Representing the Mental World in Children’s Social Behavior: Playing Hide-and-Seek and Keeping a Secret

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Abstract

This study examined the relationship between children’s developing theory of mind and their ability to engage in two social behaviors which have, as their cognitive underpinning, the representation that what one knows may not be accessible to others. Children of 3, 4, and 5 years, in a quasi-naturalistic setting, played hide-and-seek and also were required to keep a secret about a surprise. The ability to play hide-and-seek was significantly related to children’s ability to refrain from disclosing the secret, and there was a significant relationship between these behaviors and children’s social cognition, as measured by theory of mind tasks. The relationship between these social behaviors and tasks measuring executive function was not significant once age was taken into account. With regard to the development of these social behaviors, few 3-year-olds, but most 4-year-olds, and almost all 5-year-olds could successfully play hide-and-seek and keep a secret. This study demonstrates the importance of the conceptual understanding of mental states in the young child’s social world.

Keywords: theory of mind; executive function; hide-and-seek; keeping secrets

Studies on children’s theory of mind (ToM) have focused not on young children’s social behavior, but on their social cognition, in particular their ability to attribute a false belief in an experimental paradigm (Flavell, 2000; Wellman, Cross, & Watson, 2001). But after we know what children know, we need a detailed account of how this knowledge, or lack of knowledge, is actually expressed in the social behavior of normal populations of young children.

Such research is often difficult to carry out and is usually studied by means of naturalistic observations of children’s spontaneous social interactions with known members of their community (Brown & Dunn, 1991; Dunn, 1991). However, spontaneous behavior yields data that, by its very nature, is often infrequent, anecdotal, and lacking in the controls of the experimental method.

Two social behaviors which have not been systematically studied, but appear to involve children’s developing understanding of the mental world, are the game of hide-
and-seek, and the ability to keep a secret about a surprise. Both of these social interactions seem to involve the conceptual understanding that what one knows may not be accessible to others. The first aim of the study was to examine these two ‘real-world’ correlates of laboratory-based theory of mind tasks in a naturalistic, yet controlled, paradigm.

An important question is whether the two social behaviors of playing hide-and-seek and keeping a secret, both of which seem to be dependent on an understanding of the inaccessibility of one’s mental states to the outer world, appear at the same time as each other. If children’s maturing conception that people may differ in terms of their state of knowledge is an important predictor of real-world social behavior, one would expect a co-relation in the developing abilities to keep a secret and play hide-and-seek.

Furthermore, if both of these behaviors have, as their cognitive foundations, the representation that others may be ignorant of what one knows to be true, it seems likely that individual differences in the appearance of such social behaviors would be related to performance on ToM tasks. Recently there have been some attempts to combine observational and experimental methods in studying the real-world consequences of children’s false-belief understanding in the lives of normally developing children. Results have been somewhat mixed: While ToM performance was found not to be related to total amount of pretend play, performance was related to two observational measures of sophisticated pretend play (Astington & Jenkins, 1995; Jenkins & Astington, 1996; Jenkins & Astington, 2000). Children who passed ToM tasks were observed to be better able to assign pretend roles, such as, ‘I’m the Mommy, you be the baby,’ and make joint plans, such as, ‘Let’s go shopping.’ Relationships between observations of sophisticated pretend play and performance on ToM tasks have also been demonstrated by Schwebel, Rosen, and Singer (1999), Taylor and Carlson (1997), and Youngblade and Dunn (1995). Studies have also found a relationship between individual differences in performance on ToM tasks and teacher ratings of social-emotional maturity (Lalonde & Chandler, 1995); teacher ratings of social skills with peers (Watson, Nixon, Wilson, & Capage, 1999); emotion understanding (Hughes & Dunn, 1998); boys’ moral justifications (Dunn, Cutting, & Demetriou, 2000); and mental state talk (Brown, Donelan-McCall, & Dunn, 1996; Hughes & Dunn, 1998). However, while success on experimental tasks involving deception has often been used as a proxy for ToM understanding (Hala & Chandler, 1996; Peskin, 1996), a recent longitudinal study (Newton, Reddy, & Bull, 2000) found no correlation between both the quantity and variety of young children’s everyday deceptions—as observed by their mothers—and their performance on a battery of ToM tasks.

Another mechanism which may play a role in the development of children’s social behavior is executive function. Executive function is a broad and not clearly specified term which covers those processes needed to hold in mind a goal amidst distracting alternatives (Griffith, Pennington, Wehner, & Rogers, 1999; Hughes, 1998). It covers functions such as inhibitory control (inhibition of a prepotent but irrelevant response) and working memory, although these processes themselves are highly interrelated. There is strong evidence that theory of mind development is related to executive control (Carlson & Moses, 2001; Carlson, Moses, & Hix, 1998; Zelazo & Frye, 1998), although the explanation for these observed developmental correlations is still not well understood (Perner, Lang, & Kloo, 2002). Individual differences in executive function may also contribute to variation in children’s developing social behaviors. For instance, not divulging a secret, as well as successfully playing hide-and-seek, both require an ability to inhibit a response. In hide-and-seek, for instance, the child must remain
hidden when playing the role of hider, and not peek when acting as the seeker. When told a secret about a surprise, the child must refrain from disclosure. Performance on tasks measuring executive function has been found to correlate negatively with antisocial behavior and poor understanding of emotion in hard-to-manage preschoolers (Dunn & Hughes, 2001; Hughes, Dunn, & White, 1998; Hughes, White, Sharpen, & Dunn, 2000); however, little is known about the contribution of executive function to variability in typically developing children’s social behaviors.

A second aim was to examine the ages at which children begin to successfully play hide-and-seek, and keep a secret about a surprise. While experimental paradigms have often involved concealing information about or hiding objects, usually in partnership with a play character (Baron-Cohen, 1992; Bridges & Rowles, 1985; Freeman, Lewis, & Doherty, 1991; Hala & Chandler, 1996; Hughes & Donaldson, 1979; Peskin, 1992; Sodian, 1991; Szarkowicz, 1999), the development of children’s actual behavior when they have to hide themselves in the popular, universal, and age-old game of hide-and-seek has not been investigated.

What we know is largely anecdotal. Perner (1991), for instance, cites an anecdote involving Heinz Wimmer’s 3-year-old son, Theo.

‘Heinz is hiding in the pantry. After some searching Theo finds him. Heinz asks, “How did you know I was in here?” to which Theo answers, “Because I opened the door.” Then it is Theo’s turn to hide. Right in front of Heinz (!) he “hides” in the pantry. Heinz plays along and calls out, “Where are you?” Theo giggles and answers, “in the pantry.”’ (p. 153)

There has also not been systematic research on when children develop the ability to keep a secret about a surprise. In the 1920s, the French psychologist, Janet, noted that children’s discovery of the concept of a secret is a huge achievement in that it signals an understanding of an ‘inner’ world separate from that of the ‘outer’ world (Meares & Orlay, 1988). The child can now represent that someone else may not know something that the child knows to be true. Using a semi-structured interview, Meares and Orlay found that, during children’s fifth year, they developed a concept of secrecy, but these authors did not study children’s actual behavior in keeping a secret. Later research on when children keep secrets has been motivated by the need to validate eyewitness testimony in child abuse cases, and has involved older children (Watson & Valtin, 1997) and/or the concealing of a transgression (Pipe & Goodman, 1991; Wilson & Pipe, 1996).

In the present study, in a staged situation to elicit quasi-naturalistic social interaction, children from the ages of 3 to 5 years were shown a birthday cake that was to be a surprise for an experimental confederate. The children were told that this was a secret. Each child also engaged in hide-and-seek play. In addition to observations of the children’s social behaviors, children were given two ToM tasks and two tasks designed to measure executive function.

**Method**

**Participants**

The participants were 54 children who attended a private laboratory school attached to a university. The children came from middle- to upper-middle-class families, and with the exception of two children, English was the first language. The children were drawn from three age groups: 18 participants of 3 years (11 girls and 7 boys; mean
age 3–7, range 3–0 to 3–11), 18 participants of 4 years (8 girls and 10 boys; mean age 4–6, range 4–1 to 4–11) and 18 participants of 5 years (8 girls and 10 boys; mean age 5–5, range 5–1 to 5–9).

Procedure and Materials

In order for the children to play hide-and-seek with the experimenter, it was important that the 3-year-olds, in particular, feel very comfortable. With this purpose in mind, the experiment was carried out in the school’s kitchen, a room which had positive associations for the young children because it was the location of their weekly baking class. Furthermore, prior to the formal part of the testing, each child engaged in hide-and-seek play using playfigures in a large doll’s house set up in the kitchen. It should be noted, in addition, that rotating student teachers were always present in the classrooms of this laboratory school, and the children were therefore at ease with new adults.

Children were tested individually. The testing was carried out by the experimenter (E) and confederate (Vicky) and an attempt was made to create a set up that was as naturalistic as possible.

Setting the Stage. First the stage was set for both the secret and for videotaping the child while playing hide-and-seek: E opened the refrigerator and pointed out food for the teachers’ lunch. She then told the child that today was Vicky’s birthday. Vicky chatted about her birthday and how she had received a video camera as a gift. E said, ‘Vicky, why don’t you get your new camera and show it to (child’s name).’ While Vicky left the room, ostensibly to get the camera, E excitedly unwrapped an opaque plastic bag in which was an iced and brightly decorated birthday cake. E told the child that she was only going to give it to Vicky when school ended so Vicky could take it home to her family. E continued in a hushed, conspiratorial voice, ‘It’s a secret. Don’t tell Vicky the secret. Let’s put the cake back in the bag before Vicky comes back.’ The cake was fully covered but remained on the kitchen table. Vicky then re-entered the room and excitedly showed the child her video camera saying, ‘I’m going to try it out right now.’

Each child then played hide-and-seek with playfigures in a large ‘Sailor Moon’ doll’s house. E introduced it, saying, ‘Here is a Daddy and here is a little girl/boy. The little girl/boy says, “Daddy, will you play hide-and-seek with me?”’ The Daddy says, “Sure, I will.” (To the child) You hold the Daddy and the little girl/boy, and let them play hide-and-seek.’ Vicky videotaped the child’s play so that they would become quite relaxed with the camera for the formal part of the testing.

After setting the stage, formal testing began. The child was asked, ‘Tell me how you play hide-and-seek,’ and the answer was recorded. This was followed by observations of two social behaviors, performance on two ToM tasks, and two executive function tasks, all given in counterbalanced order.

Social Behaviors

Hide-and-seek. E told the child, ‘Now you and I are going to play hide-and-seek in the kitchen. Let's look at some hiding places where we can hide.’ E pointed out four different hiding places: under the eating table covered with a table cloth; under the kitchen sink which had been closed in using a sheet; and inside two empty cupboards. Then, to make the young children feel comfortable, E climbed under the table and asked the child to join her, saying, ‘Isn’t this a cosy hiding place.’ Next, she hid with
the child under the kitchen sink, again saying, ‘Isn’t this a cozy hiding place.’ E then said, ‘I don’t know how to play hide-and-seek very well, so you tell me how we should play.’ If there was no response, E continued, ‘What should I do now? You tell me how we’re going to play.’ A round of hide-and-seek was played, based on the child’s instructions, such as, ‘You be the hider,’ or ‘You count.’ Then, if the child did not spontaneously tell E to switch the hider/seeker roles, E asked, ‘OK, now what do we do? What happens now?’ If more help was needed, E said, ‘Now we’re going to play again. What do we do this time?’ E followed the child’s instructions even for the few who did not appear to understand that each person should have a different role. This will be discussed in greater detail in the qualitative description of children’s hide-and-seek play in the results section. No attempt was made to correct a child. Vicky videotaped the hide-and-seek game. Only one of the 3-year-olds refused to play and was excluded from the study.

To be scored as successfully playing the game of hide-and-seek, the child needed to demonstrate an understanding of the game as one involving mental states, in that the seeker is ignorant of the hider’s location. In operational terms, if children made any one of the following errors they were scored as not correctly playing the game: When hiding, if the child told E where he or she was going to hide; did not attempt to hide from view; hid before E’s vision was blocked; or did not remain physically hidden and quiet. When playing the role of the seeker, if the child told E where to hide; or if the child did not turn around and/or cover his or her eyes; or if the child peeked. Any of the above errors, whether hider or seeker, disqualified the child from being scored as successful. The no-peeking part of the criteria might appear to be stringent, as even children who can well-represent mental states do ‘cheat.’ However, Vicky was standing just a few feet from the child, ‘trying out’ her video camera, which effectively eliminated any possibility of successful cheating. No 5-year-olds cheated. One 4-year-old began to peek as E was looking for a place to hide, but glanced at the video camera and did not cheat again.

Although an attempt was made to create some kind of quantitative scale of the children’s performance, difficulties arose in deciding how to weight such a scale, and more importantly, a scale exaggerated the problem of children’s differential experience in playing hide-and-seek. For instance, children who have a lot of experience playing hide-and-seek might be quite adept at much of the game, but may reveal, in just one way, that they do not understand that it is a game which involves knowledge states. Such a child would obtain a high score on a scale, whereas a less experienced child would obtain a low score, yet both children are identical in not understanding that the seeker must be ignorant of the hiding place. For these reasons it was decided to simply assign a score of ‘0’—or fail—if the child made any one of the errors described above, and a ‘1’ if no errors were made. A qualitative description of the children’s hide-and-seek behavior will be given in the results section.

Keeping A Secret. E made an excuse to leave the room, leaving Vicky alone with the child. Vicky said, ‘I’m very hungry. I wonder whether there is anything to eat in this kitchen.’ Vicky repeated this twice, noting whether the child pointed to, or told about the birthday cake hidden in the bag, or whether the child was able to keep the secret (usually telling Vicky to look for food in the fridge). Children who pointed to the cake and/or told Vicky that there was a birthday cake, received a score of ‘0.’ All others received a ‘1.’
ToM Tasks

Location. The experimenter acted out the task using the doll’s house and playfig-
ures. ‘The boy has a dinosaur. He puts it away in his school bag. He goes upstairs.
While he’s gone his sister takes the dinosaur out of the school bag. She plays with it,
then she puts it away. She puts it away in the box. Then the girl goes outside. The boy
comes back. He wants to play with his dinosaur.’ The child was asked the false belief
Location question, ‘Where does the boy think the dinosaur is?’ and two control ques-
tions, ‘Where is the dinosaur really?’ and ‘Where did he put the dinosaur before he
went upstairs?’

Contents-Self and Contents-Other. The child was shown the box of a videotape
apparently starring ‘Franklin,’ a favorite story/video character, and asked, ‘What do
you think is inside this box?’ After answering, the child opened it to find Lego pieces
inside. The Contents-Self question was then asked, ‘What did you think was inside
this box before you opened it?’ This was immediately followed by the Contents-Other
question about Michael, a child in the class who had not yet been tested: ‘Michael
hasn’t yet seen inside this box. When he comes in, what will he think is inside it before
he opens it?’

There were, therefore, three ToM experimental questions altogether; that is, Loca-
tion, Contents-Self, and Contents-Other. Children were given a score of ‘1’ for pass
and ‘0’ for fail for each of these three questions.

Executive Function Tasks. Two frequently used tasks were given which required chil-
dren to respond counter to a prepotent tendency (Carlson & Moses, 2001):

Day/night task. This was based on the Stroop-like task adapted by Gerstadt, Joo
Hong, and Diamond (1994). E confirmed initially that children associate a black card
showing the moon with ‘night time’ and a white card showing a large sun with ‘day
time.’ The children were then shown the moon card and told, ‘When you see this card,
I want you to say “day” ____ Can you say “day” again?’ The child was then shown
the sun card and told, ‘When you see this card, I want you to say “night” ____ Can
you say “night” again?’ E then showed each of the two cards again, asking, ‘What do
you say for this one?’ When the child was correct on both cards, the test began. If the
child was not correct, E repeated the rules and the two practice trials. If necessary this
was to be repeated once more, that is, up to six trials but, in fact, no child needed
more than two sets of trials. Each child then received 12 trials without feedback in a
fixed random order so that their final score was out of 12. If the child used a differ-
ent term from that of E, for instance, ‘dark’ instead of night, or ‘morning’ instead of
day, this was counted as correct.

Card sort. This was based on the dimensional change card sort task (Frye, Zelazo,
& Burack, 1998; Zelazo & Frye, 1998). The child was instructed to sort cards accord-
ing to one dimension (shape or color) and later asked to sort by the other dimension,
thus requiring them to inhibit the previous sorting rule. Materials consisted of two
shallow boxes with a ten-inch-high board attached to the back of each. On one of the
boards was a drawing of a red flower, and on the other, a blue car. E then showed the
child a stack of cards depicting either a blue flower or a red car. The test instructions
were the following: ‘We are going to play a game. This is the color game. The color game is different from the shape game. In the color game, all the red ones go in this box (point to the red flower), and all the blue ones go in that box (point to the blue car). Let me try a couple of turns first. All the red ones go here, and all the blue ones go there. Here’s a red one. I’ll put it in this box because that’s where the red ones go in the color game.’ To be repeated on every trial: ‘All the red ones go here, and all the blue ones go there. Here’s a red/blue one. Where does it go?’ Each child received six pre-switch trials, with the cards presented in a random order. Feedback was given only after the first trial.

The post-switch instructions were, ‘OK, now we are going to switch. We are not going to play the color game anymore; we are going to play the shape game. The shape game is different from the color game. In the shape game, all the cars go in this box, and all the flowers go in that box.’ To be repeated every trial: ‘All the cars go here, and all the flowers go there. Here’s a car/flower. Where does it go?’ Each child received six post-switch trials with no feedback, and their score was out of six for the post-switch trials. Half of the children, in counterbalanced order, received the shape game first and had to switch to the color game.

Results

With regard to the practice trials on the Day/night task, only four 3-year-olds and one 4-year-old did not succeed on the first two practice trials. As these numbers were so low, following Gerstadt et al. (1994) the practice trials were used only to ensure that the children understood what we were asking of them, and the dependent measure was the number of correct trials after the practice trials.

Results will be reported as follows. First, differences between the three separate age groups, 3-year-olds, 4-year-olds, and 5-year-olds, when playing hide-and-seek and keeping a secret will be described. Secondly, the relations between individual differences in social behavior (hide-and-seek and keeping a secret), social cognition (ToM tasks), and tasks measuring executive function will be provided for the total sample of children. Thirdly, there will be a qualitative description of children’s hide-and-seek play.

Group Differences in Playing Hide-and-Seek and Keeping a Secret

As can be seen in Table 1, when playing hide-and-seek, only three (17%) of the 3-year-olds ensured that the seeker did not know where the hider was hidden. However, 14 of the 4-year-olds (78%) and 17 of the 5-year-olds (94%) demonstrated an ability to play hide-and-seek appropriately. A two-way contingency table analysis demonstrated that the relationship between age and playing hide-and-seek was significant, Pearson $\chi^2 (2, N = 54) = 25.9$, $p = .001$.

Similarly, there was a significant relationship between age and telling a secret. While only six (33%) of the 3-year-olds kept the secret, 12 (67%) of the 4-year-olds and 16 (89%) of the 5-year-olds refrained from disclosure, Pearson $\chi^2 (2, N = 54) = 12.07$, $p = .01$.

The children’s performance on the ToM and executive function measures is also shown in Table 1. It is worth noting that, within each of the three age groups, the total number of children who successfully played hide-and-seek and kept a secret was similar to the total number of children succeeding on the theory of mind tasks. It is
more difficult to make such comparisons for the executive function tasks as EF tasks traditionally involve a number of trials.

Relations Between Individual Differences in Social Behavior, ToM, and Executive Function

A $\chi^2$ analysis was carried out to examine whether there was a significant relationship between the three false belief questions, that is, Location, Contents-Other, and Contents-Self. Contents-Other and Contents-Self were significantly related, Pearson $\chi^2 (1, N = 54) = 35.729, p < .001, \Phi = .813$, and Location was related to both Contents-Self, Pearson $\chi^2 (1, N = 54) = 12.834, p < .001, \Phi = .488$, and Contents-Other, Pearson $\chi^2 (1, N = 54) = 17.182, p < .001, \Phi = .564$. Because the tasks appeared to be tapping a common underlying construct, a ToM aggregate score (number correct out of the three questions) was calculated for each participant.

Similarly, the two social behaviors of hide-and-seek and keeping a secret were found to be significantly related, Pearson $\chi^2 (1, N = 54) = 19.63, p = .001, \Phi = .603$, and were, therefore, aggregated to comprise a social behavior measure (SB aggregate).

The raw correlations between the two measures of Card sort and Day/night were also significant, $r (52) = .28, p < .05$, and were, therefore, standardized and aggregated to create an executive function aggregate measure (EF aggregate). While this correlation may appear somewhat weak, most EF tasks have been found to have only weak to moderate relationships with each other, and a correlation of .28 would be
above the median in, for instance, the large study on ten EF tasks by Carlson and Moses (2001).

As can be seen in Table 2, all the raw correlations between the individual ToM and executive function measures and the two social behaviors were significant. These measures were significantly related to age, but not to gender. The analyses were, therefore, rerun controlling for age in months.

The partial correlations carried out on the non-dichotomous variables in the data set can be seen in brackets in Table 2. The relationship between the social behavior aggregate measure and the ToM aggregate remains statistically significant even after controlling for age, but the social behavior aggregate is no longer significantly correlated with any measure of executive function.

To control for age among the dichotomous variables, logistic regressions were carried out with hide-and-seek and keeping a secret as the dependent variables. In each analysis, age was entered on the first step and the various ToM or executive function measures were entered on the second step. The effect of age was significant in every model at the .001 level and will not be further reported. The results of these incremental tests on step 2 of the models can be seen in Table 3. The significant relationship between hide-and-seek and the ToM Location task, as well as the significant relationship between keeping a secret and the Contents-Other task are intriguing. Both hide-and-seek and Location involved the representation of ignorance regarding the location of the hidden object or person; and both keeping a secret and Contents-Other involved the representation of someone else’s ignorance regarding what was inside a container.

A further logistic regression showed that there was a significant relationship between the two social behaviors themselves even after controlling for age in months. With hide-and-seek as the dependent variable, age was entered on the first step and keeping a secret was entered on the second step, \( \chi^2(1, N = 54) = 4.53, p < .05 \).

Finally, because the aggregate of the ToM tasks was significantly related to the aggregate of the executive function tasks even after age was partialled out, \( r(51) = .33, p < .05 \), it was decided to partial out executive function in addition to age. The aggregate of the ToM measures was still significantly correlated with the aggregate of the social behaviors, \( r(50) = .38, p < .01 \) after controlling for both age and executive function.

To control for age and executive function among the dichotomous variables, logistic regressions were carried out where age and executive function are entered on the first step. As can be seen in Table 4, being able to keep the secret continues to be significantly related to Contents-Other as well as to the ToM aggregate, but the relation between hide-and-seek and the ToM location task is reduced slightly and is no longer significant.

**Qualitative Description of Children’s Hide-and-Seek Play**

With regard to children’s responses to the question, ‘Tell me how you play hide-and-seek,’ 17 (94%) of the 3-year-olds mentioned the two roles in the game structure, that is, hiding on the one hand, and counting or finding on the other, for instance, ‘Someone hides. Someone counts.’ Or ‘hide and find.’ Or ‘A person counts and you hide. And then it’s your turn, the other person’s turn.’ Other than a few missing pronouns, these responses were no different in structure or detail from the responses of the successful 4- and 5-year-olds. While this does not mean that the 3-year-olds’ understanding
Table 2. Correlations Between Measures of Social Behavior, ToM and Executive Function

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<th>Location</th>
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**Note:** For the non-dichotomous variables, partial correlations controlling for age in months are shown in parentheses N = 54.  
* = p < .05; ** = p < .01; *** = p < .001.
of the word ‘hide’ was the same as that of the older children, that is, involving a representation that the seeker should be ignorant of the hiding place, it does demonstrate that the younger children knew the surface rules of the game. However, their performance was poor.

Of the 20 children who failed the hide-and-seek task, three 3-year-olds and one 4-year-old did not follow the role distribution within each round of hide-and-seek. Three of these children told E to hide and then the child also hid; and one child set up two seekers and no hider, instructing E, ‘You go to the door and I’ll go to the fridge and we’ll both look in different places.’ Of the remaining 16 children who failed hide-and-seek, 14 of the children did not correctly play the role of the hider, for instance, telling E where he or she was going to hide (two children); and/or hiding before the seeker turned around (six children); and/or not attempting to hide from view (three children); and/or not remaining physically hidden (seven children); and/or not remaining quiet (two children). In the role of the seeker, 11 of the children did not ensure that they remained ignorant of the hiding place, for instance, instructing the hider where to hide (two children) or facing the hider and counting with their eyes open (four children).

An interesting observation was that of a ritualistic hide-and-seek routine. This was an accidental finding resulting from the small space into which E—when playing the
role of the hider—had to squeeze herself, which left clear bulges in the sheet so that the children knew where she had hidden. This did not affect the aim of the research, which was to examine whether children knew to remain ignorant of E’s hiding place while they were counting; and it usually helped E by shortening the time she had to spend crouched in a hiding place. It did, however, allow the observation of four children (three who failed hide-and-seek and one who passed) carrying out a mock search, pretending to search for E in other places, loudly verbalizing, ‘She’s not here. She’s not here,’ before lifting the cover, with a loud, ‘Here she is.’

Discussion

This study found that children’s developing ability to think about the mediating role of the mental world, as determined by tasks that measure a false belief, contributed to variability in their actual social interactions. The behaviors of playing hide-and-seek and keeping a secret were significantly correlated both with each other and with children’s performance on ToM tasks even after controlling for age in months and executive function. With regard to the development of these social behaviors, few 3-year-old children, but most 4-year-olds, and almost all 5-year-olds, could successfully play hide-and-seek, and refrain from disclosing a secret about a surprise.

In examining the particular types of mental representations required in social behaviors, there is evidence of a rather intriguing relationship. First, after controlling for age, there was a significant correlation between having to represent someone’s ignorance of an object’s hidden location in the false belief Location task, and representing a person’s hidden location in actual social behavior when actually playing hide-and-seek. Secondly, after controlling for both age and executive function, there was a significant relationship between having to represent someone’s ignorance of what is inside a container in the false belief Contents-Other task, and representing someone’s ignorance about the cake (contained in an opaque bag) when keeping a secret. That there could be a relationship between specific types of mental representations and types of behavior was not anticipated and should be further investigated.

With regard to executive function, although the children had to inhibit the telling of the secret about the birthday cake, and needed to remain quietly hidden when playing hide-and-seek, there was not a significant relationship between these social behaviors and measures of inhibitory control once age was partialled out. As discussed in the introduction, the relationship between executive function and social behavior has previously been studied with atypical populations. For instance, poor performance on tasks of inhibitory control is significantly related to poor understanding of emotion and antisocial behavior in hard-to-manage children (Dunn & Hughes, 2001; Hughes et al., 1998; Hughes et al., 2000). In the current study, however, a typically-developing population of young children engaged in normal social activities, and inhibitory control did not contribute to variability. This is interesting in that, in the present study, as in previous studies (Carlson & Moses, 2001; Zelazo & Frye, 1998), executive function was significantly related to children’s ToM. Inhibitory control seemed to play a role in tasks that aim to measure children’s social cognition, but did not appear to play a significant role in the children’s social behavior. Russell (1996) proposed two possible accounts of the relationship between executive function and theory of mind. In a ‘performance’ account, immature executive function prevents young children from demonstrating their knowledge. In the more deep-seated ‘competence’ account, difficulty with executive function prevents children from thinking...
about the mental world and actually impedes conceptual development. The present study provides some evidence that the relationship between individual variability in executive function and the ability to represent one's mental states may not be accessible to others, is a result of performance issues rather than competence, as the relationship between executive function and mental state representation appears to be task-specific. On ToM tasks, which are somewhat artificial and outside the realm of young children's usual activities, executive function was significantly related to task performance. On the other hand, when children were emotionally engaged in actual social interactions which required the representation of the mental world, individual variability in inhibitory control was unrelated to their success in concealing a secret and playing hide-and-seek.

In Piaget's writings on the language and thought of the developing child, he seemed to wrestle with the contributory roles of the two mechanisms that have been examined in the current research—inhibiting one's natural tendency, as well as thinking about other people's points of view. He writes that 'the child up to an age as yet undetermined, but probably somewhere about seven, is incapable of keeping to himself the thoughts which enter his mind. He says everything. He has no verbal continence' (1926/1955, p. 59). This would appear to be an explanation in terms of not being able to inhibit one's responses. However, in a later comparison of the child and the adult, Piaget describes the child as having 'less verbal continence simply because he does not know what it is to keep a thing to himself. Although he talks almost incessantly to his neighbor, he rarely places himself at their point of view' (1926/1955, p. 60). In the present study, where 3-year-olds blurted out the secret, there appears to be some support for Piaget's assertion that the lack of 'verbal continence' is because the child does not yet think about the mental world of another. Between the ages of 3 and 5 years the ability to inhibit one's responses did not seem to play a role in individual variability in keeping the secret, but the ability to take another's 'point of view' as required in the ToM tasks was shown to be significantly related.

On the other hand, differing from Piaget's predictions regarding age norms, the present study showed that children were able to keep a secret well before the age of '7.' Two-thirds of the 4-year-olds and nearly 90% of the 5-year-olds in the study did not reveal the secret. It should be noted that these children came from middle- to upper-middle-class homes, and the age of success on ToM tasks, for instance, is somewhat later when the sample is from low-income families (Astington, 2000).

Previous studies on keeping a secret have examined secrets involving a transgression, such as breaking a toy, where disclosure would result in an offender getting 'into trouble' (Pipe & Goodman, 1991). In the present study, however, the secret involved positive affect in that disclosure was likely to result in pleasure. Despite this difference in the specificity of the secret, the developmental trajectory appears similar, with few 3-year-olds but many to most 5-year-olds being willing to conceal the transgression or the surprise. The exact numbers in the telling of any secret will of course be dependent on the context within which the secret is embedded. For instance, in the present study, having the cake in view, and Vicky announcing that she was hungry, most likely influenced the younger children to blurt out the secret. More interesting, however, is that, despite Vicky's announcement and the cake in front of them, only one 5-year-old revealed the surprise birthday cake. By the age of 5 years, children could well represent Vicky's ignorance.

With regard to the game of hide-and-seek, Garvey (1990) notes that games are play activities that have become institutionalized. They involve an explicit set of rules that
have been learnt. And Piaget (1962) writes that playing marbles and hide-and-seek are closely related in that ‘in both cases there are rules which have been handed down by the social tradition of children’ (1962, p. 108). He later comments, ‘Games with rules rarely occur before . . . age 4–7’ (Piaget, 1962, p. 142). In the present study nearly 80% of the 4-year-olds successfully played hide-and-seek, which makes the game a very early example of a rule-based game. The study examined not only the children’s actual behavior but also their explanation as to how one plays the game, and while 3-year-olds could not successfully play hide-and-seek, they could successfully state the primary rule of the game. As discussed in the qualitative results section, other than a few missing pronouns, as in a response such as ‘Hide and find,’ their rule explication was no different from that of the 5-year-olds. Katherine Nelson, in describing language development, writes that there is often use before conceptual understanding (Nelson, 1996). Enculturation before conceptual understanding can also be seen when children tell faulty riddles, laughing uproariously before understanding the concept of a riddle (Olson, 1994). In the case of hide-and-seek, while 3-year-olds did not understand the point of the game—that the seeker must be ignorant of the hiding place—all but three of them appeared to have had experience in following the surface rules of hide-and-seek, that is, a turn-taking routine whereby one person hides while the other person counts and then searches, which is then followed by a role change. The influence of culture was further evident when a few children demonstrated a ritualized routine, often carried out by parents, of pretending to seek in the wrong place even when the correct hiding place was known.

In addition to the conceptual and cultural components of the game of hide-and-seek, there is an affective component. In this study the situation was staged in order to elicit fairly naturalistic social interaction. There was an attempt to bring the social world, with its emotional content and vividness, into the laboratory. The children seemed genuinely excited by the secret birthday cake, and intensely engaged in their playing of hide-and-seek. As described in the qualitative results section, nine of the children, when hiding, attracted attention to themselves by giggling loudly or jumping out of the hiding place before being found. Is it possible that these children understood the point of the game but that it was emotionally more satisfying to make themselves known? From an early age children find the notion of disappearance and appearance pleasurable and engaging. In a study on young children playing ‘peekaboo,’ Bruner and Sherwood (1976/2001) talk about a ‘preadapted readiness to respond to disappearance and reappearance’ (p. 72), and Bower (1971) has shown that the ‘looming’ nature of the appearance in peekaboo produces much excitement. In the current study it was as if some of these children were playing peekaboo, delighted to be found. However, while this delight may have been rewarding, it is more likely that playing hide-and-seek as peekaboo is a result of not understanding the importance of mental states. All but three of these nine children demonstrated in an additional manner that they did not understand the point of hide-and-seek, most commonly by failing to be ignorant of E’s hiding place when playing the role of the seeker.

In conclusion, the study found that few 3-year-old children can successfully play hide-and-seek and keep a secret. These two social behaviors share, as their cognitive underpinning, the need to represent someone’s ignorance of what the child knows to be true, and to act on this knowledge by concealing information. Not only was the onset of successful performance on both of these social behaviors related to each other, but successful performance appears to be related more to young children’s developing ability to represent someone’s ignorance, than their developing ability to inhibit a
salient response. This study supports the importance of a conceptual understanding of mental states in the development of young children’s social behavior.

References


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