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A Child-Centred Exploration of the Relevance of Family and Friends to Theory of Mind Development

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Abstract

Theory of Mind (ToM) is said to develop at around 4 years-old. But some studies suggest it develops considerably earlier than this, with others suggesting it develops much later. Although several recent studies have found that social factors (like gender, family size, number of siblings, and number of friends) can impact on ToM, other studies contradict those findings. We wondered whether addressing several procedural issues and ensuring the task concerns real protagonists in real time, would bear on the above issues. Here, 114 children of 3-6 years completed 4 ToM tasks incorporating controls from experimental psychology, including randomly varying the order of ToM and non-ToM questions across participants. Now, children passed ToM tasks from around 5 years-old, rather than 4 years or earlier. Girls did not develop ToM any earlier than boys. There was clear correlational evidence for the older-sibling effect and effects of friends but no reliable effects of nuclear or extended family. However, when these factors were set in the context of one another, the sibling effect was driven by a negative influence from younger siblings (as opposed to older siblings) and the friends effect was driven by friends at school (as opposed to friends at home). Finally, “friends” was a stronger predictor than siblings but memory (a cognitive factor) and age (a maturational factor) were the strongest predictors of all.

Keywords: Children; Gender; Social Reasoning; Theory of Mind

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Children's understanding of how the mind mediates between knowledge and behaviour (Theory of Mind – ToM) begins quite early in life (Leslie, 1987; Wellman, Cross & Watson, 2001). However, "The most crucial development occurs around age 4, when they realise that thoughts in the mind may not be true." (Astington, 1998, pp.45). Astington's statement captures two key positions on development of ToM in children. First, crucial to ToM is the realisation that other people can hold beliefs that sometimes may be different from one's own beliefs (i.e., false-beliefs – Wimmer & Perner, 1983). Second, children undergo some kind of shift in conceptual understanding at around age 4 but not much before this age, perhaps mediated by the coming on-line of new mental representational capacities, and this is what is responsible for the appreciation of false-belief (Perner, 1991; Wellman et al., 2001).

But children may not need a conceptual/representational theory-shift. For example, Sabbagh, Moses and Shiverick (2006) explain the under-4s false-belief tasks failures in terms of a combination of difficulties with cognitive inhibition (disengaging from the current real-world situation), memory difficulties (maintaining a stable internal mental representation of outmoded knowledge) and difficulties with directing the response (inhibition or suppression of the pre-potent way of responding). Such an "executive processing account" may well be more parsimonious than a conceptual-representational account. But how would it explain the finding that during middle childhood, children with superior ToM tend to have lower self-esteem and greater anxieties (Cutting & Dunn, 1999; Hughes, Deater-Deckard & Cutting, 1999)? It also does not explain Sutton, Smith and Swettenham's (1999) contrasting finding that ringleader bullies often show superior ToM. Such findings point to social factors in development of ToM, even if cognitive factors also play a role (Hughes et al., 1999).

Hobson (1991) proposes children have an innate ToM mechanism. Then, experiencing "personal relatedness" causes them to realise that there are social benefits from using this innate ability. On this view, children treated socially-differently should exhibit differing ToM developmental profiles

(Cicchetti, Rogosch, Maughan, Toth & Bruce, 2003; Minter, Hobson & Bishop, 1998). One test case is "gender". Here, Hughes et al. (1999) used false-belief tasks with 4 year-olds plus self-report measures about parental style given to the children's parents. They identified different parental treatment of girls compared to boys but found no difference between girls' and boys' level of ToM. However, from their meta-analyses of two large datasets, Charman, Ruffman and Clements (2002) concluded that girls actually have superior ToM compared to boys, although only at 3 to 4 years.

Gender findings may become more robust in the context of other social factors (Hughes & Leekam, 2004). On one such factor, Perner, Ruffman and Leekam (1994) found that a 3 year-old having two or more siblings, enjoys roughly a 1 year advantage in ToM. But such findings may not always replicate (Cutting & Dunn, 1999; Hughes & Ensor, 2005). For example, when using statistical modelling, Pears and Moses (2003) report no correlation at all between number of siblings and ToM.

In Perner et al. (1994), many children were 3 year-olds and so their siblings tended to be older siblings, but in Pears and Moses (2003) a much greater proportion were 5/6 year-olds and so they would tend to have more younger siblings. If younger siblings have different impacts on ToM than older siblings, this might explain the contrast seen between Perner et al. (1994) and Pears and Moses (2003). In line with this view, Cutting and Dunn (2006) found that older siblings are more beneficial to ToM than younger siblings, with Ruffman, Perner and Parkin (1999) showing this advantage remains even after verbal-mental-age is accounted for. The older sibling effect now needs to be replicated with a good balance of 3/4 year-olds versus 5/6 year-olds.

Additional to siblings, some other family variables, parenting variables and even demographic variables might also be important to ToM. One candidate is family size, as opposed to number of siblings per-se (Lewis et al., 1996). Crucially, a family may be larger because of having more siblings and both parents (Nuclear/Immediate family), or larger because of having more grandparents, aunts/uncles etc. (Extended family). Jenkins and Astington (1996) have reported that the sibling effect is more due to extended family than to younger/older siblings. Family size may be

important because of providing increased opportunities for social interaction. Studies have confirmed that such opportunities (e.g., for play) do indeed lead to a ToM advantage, with the advantage originating from the playful contact leading to increased use of mental state attributions when talking to the child, which in turn impacts on ToM (Meins, Fernyhough, Russell & Clark-Carter, 1998; Ruffman, Slade & Crowe, 2002). One might therefore expect that children with more adult members, who can provide opportunities for play, will as a result tend to do better at ToM. Against this expectation, in a 2.5 year longitudinal study, Turnbull, Carpendale and Racine (2009) found that the number of mental state terms used by mothers about their child during play, is actually not a good predictor of ToM (see also Ruffman, Slade, Devitt & Crowe, 2006).

The activities a child has with a friend can be very different to play with parents, extended family or even other siblings; for example involving more self-control and a greater need for mutual-cooperation (Brown, Donelan-McCall & Dunn, 1996). Consistent with this thesis, Slaughter, Dennis and Pritchard (2002) found that greater ToM scores predicted greater peer acceptance and hence number of friends; although only at ages 5 to 6 years. Cutting and Dunn (2006) found that number of friends was an important predictor of 4 year-olds ToM but did not correlate with number of siblings. They concluded that the effect of friends may actually take primacy over the impact of siblings; although they also conceded that their dataset could not be conclusive on this issue.

Purpose of the Present Study

The present study aimed to: (a) Determine the extent to which three social potential factors (number of siblings, family members offering play opportunities and number of friends) were each related to the child's ToM. (b) Determine for each potential factor, which of its two opposing ends of the social dimension (i.e., younger v older siblings, play with nuclear v extended family, number of friends in the home environment v school environment) had the greater association with ToM. (c) Determine the extent to which a model containing all three social factors would predict ToM performance and the strength of each social factor compared to a general cognitive factor (the child's memory). We utilised a short structured interview with the child, which followed questions

on a questionnaire (Appendix 1). This was based on Wright-Cassidy et al. (2003) who proposed suitably-worded questionnaires as an acceptable way of collecting data surrounding children's social environment and behaviour characteristics.

Finally here, theorists often talk of Theory of "Mind" but actually most ToM tasks do not involve actual minds. Instead, studies typically involve puppets, video sketches with dolls, written or spoken stories, cartoons, or even just computer-generated entities such as geometric shapes (Baron-Cohen, Leslie & Frith, 1985; Guise et al., 2007; Perner, Kain & Barchfeld, 2002; Wang & Su, 2009; Wellman & Lagattuta, 2000). But the present tasks really did involve actual "minds", utilising real people as protagonists with real-time interaction with the child being tested (Leslie & Frith, 1988). This study was therefore well placed for additionally testing the thesis that there are gender differences in ToM (contrast Charman et al., 2002 with Hughes et al., 1999).

Method

Participants

These were 114 typically-developing children from four local nursery/primary schools, 53 of whom were girls. The sample comprised a 3 year-old group (N=18, M=3.78 years, SD=0.29), A 4 year-old group (N=33, M=4.83 years, SD=0.26), A 5 year-old group (N=41, M=5.66 years, SD=0.28), and a 6 year-old group (N=22, M=6.53 years, SD=0.26).

Materials

These were a questionnaire to be given verbally to the children in the form of a short structured interview, and a number of props for four false-belief ToM tasks. The structured interview asked a few basic questions about friends, siblings, and playing behaviours (Appendix 1). Children's answers were recorded on an answer sheet. The first of the ToM tasks involved two colourful paper bags; one containing a bag of sweets and the other containing a teddy bear. The second task used two plastic lunch boxes, each containing a sandwich plus either a Mars Bar or a Kit Kat (well-known chocolate bar). The third task involved a jug of water, a jug of lemonade, plastic cups and

biscuits. The final ToM task used a smarties tube, some smarties (well-known candies) and a few small pebbles.

Design

The study utilised a between-subjects design. The dependent variables were ToM score and memory-check score. The main independent variables were age-group, gender and question-position. Question-position controlled for a potential order effect, not previously acknowledged in ToM research. To avoid order effects here, the ToM question was asked after the memory question half of the time, and before the memory question the other half. Experimental psychological designs often do this to neutralise any potential bias.

A correlational/regression aspect was also incorporated into the design. The main variables were the child's reported number of younger siblings, number of older siblings, number of friends at home, number of friends at school, and the number of sources within the immediate (nuclear) family and the extended family that the child routinely played with. Here, the criterion variable was ToM score (dependent variable) and the social variables were predictors (independent variables).

Procedure

To minimise researcher-effects on the children's behaviour (Woodhead & Faulkner, 2000), the researchers went into the schools helping with some of the children's activities in the two weeks leading up to the study. During the study itself, the child was re-introduced to both researchers and asked whether s/he was happy to take part in some activities with them. They were then seated at a small table. One researcher asked the questions from the structured questionnaire. The child was told that the researchers have brought along a few of their favourite things, and was asked to observe the researchers' actions and play along with them if they liked.

The first task was based on Baron-Cohen et al.'s (1985) Sally-Anne task. It involved presenting two colourful paper bags, one belonging to the first researcher and the other belonging to the second researcher. The first researcher's bag contained a small teddy bear and the second researcher's bag contained a small packet of sweets. Once the child had seen the content of both bags, the first

researcher made an excuse to leave the room for just a moment, saying that she would leave her bag here. While she was absent, the second researcher said that she would like to play a little trick on her friend (the first researcher), checking with the child that it was ok to do so. With the child's consent, the second researcher switched the contents of the two coloured bags, so that the first researcher's bag now contained the sweets instead of the teddy bear.

Following recent ToM studies (see Sabbagh et al., 2006; Tager-Flusberg & Sullivan, 2000; Wang & Su, 2009), two critical questions were then asked: Before the first researcher returned, the child was asked a ToM question "Where will Amy look for her teddy bear?". Then, pointing to the coloured paper bags in turn, the second researcher added "In this one or in this one?". Another question was also asked to check that the child had remembered the sequence of events and tracked the current location of the items. This was the memory-check question and it was worded "Where is the teddy bear now?". The order of asking these two questions was determined in advance of the test session, with each child being assigned to one or other question order on a random basis, subject to approximately half the children being given each order. We refer to this manipulation as Question-Position (position of the ToM question or the memory-check question).

The second task was based around the contents used by Wimmer and Perner (1983). It was therefore similar to the first task, apart from relying on two lunch boxes with a Mars Bar and a Kit Kat, as opposed to the items of task 1. The third task was based around a task that used the first researcher's preference for one particular drink over another (Minter et al., 1998). It used a jug of water and a jug of lemonade. The first researcher asks for lemonade but, while she is gone, the second researcher pours water into her cup instead of the requested lemonade. The final task was based around Perner, Leekam and Wimmer (1987) and did not necessitate either researcher leaving the room. It tested the child's "own-prior belief" rather than the other tasks which had assessed the child's understanding of another person's belief ("own-other belief"). The child was presented with a smarties tube and asked "What do you think is in here?". Each child replied "smarties" or "sweets". The tube was then opened to reveal that actually there were pebbles inside rather than the expected contents of sweets. Upon returning the pebbles to the tube and closing it, the child was

asked two questions: One question was “When I first showed you this (pointing to the smarties tube), what did you say was in here?” The associated memory-check question was “What is really in here?”.

The above tasks were given in a random order. Once all four tasks were completed, children were thanked for their participation and given a sweet or a sticker, as agreed with the teachers beforehand. Each test session was recorded using an Olympus WS-110 Digital Voice Recorder, which permitted confirmation of all the child’s verbal responses later on. For the ToM question and the memory questions, the maximum number of correct answers was 4. These data were deemed suitable for parametric statistical tests, and so they were analysed using Analysis of Variance (ANOVA). Although the social variables were also quantitative here, preliminary analyses showed that they tended not to fit a normal distribution as well as the ToM data. Therefore these social variables were analysed using non-parametric statistical tests. Finally here, the predictive impact of each of these variables plus each child's age, was assessed via a series of pair-wise correlations and a simultaneous-entry linear regression.

Results

The first analysis assessed whether the methodology had been equally successful with each age group, when it came to ensuring good memory on the ToM task. It was also possible that the specific order in which the memory check questions and ToM questions was asked, might have affected memory retention, and that any differences found had been caused more by one gender than by another. Relevant data are summarised in Table 1. Table 1 gives mean scores converted into percentages to aid ready comparison with other studies. Table 1 shows memory performance was very high even for 3 year-olds. There appeared no tendency towards superior memory-check performance when the memory question was asked first compared to when it was asked second (difference = -0.9% indicating a slight overall advantage to the second question position). The direction of the question-position advantage did not appear to alter much as a function of age-group. Across all four age groups, boys did slightly better than girls on memory. For the ages taken

separately, boys tended to do better at 3, 4 and 5 years. However, by 6 years any advantage was in favour of girls.

Insert Table 1 about here.

A three-way ANOVA was conducted for the memory-check scores. Taking Gender first, there was no statistically significant main effect, indicating that any tendency towards boys being better at remembering the current location of the object was not reliable (F (1, 98) = 1.59, p = 0.211). The main effect of Memory Question-Position was not statistically significant (F <1); and nor was age-Group (F (3, 98) = 2.20, p = 0.094). None of the two- or three-way interactions were statistically significant (each F <1).

So memory did not really differ from one age group to the next. Moving on to ToM performance, these scores are summarised in Table 2 according to age-group, question-position and gender, just as was done for memory earlier. The first thing to note is the below chance performance of the two younger age groups (less than 50%) and the above chance performance of the two older groups. Considering gender, the overall ToM performance of girls and boys was virtually identical. However, when viewing these data according to age and gender together, it is apparent that at age 3 and 4 years, girls tended to show a ToM advantage; but at age 5 and 6 years, any tendency was in favour of boys.

Insert Table 2 about here.

Regarding question-position effects, it seems children tended to do better on ToM tasks when they have had the opportunity to remind themselves of the actual current location of the object in question. However, unlike for memory earlier, the question-position advantage appeared to vary with age-group. The 3 year-olds, showed a -23% difference between the first question-position and the second question-position, favouring the latter. By contrast, 4 year-olds showed 9.5% superior ToM performance when asked ahead of the memory question. Then from 4 years to 6 years, the ToM advantage for the first question-position first reduced and then reversed.

A three-way ANOVA confirmed a statistically significant main effect of Age-Group on ToM (F (3, 98) = 8.76, p < 0.001). There was no statistically significant main effect of Gender (F <1). Any

overall tendency towards superior ToM performance for the Second Question-Position also failed to approach statistical significance (F <1). None of the two- or three-way interactions were statistically significant (Age-Group & Question-Position F (3, 98) = 1.45, p = 0.233; Age-Group & Gender F (3, 98) = 1.28, p = 0.284; Gender & ToM-Question-Position F (1, 98) = 1.09, p = 0.299; Age-Group * ToM-Question-Position * Gender F <1).

Focus now turns to the social variables which we reasoned may relate to ToM performance to various degrees. Average values both for the groups combined and for the age groups considered separately, are presented in Table 3. Table 3 shows a tendency for the magnitude associated with each of the social variables generally to increase with age. However, when these trends were assessed using Kruskal-Wallis tests, in every case the trend was not statistically significant (Younger-Siblings - N=114, df = 3, X^2 = 2.54, p = 0.468; Older-Siblings – N=114, df = 3, X^2 = 1.67, p = 0.644; Total-Siblings - N=114, df = 3, X^2 = 5.24, p = 0.155; Play-Nuclear – N=114, df = 3, X^2 = 1.12, p = 0.772; Play-Extended – N=114, df = 3, X^2 = 2.84, p = 0.417; Play-All-Family – N=114, df = 3, X^2 = 1.52, p = 0.677; Friend-Home - N=114, df = 3, X^2 = 5.07, p = 0.166; Friend-School - N=114, df = 3, X^2 = 6.14, p = 0.105; Total-Friends - N=114, df = 3, X^2 = 7.27, p = 0.064). Insert Table 3 about here.

We are now in a position to consider the issue of what our social variables might contribute to ToM. This was done with the aid of a number of bivariate Pearsons correlations which are summarised in Table 4. One question was how ToM might be associated with number of younger siblings compared to number of older siblings? However, a related question was whether considering siblings in this way was better or whether it was better to combine these two counts into a single count of total number of siblings (see Table 3)? Table 4 shows a positive and statistically significant association between number of older siblings and ToM. An interesting finding was that number of younger siblings was negatively correlated with ToM. Although this was a weaker trend than seen for older siblings, it nevertheless raises the issue of whether the fewer younger siblings a child has, the better that child does on ToM tasks. Number of younger siblings correlated negatively with number of older siblings. The opposing effects of younger versus older siblings on ToM,

resulted in total number of siblings being only weakly and non-significantly correlated with ToM ($r = 0.09$, $p = 0.331$).

Insert Table 4 about here

Turning to correlations about the child's friends, Table 4 shows that the number of friends in the home environment was not significantly correlated with ToM. By contrast, the number of friends at school did correlate positively and significantly with ToM. Thus, the more friends a child feels s/he has at school the better is his/her ToM performance. Interestingly, the number of friends children have at school was not related to the number of friends at home. This point notwithstanding, when an additional correlation of total number of friends against ToM was conducted, this showed a slightly stronger correlation with ToM than the best of its two sub-categories ($r = 0.31$, $p = 0.001$).

The last social construct here was family play. A question here was whether the opportunities for the child to play with adults in the child's immediate and extended family was associated with the child's greater ToM? Table 4 shows that the number of sources of play in the nuclear family did not correlate significantly with ToM. The number of sources from the extended family also failed to correlate with ToM. However, even though Table 4 showed that nuclear family play correlated positively with ToM but extended family play showed a weak negative correlation with ToM, there was a positive and significant correlation between opportunity for play with nuclear family and extended family (Table 4). This said, when an additional correlation of the total of family members against ToM was computed, the correlation was no better than for either sub-category ($r = 0.01$, $p = 0.926$).

In addition to considering the above social variables, the correlations of memory and age to ToM were also considered. Table 4 shows that, ignoring other variables such as age, memory had quite a strong positive correlation with ToM ($r = 0.39$, $p < 0.001$). Regarding a main focus which was on ToM, the apparent contrast in the ANOVA analysis versus the correlational analysis can be explained in terms of lower memory being associated with lowered ToM performance regardless of whether the child was in a lower age group or higher age group.

The correlation between age and ToM showed the highest of all associations of any of our variables to ToM ($r = 0.51$, $p < 0.001$). Memory and age were also positively and significantly correlated with each other ($r = 0.28$, $p = 0.002$). This is an indication that, even though it did not improve reliably from one age group to another, memory performance did tend to vary with each child's exact age.

The social variables were entered as predictors (notional independent variables) in a linear regression. The two variables about family play were included, plus the variable for number of friends in the home environment each having no statistically significant bivariate correlation with ToM. This was done mainly because we were mindful of the possibility that a variable showing only a very weak bivariate association with ToM, might still be a significant predictor when taken in the context of one or more additional predictor variables (i.e., two variables might work together in predicting ToM).

In the model, the criterion variable (notional dependent variable) was ToM score. The variable "memory" was included as a predictor because, even though it had not reliably distinguished between the different age groups, it had been correlated with ToM scores when not viewed in the context of age. The last variable included in the regression was age. It was included largely because the earlier analyses had shown that ToM improves with age-group, and so it might be that within each age-group, ToM also improves with the child's exact age on the day of test.

Table 5 summarises the regression model. The model was statistically significant at better than the $p = 0.001$ level and had a correlation coefficient of $r = 0.63$, accounting for 39.2% of the variability in the ToM data. The strongest predictor was the child's age, followed by memory-check score. Of our social predictor variables, the strongest was number of friends at school. Each of these variables showed a statistically significant Beta Coefficient. The other variables showed statistical significance levels that were worse than $p > 0.10$, with only one exception. This exception was number of younger siblings, which approached the $p < 0.05$ level of significance.

Insert Table 5 about here

Discussion

In line with the consensus view on age, 3 year-olds tended to fail false-belief tasks of Theory of Mind, and 5 year-olds tended to pass (Perner et al., 1994; Wellman et al., 2001). Where we might depart slightly from the standard view is in the precise location of the change from fail to pass; with our finding apparently indicating it comes around 1 year later than the standard view (Charman et al., 2002). Our finding must be taken in the context of some other recent findings on ToM at below even 4 years (O'Neill, 1996; Onishi & Baillargeon, 2005; Repacholi & Gopnik, 1997). However, in agreement with Southgate, Senju and Csibra's (2007) interpretation of their own finding of ToM in 2 year-olds, such studies may be best interpreted as pertaining to implicit ToM rather than explicit ToM.

We can have confidence in the validity and reliability of the finding of explicit ToM at nearer 5 years than below 4 years for four reasons. First, this study avoided the exclusion of children who did not attain perfect performance on the memory questions, but noted that no child was below chance on these questions. Past studies have tended to ignore data from those children who obtained less than perfect performance. However, just because a particular child gets a particular memory question wrong, it does not follow that s/he should also get the associated false-belief question wrong. Indeed, a number of studies of children's and adults' reasoning have established that it is quite possible that a child arrives at the "gist" of the protagonist's subjective knowledge (here, false-belief), and yet has some difficulty retrieving the verbatim memory that led to this subjective appreciation (Brainerd & Reyna, 1993; Reyna, 2004). Thus, our findings are based on the average of what children generally do within a fair (more-representative) sample of children, rather than just on what those children who show perfect memory performance do.

The second reason for confidence in the present findings is that they were obtained in the context of achieving similar overall memory-check performance from one age-group to the next. Indeed, the regression model (Table 5), showed that memory reliably predicted ToM quite independently of age or any other variable, in so far as the partial-correlation for memory was most similar to its Beta

coefficient in the regression. Accepting Brainerd and Reyna's view that memory and reasoning are independent, this finding would seem to indicate that they nevertheless share a common resource - perhaps the ability to set up and use mental representations (Perner, 1991; Sabbagh et al., 2006).

Third, the study included a methodological control that ensured that any findings both for ToM and for memory could not be due to question-order effects. Here, 50% of the time the memory-check question came first and the ToM question came second, and for the remaining 50% of occasions this order was reversed. Although some theorists note that order effects might have biased their own data (e.g., Minter et al., 1998), we are yet to identify another developmental study that randomised question order to prevent any bias inflating performance. Indeed, this fact alone might explain the later age estimate from the present study.

The fourth reason for believing the present findings on age to be both valid and reliable is, whereas most ToM tasks do not involve real minds, our tasks did so. From their meta-analysis of ToM studies, Wellman et al. (2001) concluded that the nature of the protagonist has no effect on false-belief performance but involvement of the child participant in the task procedures does have an impact. Regarding the former, given the issue is understanding of minds, there can be no objection to tasks that involved real minds. Regarding the latter, the present study ensured the child interacted socially with the two protagonists. Furthermore, following Leslie and Frith (1988), it was ensured that each child participant actually interacted with these minds in realistic social settings (a play situation where the two protagonists might be in friendly competition).

Thus, it is maintained that the present findings on age were due to assessing explicit ToM, involving real minds, including a more representative sample and adequate age range, and avoiding possible-biases due to fixed question-order. The present conclusions on age are in line with those from several other studies (Abu-Akel & Bailey, 2001; Leslie, Knobe & Cohen, 2006; Perner et al., 2002; Walker, 2005). However, it is also contended that studies not concerning real minds, are still relevant to ToM; but in terms of reasoning “as if about minds” as opposed to reasoning “about actual minds”. On our position, ToM performance should be related to conditional reasoning or

causal reasoning. On this issue, Guajardo and Turley-Ames (2004) have reported that children's ToM is indeed related to their counterfactual reasoning abilities from as early as 3 years old.

Earlier, research was considered that suggested a gender difference in ToM in favour of girls (Bosacki & Astington, 1999; Walker, 2005), against research that concluded there are no gender differences in ToM (Hughes et al., 1999; Pears & Moses, 2003). Our results did show a tendency towards superior performance for girls at 3 and 4 years (Charman et al., 2002). However, no trend that involved gender was statistically reliable here, and much like Charman et al. (2002) and Walker (2005), those trends that were observed occurred in the context of both girls and boys reliably failing our ToM tasks. On the view that one should wait until the time point when at least one gender begins to perform at above chance, before making any claims about either gender developing ToM faster than the other gender, the appropriate age is 5 years-old. However, if anything, there was a slight (but non-reliable) tendency for boys to do better than girls at 5 years. It is therefore concluded that, despite there being differences in their emotional input from parents, there are no significant gender differences in ToM (Bosacki & Astington, 1999; Hughes et al., 1999; Pears & Moses, 2003; Wang & Su, 2009).

Although gender as a social construct may not influence ToM development, evidence did emerge for the influence of two of the three other social variables. But before considering these, it is worth briefly considering the similarities between our social variables (see Table 3). Although it was not actually predicted that number of family members would increase as the target child gets older, it was predicted that total number of siblings and friends might do so (Pears & Moses, 2003; Perner et al., 1994). However, none of the rather slender increases were reliable, although total number of friends did border on statistical significance. On number of younger versus older siblings at each age, Table 3 shows that throughout the entire 3-6 year age range, children had slightly more older siblings than younger ones (Pears & Moses, 2003). It was also noted that children tended to have more friends than family members, and more family members than siblings. However, as we settled on non-parametric statistical tests regarding these social variables, and such tests are not readily

amenable to three-way analyses with mixed between-subject plus within-subject factors, we had elected to statistically analyse the age differences only.

On the social variables and their association with ToM, the one variable for which there seemed no association with ToM was interactions with nuclear and extended family (contrast Lewis et al., 1996; Meins et al., 1998; Turnbull et al., 2009). But although no association was found here between ToM and adult family, there were associations for one specific part of the family - namely siblings (Cutting & Dunn, 2006; Perner et al., 1994; Ruffman et al., 1999). Importantly, this was done with a sample of children spanning a greater age range than studies which have failed to support the sibling effect (Pears & Moses, 2003). Given that the present research found sibling effects but no effect of wider family members, the findings do not support Jenkins and Astington's (1996) view that the sibling effect is actually just part of a more general effect of overall family members (Hughes & Ensor, 2005).

Concerning the relative influences of older versus younger siblings to the child's false-belief performance, children in the present study had quite similar numbers for average younger versus older siblings, permitting a more balanced assessment. Here, the data showed a positive and reliable correlation between older siblings and ToM, which came in stark contrast to the negative and non-reliable correlation observed here for younger siblings (Ruffman et al., 1999). This profile demonstrates that the younger siblings effect and the older siblings effect have opposite influences on ToM. This makes it likely that studies finding no overall sibling effect had a greater proportion of younger siblings than older ones (i.e., the participants were older - Pears & Moses, 2003).

Interactions with an older sibling may impact on ToM via providing the child with scaffolding from a more skilled partner, who routinely stretches the child's understanding of false-belief to just above the child's own independent competence (Hughes & Leekam, 2004; Vygotsky, 1978). However, here the older sibling effect only held for bivariate correlational analyses. When the various social factors were allowed to exert their effects in the context of all the factors (in a regression model), older siblings was replaced by younger siblings as a marginally-significant

predictor of ToM (Jenkins & Astington, 1996). In line with that finding, Wright-Cassidy, Shaw-Fineberg, Brown and Perkins (2005) argue that the antagonistic younger sibling versus older sibling effect may arise because parents frequently have to interrupt an explanation to the older child (the participant) in order to tend to some request by the younger child. Thus, in some sense, the mere existence of the younger child might well impact negatively and indirectly on ToM development in a child slightly older in age, as opposed to the older sibling effect which may stem from the older child having a more direct tutoring role.

Having a more developed ToM is argued to render the child more socially acceptable and this results in acquiring more peers and friends (Slaughter et al., 2002). Consistent with this thesis, in the correlational analyses, children having lots of friends performed consistently better than children having fewer friends. This extends Slaughter et al.'s (2002) findings of a friends effect in 5-6 year-olds, across a much larger age range of 3-6 years. However, consider the opposing view that, rather than better ToM leading to gaining more friends, it might be the presence of more friends that improves ToM (Brown et al., 1996). Our regression model supports the view that a child already having more friends for whatever reason (e.g., because of now being in Primary Schooling), subsequently has a greater number and variety of social relationships. These promote experiences relevant to ToM (Cutting & Dunn, 2006; Ruffman et al., 2002), plus promote more discussions which teach the child that s/he is expected to relate to other people by talking about minds (Ruffman et al., 2006; Turnbull et al., 2009).

It is likely that both causal directions are partly correct. There may even be a bootstrapping (mutually beneficial) relationship between ToM and acquisition of friends. However, it is suggested here that the primary direction is from friends to ToM rather than the other way around. This can be seen in a study by Wang and Su (2009), who showed that if number of siblings is held constant (i.e., only include children having no siblings), then 4 year-olds' ToM is boosted if they are in a class containing mixed age groups compared to a class containing a narrow age group. Wang and Su argue that this finding stems from the increased opportunities for each child to encounter more varied views from children some of whom are just old enough to act as more skilled partners

(Hughes & Leekam, 2004; Wright-Cassidy et al., 2005). In the present regression model, friends-at-home was not reliable whereas friends-at-school was reliable. This sets Wang and Su's findings in the context of friends more generally, suggesting that the wider friendships at school are more influential on ToM than are the possibly more narrow friendships at home.

Finally here, considering the relative contributions of siblings and friends, the present study found that number of friends was not correlated with number of siblings. However, both were factors in level of ToM, with friends (at school) being more important than siblings (younger siblings). Thus, this study has confirmed Cutting and Dunn's (2006) view that friends are more important than siblings in the child's ToM development.

In summary, this research offered a ToM study incorporating tighter methodological controls than in many other ToM studies, and found that the explicit demonstration of understanding of mind develops at around 5 years rather than 4 years as typically espoused. A number of social variables were also considered, and the present findings were in line with Hughes and Leekam's (2004) view that no one social factor on its own drives ToM development. But this study also extends that view, with the prominence of memory and age over the four social factors leading us to expect that cognitive and maturational factors play their role in ToM development, working alongside various social factors. But concerning specifically social factors, neither the child's gender nor the number of adults in the nuclear/extended family has any real impact on ToM. By contrast, number of friends (an external social factor) has a bigger impact than number of siblings (a family factor); but both are reliable influences on ToM in isolation and in the context of each other. Friends, however, are a stronger predictor than siblings. Concerning friends, ToM is driven more by friends at school than friends at home. The implication here is that ToM is driven by social experiences which are broad because of coming from many diverse individuals (including being diverse in age - Wang & Su, 2009). Finally there is even some diversity regarding sibling effects, with older siblings being more beneficial to ToM than younger siblings, but at the same time younger siblings having a greater impact on ToM in the context of the other social variables, although this impact is a negative one. It is concluded that social experience of others is vital to children’s ToM development

although precisely what component of social experience helps drive ToM, will require further research (i.e., experience itself v opportunities to talk about experience - contrast Hobson, 1991 with Turnbull et al., 2009).

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Table 1: Memory Performance by Age Group, Gender and Question Position

	3 Year-Olds	4 Year-Olds	5 Year-Olds	6 Year-Olds	All Children
Girls 1st Pos	75.0% (6.25)	87.5% (5.50)	88.9% (5.25)	93.8% (7.75)	86.3% (3.00)
Girls 2nd Pos	83.3% (9.00)	84.4% (5.50)	95.0% (5.00)	95.8% (6.25)	89.6% (3.25)
Boys 1st Pos	91.7% (9.00)	87.5% (4.50)	96.4% (5.75)	95.8% (6.25)	92.9% (3.25)
Boys 2nd Pos	83.3% (6.25)	95.0% (7.00)	95.0% (4.00)	91.7% (6.25)	91.3% (3.00)
All Girls	79.2% (5.50)	87.1% (3.75)	92.0% (3.50)	94.8% (5.00)	88.0% (2.25)
All Boys	87.5% (5.50)	91.3% (4.00)	95.7% (3.50)	93.8% (4.50)	92.1% (2.25)
All 1st Pos	83.3% (5.50)	87.5% (3.50)	92.7% (3.75)	94.8% (5.00)	89.6% (2.25)
All 2nd Pos	83.3% (5.50)	89.7% (4.50)	95.0% (3.00)	93.8% (4.50)	90.5% (2.25)
All Children	83.3% (3.75)	88.6% (2.75)	93.8% (2.50)	94.3% (3.25)	90.0% (1.50)

Note: Numbers in parentheses are standard errors, numbers in italics are percentages. 1st pos and 2nd pos refer to the memory questions being asked first v second respectively.

Table 2: ToM Performance by Age Group, Gender and Question Position

	3 Year-Olds	4 Year-Olds	5 Year-Olds	6 Year-Olds	All Children
Girls 1st Pos	25.0% (11.75)	53.1% (10.25)	61.1% (9.75)	56.3% (14.50)	48.9% (5.75)
Girls 2nd Pos	50.0% (16.75)	50.0% (10.25)	65.0% (9.25)	75.0% (11.75)	60.0% (6.25)
Boys 1st Pos	16.7% (16.75)	45.8% (8.25)	75.0% (11.00)	79.2% (11.75)	54.2% (6.25)
Boys 2nd Pos	37.5% (11.75)	30.0% (13.00)	60.0% (7.50)	83.3% (11.75)	52.7% (0.22)
All Girls	37.5% (10.25)	51.6% (7.25)	63.1% (6.50)	65.6% (9.25)	54.4% (4.25)
All Boys	27.1% (10.25)	37.9% (7.75)	67.5% (6.50)	81.3% (8.25)	53.5% (4.00)
All 1st Pos	20.8% (10.25)	49.5% (6.50)	68.1% (7.25)	67.7% (9.25)	51.5% (4.25)
All 2nd Pos	43.8% (10.25)	40.0% (8.25)	62.5% (5.75)	79.2% (8.25)	56.4% (4.00)
All Children	32.3% (7.25)	44.8% (5.25)	65.3% (4.75)	73.5% (6.25)	53.9% (3.00)

Note: Numbers in parentheses are standard errors, numbers in italics are percentages. 1st pos and 2nd pos refer to the ToM questions being asked first v second respectively.

Table 3: Summary of the Social Variables by Age Group

	3 Year-Olds	4 Year-Olds	5 Year-Olds	6 Year-Olds	All Children
			Number of Siblings		
Younger	0.39 (0.19)	0.61 (0.14)	0.78 (0.12)	0.73 (0.17)	0.63 (0.08)
Older	0.72 (0.24)	1.00 (0.17)	0.90 (0.16)	1.32 (0.21)	0.99 (0.10)
Both	1.11 (0.27)	1.61 (0.20)	1.68 (0.18)	2.05 (0.25)	1.61 (0.11)
			Sources of Play Opportunities		
Nuclear	1.44 (0.15)	1.55 (0.11)	1.54 (0.10)	1.46 (0.13)	1.50 (0.06)
Extended	0.78 (0.17)	1.00 (0.12)	0.83 (0.11)	1.09 (0.15)	0.92 (0.07)
Both	2.22 (0.26)	2.55 (0.19)	2.37 (0.17)	2.55 (0.23)	2.42 (0.11)
			Number of Friends		
Home	0.50 (0.24)	0.39 (0.18)	0.85 (0.16)	1.09 (0.22)	0.71 (0.10)
School	2.39 (0.37)	3.36 (0.27)	3.37 (0.24)	3.18 (0.33)	3.08 (0.15)
Both	2.89 (0.46)	3.76 (0.34)	4.22 (0.30)	4.27 (0.41)	3.79 (0.19)

Note: Numbers in parentheses are standard errors.

Table 4: Bivariate Correlations Between all the Variables

			Siblings		Play Opportunities		Friends	
	Memory	Age	Older	Younger	Nuclear	Extended	Home	School
ToM	0.39 (0.001)	0.51 (0.001)	0.19 (0.047)	-0.10 (0.292)	0.03 (0.792)	-0.01 (0.930)	0.17 (0.076)	0.28 (0.003)
Memory	-	0.28 (0.002)	0.11 (0.232)	-0.05 (0.580)	-0.08 (0.393)	0.03 (0.753)	0.07 (0.466)	0.13 (0.169)
Age	-	-	0.15 (0.109)	0.14 (0.153)	-0.04 (0.674)	0.05 (0.574)	0.18 (0.055)	0.12 (0.199)
Siblings Older	-	-	-	-0.19 (0.046)	0.17 (0.078)	0.10 (0.317)	-0.11 (0.244)	0.02 (0.847)
Siblings Younger	-	-	-	-	0.26 (0.006)	0.06 (0.533)	-0.04 (0.647)	-0.09 (0.344)
Play Ops Nuclear	-	-	-	-	-	0.35 (0.001)	-0.08 (0.387)	-0.06 (0.563)
Play Ops Extended	-	-	-	-	-	-	0.02 (0.865)	-0.02 (0.843)
Friends Home	-	-	-	-	-	-	-	0.09 (0.356)
Friends School	-	-	-	-	-	-	-	-

Note: Numbers in parentheses are significance levels for correlations. Play Ops refers to Sources of play opportunities within the family.

Table 5: Regression Model for ToM with all Predictors Entered

	Variable Name	Standardised Beta	Partials	p Value
Step 1	Age	0.43	0.45	0.001
	Memory	0.24	0.28	0.004
	Siblings Younger	-0.14	-0.17	0.066
	Siblings Older	0.06	0.07	0.480
	Play Ops Nuclear	0.13	0.15	0.130
	Play Ops Extended	-0.08	-0.09	0.335
	Friends Home	0.07	0.09	0.375
	Friends School	0.18	0.23	0.020

Note: Play Ops refers to sources of play opportunities within the family.

Appendix 1

Questionnaire for Children

1. How old are you? _____

2. Do you know your Birthday? _____

3. So do you like school? Yes No ☐

How much do you like it? (Tick whichever is closest to child's answer)

A lot ☐ Sometimes ☐ Yes and no ☐ Not really ☐ No ☐

4. Do you like playing with toys? Yes ☐ No ☐

→ What is your favourite toy? _____

How much do you like playing with toys? (Tick whichever is closest to child's answer)

A lot ☐ Sometimes ☐ Yes and No ☐ Not really ☐ No ☐

5. Do you play with your friends as well? Yes ☐ No ☐

→ Who are your friends at school? (Note number of friends) _____

→ Who do you play with when you are not at school? (No. of Friends)_____

6. Do you have any brothers or sisters? Yes ☐ No ☐

(any information given)_____

If yes, do you like playing with them? Yes ☐ No ☐

How much do you like playing with them? (Tick whichever is closest to child's answer)

A lot ☐ Sometimes ☐ Yes and no ☐ Not really ☐ No ☐

7. Do you play with your mummy and daddy when you are at home?

Yes ☐ No ☐

8. And what about your nana and granddad?

Yes ☐ No ☐

9. And what about your auntie and uncle?

Yes ☐ No ☐