Gender Difference in Theory of Mind Development

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Abstract

This study investigated the age and gender dependent sequential unfolding of theory of mind abilities during childhood. It was first hypothesized that children continue to develop a more complex theory of mind between the ages of 3 and 13 years. Secondly, it was hypothesized that girls will have better theory of mind abilities than boys of the same age and that this gender difference would be more significant in younger ages. This study included 154 coloured, English speaking participants from Cape Town between the ages of 3 and 13 years. Each child was administered the UCT Theory of Mind Battery. Three variables were also obtained that have been shown to influence children's level of theory of mind, which is number of siblings, working memory and verbal intelligence. It was found that girls only significantly outperformed boys on theory of mind at younger ages, between the ages of 3 and 7 years. It was also found that age continued to predict theory of mind ability from the age of 3 years to the age of 13 years. Vocabulary was found to significantly predict theory of mind in the overall sample but it was not significant in the younger ages only. Working memory and number of siblings both did not significantly predict level of theory of mind. The findings in this study demonstrate that children's theory of mind continues to develop through their childhood. They also demonstrate that girls only have better theory of mind early in their childhood and it is thought that girls acquire theory of mind earlier than boys due to gender differences in social experiences. Literature suggests that boys catch-up to girls' level of theory of mind in older ages by eventually receiving the necessary amount and quality of social experiences that girls receive at a younger age.

Gender difference in theory of mind development

Introduction

A socio-cognitive developmental milestone in children's lives is the ability to understand that people's behaviour may not be influenced by reality directly, but rather by how they believe or perceive reality to be (Callaghan et al., 2005). This concept has been referred to as theory of mind and psychologists have attempted to investigate its onset and progression for over 35 years (Premack & Woodruff, 1978). Theory of mind includes the acknowledgement that people are beings who have different mental states, such as desires, beliefs, and thoughts, and that these different states affect behaviour (Nielsen & Haun, 2016). Theory of mind ability allows one to understand that the mental states of others can be different from reality and from one's own mental states. Theory of mind progresses as one grows older and developmental studies have attempted to investigate the sequential unfolding of abilities that constitute theory of mind (Wellman & Liu, 2004). Research suggests that there is a gender difference in the development of theory of mind abilities, such that girls are significantly better than boys in theory of mind tasks (Baron-Cohen & Hammer, 1997; Bosacki & Astington, 1999; Charman, Ruffman, & Clements, 2002). Relatively few studies have investigated gender difference in theory of mind abilities and more research is needed to confirm the existence of a gender difference.

Assessing Theory of Mind

Research in this field is particularly interested in trying to understand how children begin to consider the mental state of others when judging their observable behaviour (Callaghan et al., 2005). Research has predominantly used false belief tasks to be the primary indicator that children have developed this ability. An example of a typical false belief task involves telling a child that a doll put a sweet in location A and then left the room (Callaghan et al., 2005). While the doll was out of the room the sweet was moved to location B without the doll's knowledge. The children were then asked where the doll would look for the sweet when she re-entered the room (Callaghan et al., 2005). Children would pass if they said the doll would look in location A and would fail if they said the doll would look in location B. In a meta-analysis of over 500 studies on false belief task performance, substantial changes between the ages of 3 and 5 have been demonstrated in children's ability to understand how the mental state of others affects their overt behaviour (Wellman, Cross, & Watson, 2001). This has been reflected by most 3 year olds consistently failing tasks of false belief, which they begin to pass after the age of 4-5 (Mayer & Trauble, 2012).

Gender difference in Theory of Mind

The quantity and quality of emotion and mental state talk that occurs between parents and their children and between siblings has a known gender difference (Charman et al., 2002). Research has shown that early in the child's life mothers verbally support and talk to their daughters more than their sons (Leaper, Anderson, & Saunders, 1998). When children are 2 years old, mothers will talk about emotions significantly more with their daughters than with their sons (Cervantes & Callanan, 1998). Older siblings also talk about feeling states significantly more with girls than they do with boys. When parents and siblings talk of individuals' mental and emotion state with very young children, it is linked to more feeling state talk in girls than it is in boys (Brown, Donelan-McCall, & Dunn, 1996).

This difference in social experience is theorised to initiate girls' acquisition of theory of mind ability earlier than takes place for males. A study testing performance on false belief tasks in young children found that girls had a significantly better theory of mind ability than boys (Charman et al., 2002). Other studies have found more long-lasting effects, with girls outperforming boys at 11 years of age on tasks that require them to assess the feelings and motives of story characters (Bosacki & Astington, 1999). Another study on mindreading abilities demonstrates a female advantage in adulthood (Baron-Cohen & Hammer, 1997). However, very few studies have investigated the association between gender and theory of mind abilities and even fewer have found a significant difference. A possible reason for why many studies have not found a significant effect of gender may be because the studies did not have the statistical power to find an effect for gender, which likely only has a weak or moderate effect. Typically theory of mind studies use samples of about 50 participants, which may be too small to show a weak effect (Charman et al., 2002).

Cognitive and social influences on theory of mind

Two cognitive factors that have been associated with performance on theory of mind tasks are working memory and verbal intelligence. Studies have demonstrated that children's working memory is associated with theory of mind task performance, such that higher levels of working memory are associated with more advanced theory of mind abilities (Carlson & Moses, 2001; Hughes, 2002; Perner, Kain, & Brachfeld, 2002). Similarly, it has been found that children with higher levels of verbal intelligence generally perform better on theory of mind tasks (Milligan, Astington, & Dack, 2007). The nature of the relationship between these two cognitive skills and theory of mind has been debated in various ways. One way is to view verbal intelligence and working memory as important skills that are needed to perform theory

of mind tasks, however, they do not have any relationship with the underlying theory of mind competency (Jenkins & Astington, 1996). This view is reflected in studies that decreased the linguistic and working memory loads of the typical theory of mind tasks and found that children of younger ages were passing these new tasks, compared to the original tasks. This may demonstrate that theory of mind tests may be largely testing for linguistic and working memory abilities, instead of an underlying theory of mind ability (Jenkins & Astington, 1996). Another view is that as one's verbal intelligence increases, one has a more effective scaffolding to build symbolic representations that are required for increasingly complex theory of mind tasks. This view sees verbal intelligence as aiding children in developing theory of mind abilities (Jenkins & Astington, 1996).

When researching the social influences in the development of theory of mind, certain variables in the child's social environment seem to be important in children's theory of mind ability (Chasiotis, Kiessling, Hofer, & Campos, 2006; Perner, Ruffman & Leekam, 1994). Children's accrual of a false belief understanding has been shown to be influenced by the number of siblings children have (Jenkins & Astington, 1996; Perner et al., 1994). Some studies have only found this effect with older and not younger siblings (Ruffman, Perner, Naito, Parkin, & Clements, 1998; Lewis, Freeman, Kyriakidou, Maridaki Kassotaki, & Berridge, 1996). The manner in which this variable may facilitate theory of mind development could be through greater opportunities for pretend play and feeling or internal mental state talk. This theory is supported by a study that demonstrated that the amount of mental state talk between siblings and the amount of co-operative interactions between siblings is associated with false belief task performance in the future, after taking verbal intelligence into account (Hughes & Dunn, 1998).

Social competence and theory of mind

Achieving an understanding of false beliefs and other forms of theory of mind abilities is important for children to be able to have increasingly more complex social interactions and social understandings (Miller, 2009). Once children develop a mentalistic orientation, they will be able to cooperate, console, and coordinate their actions according to the desires or beliefs of those with whom they interact. This assertion finds support in a growing body of literature which has found a positive relationship for different types of social behaviour and theory of mind understanding (Astington, 2003; Hughes & Leekam, 2004). Similarly, achieving second order false belief understanding is seen as necessary for exhibiting more complex social behaviour that does not occur earlier in childhood. Theory of mind has been

shown to be associated with social development more broadly, including concepts such as social skills, social standing, and social competence (Miller, 2009). Although uncertain, discussions on the direction of causality of social competence and theory of mind have generally agreed that causality runs in both directions, with previous social experiences being associated with later theory of mind and early theory of mind being associated with later social competency (Miller, 2009). Considering the importance of theory of mind abilities in everyday social encounters, it is important to investigate its typical developmental progression as people age and between the sexes.

Gaps in the literature

A possible flaw in the literature of theory of mind is the predominant reliance on one categorical measure for this ability, such that a child has either achieved or not achieved theory of mind. Studies should not only focus on the age of onset of false belief tasks, as this simplifies theory of mind to one attribute. Very few studies investigate theory of mind development across childhood with measures varying from false belief tasks, however, those that have, demonstrate that children go through a developmental progression from the age of 2 till 13 years, in which different mental state concepts are mastered (Wellman & Liu, 2004). Some of these mental state concepts include: diverse desires, where children understand that others can like something that the child dislikes and vice versa; diverse beliefs, where children understand that others can believe something different to the child about a situation; knowledge access, where children understand that others may have incorrect information about something; and hidden emotions, where children understand false belief and know that how one appears to be feeling may not be how they truly feel (Nielsen & Haun, 2016).

Studies that have investigated theory of mind development using these measures have demonstrated that individuals from different cultures often have a different developmental trajectory of theory of mind accrual. One such study found that Australian children of the same age were better than Iranian children in grasping the concept of diverse beliefs, however, Iranian children were better at understanding knowledge access (Shahaeian, Peterson, Slaughter, & Wellman, 2011). Some research suggests theory of mind develops in a culturally invariant manner (Wellman et al., 2001; Callaghan et al., 2005), whereas, other studies demonstrate a large influence of culture in aspects, such as the time of onset (Nielsen & Haun, 2016). It is important to conduct more theory of mind studies in areas with culturally diverse backgrounds and to investigate if a gender difference exists universally, as most studies originate from Western societies.

Rationale

This study will provide valuable insight into the possible gender-specific developmental trajectory of theory of mind abilities in English-speaking coloured people from the Western Cape. Theory of mind is an important socio-cognitive developmental milestone with implications for the child's future social competence. Therefore, understanding how age and gender affect the developmental timeline of this construct is extremely important. If studies consistently demonstrate that males perform more poorly than females on theory of mind tasks, studies can begin to look at the factors that influence this relationship, such as parenting styles and siblings interactions. By having a greater understanding of the factors that lead to girls having better theory of mind than boys, we can begin to alter these factors for boys in order to foster their theory of mind development. This study takes a first step in this direction by investigating the effects of gender as well as the influence of age on theory of mind development in children aged 3 to 13 years in the Western Cape.

Specific aims and hypotheses

Research question 1: The first research question that was investigated is the possibility of a gender difference in theory of mind development in the South African context. According to past research, girls tend to have greater levels of theory of mind ability at a young age (Charman et al., 2002) and some evidence has pointed to a longer-lasting effect of gender on theory of mind ability (Baron-Cohen & Hammer, 1997; Bosacki & Astington, 1999). It was, therefore, hypothesized that girls between the ages of 3 and 13 years will exhibit better performance on tasks of theory of mind ability than boys of the same ages.

Research question 2: The second research question investigated the age-dependent sequential unfolding of abilities that underlie a full theory of mind capacity between ages of 3 and 13 years. Most studies have focused on the development of a false belief understanding in children between the ages of 4 and 5, however, research has demonstrated that performance on theory of mind tasks continues to improve into late adolescence (Dumontheil, Apperly, & Blakemore, 2010) and other studies even argue that theory of mind develops and changes throughout life (Bosacki & Astington, 1999; Apperly, 2012; Moran, 2013). This study, therefore, hypothesized that theory of mind is attained progressively as one grows older, such that older children would pass more theory of mind tasks that assess increasingly more complex abilities than younger children.

Research question 3: The last research question investigated an interaction effect between age and gender on theory of mind performance. A study conducted by Charman and

colleagues (2002) found a significant effect of gender on theory of mind performance when the children were young and this effect became weaker as age increased. It was hypothesized that the gender difference in theory of mind performance would decrease as the age of the participants' increased.

Lastly, it was hypothesized that working memory, number of siblings, and verbal intelligence are predictors of children's level of theory of mind. Theory of mind literature has consistently demonstrated that these variables are significant predictors of theory of mind ability (Jenkins & Astington, 1996; Carlson & Moses, 2001; Milligan at al., 2007). The three variables were not of direct interest in this study but were included as controls because of their known influence on theory of mind. By including these variables in the study, their influence could be statistically removed to find the unique influence of the predictor variables of direct interest in this study.

Methods

Design and setting

This study took place as part of an on-going larger study on children's development of moral reasoning and empathy. The study began in 2013 and data has already been collected from 535 children between the ages of 3 and 13 years. Data collection continues to take place at the schools the children attend. A team of researchers administers several neuropsychological tests to each child participant in a quiet room during school hours and the parents or guardians of the children are required to complete various questionnaires in their own time.

This honours study used a cross-sectional design to investigate the main effects of gender and age on theory of mind and an interaction effect of age and gender on children's level of theory of mind. Quantitative measures were used to assess each participant's level of theory of mind (outcome variable). The influence of three control variables, that have been shown to have an association with theory of mind performance, were assessed in order to statistically remove their influence to find the unique effects of the variables of direct interest in this study. The control variables included number of siblings, working memory and verbal intelligence. Questionnaires were used to ascertain how many siblings each participant had and direct child assessment was used to establish working memory and verbal intelligence.

Participants

Due to the large diversity of individuals in the South African population, there were many potential influential demographic variables that could have affected this study. It was

not possible to stratify for all these potentially influential variables in the limits of an honours project, however, this study attempted to create a homogenous sample on key variables in the study. 154 participants were used in this study, with a sample of 14 children at each age between the ages of 3 to 13 years. An equal number of boys and girls from English-medium schools in the Western Cape with lower-middle socioeconomic backgrounds were used. All the participants were coloured and they all spoke fluent English. Non-probability, purposive sampling was used to recruit participants because selection relied on willingness to participate and eligibility.

Ethical considerations

The study followed the ethical guidelines as stipulated by the University of Cape Town (UCT) Codes for Research and the Health Professions Council of South Africa (HPCSA). The study obtained ethical approval from the Western Cape Department of Education (see Appendix A) and the University of Cape Town (UCT) Psychology Department's Ethics Committee (see Appendix B). Permission was obtained from the relevant schools to send forms home with the parents and approach their students to ask them to participate.

Consent, voluntary participation, and confidentiality. Parents were given an information sheet that described what the study was about and what kind of tasks the children were expected to complete. The letter emphasised that participation in the study included no risk, was completely voluntary, that information remained confidential, and that only the research team had access to the information. Parents and children were able to decide to drop out of the study at any time without penalty and the letter ensured that all information would remain strictly confidential. Parents were informed that the children would receive a small snack and a few stickers during the tasks and that the parents would receive R100 once they completed all of the forms. Parents were then asked to sign a consent form that stated that they had received adequate explanation about what the study entailed. Children were asked to sign an assent form before they participated in the tasks (see Appendix C).

Inclusion and exclusion criteria

This study aimed to investigate theory of mind in typically developing children, therefore, children with Autism Spectrum Disorders, conduct disorder or oppositional defiant disorder (ODD), communication disorder, learning difficulties such as dyslexia or attention-deficit/hyperactivity disorder (ADD/ADHD), a history of head injury, or neurological problems were excluded from this study. Inclusion in this study required participants to speak fluent English and to be have a lower-middle socio-economic status. This was required in

order to obtain a sample that was mostly homogenous on key variables that would have influenced the outcome variable. The participants all needed to be between the ages of 3 and 13 years in order to assess the progression of theory of mind ability throughout childhood.

Estimated required sample size

An a priori power analysis was performed using *G*Power 3.1*. The power analysis was performed in order to assess what the minimum required sample size would be to perform the hierarchical multiple linear regression, assuming a small-moderate effect size (f^2=0.09). The effect size was estimated from the results of two studies that both tested for the age-difference and gender-difference in theory of mind ability, which both found small-moderate effects (Baron-Cohen, O'Riordan, Stone, Jones, & Plaisted, 1999; Ibanez et al., 2013). After the analysis was performed, it was found that the minimum required sample size was 149 participants to detect a small-moderate effect (f^2=0.09) in a multiple linear regression with parameters of α= .05 and β=0.2 and five predictor variables. Therefore, the sample size of 154 participants was sufficient to allow statistical analyses to have a high level of power and to permit the inclusion of important covariates in the analyses.

Measures

The UCT Theory of Mind (ToM) Battery (Hoogenhout & Malcolm-Smith, 2014) was used to measure children's achieved level of theory of mind. The battery measures a broad developmental range of theory of mind abilities, beginning with tasks measuring early mental state understanding to increasingly more advanced tasks. The battery was initially based on the work of Steele, Joseph, and Tager-Flusberg (2003) who attempted to create a measure that included a developmentally sensitive range of theory of mind tasks instead of relying simply on false belief tasks, as was common practice at that time. The battery was altered and expanded upon by Hoogenhout and Malcolm-Smith (2014) and includes more well-known and validated ToM tasks (Baron-Cohen, Leslie & Frith, 1985; Happé,1995; Wellman & Liu, 2004). The *UCT ToM Battery* consists of four modules which include tasks of increasing difficulty. The first, early module consists of tasks of desire/intention leads to action, perception-knowledge, diverse desires, and diverse beliefs. The second, basic module consists of tasks assessing location change false belief, unexpected contents false belief, belief-emotion, and real apparent emotion. The third, intermediate module consists of tasks of second order false belief and strange stories. The fourth, advanced module consists of tasks of understanding sarcasm and faux pas. On average, 3-year-old children should pass the early module and children between the ages of 4 and 5 years should begin to pass the basic module. Children between the ages of 6 and 7 years should be able to pass the intermediate module

and those between the ages of 8 and 13 years should be able to pass all the modules. Detailed information on all of these tasks can be obtained from Steele and colleagues (2003), Happé (1995), Baron-Cohen and colleagues (1999), and Wellman and Liu (2004).

Children began assessment with an age appropriate module and continued onto the next module if they passed. Children who passed the starting module were credited with all the previous modules' items. If the child failed the age-appropriate module, they were required to do the previous module(s). All the modules consisted of both control and test questions and if the child answered half or more of the test questions correctly they would continue onto the next module. The *UCT ToM Battery* was successfully used by Hoogenhout and Malcolm-Smith (2014) to analyse the pattern of theory of mind development in children with autism spectrum disorder in South Africa.

Measures of working memory. The backward digit span (average reliability= .80, for children between the ages of 6 and 16) was used to assess the working memory of children from the ages of 6 years to 13 years. The backward digit span test is included in the *Wechsler Intelligence Scale for Children, fourth UK edition* (WISC-IV-UK, Wechsler, 2004) under the *Working Memory Index* (WMI). The WISC-IV-UK was initially created to test children between the ages of 6 and 16 years in Britain, however, this measure also works effectively in a South African context because the participants' scores are compared to their peers.

The working memory of children below the age of 6 years was assessed using the picture memory test (average reliability= .91 for children between the age of 2 years 6 months and 7 years 7 months) from the *Wechsler Preschool and Primary Scale of Intelligence* (WPPSI-IV-UK, Wechsler, 1989). The measure was originally developed by David Wechsler in 1967 and it was designed for children between the ages of 2 years 6 months to 7 years 7 months. The reliability of the WPPSI-IV-UK for children below the age of 7 years has been tested in a Western population and it was found to be sufficiently precise and robust measure for clinical use (Watkins & Beaujean, 2014). As is the case with the WISC-IV-UK, a participant's score on this measure was only compared with their peers and it was, therefore, not important that it has not been normed to a South African population.

Measures of verbal intelligence. The vocabulary subtest in the short form of the *Wechsler Abbreviated Scale of Intelligence* (WASI, Wechsler, 1999) was used as an indicator of verbal intelligence (average reliability= .89 for children between the ages of 6-16 years) for children aged 6 years and older in our study. To obtain a full verbal intelligence quotient (VIQ) 2 verbal subtests need to be completed, however, this study only used scaled scores from the vocabulary subtest. The study, therefore, only has an indicator of a VIQ. The test

assesses people's word knowledge by asking them to provide definitions for words in a given list. The words become increasingly more difficult to define as the list continues. The norms of the WASI were based on English speaking American people between the ages of 6 and 89 years, however, this is not a problem because the participants' scores in this study were normed against each other. The receptive vocabulary subtest of the WPPSI-IV-UK was used as an indicator of VIQ for children younger than 6 years in this study. This test has been found to reliably predict verbal intelligence for children younger than the age of 6 years and each participants' score will be normed against the other scores obtained in this study.

The **Demographic Questionnaire** (see Appendix D) needed to be completed by a parent or guardian in order to check that the inclusion criteria had been met and the exclusion criteria had not been met. The questionnaire consisted of questions related to the demographic information about the children, such as their age, sex and number of siblings. Various questions that pertained to exclusion were included, such as if the child had any neurological disorder or any type of learning difficulty.

Procedure

Subsequent to ethical approval, researchers approached schools of lower-middle socio-economic status and asked for permission to recruit their students as participants in the study. Once the schools agreed to allow us access to their students, envelopes containing various forms were given to the parents of the children to be filled out at home and returned to the school at their earliest convenience. The forms included a demographic questionnaire, in which inclusion/exclusion questions and questions related to socio-economic background were asked, an information sheet providing details of the study (see Appendix E), and a parental consent form (see Appendix F). Child assessments were done separately and took place in a quiet room in the child's school during school hours. Children were assessed in two sessions that took place on different days and each session was between 45 to 60 minutes in duration. During these sessions, children completed various tasks under the guidance of the researcher.

Statistical analysis

Once data collection was complete, statistical analyses were used to determine if there were significant main effects for both gender and age and a significant interaction effect for gender and age on theory of mind performance. A hierarchical linear regression was used to investigate the main effects of both gender and age and the interaction effects of age and gender together on theory of mind performance. To exclude the influence of verbal intelligence, number of siblings and working memory, on the outcome variable, these

variables were entered into the regression model. These three control variables were entered into step one of the model. This allowed for the unique effect on theory of mind of the next variables entered into the regression model to be analysed by statistically removing the effect of the control variables. Age was entered into step 2 of the model, as research has demonstrated age to be a strong predictor of theory of mind ability. Gender was entered into step 3 of the model and, lastly, the interaction effect was entered into step 4 of the model.

A second multiple regression was performed with the same variables and steps as the first analysis but it only included data from children who were 7 years old and younger. This was to ascertain if a gender difference existed in theory of mind ability at younger ages only. This was performed because the descriptive data indicated a more evident gender effect at younger ages compared to the older ages. Literature suggests that a gender difference in theory of mind may only be apparent in younger children and begins to become less significant with age. This age-dependent gender difference might not be demonstrated when investigating an interaction effect of age and gender on theory of mind because the study might be lacking in the statistical power necessary to demonstrate this small interaction effect. Before performing the statistical analyses, the data was checked to ensure that the assumptions for a multiple linear regression were upheld, which included the assumptions of normality, multicollinearity, homoscedasticity, linearity, multivariate outliers, and normality of residuals. A discussion of the independence of observations and the reliability of the model with residual graphs can be found on Appendix G. There may have been a problem with homoscedasticity, as the scatter plot of residuals against predicted values seemed to display a pattern, however, this is further discussed in Appendix G.

Results

Statistical analyses were performed on data collected from a sample of 154 coloured children between the ages of 3 and 13 years. The children all came from schools with lower-middle socioeconomic backgrounds and equal numbers of girls and boys were sampled. Equal numbers of boys and girls were sampled for each age as is demonstrated in Table 1. Means and standard deviations of the outcome variable and the three control variables for each sex can be found in Table 2, as well as results from independent sample *t* tests with gender as the grouping variable.

Table1

Descriptive statistics

Age	Gender	Average ToM (Std)	Sample size (*n*)
3	Male	26.79 (10.65)	7
	Female	26.75 (10.64)	7
4	Male	26.75 (10.63)	7
	Female	82.86 (29.30)	7
5	Male	123.82 (39.30)	7
	Female	172.17 (87.52)	7
6	Male	143.85 (43.31)	7
	Female	178.96 (28.44)	7
7	Male	138.69 (62.37)	7
	Female	218.60 (10.61)	7
8	Male	213.30 (20.38)	7
	Female	217.14 (21.45)	7
9	Male	281.66 (76.67)	7
	Female	293.10 (57.05)	7
10	Male	296.46 (65.30)	7
	Female	268.81 (74.35)	7
11	Male	337.92 (25.42)	7
	Female	339.68 (15.03)	7
12	Male	346.80 (20.44)	7
	Female	338.37 (12.25)	7
13	Male	322.60 (39.81)	7
	Female	347.38 (15.98)	7
			154

Table 2

Sample Characteristics

	Male (n=77)	Female (n=77)	Independent Sample *t* test		
			t	*p*	*d*
ToM	209.42 (117.44)	225.80 (109.13)	.90	.371	0.14
No. siblings	1.62 (1.30)	1.32 (1.07)	1.56	.121	0.25
VI	6.92 (3.10)	7.57 (2.79)	1.34	.174	0.22
Working memory	7.42 (3.25)	7.25 (2.61)	.36	.723	0.06

Note: Means with standard deviations in brackets are presented

VI= verbal intelligence

From the correlation matrix in Table 3 below, we can see that verbal intelligence (*r*=.16) and working memory (*r*=.28) have small and positive relationships with theory of mind, where higher scores on verbal intelligence and working memory are associated with higher levels of theory of mind. Age has a large, positive relationship to theory of mind (*r*=.90), therefore, as age increases so does theory of mind. Verbal intelligence has small and positive relationships with number of siblings (*r*=.16) and working memory (*r*=.25). Working memory and age have a moderate positive relationship (*r*=.26), with working memory increasing as age increases.

Table 3

Correlation matrix for predictor and outcome variables

	ToM	No. Siblings	VI	Working memory	Age
No. siblings	.11				
VI	.16*	.16*			
Working memory	.28*	-.02	.25*		
Age	.90*	.07	.03	.26*	
Gender	.07	-.14	.11	-.03	.00

Note: VI= verbal intelligence

*p< .05

A four stage hierarchical multiple regression was performed to model age and gender as predictors for one's level of theory of mind. A possible interaction effect between age and gender on the level of one's theory of mind was also investigated. Three control variables were entered first simultaneously into the regression, which were the participant's verbal intelligence, working memory, and the number of siblings of each participant. Numerous psychological studies have demonstrated that these three variables influence individual's level of theory of mind and they have, therefore, been entered into the regression model first in order to statistically remove their influence and find the unique effects of age and gender on theory of mind.

Age was entered second in the model, as literature has demonstrated that age has a very large effect on one's theory of mind. Gender was entered third into the model because its association to theory of mind has not been as consistently demonstrated in literature as age. We will, therefore, be able to see if gender does in fact have an effect on theory of mind if the influence of age is statistically removed. Gender was entered as a dummy variable, with males being coded as 1 and females as 2. There were equal numbers of participants for each gender and in each age group, as is demonstrated in Table 1 above.

Lastly, the product of age and gender was entered into the model in order to investigate a possible interaction effect. The interaction effect of age and gender has not been demonstrated in literature and was exploratory, which is why it was entered last in the model.

An analysis of variance of model 1, which included number of siblings, working memory and verbal intelligence, showed that it was statistically significant, $F(3,150)=5.51$, $p=.001$, and it had a moderately small associated value of $R^2 =.10$. The individual slope coefficients for number of siblings, $t=1.29$, $p=.198$, and working memory, $t=.83$, $p=.408$, were

not significant. Only verbal intelligence had a significant slope coefficient, t=2.99, p=.003, which indicates that higher levels of verbal intelligence are significantly associated with better theory of mind abilities. However, when number of siblings and working memory were removed from the model, there was no change in R^2, and they were, therefore, left in the model. When age was included in the model, the model remained statistically significant, F(4,149)=174.83, p<.001, and it was associated with a large change of R^2 =.73. The individual slope coefficient of age was significant, t=24.97, p<.001. We can, therefore, see that age was a good predictor of one's level of theory of mind, and as age increased so did one's level of theory of mind. When gender was entered into the model, the model was statistically significant, F(5,148)=143.20, p<.001. The individual slope coefficient for gender was just below statistical significance, t=1.94, p=.055, and it was associated with a low change of R^2 =.004. Gender was retained in the model, however, because it was very close to being statistically significant. The interaction effect was found to be insignificant and was removed from the model, t=-1.03, p=.307.

The final model was the 3rd model and it could explain a large amount of the variance in one's level of theory of mind, R^2=.83. A summary of the models can be seen in Table 4 and 5 below.

Table 4

Model Summary

Model	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df 1	df2	Sig. F Change
1	.10	.08	108.59	.10	5.51	3	150	.001
2	.82	.82	48.11	.73	615.16	1	149	<.001
3	.83	.82	47.67	<.01	3.75	1	148	.057
4	.83	.82	47.69	<.01	.88	1	147	.349

Dependent variable: ToM

1. Predictors: no. siblings, working memory, verbal intelligence
2. Predictors: no. siblings, working memory, verbal intelligence, age
3. Predictors: no. siblings, working memory, verbal intelligence, age, gender
4. Predictors: no. siblings, working memory, verbal intelligence, age, gender, age*gender

Table 5

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
3	(Constant)	-102.55	19.07		-5.38	<.001
	No._sibling	4.32	3.33	.05	1.29	.198
	VI	4.14	1.39	.11	2.99	.003
	Working memory	1.17	1.41	.03	.83	.408
	Age	31.55	1.26	.88	24.97	<.001
	Gender	15.18	7.84	.07	1.94	.055

Dependent Variable: Total_ToM

Note: VI= verbal intelligence

A further analysis was performed to investigate if there was a gender difference in the younger ages only. This may have not been reflected in the outcome of the test for an interaction effect of age and gender on theory of mind because the study had too few participants to have the statistical power to demonstrate an interaction effect. A three stage hierarchical regression was performed on data collected from participants between the ages of 3 to 7 years. The three control variables, working memory, number of siblings and verbal intelligence, were first entered into the regression. As was done previously, age was entered second in the model and gender was entered third.

An analysis of variance of model 1, which included number of siblings, working memory and verbal intelligence as predictors of theory of mind, showed that the model was statistically insignificant ($F(3,66)=.17$, $p=.92$) and it had a low associated R^2 value (.01). The individual slope coefficients of working memory ($t=.77$, $p=.445$), number of siblings ($t=-.23$, $p=.816$), and verbal intelligence ($t=.66$, $p=.515$) were all very insignificant. When age was taken into account in model 2, the model became statistically significant ($F(4,65)=21.13$, $p<.001$) and was associated with a high change in R^2 (.56). The individual slope coefficients of age were statistically significant ($t=9.28$, $p<.001$), indicating that theory of mind increased as age increased. Lastly, when gender was entered into model 3, the model remained statistically significant ($F(5,64)=19.87$, $p<.001$) and was associated with a low change in R^2 (.04). The individual slope coefficients of gender were statistically significant ($t=2.65$,

p=.010), demonstrating that gender was a predictor of children's level of theory of mind between the ages of 3 and 7 years, with girls outperforming boys on theory of mind tasks. Summaries of these findings can be found in Table 6 and 7 below.

Table 6

Model Summary

Model	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df 1	df2	Sig. F Change
1	.01	-..04	76.20	.01	.17	3	66	.916
2	.57	.54	50.83	.56	83.35	1	65	<.001
3	.61	.58	48.62	.04	7.02	1	64	.010

Dependent variable:ToM

1. Predictors: no. siblings, working memory, verbal intelligence
2. Predictors: no. siblings, working memory, verbal intelligence, age
3. Predictors: no. siblings, working memory, verbal intelligence, age, gender

Table 7

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
3	(Constant)	-146.22	34.31		-4.26	<.001
	No._sibling	-1.10	4.73	-.02	-.23	.816
	VI	1.51	2.31	.06	.66	.515
	Working memory	1.66	2.16	.06	.77	.445
	Age	39.44	4.20	.75	9.28	<.001
	Gender	32.01	12.08	.22	2.65	.010

Dependent Variable: Total_ToM

Note: VI= verbal intelligence

Discussion

This study investigated the age-dependent sequential development of theory of mind abilities and a possible gender difference in this process. It was first hypothesized that girls would demonstrate higher levels of theory of mind compared to boys of the same age between the ages of 3 to 13 years. Secondly, it was hypothesized that theory of mind would continue to develop from the age of 3 years to 13 years, with older children exhibiting higher levels of theory of mind abilities. It was next hypothesized that there would be an interaction effect between age and gender, where the gender difference in theory of mind ability would be greater in younger children and would begin to decrease as age increased. Lastly, it was hypothesized that number of siblings, level of working memory, and verbal intelligence would be associated with one's level of theory of mind. Having more siblings and higher levels of working memory and verbal intelligence were expected to be associated with higher levels of theory of mind. These variables were not of direct interest but were included in the regression model as controls to find the unique effect of age and gender by statistically removing the influence of these three control variables. Within the sample of coloured students from schools in Cape Town with lower-middle socioeconomic backgrounds, support was found for the second and third hypotheses, with the first and last hypotheses yielding mostly insignificant results.

Gender was not found to be a significant predictor of theory of mind between the ages of 3 to 13 years but it was very close to significance. The first hypothesis, therefore, did not find support in this study. Gender was, however, found to be a significant predictor of theory of mind for children aged 7 years and younger. The gender difference in younger ages will be discussed below when describing the interaction effect. The limited literature on a gender difference in theory of mind has yielded mixed results, with some studies finding a small, yet significant effect and others finding no effect (Ibanez et al., 2013; Charman et al., 2002; Bosacki & Astington, 1999). It may be the case that a gender difference between the ages of 3 and 13 years was not detected because gender had such a weak effect on theory of mind overall in the sampled ages and the current sample size was not adequate enough to detect the effect. Because the association between gender and theory of mind was very close to significance, it will be worthwhile for more studies to investigate the possibility of a gender difference from the age of 3 up to the age of 13 years by using larger sample sizes.

Age was found to be a very strong predictor of theory of mind ability, with younger ages being associated with lower levels of theory of mind. Evidence was found, therefore, for the second hypothesis. This finding has been consistently demonstrated in the theory of mind

literature, however, the vast majority of studies have focused purely on the preschool period and the development of false belief understanding between the ages of 3 and 5 years (Miller, 2009). This study has demonstrated that age continues to be a significant predictor of theory of mind up to the age of 13 years. This study has replicated the finding of Wellman and Liu (2004) that found that children go through a developmental progression from the age of 2 to 13 years where theory of mind ability continues to increase.

The third hypothesis, that there would be an interaction effect between age and gender on theory of mind ability, found support in this study. Girls were found to have significantly better theory of mind abilities than boys of the same age in the younger children and not the older children. Gender was found to be a significant predictor of theory of mind ability for children between the ages of 3 to 7 years and it was not a significant predictor when the overall sample was used, which included 3 to 13 year olds. This demonstrates that the gender effect was only significant in younger ages and it became insignificant as age increased. An interaction effect between these two variables has not been investigated much in the literature and was mostly exploratory. The findings in this study were in line with the scant literature that investigated an interaction effect of age and gender on theory of mind, which has suggested that a gender difference in theory of mind is only apparent in younger ages and begins to become less significant as age increases (Charman et al., 2002). Investigation of an interaction effect was based on the hypothesis that girls are exposed to a different social experience and social milieu when they are younger that may allow girls to acquire a theory of mind understanding earlier than boys, however, this gender difference will decrease with time after boys eventually receive the necessary amount and quality of social experiences in order to develop better theory of mind skills (Charman et al., 2002). This hypothesis was based on the observations that mothers talk to girls more than boys and the talk with girls contains more supportive speech acts (Leaper et al., 1998), mothers talk about emotions more to their daughters than their sons at age 2 (Cervantes & Callanan, 1998), and older siblings describe more feeling states to girls than boys (Brown et al., 1996), which are all thought to facilitate the development of a theory of mind understanding.

It is interesting to note that direct investigation of a possible interaction effect between age and gender on theory of mind ability showed that the effect was not significant. It is possible that the sample size was not large enough and the power of the study was too small to detect this interaction effect. Future studies may want to investigate this interaction effect with larger sample sizes, in order to have the necessary power required.

In this study, number of siblings did not significantly predict the participant's level of theory of mind in the younger ages and in the overall sample. The theory of mind literature on the so-called sibling-effect has yeilded inconsistent results. The sibling-effect is the observation that children who have more siblings are more likely to develop theory of mind abilities earlier than children with fewer or no siblings. Some studies found significant sibling-effects on theory of mind abilities (Jenkins & Astington, 1996; Perner et al., 1994), however, others found that the effect only occurs with older siblings and not younger siblings (Ruffman et al., 1998; Lewis et al., 1996). The current study included both younger and older siblings in one measure and the insignificant association of number of siblings and theory of mind in this study may be an indication that what is actually important is the number of older siblings and not merely the overall number of siblings. However, some studies have not found a link between theory of mind and siblings at all, whether they are younger or older (Cole & Mitchell, 2000; Cutting & Dunn, 1999). Therefore, number of siblings might not be associated with theory of mind and the finding might have been insignificant regardless of using only older siblings.

Working memory also did not significantly predict theory of mind ability in the younger ages and in the overall sample. This is at odds with the literature, as many studies have demonstrated a positive correlation between working memory and successful false belief task performance (Hughes, 2002). Working memory has also been shown to be significantly correlated with second-order false belief comprehension (Perner et al., 2002). Likewise, numerous studies have included measures of working memory as controls in their theory of mind studies in order to statistically remove the influence of working memory to find the unique effect of their main variable of investigation, indicating that working memory is known to have an effect on theory of mind (Talwar & Lee, 2008, Filoppova & Astington, 2008). In this study, working memory was recorded using the reverse digit span task, which is the best-known and most frequently used measure of working memory. Studies have demonstrated that the combination of working memory and inhibitory control may be critical in predicting theory of mind, instead of working memory on its own (Carlson & Moses, 2001). Studies have found that the predictive ability of working memory for theory of mind disappears once inhibitory control is included in the model, demonstrating that inhibitory control may be more important than working memory (Carlson, Moses & Breton, 2002). It may have been more effective, therefore, to include both inhibitory control and working memory in this study. This, however, was not done in the current study because the data that was available did not include measures of inhibitory control. Another possible reason why

working memory did not get a significant effect may be because the stories in the theory of mind battery used in this study were accompanied with illustrations and both the stories and illustrations were left in front of the child. This was done specifically to reduce demands on working memory when performing these tasks and this may have caused the insignificant results with working memory.

Verbal intelligence was the only control variable that significantly predicted theory of mind ability in the overall sample. A positive correlation was found between verbal intelligence and theory of mind, with higher levels of verbal intelligence being shown to predict higher levels of theory of mind. This finding is reflected in the theory of mind literature, where the association between verbal intelligence and theory of mind has consistently been demonstrated (Milligan et al., 2007; Hasselhorn et al., 2005). Longitudinal studies have demonstrated a bidirectional causal relation between theory of mind and verbal intelligence, where early theory of mind predicts later verbal intelligence and early verbal intelligence predicts later theory of mind (Milligan et al., 2007). However, the verbal intelligence to theory of mind causal direction seems to have a stronger relation. It was, therefore, worthwhile to include verbal intelligence as a control variable and statistically remove its influence to find the unique effects of age and gender on theory of mind. Verbal intelligence, however, did not significantly predict theory of mind in children between the ages of 3 and 7 years. This may be due to the simple nature of the early and basic modules that do not require a high level of verbal intelligence. Verbal intelligence most probably became more important as the modules became more advanced and complex.

Limitations and suggestions for future research

A major limitation in this study is that it was only correlational and we cannot take away the possibility that the association between the predictor and outcome variables is a result of unexamined, confounding variables. In this case, the correlation between age and theory of mind may be an artefact of their correlations to executive function. Improved performance with age on tasks of theory of mind may just be a function of better executive control (Apperly, 2012). Tasks assessing higher-order theory of mind place much higher demands on executive function and working memory. Individual differences in performance may be a function of these different cognitive demands and not a difference in level of conceptual theory of mind understanding (Apperly, 2012). For both children and adults, studies have demonstrated that an individual's results on tests of executive control are correlated with false-belief task performance (Carlson & Moses, 2001 2006).

This limitation is also reflected in the amount of unexplained variance in the models,

which demonstrates that many other factors are likely to be influential in affecting children's level of theory of mind. Future studies should attempt to include more variables that are thought to influence theory of mind in order to create a more complete picture of factors that affect theory of mind development.

The correlational nature of this study also results in us not being able to explain why gender results in different theory of mind abilities. Variables cannot be experimentally manipulated to demonstrate causal effects and this study can, therefore, only describe the gender difference. Because the gender effects are weak, it might be better to view them as general tendencies with exceptions being the norm (Charman et al., 2002). It might not be the case that girls are innately better in theory of mind than boys but, instead, other psychosocial factors that are related to gender, such as parenting style (Ruffman, Perner, & Parkin, 1999), sibling interactions (Hughes & Dunn, 1998; Lewis et al., 1996), and family environment (Perner et al., 1994) are important for predicting theory of mind abilities. Future research may want to investigate the gender difference in theory of mind with the aforementioned psychosocial factors as mediator variables.

This study can also not be generalised to the whole South African population. The study is not representative of the South African population because the sample was homogenous in socio-economic status, race, and language. Future studies will need to take place that sample increasingly more diverse populations in South Africa in order to make a more complete picture of theory of mind development in our country.

Another limitation in the study is that the sample did not include participants younger than the age of 3 years. There is some evidence that children younger than the age of 3 years can display false belief understanding and researchers claim they can detect an "implicit ToM" in infants by using spontaneous response tasks (Trauble, Marinovic, & Pauen, 2010). Studies have found that infants as young as 7 months might be able to think about another person's false belief and other mental states (Kovacs, Teglas, & Endress, 2010). What such findings mean is still subject to considerable debate and this is an avenue of inquiry that future research should focus on.

A necessary task for future research will be to broaden the diversity of populations used to investigate second order and other forms of higher-order reasoning. Research on first-order reasoning includes studies with diverse populations, including participants from Western countries, Asian countries (e.g., Liu, Wellman, Tardif, & Sabbagh, 2008), and some traditional non-industrialised societies (e.g., Vinden, 2002). Research on first-order reasoning also includes participants from a range of ethnic and socioeconomic groups (e.g., Shatz,

Diesendruck, Martinez-Beck, & Akar, 2003). In contrast, literature on second-order reasoning is all based on Western populations with mostly White, middle-class participants, except for a few studies in Japan. It is, therefore, necessary for studies to be conducted on higher-order reasoning in non-Western populations.

Another possible avenue for future studies could be inclusion of naturalistic data on higher-order reasoning, which has taken place in the literature on first-order reasoning (Miller, 2009). The literature on first-order reasoning primarily involves data that was collected in experimental test situations, however, there is also experimental data on first-order reasoning that is complemented with naturalistic data. An example of where this has occurred is in the study of lying, where both experimental and naturalistic approaches coexist (Miller, 2009). In comparison, the literature on higher-order reasoning is all collected through experimental means. Future inclusion of a naturalistic component in second order reasoning investigations could lead us to find interesting observations that could broaden our understanding of higher-order theory of mind abilities.

Conclusion

This study has demonstrated that one's level of theory of mind continues to increase from the age of 3 to 13 years. Gender was found to influence children's level of theory of mind for children that were aged from 3 years to 7 years. A significant gender difference was not found for children older than 7 years of age. These findings demonstrate that the gender difference in theory of mind ability is age-dependent, where the gender difference occurs in younger and not older children. This study provides more information about the age-dependent and gender-dependent sequential unfolding of theory of mind abilities in the South African context. The vast majority of studies on theory of mind have taken place in a Western context and this study provides further insight regarding similar patterns in a different context. Future studies are required that assess a more diverse strata in South Africa for findings to be generalized to the whole country. Furthermore, this study has demonstrated the need to investigate changes in one's theory of mind ability beyond the preschool years, which was the period where early studies on theory of mind almost exclusively used. Future studies should investigate the possibility of detecting theory of mind ability in those even younger than has been sampled in this study. Finally, future studies should continue to investigate a possible gender difference in theory of mind development and may want to identify psychosocial factors that could mediate the relationship between gender and theory of mind.

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Appendix A

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ENQUIRIES: Dr A T Wyngaard

Dr Susan Malcolm-Smith
Department of Psychology
UCT
Rondebosch

Dear Dr Susan Malcolm-Smith

RESEARCH PROPOSAL: THE DEVELOPMENT OF MORAL REASONING

Your application to conduct the above-mentioned research in schools in the Western Cape has been approved subject to the following conditions:

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Educators' programmes are not to be interrupted.
5. The Study is to be conducted from **15 February 2016 till 30 September 2018**
6. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations (October to December).
7. Should you wish to extend the period of your survey, please contact Dr A.T Wyngaard at the contact numbers above quoting the reference number?
8. A photocopy of this letter is submitted to the principal where the intended research is to be conducted.
9. Your research will be limited to the list of schools as forwarded to the Western Cape Education Department.
10. A brief summary of the content, findings and recommendations is provided to the Director: Research Services.
11. The Department receives a copy of the completed report/dissertation/thesis addressed to:

    The Director: Research Services
    Western Cape Education Department
    Private Bag X9114
    CAPE TOWN
    8000

We wish you success in your research.

Kind regards.
Signed: Dr Audrey T Wyngaard
Directorate: Research
DATE: 11 February 2016

Appendix B

UNIVERSITY OF CAPE TOWN

Department of Psychology

University of Cape Town Rondebosch 7701 South Africa
Telephone (021) 650 3414
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5 March 2013

Dr. Susan Malcolm-Smith
Department of Psychology
University of Cape Town
Rondebosch 7701

Dear Dr Malcolm-Smith,

I am pleased to inform you that ethical clearance has been given by an Ethics Review Committee of the Faculty of Humanities for your project:

The development of moral reasoning

Please use the reference PSY2013-001 if required. I wish you all the best for your study.

Yours sincerely,

Johann Louw PhD
Professor
Chair: Ethics Review Committee

APPENDIX C

UNIVERSITY OF CAPE TOWN

DEPARTMENT OF PSYCHOLOGY

The Development of Moral Reasoning and Empathy

Assent Form

Hello! We want to tell you about a research study we are doing. A research study is a way to learn more about something. We would like to find out more about how children feel about good and bad behaviour, and how they understand what other people are feeling and thinking.

If you agree to join this study, you will be asked to do some tasks on the computer. For example, we will show you some pictures and ask you how you feel about them. We will also show you some short movies on the computer screen. These are not the kind of movies you see on TV. They are movies that we made to help us study how children feel about good and bad behaviour. It is very important that you watch the pictures carefully. You will also be asked to do some other tasks, like tell us the meaning of some words, and we will ask you to answer questions about short stories we will read to you.

Together these tasks will take about 90 minutes. We will take a break after you've done some of the tasks. We can take other short breaks too if you get tired.

You do not have to join this study. It is up to you. No one will be angry with you if you don't want to be in the study or if you join the study and change your mind later and stop.

Do you have any questions about the study? If you think you can do it and you don't have any more questions about it, will you sign this paper? If you sign your name below, it means that you agree to take part in this study.

Child's Signature: _____ Date: _____

Interviewer's Signature: _____ Date: _____

APPENDIX D

DEMOGRAPHIC QUESTIONNAIRE

A. Child's Information:

Name: _____ School: _____

Age: _____ Date of Birth: _____

1. Sex (circle one): *Male* *Female*
2. Ethnicity: *White* *Black* *Indian* *Coloured*
   Asian *Other* *If other please specify:* _____
3. Home Language: _____
4. Handedness (circle one): *Left* *Right* *Ambidextrous*
5. Number of siblings: _____
6. Number of **older** siblings: _____
7. Who is the child's primary caregiver? _____
8. What is your relationship to the child (e.g. mother, father, etc)? _____
9. Has your child ever been diagnosed with Autism Spectrum Disorder? YES
   NO
   a. Please indicate any other diagnoses or information related to your child's Autism Spectrum Disorder:

_____

_____

_____

10. Has your child ever been diagnosed with a disruptive, impulse-control, or conduct disorder, such as conduct disorder or oppositional defiant disorder (ODD)? YES
    NO
    If yes, please specify:

_____

_____

_____

11. Has your child ever had a communication disorder? (For example: Having problems with understanding or producing speech, slow vocabulary development, difficulties recalling words or problems with producing sentences appropriate for his/her age.) YES
    NO
    If yes, please specify:

_____

_____

_____

12. Has your child ever experienced learning difficulties such as dyslexia or attention-deficit / hyperactivity disorder (ADD/ ADHD)? YES NO
If yes, please specify:

13. Has your child ever experienced a head injury? (e.g., being hit on the head with an object and losing consciousness as a result) YES NO
If yes, please give details:

14. Has your child ever experienced any of the following medical conditions:
a. Neurological problems (e.g., epilepsy, meningitis, cerebral palsy, encephalitis, Tourette's syndrome, brain tumour, other) YES NO
If yes, please specify:

b. Depression YES NO
If yes, please specify:

c. Memory problems YES NO
If yes, please specify:

d. Problems with their vision: YES NO
If yes, please specify:

e. Problems with their hearing (e.g. difficulty hearing, needing hearing aids, needing grommets): YES NO
If yes, please specify (please include details on how this affected their language development):

f. Is he/she currently taking any prescription medication? YES NO

If yes, what medication(s)?

B. Parent / Guardian Information:

Please note that information on the primary caregiver is required. If the child is adopted, please indicate this.

If the primary caregiver is not the biological or adoptive mother or father, please place their information under "Guardian".

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1. What is the total monthly income of your household? (Tick the appropriate block):

[NOTE: This should be total household income, not personal income.]

0 – R2999		R3000 – R6299		R6300 – R 10 499		R10 500 – R 14599	
R14 600 – R18 799		R18 800 – R22 999		R23 000 – R26 999		R27 000 – R31 299	
R31 300 – R35 499		R35 500 - R39 499		R39 500 – R43 750		more than R43 750:	
What is the estimated value of your total monthly household income: R							

2. Highest level of education completed for mother, father, and/or guardian (please circle appropriate number).

	Mother	Father	Guardian
1) 0 years (Never went to school)	1	1	1
2) Grade 1	2	2	2
3) Grade 2	3	3	3
4) Grade 3 / Standard 1	4	4	4
5) Grade 4 / Standard 2	5	5	5
6) Grade 5 / Standard 3	6	6	6
7) Grade 6 / Standard 4	7	7	7
8) Grade 7 / Standard 5 [Completed primary school]	8	8	8
9) Grade 8 / Standard 6	9	9	9
10) Grade 9 / Standard 7	10	10	10
11) Grade 10 / Standard 8	11	11	11
12) Grade 11 / Standard 9	12	12	12
13) Grade 12 / Standard 10 [Matric; Completed high school]	13	13	13
14) Tertiary education: Higher education certificate	14	14	14
15) Tertiary education: Diploma received	15	15	15
16) Tertiary education: Bachelor's degree received	16	16	16
17) Tertiary education: Post graduate degree received	17	17	17

18)Don't know	18	18	18

3. Parental employment: (Please circle appropriate number)

	Biological mother	Biological father	Guardian
1. Higher executives, owners of large businesses, major professionals (e.g. doctors, lawyers)	1	1	1
2. Business managers of medium sized businesses, professions like nurses, opticians, pharmacists, social workers, teachers, accountants	2 3	2 3	2 3
3. Administrative personnel, managers, owners / sole proprietors of small businesses (decorator, actor, reporter, travel agent)	4	4	4
4. Clerical and sales, technicians, (e.g. bank teller, bookkeeper, clerk, draftsperson, timekeeper, secretary)	5	5	5
5. Skilled manual – usually having had training (e.g. baker, barber, chef, electrician, fireman, machinist, mechanic, welder, police, plumber, electrician)	6	6	6
6. Semi-skilled (e.g. hospital aide, painter, bartender, bus driver, cook, garage guard, checker, waiter, machine operator)	7 8	7 8	7 8
7. Unskilled (e.g. attendant, janitor, construction helper, unspecified labour, porter)	9	9	9
8. Homemaker			
9. Student, disabled, no occupation			

4. Material and financial resources (please answer for each item).

Which of the following items, in working order, does your household have?

Items	Yes	No
1. A refrigerator or freezer	Yes	No
2. A vacuum cleaner or polisher	Yes	No
3. A television	Yes	No
4. A hi-fi or music center (radio excluded)	Yes	No
5. A microwave oven	Yes	No
6. A washing machine	Yes	No
7. A video cassette recorder or dvd player	Yes	No

Which of the following do you have in your home?

Items	Yes	No
1. Running water	Yes	No
2. A domestic servant	Yes	No
3. At least one car	Yes	No
4. A flush toilet	Yes	No
5. A built-in kitchen sink	Yes	No
6. An electric stove or hotplate	Yes	No
7. A working telephone / cellular phone	Yes	No

Do you personally do any of the following?

Items	Yes	No
1. Shop at supermarkets	Yes	No
2. Use any financial services such as a bank account, ATM card or credit card	Yes	No
3. Have an account or credit card at a retail store	Yes	No

Appendix E

UNIVERSITY OF CAPE TOWN
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The Development of Moral Reasoning and Empathy

Principal Investigator:
Dr Susan Malcolm-Smith
Senior Lecturer
Department of Psychology
University of Cape Town
Principal Investigator:
Dr Jean Decety
Department of Psychology
University of Chicago

Dear Parent/Legal guardian,

You and your child are invited to participate in a research study investigating the development of moral reasoning in children. This study focuses on how children of different ages feel about good and bad behaviour.

What is involved in this study?

Approximately 360 children aged 3 to 13 years will participate in this study. If your child participates, a researcher will guide her/him through several computer-based tasks. In one task, children will be asked to view pictures of hands or feet in neutral situations (e.g. a hand opening a door) or in situations that could be painful (e.g. a hand getting stuck in a door). In another task, children will view short videos of one person accidentally hurting another person (e.g. a person being bumped) or one person intentionally hurting another person (e.g. a person being pushed). After viewing these pictures and videos, children will be asked how mean the person in the picture is and how good/bad the action was. All pictures are appropriate for children as young as 3 years of age and have been taken from situations children readily observe in every-day life.

Additionally, children will complete a number of pencil and paper tasks. In one such task, your child will answer questions about short stories. These questions will look at their ability to take another person's point of view. Children will also play a game where they have an opportunity to share rewards (stickers) with others or not, and their interactions with others (such as their friends) will be observed. Altogether this study will take about 2 hours of your child's time. Two sessions (an hour each) will take place either right after school, or during the school day (depending on your and your child's school's preference). We will take a break after completing some of the tasks, and take additional short breaks if your child gets tired. We also have a number of questionnaires that will ask you questions about your own views and questions about your child's views. Your completion of these documents is completely voluntary.

Are there any benefits to taking part in the study?

Your child will receive a snack for her/his participation, as well as some stickers of her/his choice, and you will receive R100 if you complete all questionnaires. More importantly, should we identify any behavioural or learning difficulties that are likely to affect your child's capacity to learn, we will provide you with written feedback, and referrals to appropriate service providers where necessary. Furthermore, the results of this research could provide essential information about how children process emotional and moral information and this may be helpful in planning effective educational programs for children with social difficulties.

What are the risks of the study?

There are no risks to you or your child through participating in this research. However, if any child does become at all upset, or tired, she or he may stop participating at any point. We would like to emphasise that participation in this study is entirely voluntary, and will not affect your child's education. All results will be securely stored, and kept strictly confidential.

If you would like your child to participate in the study, please complete the consent form, as well as the demographics survey, and return to your child's school. Please answer all the questions as accurately and truthfully as possible. We understand that some of this information may be sensitive, but be assured that all information will be kept strictly confidential.

Should you have any questions or queries about the research or your participation, please do not hesitate to contact Lea-Ann Pileggi: (email) leapileggi@gmail.com, or Susan Malcolm-Smith: (phone) 021 650 4605, (email) Susan.Malcolm-Smith@uct.ac.za, or contact Professor Johann Louw (Psychology Ethics Committee): (phone) 021 650 3417, (email) Johann.Louw@uct.ac.za.

Thank you for your participation.

Appendix F

Parental Consent Form

CONSENT FORM

The research project and the procedures associated with it have been explained to me. I hereby give my permission for my child to participate in the above-described research project.

Child's name: _____

Parent/guardian's name: _____

Date: _____

Signature of parent/guardian: _____

Please provide a contact number below should you be willing to complete the additional questionnaires (for which you will be compensated with R100 upon completion), and indicate which time/s would be most convenient to receive this phone call.

Phone: _____
Time/s: _____

Appendix G

To check the assumption of independence of observations for a linear regression, it was investigated if the school the child goes to was a significant contextual variable. If this were the case, the residuals would be correlated because we would have non-independent observations. Linear regressions were modelled for each age group with school as the predictor and theory of mind as the outcome variable. Regressions were performed for each age group instead of performing one regression on the entire data set because age and school are highly correlated and this may lead to one incorrectly attributing the correlation of age and theory of mind as a correlation of school and theory of mind. School was not a significant predictor of theory of mind in any of the ages, demonstrating that the school the child goes to does not have a significant effect on their level of theory of mind in this sample. The assumption for independence of observations is, therefore, upheld.

The reliability of the model can be checked in various ways. One way is to check the zero-order correlations and the part and partial correlations in Table 5 in the main thesis. It is natural for the zero-order correlations to be higher than the part and partial correlations but they must not be too low that they show no effect at all. The part and partial correlations for vocabulary, age, and gender are adequately high in relation to their corresponding zero-order correlations. The part and partial correlations for number of siblings and working memory are fairly low compared to their corresponding zero-order correlations, which is expected given that they did not have a statistically significant effect in our final model. However, because this study is exploratory these two variables will be retained in the model as studies in the future may find a significant effect for them.

The VIF, or variance inflation factor, shows whether one independent variable is strongly correlated with any other independent variables. A VIF score of higher than 10 indicates multicollinearity and all of the scores are well below this, indicating that there is not multicollinearity in the data. The value for Tolerance demonstrates how much the model can tolerate the variable. It is measured from 0 to 1 and should be as high as possible. The Tolerance scores are all very high, indicating that all of the predictors can be tolerated in the model.

Next we can check the casewise diagnostics to see if any data points have standardized

residuals higher than 2.5. As a rough guide, if more than 5% of the total data points have standardized residuals greater than 2.5, then the model is not a good representation of the world. In the final model, there were only 4 data points that had standardized residuals greater than 2.5 and are, therefore, outliers. However, the outliers only constitute 2.60% of the total data set and is, therefore, not a cause for concern.

The effect of individual cases on the model can be checked by looking at values for Cook's distances and Malhalanobis distances. Cook's distance measures how much effect any one case has on the model and any cases higher than 1 is a cause for concern, as those cases could have an undue influence on the model. In our model, none of the individual cases had Cook's distances above 1, indicating that none of the data points have too great an influence on the model. Malhalanobis distances shows how far away a case is from the average of the independent variables, with values greater than 15 in a small data set indicating that a data point may have an extreme value for one of the independent variables. None of the Malhalanobis scores were above 15, indicating that none of the data points had extreme values of an independent variable.

Next, we can look at residual plots for normality in Figure 1 and 2 below. From these graphs, we can see that the residuals are normally distributed and this increases the reliability of the model. Lastly, we can check for homoscedasticity in Figure 3 below, which is a scatter plot of residuals against predicted values. The dots in this graph should not have a pattern, as this may indicate that the relationship between variables is non-linear. Figure 3 is a bit worrying, as it appears that it may be trimodal with 3 subgroups. This may indicate that there is a variable that is not being controlled for that may have an influence on the data. However, because this study is exploratory and because the sample size is fairly large, this is not a great cause for concern.

To summarise, all of the measures for the model's reliability demonstrate that the model is adequately reliable. We can, therefore, concluded with a large amount of certainty that the final model of a good reflection of the world.

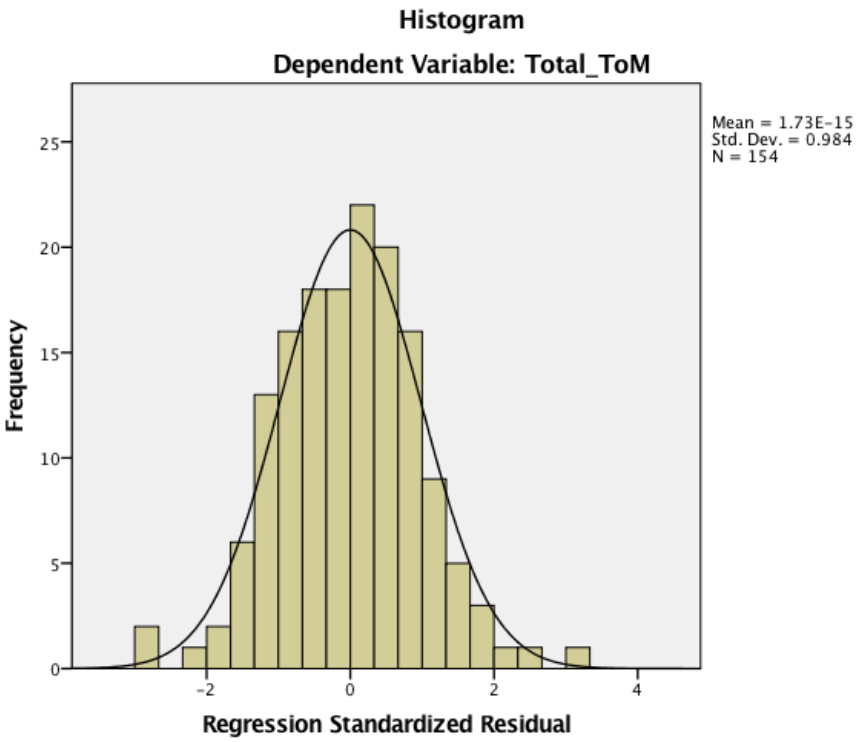

Figure 1.

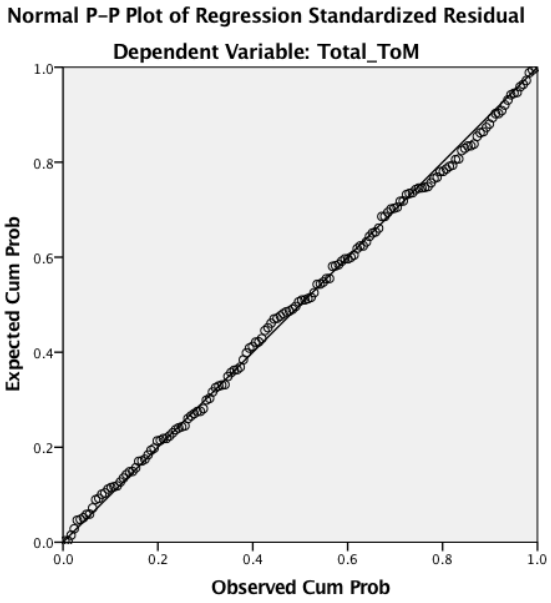

Figure 2.

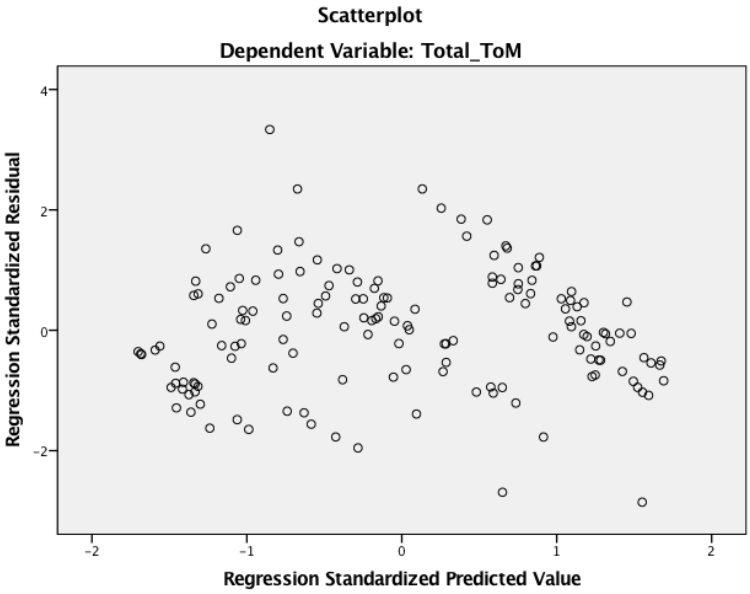
Scatterplot
Dependent Variable: Total_ToM
Regression Standardized Residual
Regression Standardized Predicted Value
4
2
0
-2
-2
-1
0
1
2

Figure 3.