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Links between Theory of Mind and Executive Function: Towards a More Comprehensive Model

This paper addresses the problem of relationships between the development of theory of mind (ToM) and executive function (EF). An overview of empirical findings leads to the conclusion that the complex picture of the relations between EF and ToM development may result from the intertwining of different types and levels of reciprocal influences. It is, on the one hand, the level of emergence-type vs. expressive-type influences, and, on the other hand, direct vs. indirect ones. Data from longitudinal and training studies suggest the asymmetry of reciprocal influences between EF and ToM, with the stronger impact of EF on ToM development, which supports the view that EF is a prerequisite of ToM development. A model is proposed that explains how different EF and ToM skills are involved in the specific types and levels of influences. The issue of disentangling in the analysis the different types of reciprocal impacts is also discussed.

Key words: *theory of mind, executive function, emergence account, expression account*

Introduction

The relationship between the development of executive function (EF) – processes involved in the conscious control of thought and action (e.g. Zelazo & Müller, 2002) and theory of mind (ToM) – the ability to attribute mental states to oneself and others – is a subject of numerous studies dating back to a pioneer study of Russell et al. (1991) with the “windows task”. The first attempt to summarize the main theoretical frameworks explaining this relationship, and to evaluate empirical evidence, was made by Perner and Lang (1999, 2000) in their review of studies carried out up to the year 1998. Since then, new data have been collected from studies on normal as well atypical development which shed further light on the relation between these two kinds of abilities. The main purpose of the present article is to show the picture that emerges from the current state of research, to highlight the most important results, and to outline a theoretical model explaining the links between EF and ToM. We start with a short description of the main positions on the relation between EF and ToM, and then present crucial empirical findings concerning this relation.

Main Positions in the Debate on EF-ToM Link

There are five main theoretical positions explaining the relation between EF and ToM. The first (T1) (e.g. Perner, 1998) assumes that the development of ToM leads to improved self-control, because insight into the causal consequences of belief, based on the development of metarepresentational capacity, improves the child’s ability to control her or his own action, especially to inhibit interfering action tendency, the ability that is the essence of executive control. According to this position, ToM is a necessary, albeit insufficient, condition for the development of EF (executive control), which implies that there are possible cases of intact ToM and impaired EF, but not cases with the reverse pattern.

The second position (T2), proposed by Russell (1997), assumed in its earlier version that the development of executive control leads to improvements in ToM through self-monitoring of action and increasing insight into the intentional nature of action. In the light of data indicating that there is no deficit in action monitoring in autism, Russell (2002) revised his theory and suggested that impairment in ToM abilities in autism might result from an inability to hold

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in mind and shift between arbitrary rules or cognitive domains. The general assumption of this position is held by an executive emergence account (Moses, 2001), according to which certain level of executive ability is required to gain insight into thought and action, and to acquire a belief concept. In sum, both positions assume a significant functional link between the development of EF or some its aspects, e.g. executive control, and the development of ToM, but differ according to the direction of causal dependencies. Whereas the first position assumes that the development of ToM is a necessary condition for self-control (one of the aspects of EF), the second treats the development of EF (executive control) as a necessary condition for ToM development.

The remaining three positions explain the relationship between EF and ToM in different ways. In accordance with one of them (T3), a correlation between performance on false-beliefs tasks and EF tasks, such as, e.g. the Dimensional Change Card Sort task (Frye et al., 1995; Frye, 2000) results from a common conditional reasoning structure underlying these tasks. Another position (T4) assumes that a link between EF and ToM is mediated by common (a strong version of this position) or closely related brain structures (Ozonoff et al., 1991). And finally, according to the last position (T5), the relationship between EF and ToM is the result of executive demands of ToM tasks – some level of executive abilities is required to give correct answers in these tasks, especially to predict behaviour of a protagonist in the false-belief task (Carlson & Moses, 2001; Leslie et al., 2005; Moses, 2001; Russell et al., 1991). Since all these three positions view the essence of the link between EF and ToM in the existence of some common factor underlying both kinds of abilities, dissociations between EF and ToM abilities (if the strong version of position T4 is assumed) provide evidence against these positions.

Important Findings in Studies on Relations Between EF and ToM

Although each position is supported by some data, none of them is devoid of criticism. Despite some controversy, an agreement was reached in several issues. First, all longitudinal studies (Carlson, Mandell et al., 2004; Hughes, 1998b; Hughes & Ensor, 2007; Schneider et al., 2005) have consistently shown that the earlier level of EF was the only significant or better predictor of later level of ToM, but not vice versa. In accord with these results are also findings from a microgenetic study by Flynn et al. (2004), in which the vast majority of children developed a good level of executive control earlier than a good level of false-belief understanding. Recently Pellicano (2007) examined the pattern of ToM-EF impairments in young children with autism of normal intelligence, and found, in 27% of the group, a dissociation in one direction only: impaired ToM and intact EF, a pattern consistent with an executive emergence account, according

to which EF is a necessary, but not sufficient, condition for the development of ToM. Hence these studies provide strong evidence for position T2, and at the same time against T1.

When Perner and Lang (1999, 2000) formulated the main conclusions, based on a review of studies conducted by up to the year 1998, there was no convincing evidence against position T1, except for the results of the first in this field longitudinal study by Hughes (1998b). However, the results of subsequent longitudinal research, as well as those of de Villiers (2005) study, which showed that deaf children exhibit a deficit in ToM, while the development of EF is normal, all of them speak against position T1. The dissociations between EF and ToM abilities, found by Pellicano (2007) and de Villiers (2005), provide, at the same time, counterevidence for positions T3 and T5, and for a strong version of T4.

Secondly, longitudinal studies consistently indicate that, among different executive skills, it is inhibitory control¹ (executive control or executive inhibition – terms of similar meaning, preferred by different researchers) that is relatively the best predictor of later ToM abilities. Additional support for this claim is provided by the results of Carlson, Moses et al. (2004) study, who reported that inhibitory control was independent of the planning ability predictor of ToM. As regards planning ability, which is usually measured by some kind of the Tower task, it appeared to be a better predictor of ToM than inhibitory control, but rather only in autistic children (cf. Tager-Flusberg & Joseph, 2005). This finding can be interpreted as indicating that mental-state reasoning in children with autism depends, to a large extent (in addition to language skills), on more general cognitive ability, and that performance on the Tower task reflects this kind of ability. Against the role of planning ability in the development of ToM seem also to speak the results of Perner, Kain et al. (2002), which showed that the level of this ability in children at risk for ADHD was lower than in normal developing children, but there was no difference in ToM abilities between both groups.

Another consistent finding concerns the role of working memory. In general, as regards the role of this factor (or in broad terms, information processing capacities) in the development of ToM, there are two positions. According to a view represented by Fodor (1992) and Leslie (e.g. Leslie & Thaiss, 1992), increases in cognitive resources allow a child to express or apply ToM abilities. In contrast, according to the view that sources can be found in the work of Case (1985), the increase of cognitive resources is not responsible for the expression, but for the development (acquisition) of ToM – the position represented later, amongst others, by Davis and Pratt (1995). All longitudinal research consistently showed that measures of working memory obtained in the earlier period of development were not significant predictors of later ToM skills. A significant link

¹ For example, Carlson and Moses (2001) define inhibitory control as “the ability to inhibit responses to irrelevant stimuli while pursuing a cognitively represented goal” (p. 1032).

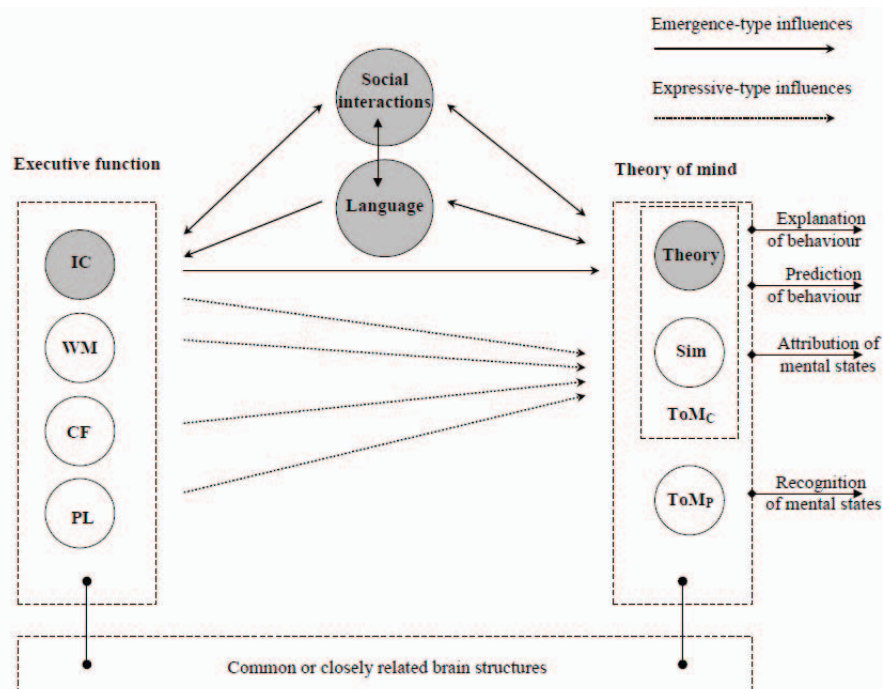


Figure 1. Hypothetical model of direct and indirect links between EF and ToM based mainly on the results of longitudinal studies (Theory – theory-like knowledge structures; Sim – simulation; ToM_C – cognitive component of ToM; ToM_P – perceptual component of ToM; IC – inhibitory control; WM – working memory; CF – cognitive flexibility; PL – planning ability).

between ToM and working memory was only found within a given phase of measuring in longitudinal studies but not between them (e.g. Hughes, 1998b; Schneider et al., 2005), which is construed as indicating that the role of working memory is limited to the factor determining the ongoing process of mental-state reasoning, rather than to the factor responsible for the development of conceptual knowledge about mind. This claim is also supported by Davis and Pratt (1995), who showed that the relationship between working memory and performance on false-belief tasks is not specific – measures of working memory correlated also with performance on a false-photo task, which is structurally similar to the false-belief task, but does not require mental-state understanding. According to Carlson, Moses et al. (2002), differences in working memory capacity can be important if a task requires that children override a salient mental representation or a prepotent response based on one perspective, and at the same time, induce a response based on another perspective, which could constitute a burden for working memory (cf. also Carlson, Moses et al., 2004).

The Comprehensive Model of Relations Between EF and ToM

The above conclusions, drawn primarily from the results of longitudinal studies, provide some premises to outline the comprehensive model of the relations between EF and ToM, shown in Figure 1. In accordance with the results

of factor analysis, based on data from preschool-aged children (cf. Hughes, 1998a), the model assumes that EF is a complex function comprised of several abilities, such as inhibition control, working memory and cognitive flexibility. This group of abilities also includes planning ability, because studies (mainly) on executive functioning in autism (cf. Tager-Flusberg & Joseph, 2005) revealed a significant relationship between this ability and ToM.

In the group of abilities that constitute ToM we can distinguish a cognitive and a perceptual component (Tager-Flusberg & Sullivan, 2000). According to Tager-Flusberg and Sullivan (p. 61), the cognitive component of ToM encompasses the conceptual understanding of the mind as a representational system, and its basic measure is the false-belief task. The perceptual component of ToM involves the ability to “make on-line rapid judgments about people’s mental state from their facial and body expressions” (p. 62). It could be assumed that the crucial ingredients of the cognitive component of ToM are theory-based knowledge structures and the mechanism of simulation, where the first are used primarily for action prediction, and the second for belief fixation (cf. Perner, 2000).

The model highlights the two types of links between EF and ToM: emergence-type and expressive-type, in accordance with the proposal of Moses (2001). The emergence-type influence can be direct (as in the case of inhibitory control, which, as shown by longitudinal studies, proved to be independent of several control variables, including language, predictor of ToM), or indirect through social

and language interactions. Other abilities that make up EF play the role of “expressive” factors, because longitudinal studies have not confirmed their influence on ToM development. To other aspects of relations between the EF and ToM, included in the model, we return later.

Expressive-Type Influences

The question arises, at what phase of ToM development, at rather its early or late phase, executive factors associated with ongoing reasoning in ToM tasks play an important role. Results obtained by Carlson and Moses (2001) may be helpful in finding an answer to this question. This study showed that performance on ToM tasks correlated substantially stronger with the battery of “conflict” EF tasks than with “delay”² EF tasks in the group of 4-year-olds, whereas, in the group of 3-year-olds, the difference between the strength of correlations was not significant. Given that children begin to pass false-belief tasks at about the age of 4, the stronger relationship between performance on these tasks and a battery of “conflict” EF tasks suggests that children’s success in false-belief tasks at this age depends on inhibitory control. This conclusion is also supported by longitudinal study Schneider et al. (2005), where it was found that the relationship between ToM and executive control was strongest during phase 3 in this study, when children were at an average age of 4, the critical age for false-belief understanding. The increase of relation between ToM and EF with age could also be noted in Carlson, Mandell et al. (2004), showing that, when children were at an average age of 2, there was no correlation between the two types of abilities, but during phase 2, when children were at a mean age of 3 years and 4 months, there was already a significant correlation.

It should be noted that meta-analysis carried out by Wellman et al. (2001) showed that the manipulation of such factors as the saliency of the real state of affairs, or the saliency of mental representations rises, at a certain age, performance on the false-belief tasks to a level higher than random, although not removing all difficulties children have in these tasks. The advocates of an executive expression account (e.g. Leslie et al., 2005) argue, however, that it is not known whether these manipulations cover all executive demands that ToM tasks make for children, or whether it is possible to reduce all these demands.

Emergence-Type Influences

In addition to the data from longitudinal research, there are other arguments in favour of an executive emergence ac-

² The demands of “delay” tasks include only inhibition of responses, whereas in “conflict” tasks, in addition to the inhibition of an inappropriate response, a subject has to activate a conflicting, novel response (Carlson & Moses, 2001, p. 1047).

count, according to which executive function plays an important role in the development of conceptual knowledge about mind. Evidence for this account comes, as noted Moses et al. (2005), among others, from studies showing that answers requiring to explain the behaviour of a protagonist in the false-belief task correlated equally strongly with measures of EF as answers requiring to predict behaviour (e.g. Perner, Lang et al., 2002). It is assumed that such executive requirements as the need to inhibit a reference to a salient real state of affairs, or to a subject’s own salient mental representation, are absent when a question requires to explain the behaviour of a protagonist in the false-belief task. Similar correlations were found between EF and other ToM tasks, which, as assumed, are devoid of these requirements – the test of source of knowledge and the task in which a subject is asked to assess the level of certainty of beliefs held by some other person, who has full or limited access to the relevant information (Moses et al., 2005). However, Sodian and Hülken (2005), who in their study on children with ADHD also used the task requiring to evaluate the certainty of beliefs (the epistemic state attribution task), seem to interpret the relationship between performance on this task and EF in terms of an executive expression account.

The discrepancy between researchers as to the interpretation of the links between performance on particular kinds of ToM and EF tasks may result from the fact that not all assume that the explanation of behaviour in the false-belief task, or answering to a question in such a task as the epistemic state attribution task, is devoid of executive requirements. Unless these tasks make executive demands related to inhibition, it cannot be excluded that they still make other executive demands. These demands may be related either to switching from a subject’s own perspective to the perspective of another person whose behaviour is to be explained, or to maintaining in memory relevant information while inferring some other information.

Could Different Types of Influences Be Disentangled in the Analysis?

The controversy depicted above about the interpretation of the links between some EF and ToM tasks leads to a more general question. It concerns the possibility of the separation of the two types of EF influences – emergence-type and expressive-type – in the analysis. To find a task that will enable the measurement of one of these aspects, while not making demands related to the second, remains a problem. It appears that, in the case of tasks that require reasoning about mental states, both aspects are intimately tied – to give an explicit correct answer one should possess not only a proper knowledge but also be able to use it. There are, however, some ToM tasks that do not require reasoning about mental states, but rather direct “reading” them from facial expressions. Some researchers (e.g. Bar-

on-Cohen et al., 2001; Klin et al., 2000; Tager-Flusberg & Sullivan, 2000) proposed taking a broader perspective on ToM research, covering not only the ability to reason about mental states, but also the ability to recognize mental states on the basis of directly available perceptual information, such as body movements, gaze and facial expression. This distinction is reflected in the componential model of ToM proposed by Tager-Flusberg and Sullivan (2000), which assumes that abilities related to reasoning about mental states are relatively independent of those related to “reading” mental states on the basis of nonverbal clues.

Therefore, the question is whether EF influences only more “cold”, cognitive aspects of ToM, or also more “hot” ToM abilities that make up the perceptual component. An answer to this question could be helpful in determining the scope of the emergence-type influence of EF on ToM development. Supposedly in the case of tasks that require only to “read” mental states from facial expressions, the involvement of executive processes associated with the inhibition of response, switching between perspectives or maintaining relevant information in memory, is minimal.

Data concerning a relation between the perceptual component of ToM and EF are scarce and ambiguous. Speltz et al. (1999) found that children with conduct disorder (ODD with or without comorbid ADHD), in comparison to the control group, performed worse on the test of emotion recognition and the test of verbal fluency, as a measure of EF, which may indicate that there is some developmental link between these skills. In another study concerning this issue (Radecka, 2007) it was found that “reading” mental states from facial expression (Baron-Cohen et al.’s “reading the mind in the eyes” task, as a measure of the perceptual component of ToM) correlated only marginally with the results of an extended version of the Dimensional Change Card Sorting task (DCCS; Honwanishkul et al., 2005), as a measure of EF, while the understanding of second-order false-belief (the cognitive component of ToM) correlated moderately with this task, even if age, sex and parental education were partialled out. If such a task as Baron-Cohen’s “reading the mind in the eyes” task could be considered as a relatively “clean” ToM task that is devoid of executive demands (e.g. Kaland et al., 2002, p. 518), then the lack of correlation between performance on this task and executive control speaks against the emergence-type impact of EF on ToM (or at least on the perceptual component of ToM).

It should be noted, however, that this perceptual task has, in turn, a greater emotional component than tasks tapping the cognitive aspect of ToM, such as the false-belief task. It is evidenced by the results of functional neuroimaging research indicating that during solving this task there is activated not only the prefrontal cortex but also the limbic structures (Baron-Cohen et al., 1999). The

relationship between such tasks as Baron-Cohen’s “eye” test and other measures of EF should be the subject of further studies. Alternatively, it might be that the perceptual component of ToM is not subjected to a direct developmental influence by EF, which is marked on Figure 1 by directing emergence-type arrows only towards the cognitive component of ToM. Possibly the influence of EF on the perceptual component of ToM may be mediated by social interactions and becomes noticeable in clinical groups, in which the disorders of social interactions may be caused by deficit in EF.

Indirect Links Between EF and ToM

Most existing research has focused on seeking a direct link between EF and ToM. The assumption of a direct link is held by Moses (2001), who describing an executive emergence account has stressed that the acquisition of the crucial concept of ToM - a belief concept - requires a certain minimum level of executive ability to “distance oneself from the immediate situation, and some ability to inhibit salient but misleading knowledge” (p. 688). Hughes and Leekam (2004) suggest, however, that the relationship between EF and ToM may not be direct but may be mediated by social interactions. According to their proposal (p. 597), executive deficits may impoverish social interactions and in this way influence the development of ToM; the reverse dependency is also possible: rich social interactions may provide the opportunity for practising, and in turn, developing executive skills by children.

The specific kind of interactions are those between siblings, which, as is shown by the sibling effect (Jenkins & Astington, 1996; Perner et al., 1994), are an important environmental factor for ToM development. In Perner et al.’s (1994) study it was found that children who had two or more siblings performed on the false-belief tasks nearly twice as well as children having no siblings. However, since not all studies have confirmed the presence of the sibling effect (e.g. Cutting and Dunn, 1999), this may indicate that it is the interaction between two or more factors that is responsible for this effect. For example, Cole and Mitchell (2000) found a relationship between the number of older siblings of a child and inhibitory control, but paradoxically they did not find a link between the number of siblings and ToM skills in children from primarily working-class families. In another study (Putko, 2004), which used more extended measures of ToM, it was found that ToM skills depended both on the number of older siblings and on inhibitory control. The regression analysis showed, however, that only inhibitory control was the source of variance in false-beliefs understanding marginally independent of the number of older siblings. This may indicate that both effects – influence of the number of older siblings and inhibitory control on false-belief

understanding – at least partially overlap with the impact of inhibitory control being relatively stronger than that of the second factor.

Asymmetry of Reciprocal Influences

Although the majority of longitudinal studies show that EF have an impact on the development of ToM but not vice versa, data obtained in Hughes and Ensor's (2007) study indicate that there might occur, at least in part, a reverse dependency. The possibility of reciprocal influences is also suggested by the results of Kloo and Perner's (2003, exp. 2) study, which demonstrated that children trained in solving the DCCS task improved their performance on the false-belief tasks in comparison with the control group which was trained in solving a task that did not require executive control. The reverse dependency occurred also: the group trained in solving the false-belief task improved their performance on the DCCS task, although the effect of this training was weaker. Since the results of Kloo and Perner's study suggest the possibility of reciprocal influences in the development of EF and ToM, it seems that positions T1 and T2 would need to be considered as not mutually exclusive but rather as complementary.

The more compromise solution outlined above could be treated as a variant of the model presented in Figure 1, allowing the existence of reciprocal direct dependencies between the development of ToM and EF. But similarly as suggested by the results of the training study conducted by Kloo and Perner (2003), the influence of EF development on ToM seems stronger (as also evidenced by longitudinal studies) than that occurring in the opposite direction. It cannot be excluded, however, that the greater impact of EF development on ToM may result from some additive effects of emergence-type and expressive-type impacts.

Concluding Remarks

The complex picture of relationships between the development of ToM and EF that emerges from the current state of research may be the result of the existence of different types and levels at which these dependencies are undergoing. On the one hand, this is the level of emergence-type vs. expressive-type dependencies, and, on the other hand, direct vs. indirect ones. Probably, in this picture of relationships, are also involved the links resulting from the fact that both types of abilities are underlain by partly common or closely related brain structures. It seems, therefore, that the assumptions held by the two competing positions T1 and T2 would be substantially weakened and instead of speaking about necessary but insufficient factors for the development of EF or ToM, we should rather treat these factors as supporting their devel-

opment. A clearer separation of different types and levels of influences is an important challenge facing future research in this area.

References

- Baron-Cohen, S., Ring, H., Wheelwright, S., Bullmore, E.T., Brammer, M.J., & Simmons, A. et al. (1999). Social intelligence in the normal and autistic brain: an fMRI study. *European Journal of Neuroscience*, *11*, 1891-1898.
- Baron-Cohen, S., Wheelwright, S., Hill, J., Raste, Y., & Plumb, I. (2001). The "Reading the mind in the eyes" test revised version: A study with normal adults, and adults with Asperger Syndrome or High-Functioning autism. *Journal of Child Psychology and Psychiatry*, *42*, 241-252.
- Carlson, S.M., Mandell, D.J., & Williams, L. (2004). Executive function and theory of mind: Stability and prediction from age 2 to 3. *Developmental Psychology*, *40*, 1105-1122.
- Carlson, S.M. & Moses L.J. (2001). Individual differences in inhibitory control and children's theory of mind. *Child Development*, *72* (4), 1032-1053.
- Carlson, S.M., Moses, L.J., & Breton, C. (2002). How specific is the relation between executive function and theory of mind? Contributions of inhibitory control and working memory. *Infant and Child Development*, *11*, 73-92.
- Carlson, S.M., Moses, L.J., & Claxton, L.J. (2004). Individual differences in executive functioning and theory of mind: An investigation of inhibitory control and planning ability. *Journal of Experimental Child Psychology*, *87*, 299-319.
- Case, R. (1985). *Intellectual development: Birth to adulthood*. New York: Academic Press.
- Cole, K. & Mitchell, P. (2000). Siblings in the development of executive control and theory of mind. *British Journal of Developmental Psychology*, *18* (2), 279-296.
- Cutting, A.L. & Dunn, J. (1999). Theory of mind, emotion understanding, language, and family background: Individual differences and interrelations. *Child Development*, *70* (4), 853-865.
- Davis, H.L. & Pratt, C. (1995). The development of children's theory of mind: The working memory explanation. *Australian Journal of Psychology*, *47* (1), 25-31.
- de Villiers, P.A. (2005). The role of language in theory-of-mind development: What deaf children tell us. In J.W. Astington & J.A. Baird (Eds.), *Why language matters for theory of mind* (pp. 267-297). Oxford: Oxford University Press.
- Flynn, E., O'Malley, C., & Wood, D. (2004). A longitudinal, microgenetic study of the emergence of false belief understanding and inhibition skills. *Developmental Science*, *7* (1), 103-115.
- Fodor, J. A. (1992). A theory of the child's theory of mind. *Cognition*, *44*, 283-296.
- Frye, D. (2000). Theory of mind, domain specificity, and reasoning. In P. Mitchell & K. Riggs (Eds.), *Children's reasoning and the mind* (pp. 149-168). Hove, UK: Psychology Press.
- Frye, D., Zelazo, P.D., & Palfai, T. (1995). Theory of mind and rule-based reasoning. *Cognitive Development*, *10*, 483-527.
- Hongwanishkul, D., Happaney, K., Lee, W.S.C., & Zelazo, P.D. (2005). Assessment of hot and cool executive function in young children: age-related changes and individual differences. *Developmental Neuropsychology*, *28* (2), 617-644.
- Hughes, C. (1998a). Executive function in preschoolers: Links with theory of mind and verbal ability. *British Journal of Developmental Psychology*, *16*, 233-253.
- Hughes, C. (1998b). Finding your marbles: Does preschoolers' strategic behaviour predict later understanding of mind? *Developmental Psychology*, *34*, 1326-1339.

- Hughes, C. & Ensor, R. (2007). Executive function and theory of mind: Predictive relations from ages 2 to 4. *Developmental Psychology*, 43, 1447-1459.
- Hughes, C. & Leekam, S. (2004). What are the links between theory of mind and social relations? Review, reflections and new directions for studies of typical and atypical development. *Social Development*, 13 (4), 590-619.
- Jenkins J. M. & Astington J.W. (1996). Cognitive factors and family structure associated with theory of mind development in young children. *Developmental Psychology*, 32, 70-78.
- Kaland, N., Møller-Nielsen, A., Callesen, K., Lykke Mortensen, E., Gottlieb, D., & Smith, L. (2002). A new 'advanced' test of theory of mind: Evidence from children and adolescents with Asperger syndrome. *Journal of Child Psychology and Psychiatry*, 43, 517-528.
- Klin, A., Schultz, R., & Cohen, D.J. (2000). The need for a theory of theory of mind in action. In S. Baron-Cohen, H. Tager-Flusberg, & D. J. Cohen (Eds.), *Understanding other minds: Perspectives from developmental cognitive neuroscience* (pp. 145-162). Oxford: Oxford University Press.
- Kloo, D. & Perner, J. (2003). Training transfer between card sorting and false belief understanding: Helping children apply conflicting descriptions. *Child Development*, 74, 1823-1839.
- Leslie, A.M. & Thaiss, L. (1992). Domain specificity in conceptual development: Neuropsychological evidence from autism. *Cognition*, 43, 225-251.
- Leslie, A.M., German, T.P., & Polizzi, P. (2005). Belief-desire reasoning as a process of selection. *Cognitive Psychology*, 50, 45-85.
- Moses, L.J. (2001). Executive accounts of theory-of-mind development. *Child Development*, 72, 688-690.
- Moses, L.J., Carlson, S.M., & Sabbagh, M.A. (2005). On the specificity of the relation between executive function and children's theories of mind. In W. Schneider, R. Schumann-Hengsteler, & B. Sodian (Eds.), *Young children's cognitive development. Interrelationships among executive functioning, working memory, verbal ability, and theory of mind* (pp. 131-146). Mahwah, NJ: Erlbaum.
- Ozonoff, S., Pennington, B.F., & Rogers, S.J. (1991). Executive function deficits in high functioning autistic children: Relationship to theory of mind. *Journal of Child Psychology and Psychiatry*, 32, 1081-1105.
- Pellicano, E. (2007). Links between theory of mind and executive function in young children with autism: Clues to developmental primacy. *Developmental Psychology*, 43, 974-990.
- Perner, J. (1998). The meta-intentional nature of executive functions and theory of mind. In P. Carruthers & J. Boucher (Eds.), *Language and thought: Interdisciplinary themes* (pp. 270-283). Cambridge: Cambridge University Press.
- Perner, J. (2000). About + Belief + Counterfactual. In P. Mitchell & K.J. Riggs (Eds.), *Children's reasoning and the mind* (pp. 367-401). Hove: Psychology Press.
- Perner, J., Kain, W., & Barchfeld, P. (2002). Executive control and higher-order theory of mind in children at risk of ADHD. *Infant and Child Development*, 11, 141-158.
- Perner, J. & Lang, B. (1999). Development of theory of mind and executive control. *Trends in Cognitive Sciences*, 3, 337-344.
- Perner, J. & Lang, B. (2000). Theory of mind and executive function: Is there a developmental relationship? In S. Baron-Cohen, H. Tager-Flusberg, & D.J. Cohen (Eds.), *Understanding other minds: Perspectives from developmental cognitive neuroscience* (pp. 150-181). Oxford: Oxford University Press.
- Perner, J., Lang, B., & Kloo, D. (2002). Theory of mind and self-control: More than a common problem of inhibition. *Child Development*, 73 (3), 752-767.
- Perner, J., Ruffman, T., & Leekam, S.R. (1994). Theory of mind is contagious: You can catch it from your sibs. *Child Development*, 65, 1228-1238.
- Putko, A. (2004). Teoria umysłu a zakres efektu starszego rodzeństwa oraz jego związki z zabawą w udawanie i kontrolą hamowania. [Theory of mind and the breadth of older siblings effect and its relations to pretend play and inhibitory control]. *Studia Psychologiczne*, 42 (2), 69-80.
- Radecka, M. (2007). Percepcyjny i kognitywny komponent teorii umysłu u dzieci zagrożonych ADHD. [Cognitive and perceptual component of theory of mind in children at risk of ADHD]. Unpublished master's thesis. Warszawa: SWPS.
- Russell, J. (1997). How executive disorders can bring about an inadequate 'theory of mind'. In J. Russell (Ed.), *Autism as an executive disorder* (pp. 256-304). Oxford: Oxford University Press.
- Russell, J. (2002). Cognitive theories of autism. In J.E. Harrison & A.M. Owen (Eds.), *Cognitive deficits and brain disorders* (pp. 295-324). London: Dunitz Martin.
- Russell, J., Mauthner, N., Sharpe, S., & Tidswell, T. (1991). The 'windows task' as a measure of strategic deception in preschoolers and autistic subjects. *British Journal of Developmental Psychology*, 9, 331-349.
- Sodian, B., & Hülshen, C. (2005). The developmental relation of theory of mind and executive functions: A study of advanced theory of mind abilities in children with ADHD. In W. Schneider, R. Schumann-Hengsteler, & B. Sodian (Eds.), *Young children's cognitive development. Interrelationships among executive functioning, working memory, verbal ability, and theory of mind* (pp. 175-187). Mahwah, NJ: Erlbaum.
- Speltz, M.L., DeKlyen, M., Calderon, R., Greenberg, M.T., & Fisher, P.A. (1999). Neuropsychological characteristics and test behaviors of boys with early onset conduct problems. *Journal of Abnormal Psychology*, 108, 315-325.
- Schneider, W., Lockl, K., & Fernandez, O. (2005). Interrelationships among theory of mind, executive control, language development, and working memory in young children: A longitudinal analysis. In W. Schneider, R. Schumann-Hengsteler, & B. Sodian (Eds.), *Young children's cognitive development. Interrelationships among executive functioning, working memory, verbal ability, and theory of mind* (pp. 259-283). Mahwah, NJ: Erlbaum.
- Tager-Flusberg, H., & Joseph, R.M. (2005). Theory of mind, language, and executive functions in autism: A longitudinal perspective. In W. Schneider, R. Schumann-Hengsteler, & B. Sodian (Eds.), *Young children's cognitive development. Interrelationships among executive functioning, working memory, verbal ability, and theory of mind* (pp. 239-258). Mahwah, NJ: Erlbaum.
- Tager-Flusberg, H. & Sullivan, K. (2000). A componential view of theory of mind: Evidence from Williams syndrome. *Cognition*, 76, 59-89.
- Wellman, H.M., Cross, D., Watson, J. (2001). Meta-analysis of theory-of-mind development: The truth about false belief. *Child Development*, 72 (3), 655-684.
- Zelazo, P.D. & Müller, U. (2002). Executive functions in typical and atypical development. In U. Goswami (Ed.), *Handbook of childhood cognitive development* (pp. 445-469). Oxford: Blackwell.