance suggest that the interaction with executive function continues into late adolescence.[25] In addition, similar relations can be found in other cultures[90,91] and in atypical populations such as ASD.[92] How these robust findings should be interpreted, however, remains far from clear.

One possibility is that executive function skills such as working memory and inhibitory control might enable the *expression* of a latent ToM, that is, a system for understanding mental states is in place but executive control over responses is needed for children to show what they know.[93,94] But, another possibility is that executive function enables the e*mergence* of ToM. Developing a sense of personal agency and top-down self-control (executive function) might in turn make it possible for children to reflect on other people's mental states, especially when they conflict with one's own.[95,96] In a reversal of the executive function–ToM emergence account, Perner et al. have argued that children must first have a representational understanding of their own mind and goals *before* they will be able to monitor and control their behavior.[89] A third theory, Cognitive Complexity and Control-Revised,[97] posits that both executive function and ToM are developmental by-products of the domain-general ability to reason about and selectively attend to hierarchically embedded rules.

Longitudinal studies are essential for resolving these discrepant views. In support of the emergence account, executive function was found to be a developmental precursor to ToM,[98] and longitudinal studies thus far have favored the conclusion that individual differences in executive function significantly predict subsequent variance in ToM (independent of child general cognitive ability and socioeconomic factors such as maternal education) better than the reverse developmental ordering. This is the case in normative,[99–101] low-income,[102,103] and autism samples.[104] On the emergence view, this evidence suggests that children must be able to suppress their own potent representations of events before they can reflect deeply and accurately on the mental states of others. Further support comes from training studies of executive function leading to improved false-belief performance[105] and recent work showing that individual differences in executive function predicted the extent to which children benefitted from direct ToM training.[106]

NEURAL CORRELATES

As we noted, behavioral research suggests that executive function, which is known to depend on prefrontal cortex, facilitates the development of ToM. To examine the mechanisms behind ToM and their change over time in a more fine-grained manner, researchers have turned to neuroimaging of ToM-related tasks. Scientific interest in the neural correlates of ToM reasoning has grown dramatically in the past 15 years, not only for its descriptive aims (i.e., which neural structures are activated when thinking about mental states) but also for theoretical purposes (e.g., understanding the overlap of executive function and ToM mechanisms) and clinical insights (e.g., what brain systems might go awry in autism or schizophrenia). As a result, ToM has now come to be associated with a fairly well-established neural network. Yet, there is still much to learn about the neural bases for ToM, in part because this network is based mostly on functional magnetic resonance imaging (fMRI) and lesion studies with adults. It is not known whether the same regions subserve ToM during the developmental period at which children begin to pass false-belief tasks. Research into the neural correlates of ToM in younger age groups has relied primarily on electroencephalography (EEG), which lacks the spatial resolution of fMRI. However, the handful of studies investigating the neural substrates of ToM in older children are intriguing because they suggest that changes in ToM reasoning occur well beyond the ages at which children first pass false-belief tasks.

In adults, converging evidence from several fMRI studies suggests that the ToM network includes medial prefrontal cortex (mPFC), temporoparietal junction (TPJ), posterior cingulate, and precuneus.[107,108] Anterior cingulate cortex and orbitofrontal cortex (OFC) have also shown activation during ToM tasks in some studies.[109,110] Differences in activation patterns between studies may be due to the tasks used. In contrast to the false-belief task in children, there is no well-established ToM task for adults. Tasks differ on the extent to which participants are asked to reason about affective versus nonaffective mental states, reason about false beliefs versus mental states in general, and answer questions versus simply listen to stories. In particular, more affective tasks are more likely to recruit more midbrain structures such as OFC. For example, the task used by Sabbagh[109] required participants to decode mental states, including complex emotions, based on facial cues. Given task diversity, the fact that a consistent network of structures has been found for ToM reasoning suggests that this network is quite robust.

Recently, much attention has been centered on the TPJ, especially in the right hemisphere. A series of studies by Saxe and Kanwisher suggest that this region is more selective than other regions in the ToM network. These researchers demonstrated that while mPFC activation was linked to thinking about others in general, TPJ activation was linked specifically to thinking about others' mental states[111] and that while mPFC and precuneus responded to both ToM and self-reflection tasks, the TPJ responded significantly only to the ToM condition.[112] In addition, Perner et al.[113] found greater TPJ response during false-belief than false-photograph reasoning. Finally, lesions to TPJ disrupt false-belief reasoning, even in a task with reduced language and executive function demands, whereas lesions to other parts of the frontal cortex do not affect performance.[114] Nevertheless, other evidence suggests that the right TPJ is involved in the more domain-general process of redirecting attention.[115] Redirection of attention might be more likely to occur when thinking about others' mental states than in other types of social or self-referential thought because attention to one's own mental states must be inhibited. Thus, the role of the TPJ might not be as domain specific as some ToM researchers suggest.

Another consideration is that the domain specificity of the TPJ and other regions in the ToM network might change with age. Across childhood, the right TPJ response appears to become more selective, first responding equally to mental and nonmental social information, but then later responding more robustly to mental-state information in older ages.[108] Such a pattern could explain why another study found no significant TPJ activation in 9-year-old children (in contrast to adults) during a ToM task when a social, nonmental-state control task was used as the baseline.[116] In addition, ToM-related activation in the mPFC has also been found to change between the ages of 9 and 16, moving from more ventral to more dorsal regions.[117] Because the ventral mPFC tends to subserve self-referential thought, while the dorsal mPFC plays a key role in cognitive control, this developmental change may reflect a shift from simulation-based ToM reasoning to a more detached, top-down type of ToM reasoning. Regardless of the specific mechanisms involved, this direction of research provides compelling evidence that changes in the process of ToM reasoning occur beyond the ages at which children pass both first- and second-order false-belief tasks. These findings are congruent with recent behavioral data demonstrating that the 'processing cost' of belief-desire reasoning decreases from age 11 to adulthood.[118]

To understand the neural processes that facilitate ToM coming 'online', researchers have turned to EEG methodology, measuring event-related potential (ERP) components generated by the brain during ToM reasoning. In young children, EEG is more suitable than fMRI because it is less sensitive to artifact associated with head movement. However, because of low spatial resolution, it is difficult to identify specific brain regions that generate components. As with fMRI, developmental differences have been found in the neural correlates of ToM. Both adults and 4- to 6-year-old children who *passed* false-belief tasks showed a negative-going late slow wave (LSW) generated by the PFC (peaking around 800 ms after the test question for adults and 1400–1500 ms for children). Children who failed false-belief tasks did not show this component.[119] The researchers suggest that the LSW reflects domain-general higher order operations in working memory. All children required more time than adults to carry out these operations, and children who failed the tasks may have done so because they could not carry out these operations at all.

Because of differences in spatial resolution and time scale, it is difficult to compare results from fMRI and ERP studies. ERP components occur on a much more rapid time scale than the blood oxygenation (BOLD) response measured in fMRI. Thus, while ERP researchers can be relatively certain they are measuring components in response to a specific stimulus (e.g., the prediction test question in a false-belief task), fMRI researchers might also be detecting neural responses linked to *forming* a representation about another's thoughts, although a few fMRI studies have distinguished between these processes.[120] Thus, we have more to learn about the separability of the neural substrates for representation formation versus prediction in ToM reasoning.

One limitation of imaging the neural correlates of ToM is the difficulty in differentiating ToM from other cognitive processes that involve overlapping brain regions, including executive function and self-referential thought. A recent meta-analysis found substantial overlap between networks that subserve autobiographical memory, ToM, and even default-mode operations, which are thought to involve mostly self-referential thought.[121] A few fMRI studies have attempted to separate thinking about one's own versus others' mental states. Saxe and Powell[112] found that reasoning about others' mental states uniquely activated the TPJ in comparison to reasoning about one's own mental states. In addition, Mitchell[115] compared activation when inferring the mental states of similar versus dissimilar others, finding greater activation of the vmPFC in the former condition and greater activation of the dmPFC in the latter. A study comparing activation in response to visual autobiographical memory cues and cues about another person's past found greater vmPFC response in the self-condition. Both greater dmPFC response and dmPFC connectivity with frontoparietal networks linked to cognitive control were found in the other condition in this study.[122] Thus, in mental-state reasoning, with greater distance from the self, the mPFC response becomes more dorsal, closer to regions associated with cognitive control. Similarly, manipulating the valence of beliefs activates vmPFC, suggesting the need to inhibit a self-perspective.[123] It is therefore unsurprising that ToM and executive function are so closely related in behavioral studies as described earlier.

One of the most valuable insights from research into the neural correlates of ToM, in conjunction with recent behavioral research, is that there appears to be more continuous rather than discontinuous developmental change from childhood to adulthood. We can no longer say that ToM is fully 'mature' when children can pass a first-order or even a second-order false-belief task. In addition, this research shows promise in differentiating domain-specific aspects of ToM from domain-general mechanisms. Current evidence suggests that both types of processes are involved, and that the neural substrates for ToM may become more domain specific with development.

FUTURE DIRECTIONS

As this brief review illustrates, the past 25 years have revealed much about the nature (and nurture) of children's understanding of other minds. The field of social cognitive development research is well poised to address new, cross-disciplinary questions, incorporating related fields such as social psychology and neuroscience,[124] but there are challenges to be overcome. For example, traditional research on ToM is limited by its near exclusive reliance on experimental paradigms that focus on a single informant (the child) typically tested in a single context (the laboratory), and quite often with a single task type (e.g., the false-belief task). Multi-informant (e.g., parents and teachers) and multisetting (e.g., lab, home, and school) assessments using a broader array of methods will be important in future ToM research.

An example of a promising new direction is research suggesting that early understanding of the mental world appears to be critically important for learning from others. The evidence described earlier suggests that children use a range of cues to speaker intent when deciding whom to trust and how far to trust them. Outstanding questions concern better understanding the role that ToM plays in these selective judgments, examining situations where selective trust goes awry, and identifying the role that socioemotional experiences play in fostering selective learning. For instance, recent research demonstrates that infants' attachment security mediated their later trust in their mother's claims.[125] Thus, the presence of positive (or negative) relationships with a parent, peer, or teacher might directly influence how well or how deeply children learn from a given person.

Another area of growth for the field is to trace the dynamic nature of executive function–ToM relations over time and well into adulthood. This effort will require further innovation and standardization of measures of ToM that are sensitive to developmental and individual differences over the lifespan. As well, it will be extremely valuable if the few longitudinal studies in existence will continue and broaden the range of outcomes associated with these constructs,[103] and if new, larger studies are undertaken that capitalize on recently improved measures of both executive function and ToM in infancy and early childhood.[52]

Lastly, investigations of neural correlates will continue to inform our theories of ToM development by providing insight into the mechanisms through which ToM operates. New methods can complement fMRI and EEG/ERP studies and provide converging evidence of neural networks involved in ToM reasoning, such as measuring dopamine activity via eyeblink rate.[126] Knowledge of these neural mechanisms will, in turn, enhance our understanding of psychopathology involving ToM delays or deficits and lead to improved clinical interventions.

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