Longitudinal Associations Between Children's Understanding of Emotions and Theory of Mind

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This is an Author's Accepted Manuscript of an article published in

O'Brien, M., Weaver, J.M., Nelson, J.A., Calkins, S.D., Leerkes, E.M., & Marcovitch, S. (2011). Longitudinal associations between children's understanding of emotions and Theory of Mind. *Cognition and Emotion, 25*(6), 1074-1086.

as published in the *Cognition and Emotion* 2011 [copyright Taylor & Francis], available online at: http://www.tandfonline.com/10.1080/02699931.2010.518417

Abstract:

Theory of mind competence and knowledge of emotions were studied longitudinally in a sample of preschoolers aged 3 (n=263) and 4 (n=244) years. Children were assessed using standard measures of theory of mind and emotion knowledge. Three competing hypotheses were tested regarding the developmental associations between children's theory of mind abilities and their knowledge of emotions. First, that an understanding of emotion develops early and informs children's understanding of others' thinking. Alternatively, having a basic theory of mind may help children learn about emotions. Third, that the two domains are separate aspects of children's social cognitive skills such that each area develops independently. Results of hierarchical regressions supported the first hypothesis that early emotion understanding predicts later theory-of-mind performance, and not the reverse.

Keywords: Longitudinal | Emotion knowledge | Theory of mind | Preschoolers

Article:

The domain of children's social understanding, including understanding of one's own and others' minds and emotions, has been the topic of much research over the past few decades. Social understanding is related to positive social skills and peer relationships, and the lack of such understanding is implicated in the development of problem behaviours (Dunn, 2000; Hughes, Dunn, & White, 1998; Weimer & Guajardo, 2005). To date, however, although an impressive volume of literature has been devoted to understanding children's developing understanding of their own and others' mental states (see Wellman, Cross, & Watson, 2001; Wellman & Liu, 2004, for reviews) and their understanding of emotions (Cutting & Dunn, 1999; Denham, 1986; Denham & Couchoud, 1990; Dunn, 2000; Hughes & Dunn, 1998), it is unclear how children's theory of mind competence and their knowledge of emotions are associated longitudinally. It has been suggested that an understanding of emotion comes "on line" early during development and informs children's understanding of others' thinking (Dunn, 2000). An alternative viewpoint holds that having a basic understanding of others' minds help children learn about emotions (Harwood & Farrar, 2006). A third possibility, suggested by Cutting and Dunn (1999), is that the two domains are separate aspects of children's developing social cognitive skills such that each area develops somewhat independently. Knowing more about the longitudinal relations between emotion understanding and theory of mind has implications for both basic research and intervention efforts aimed at promoting social competence and reducing behaviour problems (Izard et al., 2008). The present study examined children's performance on emotion-understanding and theory-of-mind tasks at two time points during the preschool years to test competing ideas about the development of these skills.

Several authors have discussed longitudinal relations between emotion understanding and theory of mind development, in both empirical and review pieces (Bartsch & Estes, 1996; Dunn, 2000; Hughes & Dunn, 1998; LaBounty, Wellman, Olson, Lagattuta, & Liu, 2008). However, there remains a lack of clear empirical evidence using a large, diverse sample on how the two constructs are related over time in development.

One possibility is that emotion understanding emerges first and supports the development of theory of mind. Evidence from Bartsch and Wellman (1995) indicates that very young children use desire and emotion terms by age 2 and only later talk about beliefs. Such a progression, according to the authors, suggests that it is through social interactions that children come to learn how beliefs influence people's behaviour. Dunn (2000) has suggested that children first understand emotional states and then extend that understanding to cognitive states. More specifically, because emotions are typically displayed outwardly and mental states are not, children may be able to recognise where their own and others' feelings differ more readily than they can recognise that their own mental state differs from another's. Situations in which another person's expressed emotion is unexpected to a child or in conflict with his or her own feelings may help children understand that other people can think differently about the same event, contributing to a developing understanding of others' mental states. Several lines of research support this hypothesis. For example, it has been observed that emotion understanding emerges earlier in the preschool years than theory of mind, as measured by false-belief tasks (Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991). Further, Hughes and Dunn (1998) found that affective perspective-taking tasks at age 4 predicted a composite of theory-of-mind performance at age 5, controlling for age, verbal ability, nonverbal ability, and age 4 theory of mind.

An alternative longitudinal hypothesis is that children need to develop an understanding of mind in order to identify others' emotional states. It may be that children must first recognise that others may have beliefs and desires that are different from their own in order to understand the motivations behind emotions. To the extent that children must take another person's beliefs or desires into account in predicting that person's feelings about a situation, theory of mind skill could be basic to an understanding of emotions beyond simple labelling. This idea has not been directly tested empirically. Hughes and Dunn (1998) were unable to examine the longitudinal relation between theory of mind and emotion understanding because by age 5 the children in their study had reached ceiling on the emotion-understanding task they used. Harwood and

Farrar (2006) suggested that affective perspective-taking performance, particularly the identification of emotions in others that differ from one's own feelings, depends upon the skills inherent in theory-of-mind tasks. In support of their idea, they found a significant correlation between theory-of-mind performance and performance on the affective perspective-taking tasks. Because their study was cross-sectional, however, this hypothesis still needs to be tested empirically using a longitudinal design. In two samples of children ages 4 to 6 who were given false-belief tasks, de Rosnay, Pons, Harris, and Morrell (2004) found that children were better able to predict actions than emotions of the story characters. They concluded that there was a lag between children's understanding of false belief and their ability to attribute emotions accurately. Again, however, these studies were cross-sectional in design, leaving open the question of the longitudinal link between theory of mind and emotion understanding.

A third possibility is that children's understanding of minds and of emotions develop in parallel; that is, the two areas of knowledge may be somewhat independent of each other. Skills may develop at approximately the same time in development but not be related in any causal way. Support for independent development of emotion understanding and theory of mind comes from studies in which children's performance on the two types of tasks is uncorrelated. For example, in a study of 3- to 5-year-old children, Cutting and Dunn (1999) found that neither emotion understanding nor false belief contributed independently to the other after accounting for age, family background characteristics, and language ability. The authors concluded that emotion understanding and false belief may be related but distinct aspects of social cognition, perhaps following different developmental paths. Similar findings have been reported by other investigators (Dunn et al., 1991; LaBounty et al., 2008; Racine, Carpendale, & Turnbull, 2007; Weimer & Guajairdo, 2005), although Hughes and Dunn (1998) found the two types of tasks to be significantly correlated in children tested at three time points between age 4 and age 5, and Harwood and Farrar (2006) reported a significant relation between 3- to 5-year-old children's theory-of-mind performance and a task requiring understanding of another's emotions as different from one's own.

The inconsistent findings across different studies may in fact be related to different rates of development in the two domains. If, for example, children's emotion understanding develops earlier than theory-of-mind understanding, it would be expected that at very young ages, emotion understanding and theory of mind would be uncorrelated, but that as theory of mind develops, the two would be more highly correlated at later ages. Many prior studies have used small samples of children, however, and have often included children of varying ages, making it difficult to identify developmental patterns.

The goal of the present study was to examine, using a relatively large, economically diverse sample of children, the developmental associations between the domains of emotion understanding and theory of mind, including tests of how each may be related to the other longitudinally. Because most children are able to participate in false-belief and emotion-understanding tasks at age 3, acquire aspects of theory of mind by age 4, but tend to reach ceiling on some of the standard emotion-understanding tasks by age 5, an examination of children's performance from age 3 to 4 was expected to be particularly insightful in providing evidence regarding the developmental sequences at the point of emergence of skills in emotion understanding and theory of mind. Within each domain, tasks were selected to tap a range of skill levels. We tested three possibilities: (1) that emotion understanding precedes and contributes to the early development of theory of mind, in which case we would expect age 3 emotion understanding to be associated with age 4 theory of mind but not the reverse; (2) that theory of mind precedes and contributes to the early development of emotion understanding, in which case we would expect age 3 theory-of-mind performance to predict age 4 emotion understanding but not the reverse; and (3) that the early development of emotion understanding and theory of mind occurs independently, in which case we would expect within- and across-age relations between the two types of measures to be similar.

Method

Participants

Participating families were part of a short-term longitudinal study examining emotional and cognitive contributions to early school success. Children and mothers came to the study site when children were 3 years old (N=263; child age M=41.79 months; SD=2.41) and again one year later (N=244; M=53.41 months; SD=1.84). Mothers in the study sample were 33 years of age on average (SD=5.91). Approximately half of the sample (49%) had less than a 4-year college degree; at the time of entry into the study, 74% of the respondents were married and living with their partner, and 79% were working outside the home. Average income-to-needs ratio at the first visit, derived by dividing the total family income by the poverty threshold for that family size, was 2.89 (SD=1.73). Approximately 37% of the sample had an income-to-needs ratio under 2.0, indicating low income; 53% were between 2 and 5; and 10% were greater than 5. Of the children, 52% were female; 58% were European American, 35% African American, and 7% other ethnicities, including children of mixed ethnicity.

The retention from age 3 to age 4 was high (93%) with few significant differences between families that participated in both waves of data versus those who did not. Mothers whose children participated in both visits were older, $t(261) = 2.36$, $p<.05$, more likely to be European American, $\chi^2(1, N=263) = 5.13$, $p<.05$, and better educated, $t(261) = 2.43$,$p<.05$, than those lost to follow-up. There were no differences between the two groups in child age, child sex, or scores on the study measures at age 3.

Procedure

Participating families were recruited from preschools and child-care centres in a small south-eastern city of the USA through letters sent home with 3-year-old children. Families interested in participating returned contact information to the researchers who then called the families to schedule a laboratory visit that lasted approximately 2 hours; a second visit was conducted approximately 12 months later. During each visit, children were videotaped while completing a variety of tasks assessing emotional and cognitive development, with task order held constant across children. Mothers provided written consent and completed questionnaires during the session. Families received $40 for the first visit and $60 for the second; children selected a toy as thanks for their participation.

Measures

Demographics

Mothers completed a demographic questionnaire at each visit including information about child age, child sex, ethnicity, and family characteristics.

Emotion understanding

Three increasingly sophisticated aspects of children's understanding of their own and others' emotions were assessed at both visits, using the procedures developed by Denham (1986); Denham, Zoller, & Couchoud, 1994): labelling of facial expressions, affective perspective taking (including both non-equivocal and equivocal situations), and understanding emotion causes.

Emotion labelling

Following Denham (1986), children were presented four felt faces, drawn to depict the emotions happy, sad, angry, and scared, and asked to name each expression (e.g., "How is this person feeling right now?") to assess accuracy of verbal emotion labelling. Children were also asked to point to each expression when requested (e.g., "Show me the _______ face.") to assess recognition of emotional expressions. For each emotion, children received a score of 2 if they identified the correct emotion, 1 if they identified an incorrect emotion of the correct valence (e.g., sad instead of angry), and 0 if they identified an emotion of the incorrect valence (e.g., happy instead of sad). Recognition and labelling scores correlated at age 3, $r(261)=.62$, $p<.01$, and at age 4, $r(244)=.42$, $p<.01$, and were summed to create one total score of emotion labelling. At age 3, 1% of children scored 0 and 5% scored the maximum of 16. At age 4, no children scored 0 and 24% scored 16.

Affective perspective taking (APT)

The vignettes of emotion-eliciting situations developed by Denham (1986) were used to assess children's understanding of others' emotions. Vignettes were presented as puppet tasks; the children were asked to indicate how the puppet felt by affixing a felt face depicting happiness, sadness, anger or fear to the puppet. The first four vignettes involved situations that evoke non-equivocal emotional reactions (e.g., happiness at getting an ice cream cone). The remaining six vignettes were more equivocal situations in which the protagonist puppet portrayed an emotional response that the mother reported as atypical for her child. (Mothers provided information about children's typical emotional reactions at the beginning of the laboratory session.) For example, if a mother indicated that her child would feel *scared* about being approached by a large, friendly dog, the puppet enacted *happiness* using standardised verbal and visual cues. For each vignette, children received a 0, 1, or 2 for the face they selected using the same criteria as the labelling of emotions scoring described above. Scores were calculated for non-equivocal (possible range 0 to 8) and equivocal affective perspective taking (possible range 0 to 12) by summing scores across the appropriate vignettes. At age 3, 2% of children scored 0 and 17% at ceiling on the non-equivocal task. For equivocal, 2% scored 0 and 2% scored the maximum of 12. At age 4, 1% scored 0 and 58% scored 8 for non-equivocal. For equivocal, 0% scored 0 and 17% scored 12. The two measures correlated significantly at age 3, $r(258)=.53$, $p<.01$, and at age 4, $r(244)=.43$, $p<.01$. Because earlier research has found these two subscales correlate differently with other measures of theory of mind (Harwood & Farrar, 2006), we retained the two separate scores.

Understanding emotion causes

Children's ability to explain the reasons for experiencing emotions was examined using a puppet task developed by Denham et al. (1994). One of four emotion faces was placed on a puppet and children were asked to identify the emotion. Then the examiner asked, “What made the puppet feel this way?” Children were encouraged to report as many as four possible reasons, and their responses were recorded verbatim and coded for the number of accurate, independent causes given (possible range 0 to 4) for each of the four emotions. A response was not considered valid if it was a description of the emotion, an action that would be taken as a result of the feeling, or if the response did not make sense for the context. Repetitive answers or answers from the same category (e.g., monsters and dragons are both considered big, scary creatures) were coded as one cause. Accuracy was defined using criteria established in past research (Barrett & Campos, 1987; Stein & Jewett, 1986; e.g., correct causes of anger involve goal blockage). The inter-observer agreement on the codes, calculated as agreements divided by agreements plus disagreements, was 85.5% at age 3 and 93% at age 4. The number of correct explanations was summed across all four emotions. At age 3, 12% of children scored 0 and no children reached ceiling on the task. At age 4, 4% of children scored 0 and again, no children scored the maximum total points.

Theory of mind

Children's knowledge of their own and others’ mental processes was measured using four tasks that varied in complexity (see Holmes, Black, & Miller, 1996; Wellman & Liu, 2004, for developmental sequences of theory-of-mind tasks): an unexpected location task in which the child was active in creating the deception; an unexpected-contents task; an appearance–reality distinction task; and a conceptual perspective-taking task. All tasks were administered at both time points.

Unexpected location (UL)

The unexpected location task, adapted from Baron-Cohen, Leslie, and Frith (1985) and Hala and Chandler (1996), involved asking the child to predict a person's behaviour that is based on a mistaken belief about the location of a hidden object. The experimenter showed the child three boxes. A second experimenter then entered the room and placed a toy in one of the three boxes. Experimenter 2 (E2) then left the room and the child was asked to move the object from one box to another while Experimenter 2 was out of the room. Two trials were presented and for each trial the child was asked two questions: “Where will E2 look for the toy when he comes back?” and “Where will E2 think the toy is?” Children received a score of 1 for each correct judgement of a false belief. The number of correct responses was summed to yield a total score for *unexpected location* that could range from 0 to 4. At age 3, 50% of children scored 0 and 4% scored the maximum of 4. At age 4, 19% of children scored 0 and 34% scored 4.

Unexpected contents (UC)

This task, developed by Astington and Gopnik (1988), assessed children's false-belief reasoning by asking them to identify their own and another character's belief about the contents of two containers. At 3 years, children were shown a band-aid box that contained blocks and a crayon box that contained spoons, and at 4 years children were shown a cereal box containing pencils and a bubble jar containing straws. First, the examiner presented the box and asked the child, “What do you think is in here?” The examiner then revealed the actual contents and asked, “Before we opened this, what did you think was in here?” Then, the examiner asked the child what a friend, who had not seen the actual contents of the box, would think was inside. Children earned a score of 1 for each correct answer summed across both trials (i.e., possible scores range from 0–4). At age 3, 44% of children scored 0 and 8% scored the maximum of 4. At age 4, 36% of children scored 0 and 23% scored 4.

Appearance–reality distinction (ART)

This task, developed by Flavell, Flavell, and Green (1983), assesses whether children can accurately describe differences between an object's real nature and its apparent nature when modified perceptually. Children were shown two realistic-looking imitation objects: a candle in the shape of an apple and an egg made of wood at age 3 and a pencil sharpener in the shape of a light bulb and an eraser in the shape of a crayon at age 4. Then the colour was modified by placing a sheet of blue tinted plastic in front of each of the objects, and the size was modified by using a large magnifying lens. Children were asked a series of questions about what the object looked like while modified (e.g., “Does it look blue or red?”, “Does it look like an apple or a candle?”, and “Does it look big or does it look little?”) and what the properties of the object *really* were (e.g., “Is it really, really blue or is it really, really red?”, “Is it really, really an apple or is it really, really a candle?”, and “Is it really, really big, or is it really, really little?”). Children received a score of 1 for each correct answer for each of these questions. The number of correct responses was summed separately across colour, object, and size domains: *appearance reality colour*; *appearance reality object*; and *appearance reality size*, to yield two scores each ranging from 0 to 4. A total sum score was computed for appearance reality distinction. At age 3, 1% of children scored 0 and 1% scored the maximum of 12. At age 4, 1% of children scored 0 and 5% scored 12.

Conceptual perspective taking (CPT)

The conceptual perspective-taking task is a theory-of-mind task that measures whether the child is able to take the perspective of others (Flavell, Everett, Croft, & Flavell, 1981; Taylor, 1988). Tasks are organised hierarchically into Level 1 tasks, in which children need only recognise that another person cannot always see the same things they can see, and Level 2 tasks, which require children to differentiate their own viewpoint about the same stimulus from the viewpoint of another person. At each lab visit, children were first presented with three Level 2 tasks in which two different pictures and a book were placed on the table in front of the child one at a time, alternating whether they were right-side-up to the child or to the experimenter. Children were asked two questions about the pictures that required them to consider the perspective of the experimenter (e.g., “What about me? When I look at the turtle, do I see the turtle standing on his feet or lying on his back?”). Following these tasks, one Level 1 task was administered in which children were shown a card with a different picture on each side. The card was then placed vertically between the child and the experimenter so that each could see the picture on only one side, and children were asked what the experimenter could see. The total *conceptual perspective-taking* score was the number of correct responses (range 0–7). At age 3, 6% of children scored 0 and 4% reached ceiling. At age 4, 5% of children scored 0 and 17% scored 7.

Language assessment

At each lab visit, children were administered the Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1997a,1997b). Standard scores derived from this measure at age 3 were used in all analyses to control for language ability, as language skills have been shown to be associated with both emotion understanding and theory-of-mind development (Cutting & Dunn, 1999).

Results

Preliminary analyses were conducted to examine the frequencies and distributions of study variables. Means, standard deviations, and ranges at 3 years and 4 years are displayed in Table 1 along with mean comparisons and correlations across the two ages. As expected, children's performance on all tasks improved significantly over one year, indicating developmental change in children's understanding of emotional and cognitive states from age 3 to age 4. Correlations from age 3 to age 4, an index of the stability of individual differences on tasks, were significant for all tasks except conceptual perspective taking.

Table 1. Descriptive data for study variables

	Time 1(3 years)			*Time 2 (4 years)*				
	M	***SD***	***Range***	***M***	***SD***	***Range***	***r***	***t***
Emotion understanding								
Labelling of emotions	11.84	3.40	0–16	14.40	1.75	5–16	.51**	13.23**
Affective perspective taking non-equivocal	5.07	2.11	0–8	7.04	1.56	1–8	.26**	13.90**
Affective perspective taking equivocal	7.10	2.90	0–12	9.72	2.16	2–12	.31**	13.91**
Knowledge of emotion causes	3.46	2.73	0–12	6.80	3.76	0–15	.51**	15.36**
Theory of mind								
Unexpected location	0.85	1.09	0–4	2.32	1.55	0–4	.19**	13.05**
Unexpected contents	1.12	1.28	0–4	1.70	1.64	0–4	.21**	5.10**
Appearance reality distinction	6.10	1.59	0–12	7.75	2.26	1–12	.30**	10.92**
Conceptual perspective taking	2.85	1.63	0–7	3.81	2.18	0–7	.09	5.69**

Note: ***p*<.01.

Additionally, Table 2 shows the zero-order correlations between all the tasks at age 3 (above the diagonal) and at age 4 (below the diagonal). The correlations within the four emotion-understanding tasks are fairly consistent across the two ages, but the theory-of-mind tasks tend to correlate more highly at age 4 than at age 3. Also, the correlations across domains are somewhat higher and more consistent at age 4.

Table 2. Correlations between emotion-understanding and theory-of-mind tasks at Time 1 (3 years) and Time 2 (4 years)

	1	***2***	***3***	***4***	***5***	***6***	***7***	***8***
1. Labelling of emotions	—	.41**	.47**	.48**	**.11**	**.04**	**.30****	**-.01**
2. APT non-equivocal	.37**	—	.53**	.38**	**.12**	**.09**	**.25****	**.01**
3. APT equivocal	.37**	.42**	—	.41**	**.16****	**.06**	**.19****	**-.02**
4. Emotion causes	.30**	.34**	.28**	—	**.15***	**.09**	**.33****	**.05**
5. Unexpected location	**.25****	**.27****	**.23****	**.31****	—	.21**	.20**	.03
6. Unexpected contents	**.13***	**.16***	**.22****	**.12**	.37**	—	.17**	.07
7. Appearance reality	**.20****	**.35****	**.19****	**.31****	.43**	.40**	—	.11
8. Conceptual perspective taking	**.19****	**.18****	**.08**	**.11**	.31**	.37**	.25**	—

Note: Correlations above the diagonal are Time 1 (age 3) variables. Correlations below the diagonal are Time 2 (age 4) variables. Correlations across domains are shown in **bold**. *p<.05; **p<.01.

Covariates

The relations between emotion-understanding tasks, theory-of-mind tasks, and demographic characteristics were examined to identify covariates. Initial correlations indicated that child ethnicity (dichotomised), gender, PPVT score, and family income-to-needs were consistently associated with both emotion-understanding and theory-of-mind scores, and thus these demographic variables were retained as controls. In addition, performance on the same task at age 3 was controlled to provide a stringent test of the effect of earlier acquisition of emotion understanding or theory of mind on growth in the other domain across a year.

Does emotion understanding predict change in theory of mind?

Four hierarchical multiple regression analyses were conducted to examine whether performance on the emotion-understanding tasks at age 3 predicts change in each of the theory-of-mind tasks between age 3 and age 4. Child ethnicity, gender, PPVT score, and family income-to-needs at age 3 were entered first as control variables. In the next block, 3-year performance on the task under consideration was entered. The set of emotion-understanding tasks at age 3 was entered as the final block. Results are shown in Table 3. The block of 3-year emotion-understanding tasks was a significant predictor of change for three of the four theory-of-mind tasks: unexpected contents, conceptual perspective taking and appearance–reality distinction. The exception was the unexpected location task. An examination of the individual emotion-understanding tasks indicated that the equivocal subscale of the affective perspective-taking task at age 3 predicted change in children's performance on both the unexpected-contents task and the appearance–reality task from age 3 to age 4 above and beyond the other emotion-understanding tasks. Labelling of emotions predicted change in children's performance on the conceptual perspective-taking task above and beyond the other emotion-understanding tasks.

Table 3. Hierarchical regressions predicting theory-of-mind tasks at Time 2 (4 years) from emotion-understanding tasks at Time 1 (3 years)

Unexpected contents				***Unexpected location***				***Conceptual perspective taking***				***Appearance reality***				
Variable	ΔR^2	***B***	***SE B***	**β**	ΔR^2	***B***	***SE B***	**β**	ΔR^2	***B***	***SE B***	**β**	ΔR^2	***B***	***SE B***	**β**
Block 1	.10**				.17**				.05*				.17**			
Child ethnicity		0.05	0.22	0.02		0.24	0.20	0.08		0.56	0.31	0.13		0.16	0.28	0.03
Child gender		–0.06	0.20	–0.02		–0.08	0.19	–0.03		0.34	0.28	0.08		–0.18	0.27	–0.04
PPVT score		0.01	0.01	0.06		0.03	0.01	0.28*		–0.01	0.01	–0.03		0.03	0.01	0.20*
Family income-to-needs ratio		0.12	0.06	0.13*		0.07	0.06	0.08		0.01	0.08	0.00		0.10	0.08	0.08
Block 2	.03*				.01				.00				.02*			

Unexpected contents				*Unexpected location*				*Conceptual perspective taking*				*Appearance reality*				
Variable	**Δ*R*** ^{2}	***B***	***SE B***	**β**	**Δ*R*** ^{2}	***B***	***SE B***	**β**	**Δ*R*** ^{2}	***B***	***SE B***	**β**	**Δ*R*** ^{2}	***B***	***SE B***	**β**
Age 3 theory-of-mind task performance		0.21	0.08	0.16*		0.15	0.09	0.11		0.11	0.09	0.08		0.15	0.09	0.10
Block 3	.04*				.01				.04*				.05*			
Labelling of emotions		0.03	0.04	0.06		–0.02	0.04	–0.04		0.12	0.06	0.17*		–0.04	0.06	–0.05
APT non-equivocal		–0.01	0.06	–0.02		0.06	0.05	0.07		0.15	0.08	0.14		0.05	0.08	0.05
APT equivocal		0.09	0.04	0.16*		0.03	0.04	0.06		–0.00	0.06	–0.01		0.14	0.06	0.18*
Emotion causes		0.06	0.05	0.10		0.01	0.04	0.02		0.01	0.06	0.01		0.09	0.06	0.12
Overall adjusted R^2	.12				.16				.06				.21			
Overall *F*	4.723 (9, 227)**				6.03 (9, 227)**				2.71 (9, 226)**				7.83 (9, 227)**			

Note: Results from the final block of hierarchical regressions reported. *$p < .05$; **$p < .01$.

Does theory of mind predict change in emotion understanding?

Hierarchical multiple regression analyses were also used to examine whether theory of mind at age 3 predicts change in emotion understanding between age 3 and 4. Again, child ethnicity, gender, PPVT score, and family income-to-needs at age 3 were included as controls in block 1, and the 3-year emotion-understanding score under consideration was entered in block 2. All four theory-of-mind tasks from the 3-year assessment were entered as a final block. The block of theory-of-mind tasks was not significant for labelling of emotions, ΔR^2=.01, $\Delta F(4, 227)$ = 0.36, p=.84, the non-equivocal subscale of the affective perspective taking measure, ΔR^2=.03,

$\Delta F(4, 227) = 2.25$, p=.07, the equivocal subscale, ΔR^2=.01, $\Delta F(4, 226) = 0.82$, p=.51, or emotion causes, ΔR^2=.02, $\Delta F(4, 227) = 1.26$, p=.29.

Discussion

The goal of this study was to examine the longitudinal relation between emotion understanding and theory of mind in children from age 3 to age 4. Our primary finding is that emotion understanding at age 3 predicts change in theory-of-mind task performance from age 3 to age 4, but age 3 theory-of-mind understanding does not predict change in emotion understanding across the same age period. Earlier work by Hughes and Dunn (1998) also found a developmental link between emotion understanding and theory of mind, but they were unable to test the reverse due to ceiling effects on emotion labelling. In addition, Harwood and Farrar (2006) found that 3- to 5-year-old children were able to perform better on an affective perspective-taking task than on theory-of-mind tasks.

In general, it was the entire set of emotion-understanding tasks rather than specific tasks that were significant predictors of theory-of-mind development. Within the set of tasks, the equivocal questions of the affective perspective-taking task uniquely predicted children's performance on the unexpected-contents task and the appearance–reality task. These results support and extend those observed by Harwood and Farrar (2006) among 3- to 5-year-old children in which they observed a relationship between the equivocal portion of the APT task and children's theory-of-mind performance. This relationship was not observed in their sample for the non-equivocal portion of the APT. The current study extends this work by looking at the relationship among children's performance on similar tasks longitudinally. Specifically, findings from the current study indicate that an initial appreciation of conflicting situations in the context of emotions may aid children developmentally in grasping that others' mental perspectives may differ from their own.

Additionally, children's ability to correctly recognise and label emotions uniquely predicted performance on the conceptual perspective task. Although it is not apparent why an ability to label emotions would be related to the ability to take another's visual perspective, it may be that labelling emotions is a basic ability indicative of a child's skill and tendency to cue into social interactions, including recognising emotional messages from others, which in turn gives them an advantage in understanding that others may have differing perspectives from their own.

These results suggest that children understand emotions prior to understanding mental states and that children with more sophisticated and earlier-emerging understanding of emotions will more readily acquire an understanding of false belief. It may be that emotions are easier for children to identify than mental states (Bartsch & Estes,1996; Dunn, 2000). Emotions are typically accompanied by internal physiological changes and outward facial expressions that are common across individuals. Although mental states may at times involve physiological or facial expression changes, such as increased arousal and a knitted brow when a person is thinking deeply, these potentially observable aspects are more subtle and less uniform across people and situations than the outward expression of emotions.

It may also be that those children who are aware of their own and others' emotions are more alert to social cues and more likely to notice discrepancies between their own and others' experiences, which may contribute to a growing understanding of the beliefs and desires that motivate others' actions. This notion is supported by work finding that very young children explain people's actions first in terms of emotions and desires and only later incorporate the idea of belief as an explanation (Bartsch & Wellman, 1995). Children who demonstrate an awareness of emotional states in themselves and others may elicit more discussion of all kinds of mental states from parents and other adults, which would in turn contribute to theory-of-mind understanding (Racine et al., 2007; Ruffman, Slade, & Crowe, 2002).

It is important to recognise that the results of the present study describe only the early emergence of theory of mind and emotion understanding skills. Other researchers, using samples of slightly older children, have reported findings suggesting that some aspects of false-belief understanding precede and contribute to emotion understanding. De Rosnay et al. (2004), for example, found that 4- to 6-year-old children were more accurate in predicting how another person would *act* than in predicting how that person would *feel*; they suggested that children need to acquire an understanding of belief prior to making accurate attributions of emotions to others. Similarly, Harris, Johnson, Hutton, Andrews, and Cooke (1989), in an experimental study, found that preschool-aged children predicted others' emotional reactions using concepts of belief and desire. Both de Rosnay et al. and Harris et al. used more complex reasoning tasks than those used in the present research and examined older children. Because the analyses in the present study cover only the time period between age 3 and age 4, we could not examine the potential transactional relations between the two types of tasks. A longer term longitudinal examination of the interplay between emotion understanding and theory-of-mind understanding is warranted to address this question.

Consistent with studies looking at the development of children's emotion understanding and theory of mind, children varied over this time period in their ability to master the tasks (Holmes et al., 1996; Pons & Harris, 2005; Wellman & Liu, 2004). Although one concern in prior research has been the issue of a majority of children reaching ceiling on particular tasks, this did not occur in the present study. The range of scores we observed indicates that the tasks were appropriate for children at these ages and tap real differences between individual children. Our goal was to examine the early emergence of these skills, and the 3- to 4-year time period appears to be the earliest age at which children can demonstrate their understanding, but not be at mastery. Despite the range of difficulty of tasks used in the present study, they still represent only basic aspects of emotion understanding and theory of mind. As noted above, different relations across domains may be found with a wider range of tasks and at older ages.

Additionally, in the present study, as has been found in past research, at both age 3 and age 4, children's performance on emotion-understanding tasks was generally higher than their performance on theory-of-mind tasks. Emotions have outward manifestations that are consistent within a culture, and therefore even young children have many opportunities to perceive the similarities between internal feeling states and facial expressions. Additionally, parents and other adults may be more likely to refer to emotions than to beliefs, thoughts, or ideas when talking with young children (LaBounty et al., 2008), thus helping children learn the labels for emotional states and map emotions onto situations. Conversations about cognitive states are likely to describe one's own thoughts ("I think it's time to go home", or "I wish it weren't raining") or ask about another's thoughts ("What do you think?") rather than explaining the complexities of situations in which two people think differently about a single event. Thus, children may more frequently be exposed to direct teaching about emotional states than about false belief and its consequences. Still, in the present sample, there was considerable variation in performance on both types of tasks. Some 3-year-old children were quite competent at the theory-of-mind tasks and some were not; some did very well on the emotion-understanding tasks and some did not. We also found that emotion-understanding and theory-of-mind task performance tended to be more consistently correlated at age 4 than at age 3. This suggests the possibility of a growing integration across these skills. Such an integration was proposed by Cutting and Dunn (1999), who saw the two types of abilities as related but distinguishable aspects of emerging social cognition. Further longitudinal work using more complex tasks would be of interest in learning more about children's social cognitive development.

The present study has a number of strengths and some limitations. The strengths include its relatively large and diverse sample of children, in contrast to much of the research in this area that has included primarily children from middle-class and advantaged families. Unlike Cutting and Dunn (1999), however, we did not find that family background variables used as controls (family income and ethnicity) were consistent predictors of children's performance on either emotion-understanding or theory-of-mind tasks. A second strength is the longitudinal design of the study, as we were able to administer the same tasks across two age points in the preschool period. This design allowed us to examine change from age 3 to age 4 in the emotion-understanding and theory-of-mind tasks. The tasks used in the present study included a range of different kinds of skills in both areas and were those most commonly used in studies of young children's emotion understanding and theory of mind. Use of these tasks allows comparison with prior studies and builds on an already existing base of knowledge. Nevertheless, it is possible that different results would have been obtained had different tasks been used.

Although emotion understanding was a significant predictor of change in children's theory-of-mind task performance, the overall amount of variance accounted for in the models tested was relatively small, ranging from 6 to 21%. Thus, there is considerably more to learn about the contributors to children's understanding of mental states. One possible avenue for future research would be to examine how parent–child discourse about emotions contributes to mental-state understanding, or to research how children's interactions with peers relates to later theory-of-mind development, particularly interactions that involve conflict and differences of opinion.

Results from this study suggest several avenues for future research. If, in fact, early understanding of one's own and others’ emotions forms the foundation for the initial acquisition of theory-of-mind understanding, then it is of importance to understand what child and family factors, and the transactions between them, contribute to the development of emotion understanding. As noted above, another important research focus for future studies is the developmental interconnections between understanding of emotions and understanding of thoughts, desires, and beliefs; as well as the usefulness of these skills as children negotiate increasingly challenging social situations. For example, it may be that children who are more advanced in reading others’ desires and emotions are better able to function successfully in the kindergarten and first-grade classroom, thus setting them on a trajectory of school success.

In sum, the present examination of children's understanding of emotions and mental states indicates the importance of early emotion knowledge. Continued work on the interrelations among emotional and cognitive domains and their combined role in both academic and social development of young children will be of value in informing early prevention and intervention programmes.

References

1. Astington, J. W. and Gopnik, A. 1988. “Knowing you've changed your mind: Children's understanding of representational change”. In *Developing theories of mind*, Edited by: Astington, J. W., Harris, P. L. and Olson, D. R.193–206. New York, NY: Cambridge University Press.

2. Baron-Cohen, S., Leslie, A. and Frith, U. 1985. Does the autistic child have a theory of mind?. *Cognition*, 21: 37–46.

3. Barrett, K. C. and Campos, J. J. 1987. “Perspectives on emotional development II: A functionalist approach to emotions”. In *Handbook of infant development*, 2nd ed, Edited by: Osofsky, J. D. 555–578. New York, NY: Wiley.

4. Bartsch, K. and Estes, D. 1996. Individual differences in children's developing theory of mind and implications for metacognition. *Learning and Individual Differences*, 8: 281–304.

5. Bartsch, K. and Wellman, H. M. 1995. *Children talk about the mind*, New York, NY: Oxford University Press.

6. Cutting, A. L. and Dunn, J. 1999. Theory of mind, emotion understanding, language, and family background: Individual differences and interrelations. *Child Development*, 70: 853–865.

7. de Rosnay, M., Pons, F., Harris, P. L. and Morrell, J. M. B. 2004. A lag between understanding false belief and emotion attribution in young children: Relationships with linguistic ability and mothers’ mental-state language. *British Journal of Developmental Psychology*, 22: 197–218.

8. Denham, S. A. 1986. Social cognition, prosocial behavior, and emotion in preschoolers: Contextual validation. *Child Development*, 57: 194–201.

9. Denham, S. A. and Couchoud, E. A. 1990. Young preschoolers’ understanding of emotions. *Child Study Journal*, 20: 171–192.

10. Denham, S. A., Zoller, D. and Couchoud, E. A. 1994. Socialization of preschoolers’ emotion understanding.*Developmental Psychology*, 30: 928–936.

11. Dunn, J. 2000. Mind-reading, emotion understanding, and relationships. *International Journal of Behavioral Development*, 24: 142–144.

12. Dunn, J., Brown, J., Slomkowski, C., Tesla, C. and Youngblade, L. 1991. Young children's understanding of other people's feelings and beliefs: Individual differences and their antecedents. *Child Development*, 62: 1352–1366.

13. Dunn , L. M. , & Dunn , L. M. 1997a . *Examiner's manual for the PPVT-III Peabody Picture Vocabulary Test* (3rd ed.) . Circle Pines, MN : American Guidance Service .

14. Dunn , L. M. , & Dunn , L. M. 1997b . *Norms booklet for the PPVT-III Peabody Picture Vocabulary Test* 3rd ed. . Circle Pines, MN : American Guidance Service .

15. Flavell, J. H., Everett, B. A., Croft, K. and Flavell, E. R. 1981. Young children's knowledge about visual perception: Further evidence for the Level 1–Level 2 distinction. *Developmental Psychology*, 17: 99–103.

16. Flavell, J. H., Flavell, E. R. and Green, F. L. 1983. Development of the appearance–reality distinction. *Cognitive Psychology*, 15: 95–120.

17. Hala, S. and Chandler, M. 1996. The role of strategic planning in accessing false-belief understanding. *Child Development*, 67: 2948–2966.

18. Harris, P. L., Johnson, C. N., Hutton, D., Andrews, G. and Cooke, T. 1989. Young children's theory of mind and emotion. *Cognition and Emotion*, 3: 379–400.

19. Harwood, M. D. and Farrar, M. J. 2006. Conflicting emotions: The connection between affective perspective taking and theory of mind. *British Journal of Developmental Psychology*, 24: 401–418.

20. Holmes, H. A., Black, C. and Miller, S. A. 1996. A cross-task comparison of false belief understanding in a Head Start population. *Journal of Experimental Child Psychology*, 63: 263–285.

21. Hughes, C. and Dunn, J. 1998. Understanding mind and emotion: Longitudinal associations with mental-state talk between young friends. *Developmental Psychology*, 34: 1026–1037.

22. Hughes, C., Dunn, J. and White, A. 1998. Trick or treat? Uneven understanding of mind and emotion and executive dysfunction in “hard-to-manage” preschoolers. *Journal of Child Psychology and Psychiatry*, 39: 981–994.

23. Izard, C. E., King, K. A., Trentacosta, C. J., Morgan, J. K., Laurenceau, J.-P.Krauthamer-Ewing, E. S. 2008. Accelerating the development of emotion competence in Head Start children: Effects on adaptive and maladaptive behavior. *Development and Psychopathology*, 20: 369–397.

24. LaBounty, J., Wellman, H. M., Olson, S., Lagattuta, K. and Liu, D. 2008. Mothers’ and fathers’ use of internal state talk with their young children. *Social Development*, 17: 757–775.

25. Pons, F. and Harris, P. 2005. Longitudinal change and longitudinal stability of individual differences in children's emotion understanding. *Cognition and Emotion*, 19: 1158–1174.

26. Racine, T. P., Carpendale, J. I. M. and Turnbull, W. 2007. Parent–child talk and children's understanding of beliefs and emotions. *Cognition and Emotion*, 21: 480–494.

27. Ruffman, T., Slade, L. and Crowe, E. 2002. The relation between children's and mother's mental state language and theory-of-mind understanding. *Child Development*, 73: 734–751.

28. Stein, N. L. and Jewett, J. L. 1986. “A conceptual analysis of the meaning of negative emotions: Implications for a theory of development”. In *Measuring emotions in infants and children: Vol. 2. Cambridge studies in social and emotional development*, Edited by: Izard, C. E. and Read, P. B. 238–267. New York, NY: Cambridge University Press.

29. Taylor, M. 1988. Conceptual perspective taking: Children's ability to distinguish what they know from what they see. *Child Development*, 59: 703–718.

30. Weimer, A. A. and Guajardo, N. R. 2005. False belief, emotion understanding, and social skills among head start and non-head start children. *Early Education & Development*, 16: 341–366.

31. Wellman, H. M., Cross, D. and Watson, J. 2001. Meta-analysis of theory-of-mind development: The truth about false-belief. *Child Development*, 72: 655–684.

32. Wellman, H. M. and Liu, D. 2004. Scaling of theory-of-mind tasks. *Child Development*, 75: 523–541.