

**Individual Differences in Theory of Mind from Preschool to Adolescence:
Achievements and Directions**

Claire Hughes

Rory T. Devine

University of Cambridge

Key words: *theory of mind, individual differences, longitudinal, social development*

Abstract

In this article, we provide a state-of-the-science overview of research on normative individual differences in theory of mind. We begin by examining achievements in research on individual differences in theory of mind in the preschool years and more recent work on middle childhood and adolescence. In doing so, we outline several converging lines of evidence for social influences on individual differences in theory of mind, and assess the claim that individual differences in theory of mind matter for children's social lives. We then evaluate two conceptualizations of individual differences in theory of mind: the *developmental lag* and *genuine differences* accounts. By placing the study of individual differences in theory of mind center stage, we aim to highlight fruitful avenues for research on normative variation in theory of mind both within and beyond the preschool years.

We have all had awkward encounters with people who struggle to appreciate others' thoughts and feelings. Like adults, children vary enormously in their ability to reason about others' mental states, and the question of how we acquire this awareness, also known as theory of mind, has engaged researchers for more than three decades. Early research focused on two questions: the age at which children first recognize that others can have mistaken beliefs and the nature of theory-of-mind impairment among children with Autism Spectrum Disorders (ASD). (For comprehensive reviews of these topics, see (1) and (2).) In this article, we focus on individual differences in reasoning about mental states, a topic that has, until recently, been overlooked. We begin by outlining research in understanding the origins and consequences of individual differences in theory of mind in the preschool years and beyond. Next, we describe two theoretical accounts of individual differences in theory of mind and evaluate how well the predictions from each fit existing evidence. Finally, we suggest directions for research on individual differences in theory of mind.

Individual Differences in Theory of Mind: The Preschool Years

Researchers were first called to pay heed to the variability in children's understanding of mind by Dunn, Brown, Slomkowski, Tesla, and Youngblade (3), who argued that this variability might contribute to later individual differences in children's social development. Since Dunn and colleagues' work, methodological advances have driven changes in our understanding of individual differences in theory of mind. Chief among these advances are the recruitment of larger and more diverse samples, and the construction of task batteries to produce continuous measures sensitive to variation in performance in early childhood (4). These task batteries have excellent test-retest stability (4), and performance on these tasks relates to individual differences in an underlying latent factor (5). Researchers using task batteries have documented individual differences in success rates on tests of theory of mind

in early childhood (6), challenging the traditional view that the development of theory of mind is an all-or-nothing matter.

Two tenets of an early and influential nativist account of the development of theory of mind (7) were that mentalizing skills reflect a dedicated cognitive system, and this cognitive system comes online through biological maturation, so environmental influences are restricted primarily to a triggering role (8). Regarding the first of these claims, variation in theory of mind in early childhood is associated closely with, and predicted by, individual differences in language ability (9) and executive function (10). While these associations are not inconsistent with a modular account of theory of mind (in that language and executive function may be needed to express an underlying competence), they open the door to alternative interpretations in which these domains play a *functional* role in the *emergence* of theory of mind (11).

Regarding the second tenet of the nativist account, alternatives to the biological maturation view of theory-of-mind development come from distinct lines of research that are relevant for our understanding of individual differences. Specifically, support for environmental influences on individual differences in theory of mind comes from four sources (12): twin studies, which typically show similar correlations between the performance of identical and fraternal twins, suggesting that environmental rather than genetic factors underpin individual differences in theory of mind (6); longitudinal studies, which demonstrate the quality of early family interactions predicts variation in theory of mind for typically developing preschoolers and (13) and young children with hearing impairments born to either deaf or hearing parents (14); training studies in which exposure to mental-state discourse improves preschoolers' theory of mind (15); and cross-cultural contrasts in the timing (16) and sequence (17) of theory-of-mind development.

Individual Differences in Theory of Mind: Beyond the Preschool Years

Recently, researchers have extended the scope of studies on theory of mind beyond the narrow confines of the preschool years. Although fewer studies have been done of school-aged children and adolescents than of pre-schoolers, progress has been made in developing tasks that vary in modality of presentation (e.g., vignettes, cartoons, animations, film clips) and capture individual differences across distinct aspects of theory of mind (e.g., cognitions, emotions, perspectives, desires, intentions). Many of these advanced tasks are sensitive to differences both between typical and atypical groups (18, 19) and between older and younger children (20, 21). In a study of 10-year-olds (22), advanced theory-of-mind tasks, including the vignette-based Strange Stories task (19), the animation-based Triangles Task (18), and the film-based Silent Film task (21), loaded onto a single latent factor. Moreover, scores on this latent factor correlated moderately with the children's prior theory-of-mind performance (at age 6) as measured by first- and second-order false-belief tasks. These correlations, both across different tasks and between advanced and standard theory-of-mind tasks, point to the convergent validity of advanced theory-of-mind tasks.

These studies have paved the way for investigations of the processes underpinning later individual differences in theory of mind. Echoing the findings from research on preschoolers, several studies have documented cross-sectional associations in school-aged children and adolescents between individual differences in theory of mind and performance on measures of executive function (23) and measures of language ability (21). Likewise, extending the scope of early longitudinal studies involving observations of conversations between mothers and children, in another study, variation in parents' use of terms referring to cognitive states (e.g., think, know) predicted individual differences in children's theory of mind at ages 6 and 10 (24). Similarly, findings from preschool interventions have stimulated

school-based group interventions in which discussions of mental states produced lasting improvements in the mental state reasoning of Italian 9-year-olds (25).

While each of these strands highlights continuities in the cognitive and social influences on theory of mind between preschool and school-age years, discontinuities also deserve mention. For example, the transition to school widens children's social horizons emphasizing new influences on theory of mind. In particular, peer acceptance in middle childhood longitudinally predicts associations with later understanding of *faux pas* (20). Consistent with this proposal that social environments increasingly affect variation in theory of mind as children grow up, the mixed findings from studies of twins also suggest a developmental shift, with heritability estimates gradually decreasing across the first decade of life (12).

Outcomes of Individual Differences in Theory of Mind

While many studies have emphasized the factors that might *predict* individual differences in theory of mind, fewer studies have examined the *consequences* of normative variation in reasoning about mental states. Delays in theory-of-mind development explain simply and powerfully the difficulty individuals with ASD experience in social interactions (7). In contrast, the evidence for a similar direct relation between theory of mind and social competence among typically developing children is far from compelling (26). Causal claims about the importance of individual differences in theory of mind for children's social development are limited by researchers' heavy reliance on ratings from teachers and parents, rather than on information gathered directly from the children or from their peers (for an exception, see 20). In addition, the social advantages associated with theory of mind may only begin to emerge in middle childhood (when children's social interactions are less supported by adults) and are likely to take time to accrue. For example, achieving an early understanding of mind might help children form and maintain friendships, which in turn

could lead to greater intimacy and awareness of mental states within these friendships. Further constraining causal conclusions is the scarcity of longitudinal studies and the focus of current studies on the preschool years. Indeed, in contrast with the mixed findings from studies of preschool children (27), more promising results have emerged from the few longitudinal studies to examine the social consequences of variation in theory of mind in school-aged children (e.g., 20). For example, in one study (22), theory of mind measured at age 6 predicted teachers' ratings of children's social competence at age 10.

Mixed findings from research on preschool children may also reflect contrasts across studies in the specific foci and assessment tools in studies on the social consequences of individual differences in theory of mind. For example, questionnaires vary, including questions that range from complex interaction skills to conventional social behaviors (e.g., sharing, helping). Moreover, the ability to attribute mental states is likely a socially neutral tool that can be applied to both prosocial goals (e.g., helping, comforting, explaining) and antisocial goals (e.g., deceiving, manipulating, excluding). Studies of the social consequences of individual differences in theory of mind need to adopt designs using many informants and provide a comprehensive picture of children's social skills across a variety of settings, use longitudinal designs to consider the underlying stability of the social outcome investigated, clarify the particular social skills investigated, and ensure greater consistency between studies regarding the instruments or methods used to investigate these skills.

However, beyond each of these factors are theoretical reasons as to why only modest associations should be expected between performance on experimental tests of theory of mind and measures of children's behavior. For example, theory of mind is sometimes necessary but never sufficient for explaining social competence (27): other factors, within the child (e.g., language ability) and outside the child (e.g., social context) also influence children's social behavior. Rather than deploying a theory of mind constantly, people often

rely on social scripts, behavioral cues, and narratives to guide their actions in social situations (28).

Given that children's use of their theory-of-mind skills is likely to be sensitive to contexts, researchers should develop methods of assessment that provide a fine-grained picture of specific aspects of children's social skills. Adopting paradigms developed within behavioral economics, such as the ultimatum game (29), is one promising approach, as this paradigm allows one to make systematic changes to the context (e.g., is recipient known / unknown, shown / unshown). For example, in one study theory of mind was associated with displays of fairness on the ultimatum game (30). Other measures might include studying children engaged in socially taxing situations, such as peer entry paradigms (26), or reporting on the frequency of social contact and the size of social networks (31).

Theoretical Accounts of Individual Differences in Theory of Mind

Theoretical accounts of individual differences in theory of mind can be divided into two camps (32). According to the *developmental lag* account, individual differences in children's theory of mind reflect differences in the speed of attaining conceptual insights about mental states: In this account, children who perform poorly on false-belief tasks will catch up with their peers eventually, much as toddlers who are late to walk usually catch up with their peers (33, 34). Consequently, individual differences in performance on theory-of-mind tasks should not differentiate people beyond early childhood (1). Alternatively, according to the *genuine variation* account, individual differences in theory of mind reflect real differences in the ease or fluency with which children or adults use their theory of mind to attribute mental states to others (26, 32, 33). While all typically developing children will eventually pass false-belief tasks, this account suggests that early differences in performance provide an index of more lasting variation in reasoning about mental states and social development.

While relevant for theorizing about the acquisition of mental-state concepts (i.e., competence) in early childhood, the developmental lag account does not address how children *use* these concepts (i.e., performance). For example, age-related gains in theory of mind across middle childhood (20, 21) are unlikely to reflect conceptual change since performance on the tasks used in these studies does not require new conceptual insights beyond an understanding of desires and beliefs. Instead, as a result of either accumulating social experience or developments in related cognitive abilities (e.g., executive function, language), children apparently gradually improve their ability to *use* their theory of mind (28). Regardless of age, an individual's performance on a task can be construed as reflecting variation in sensitivity, motivation, or ability to deploy theory of mind (32, 33). Of course, being able to reason about others' mental states is no guarantee that one will use this ability in every situation (35).

How Well Does Evidence Fit with Competing Accounts?

Teasing apart the developmental lag and genuine differences accounts requires longitudinal data on the rank-order stability of individual differences in theory of mind. But few theory-of-mind studies—approximately 1 percent (26)—are longitudinal. Moreover, most of these studies focused on early childhood and involved relatively short testing intervals (from 1 to 36 months, with a mode of 12 months). However, more recently, longitudinal research has extended into middle childhood (20). Although effect sizes vary across these studies, variation in theory of mind is moderately stable over time in the preschool years (36) and in middle childhood (37), as would be expected by the genuine differences account.

Further work is needed to examine the stability of individual differences in middle childhood and beyond. For example, although the genuine differences account assumes that the children who lag behind their peers in preschool will continue to lag in the school-age

years and beyond, it does not assume that this continuity over time is homotypic (i.e., that individual differences in theory of mind are manifest in the same ways at different ages). Moreover, the continuity over time may reflect the stability of individual differences in *performance* or the use of mental state awareness (rather than in actual competence). This distinction between what children know and how they apply this knowledge becomes increasingly relevant as children grow up and encounter more diverse social situations in school and other settings. Thus, while the lack of predictions about theory of mind *use* from the developmental lag account translates into a lack of clear tension between the two accounts, as use becomes increasingly relevant, the developmental lag account is less powerful in explaining variation in theory of mind beyond the preschool years.

Looking Ahead

Looking ahead, researchers should integrate studies on different cognitive and environmental correlates of individual differences in theory of mind to assess their relative independence and interplay from early childhood through to adolescence. Among the questions they could ask: Are environmental influences specific to theory of mind or do they overlap with social influences on language ability (38) or executive function (39)? Does variation in either language ability or executive function moderate or mediate environmental influences on theory of mind? For example, becoming adept at shifting attention should increase the efficiency with which children can extract the social information needed to recognize and reflect on differences in points of view, or to note cues that might indicate more complex or mixed emotions. Preliminary support for this hypothesis comes from a study suggesting that compared with their peers, preschool children with good executive function skills benefited clearly from a theory-of-mind training program (40).

In a related vein, analogous with studies on children's differential susceptibility to environmental risk factors (41), researchers should consider whether genetic polymorphisms

contribute to individual differences in children's ability to draw on their social experiences to develop their understanding of mind (42). Innovations are also likely to emerge from a cross-fertilization of ideas between the different streams of research outlined earlier—for example, integrating intervention designs with studies of deaf children (e.g., by tracking changes in performance in deaf children who have received cochlear implants; 43) or comparing family predictors of performance in children from different cultural backgrounds (44). In summary, individual differences in theory of mind likely reflect a complex interplay between social and cognitive influences.

Conclusion

Theory of mind research has traveled a long distance from its early reliance on single tasks administered at single points to small and homogeneous groups of preschoolers. In the studies we reviewed in this article, researchers administered theory-of-mind tasks to relatively large groups and extended their focus beyond the preschool years, finding striking individual differences in theory of mind in early childhood, middle childhood, and adolescence. Moreover, the robust associations between variation in theory of mind and children's social experiences, on the one hand, and their performance on measures of executive function and language ability, on the other, extend beyond the preschool years. As research on theory of mind continues, integrative studies need to elucidate the exact nature of social influences on theory of mind to identify the mechanisms through which individual differences in theory of mind affect children's social lives in the preschool years and beyond.

Authors' Note

Centre for Family Research, Department of Psychology, University of Cambridge,
Free School Lane, Cambridge, CB23RQ, United Kingdom.

Rory T. Devine was funded by a grant from the Isaac Newton Trust, Cambridge.

Correspondence concerning this article should be sent to Claire Hughes via e-mail:

ch288@cam.ac.uk

References

1. Wellman, H. M., Cross, D., & Watson, J. (2001). Meta-analysis of theory-of-mind development: The truth about false belief. *Child Development, 72*, 655-684.
2. Yirmiya, N., Osnat, E., Shaked, M., & Solomonica-Levis, D. (1998). Meta-analyses comparing theory of mind abilities of individuals with autism, individuals with mental retardation and normally developing individuals. *Psychological Bulletin, 124*, 283-307.
3. Dunn, J., Brown, J., Slomkowski, C., Tesla, C., & Youngblade, L. (1991). Young children's understanding of other people's feelings and beliefs: Individual differences and their antecedents. *Child Development, 62*, 1352-1366.
4. Hughes, C., Adlam, A., Happé, F., Jackson, J., Taylor, A., & Caspi, A. (2000). Good test – retest reliability for standard and advanced false-belief tasks across a wide range of abilities. *Journal of Child Psychology and Psychiatry, 41*, 483-490.
5. Hughes, C., Devine, R. T., Ensor, R., Koyasu, M., Mizokawa, A., & Lecce, S. (2014). Lost in translation? Comparing British, Japanese, and Italian children's theory-of-mind performance. *Child Development Research, 2014.*, doi: 10.1155/2014/893492.
6. Hughes, C., Jaffee, S. R., Taylor, A., Caspi, A., & Moffitt, T. E. (2005). Origins of individual differences in theory of mind: From nature to nurture? *Child Development, 76*, 356-370.
7. Baron-Cohen, S. (1995). *Mindblindness: An essay on autism and theory of mind*. Cambridge, MA: MIT Press.
8. Scholl, B. J., & Leslie, A. M. (2001). Minds, modules and meta-anaysis. *Child Development, 72*, 696-701.

9. Milligan, K., Astington, J. W., & Dack, L. A. (2007). Language and theory of mind: Meta-analysis of the relation between language ability and false belief understanding. *Child Development, 78*, 622-646.
10. Devine, R. T., & Hughes, C. (2014). Relations between false belief understanding and executive function in early childhood: A meta-analysis. *Child Development, 85*, 1777-1794.
11. Carlson, S. M., & Moses, L. J. (2001). Individual differences in inhibitory control and children's theory of mind. *Child Development, 72*, 1032-1053.
12. Hughes, C. & Devine, R.T. (2015). A social perspective on theory of mind. In M. Lamb. & C. Garcia-Coll (Eds.). *Handbook of child psychology and developmental science* (7th ed., Vol. 3, pp. 564 - 609) .Hoboken, NJ: Wiley.
13. Ensor, R., & Hughes, C. (2008). Content or connectedness? Mother-child talk and early social understanding. *Child Development, 79*, 201-216.
14. Peterson, C. C., & Siegal, M. (2000). Insights into theory of mind from deafness and autism. *Mind and Language, 15*, 123-145.
15. Gola, A. (2012). Mental verb input for promoting children's theory of mind: A training study. *Cognitive Development, 27*, 64-76.
16. Liu, D., Wellman, H. M., Tardif, T., & Sabbagh, M. A. (2008). Theory of mind development in Chinese children: A meta-analysis of false belief understanding across cultures and languages. *Developmental Psychology, 44*, 523-531.
17. Shahaieian, A., Peterson, C.C., Slaughter, V., & Wellman, H.M. (2011). Culture and the sequence of steps in theory of mind development. *Developmental Psychology, 47*, 1239-1247.

18. Castelli, F., Frith, C., Happé, F., & Frith, U. (2002). Autism, Asperger syndrome and brain mechanisms for the attribution of mental states to animated shapes. *Brain*, *125*, 1839-1849.
19. Happé, F. G. E. (1994). An advanced test of theory of mind: Understanding of story characters' thoughts and feelings by able, mentally handicapped and normal children. *Journal of Autism and Developmental Disorders*, *24*, 129-154.
20. Banerjee, R., Watling, D., & Caputi, M. (2011). Peer relations and understanding of faux pas: Longitudinal evidence for bidirectional associations. *Child Development*, *82*, 1887-1905.
21. Devine, R. T., & Hughes, C. (2013). Silent films and strange stories: Theory of mind, gender, and social experiences in middle childhood. *Child Development*, *84*, 989-1003.
22. Devine, R.T., White, N., Ensor, R., & Hughes, C. (2015). Theory of mind in middle childhood: Longitudinal associations with executive function and social competence. Unpublished manuscript.
23. Lagattuta, K.H., Sayfan, L., & Harvey, 2014. Beliefs about thought probability: Evidence for persistent errors in mindreading and links to executive control. *Child Development*, *85*, 659-674.
24. Ensor, R., Devine, R. T., Marks, A., & Hughes, C. (2014). Mothers' cognitive references to 2-year-olds predict theory of mind at ages 6 and 10. *Child Development*, *85*, 1222-1235.
25. Lecce, S., Bianco, F., Devine, R. T., Hughes, C., & Banerjee, R. (2014). Promoting theory of mind during middle childhood: A training program. *Journal of Experimental Child Psychology*, *126*, 52-67.
26. Hughes, C. (2011). *Social understanding and social lives: From toddlerhood through to the transition to school*. London, UK: Psychology Press.

27. Astington, J. W. (2003). Sometimes necessary, never sufficient: False belief understanding and social competence. In B. Repacholi & V. Slaughter (Eds.), *Individual differences in theory of mind*. (pp. 13-38). Hove, UK: Psychology Press.
28. Apperly, I. A. (2011). *Mindreaders: The cognitive basis of "theory of mind."* Hove, UK: Psychology Press.
29. Guth, W., Schmittberger, R., & Schwarze, B. (1982). An experimental analysis of ultimatum bargaining. *Journal of Economic Behavior and Organization*, 3, 367-388.
30. Takagishi, H., Kameshima, S., Schug, J., Koizumi, M., & Yamagishi, T. (2010). Theory of mind enhances preference for fairness. *Journal of Experimental Child Psychology*, 105, 130-137.
31. Stiller, J., & Dunbar, R. I. M. (2007). Perspective-taking and memory capacity predict social network size. *Social Networks*, 29, 93-104.
32. Apperly, I. A. (2012). What is "theory of mind"? Concepts, cognitive processes and individual differences. *Quarterly Journal of Experimental Psychology*, 65, 825-839.
33. Bartsch, K., & Estes, D. (1996). Individual differences in children's developing theory of mind and implications for meta-cognition. *Learning and Individual Differences*, 8, 281-304.
34. Slaughter, V., & Repacholi, B. (2003). Individual differences in theory of mind: What are we investigating? In B. Repacholi & V. Slaughter (Eds.), *Individual differences in theory of mind*. (pp. 1-12). Hove, UK: Psychology Press.
35. Meins, E., Fernyhough, C., Johnson, F., & Lidstone, J. (2006). Mind-mindedness in children: Individual differences in internal-state talk in middle childhood. *British Journal of Developmental Psychology*, 24, 181-196.
36. Hughes, C., & Ensor, R. (2007). Executive function and theory of mind: Predictive relations from ages 2 to 4. *Developmental Psychology*, 43, 1447-1459.

37. Lecce, S., Caputi, M., & Hughes, C. (2011). Does sensitivity to criticism mediate the relationship between theory of mind and academic achievement? *Journal of Experimental Child Psychology, 110*, 313-331.
38. Hoff, E. (2006). How social contexts support and shape language development. *Developmental Review, 26*, 55-88.
39. Bernier, A., Carlson, S. M., & Whipple, N. (2010). From external regulation to self-regulation: Early parenting precursors of young children's executive functioning. *Child Development, 81*, 326-339.
40. Benson, J., Sabbagh, M. A., Carlson, S. M., & Zelazo, P. D. (2013). Individual differences in executive functioning predict preschoolers' improvement from theory-of-mind training. *Developmental Psychology, 49*, 1615-1627.
41. Belsky, J., Jonassaint, C., Pluess, M., Stanton, M., Brummett, B., & Williams, R. (2009). Vulnerability genes or plasticity genes? *Molecular Psychiatry, 14*, 746-754.
42. Lackner, C., Sabbagh, M. A., Hallinan, E., Liu, Z., & Holden, J. J. A. (2011). Dopamine receptor D4 gene variation predicts preschoolers' developing theory of mind. *Developmental Science, 15*, 272-280.
43. Ketelaar, L., Rieffe, C., Wiefferink, C. H., & Frijns, J. H. M. (2012). Does hearing lead to understanding? Theory of mind in toddlers and preschoolers with cochlear implants. *Journal of Pediatric Psychology, 37*, 1041-1050.
44. Shinohara, I. (2011). Longitudinal relations among maternal mind-mindedness and children's understanding of other people's beliefs and emotions. *Japanese Journal of Developmental Psychology, 22*, 240-250.