REFERENCE No. RES-000-23-0278

Report on research

- **Background**

The ESRC-supported SUMS projects (Social understanding and mental state talk) have involved the intensive longitudinal study up to 80 children between the ages of 3 to 12, using interviews, questionnaires, assessments of social understanding (SU) and observation of mental state (MS) talk between mothers and children through childhood. Children's exposure to, and engagement with, mothers' talk about mental states (i.e., mothers' talk about thoughts, desires and feelings) has been shown to be a powerful predictor of their later theory-of mind development (e.g., Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991; Meins et al, 2002, Meins et al 2003; Ruffman, Slade, & Crowe, 2002). SUMS has been one of most frequently-cited studies in this area and because of its cross-lagged design, has provided evidence for causal relations between early mother mental state talk and children's later social understanding, independently of the child's initial level of social understanding and language, mother's education and mother's general language skill. We have pinpointed a specific role for mental state talk and this has enabled further work examining the ways that mothers seem to tailor their mental state vocabulary to stretch the particular capacities of their child (Ruffman & Taumoepeau, 2007). The newer work points to the role of Vygotsky's zone of proximal development as a framework for understanding how maternal talk about specific mental states scaffolds the development of children's later social understanding, and suggests that there are important distinctions between talk about beliefs and desires, and about own and others' mental states.

- **Aims and objectives**

The latest 3-year phase of the SUMS study had three main objectives.

1. Assessing causal relations between MS talk and child SU in middle childhood

We wanted to assess the pattern of relations between mother MS talk and child SU over a longer time period than has previously been studied. Do mother mental state utterances when children were 3 years old still facilitate social understanding five to eight years later? By keeping to our cross-lagged design (i.e., collecting measures of all key variables at each time point) we could partial out the effects of potentially mediating variables so that causal claims can be tested. We also looked at the relations between early SU and later child behaviour, in keeping with analyses we performed on the earlier data sets. We have met this objective and the results raise new questions, as discussed in more detail below.

2. Examining the role of mothers' MS talk in child SU, in comparison to mothers' SU and general ability

The second aim concerns the correlates of child SU. Two important correlates of children's SU are general language ability (e.g., Astington & Jenkins, 1999) and mothers' MS talk (e.g., Dunn et al., 1991; Ruffman et al., 2002). More mother MS talk might indicate that mothers have advanced SU, or it might be unrelated to mothers' SU, given

that the pictures mothers described for our MS talk measure do not require deep social insights.

To investigate these issues we tested mothers' general language ability and mothers' task-based SU. These measures help to determine whether mother mental state responses are a facet of mothers' broader social insights and IQ, or whether mother mental state utterances are uniquely related to children's SU task performance even after accounting for mothers' general language and task-based SU.

We achieved this objective by examining these variables over three new time points. Since mother SU and language should be relatively constant from the time when children were first tested at Time 1, we also re-examined our earlier data (Ruffman et al., 2002), to see whether mother mental state utterances at Time 1 predicted SU in children at Time 3, having partialled out mother general language (IQ) and task-based SU from the new time points. These data provide us with very strong evidence for evaluating causality. Further details are given below.

3. Assessing SU in middle childhood

The third aim of the project used the opportunity of assessing SU in middle childhood: not only is this period relatively less well understood, with fewer agreed tasks, but there is also no longitudinal evidence linking SU in early and middle childhood. We were particularly interested in developing suitable measures of SU at this age, and the data set gives us an important and unique opportunity to assess the correlations of these measures with more established measures of earlier SU, and with mothers' SU and MS talk. For most of our tasks, we included components that required mental state understanding and control components that involved social understanding but a low or non-existent level of mental state understanding. We achieved this multi-part objective, and in addition, the tasks have been useful for studies of SU in other populations (e.g. in the elderly: Sullivan, Ruffman & Hutton, 2007).

- **Methods**

We visited the families in our original sample on 3 occasions as planned, collecting data as shown in Table 1, which also shows the previous time points. Dr Sullivan made all the visits personally and each visit lasted about 90-120 minutes.

Sample: We retained 57 of the original sample of 82, and their main characteristics are summarised in Table 2. Some families dropped out at one or more time points because of child or parent illness, or moving too far away from the area, but we did re-contact some families who had dropped out from earlier time points, and our sample is still large enough to perform the analyses we planned. We maintain contact with the sample and every one of the 57 interviewed at the last time point has expressed willingness to be visited again.

Data Management. We recorded data in different ways according to its nature: for questionnaires and structured stories, responses were written down, while for language and interaction tasks we used videotape. Questionnaire tasks were scored from response sheets and structured stories from audiotapes. Videotaped tasks were, if necessary for coding, transcribed and subject to a range of different coding techniques, either derived

from our earlier work or developed specifically for new tasks. We ensured continuity by using coders from previous time points, either to do the coding or to train new coders, and we always double-coded a subset of data. All coding that we report here and for publication has adequate inter-rater agreement.

We have also performed a large amount of data archiving. Given that video formats and other recording technology have changed over the 9 years of data collection on this sample, we have now archived all the data so that videotape footage is digitised and archived, with 2 copies in separate locations. Because of major moves of labs and offices during the grant period, we have also taken the opportunity to archive paper files. We prioritised the archiving because the RF who collected all the data, Sue Sullivan, was to go on maternity leave and we needed to ensure that all data was fully documented, and that we had full instructions on the location and organisation of everything related to the grant (paper, electronic data, database of participants, materials, toys and props used, coding schemes, identity and contact details of coders).

We largely carried out the study as in the original proposal: there were no major changes. For ease of reference to this large and complex data set, Table 1 (Appendix 1) outlines all the time points over the entire project, the tasks used, the numbers and ages of children. The current project covers Time Points 4 to 6 but we have also analysed the newer data in relation to the older data.

- **Results**

We have organised discussion of the results according to the three main objectives, and this section is best read with reference to Table 1.

1. Assessing causal relations between MS talk and child SU in middle childhood

Our earlier data provided the first evidence of causal relations between early mother MS talk and later child SU. We used the new data set to see if early mother MS talk still predicted child ToM in middle childhood. For these analyses, the mean age of children at each time point is listed in Table 1.

There were no consistent relations between early (Times 1 to 3) mother MS talk and later child ToM (times 4 to 6, using a global measure of ToM). These analyses have been carried out with absolute frequency of mother MS talk, with percentages (of total mother utterances), and by splitting MS talk into five sub-types (emotion, desire, think-know, modulations of assertions, other mental states). However, mother mental state talk does correlate significantly over the previous and the new time points. In other words, mothers who use lots of MS talk at early time points also do so at later time points. Also, early measures of child ToM show low but generally significant correlations over time, and child mental state talk showed a significant correlation between the ages of 3 and 9, which remained significant after accounting for child's current age, current language, earlier language and parent education level. All these findings suggest stability in measures of child ToM and mother mental state language over time.

At Times 1 to 3, children's performance on the different ToM tasks (i.e., emotion tasks and tasks tapping knowledge or belief understanding) tended to intercorrelate both within and across time, but the same was not true at Times 4 to 6. Indeed, by and large, performance on the different tasks at Times 4 to 6 did not correlate significantly. This

meant it was not possible to create such clear composite measures of ToM at Times 4 to 6, unlike the earlier time points, and it meant that analyses examining early mother MS talk and later child ToM had to be based on individual ToM tasks at times 4 to 6

There is also some suggestion at the new time points of a general pattern: measures assessing epistemic aspects of ToM intercorrelate, and measures involving more basic emotion recognition also intercorrelate, but these two aspects of social understanding are somewhat distinct from each other. It is possible, therefore, that aspects of social understanding fractionate at some point during early to middle childhood, with emotional aspects of understanding diverging from the conceptual understanding of belief. Previous findings in this area with pre-school aged children are contradictory. Some findings suggest a developmental link between the two aspects (e.g., Hughes & Dunn, 1998; Harwood & Farrar, 2006) whereas others report that variance in false-belief understanding does not contribute independently to variance in emotion understanding (e.g., Cutting & Dunn, 1999). For work in preparation (Yuill et al, 2007), we have divided tasks at age 3 and age 9 into emotion recognition (ER) and ToM tasks. Within each domain, tasks intercorrelate over time, suggesting that we are tapping relatively stable aspects of ability. More interestingly, it appears that early ToM predicts later ER (after accounting for children's age and language ability), but early ER does not predict later ToM. However, this possibility requires more analysis before a firm conclusion is reached.

An additional aspect of the first objective was to look at relations between SU, MS talk, and behaviour. We have found in earlier time points that mothers' mental state talk predicts some aspects of children's behaviour (less conflict and more cooperation), and that mother MS talk explains additional variance in child behaviour to her personal style (warmth of parenting style: Ruffman, Slade, Devitt & Crowe, 2006). In the current time points, we included behavioural observations of mother-child cooperation and conflict at each time point and successfully adapted our previous coding for the measures, which we adapted to the older age of the children. We observed mothers and children interacting with one another as they tried to race a car around a course. They had to rely on each other because a two-lever remote control controlled the car and each person had control of one lever. Thus, one controlled the forward and backward movement of the car, and the other controlled the sideways movement. Interestingly and unexpectedly, doing better on ToM tasks at an early age tends to be associated with more negative behaviour from the child to the mother and the mother to the child. That is, children with higher ToM scores tended to show less positive behaviour, more negative behaviour and less dyadic turn-taking. This was true between Times 1 to 3 and Times 4 to 6. This finding may support Happe and Frith's (1996) claim that sophisticated ToM can be used for good or ill, and is reminiscent of findings that bullies sometimes have a more sophisticated understanding of mind

2. Examining the role of mothers' MS talk in child SU in comparison to mothers' SU and general ability

We have previously shown that mothers' MS talk facilitates children's SU independently of mothers' non-mental state utterances and their socio-economic status (Ruffman et al., 2002). However, no one had examined mother mental state utterances while accounting for mothers' task-based SU. We included a wide range of SU tasks for the mother, including the Eyes task, understanding of faux pas stories, video interactions and cartoons involving mental states, and emotion recognition. Nor has anyone considered mothers' general language ability (i.e., vocabulary), one of the best predictors of overall IQ. Mothers' non-mental state utterances (descriptions of pictures) might be very different to general language

ability, and do not clearly tap IQ. For these reasons, we examined whether mother MS talk relates to later child ToM even after accounting for mother vocabulary and task-based SU.

We found significant correlations between mother MS talk at Times 4 and 5 and later child ToM. However, mother task performance tended to be an equal or even more consistent correlate of both child ToM and child behaviour (e.g., on the mother-child interaction task). Neither variable predicted independent variance, indicating that at these later ages, mother MS talk did not have an independent effect on child ToM or behaviour, but neither was mother task performance or vocabulary uniquely related to child ToM or behaviour.

Our original results showed that early mother MS talk correlates with later child ToM, independent of a range of potentially confounding factors. We aimed to see whether this relation would hold even when we consider mother performance on the ToM tasks. Originally, there were three sets of correlations and at all three time points, early mother MS talk was a significant correlate of later child ToM. We found the same pattern in 2 out of 3 of our new time points, when accounting for mother vocabulary (at Times 4 and 6) and mother emotion recognition at Time 4. These three variables were the only parent ability variables that correlated significantly with child ToM at Times 1-3, which is why they were included. This is an intriguing result in need of replication, but suggests that early mother MS talk exerts a unique influence on child ToM independently of mother general vocabulary and her own performance on ToM tasks.

3. Assessing SU in middle childhood

The third general aim was to develop and test new tasks of SU and ToM suitable for use in middle childhood. The results for individual tasks suggest that our new tasks fulfilled their intended purpose. For instance, we developed two new tasks: the danger task had participants rate the dangerousness of faces already pre-tested in other populations, and the faux pas task used clips of embarrassing versus non-embarrassing situations based on the TV comedy 'The Office'. Both children and parents performed significantly above chance on the danger task, and they rated the faux pas scenarios as more embarrassing than the non-faux pas scenarios, as well as showing good understanding of the situations. Interestingly, at the final time point adults were not significantly better than children. The results show that the tasks were suitable for their intended purpose, with no ceiling effects. The failure to obtain correlations of these tasks as a whole with early mother MS talk therefore does not seem to be due to obvious problems in the tasks.

- **Analyses to date**

By the end of the grant we had transcribed, coded, input and archived all the data, together with archiving and some additional coding and checking of data from previous time points. Given space limitations and the size and complexity of the data set (1200 basic variables for up to 83 participants, with additional files where new variables have been created), the current report is a preliminary summary, but data analysis will be continuing, particularly in view of new questions arising in the literature which our data can address,

such as the role of earlier mother scaffolding on child's later performance, and the possible distinction between theory of mind and emotion recognition measures.

- **Activities**

In addition to the conference activities reported on Society Today, we regularly report on results to a regional group of educational psychologists and education professionals. The participants have also been sent reports after each time point. Our work has also been very useful in supporting and cross-fertilising with our various related areas of research, as mentioned earlier, in relation to early scaffolding, the elderly, and the role of syntax and semantics in theory of mind understanding.

- **Outputs**

Some of our findings were either not significant (e.g., the relation between early mother MS talk and overall child ToM at times 4, 5 and 6) or were somewhat counter-intuitive and in need of replication (e.g., the relation between better child ToM at early time points and more negative mother-child interactions at times 4, 5 and 6). For these reasons we have not as yet published all our planned papers arising from the later time points. However, in addition to the outputs in the main journals and special issues, recorded on Society Today, we have several papers in preparation, as shown below, to be submitted variously to Child Development, Social Development, British Journal of Developmental Psychology.

In some cases, the fact that we have some null results for our main hypotheses means that we have to be cautious and perform further investigation before publishing our results. We do not think that problems in data collection or task choice explain these null results, for the reasons mentioned above, but there is a clear onus to investigate other reasons for such results.

Slade, L. & Ruffman, T. (manuscript). Mother and child talk: The relative contributions of syntax, semantics and mental state terms to children's theory of mind.

Slade, L. & Ruffman, T.(manuscript.) Authoritative or mind-minded? A longitudinal study of mothers' parenting style and children's theory-of-mind development.

Yuill, N., Sullivan, S., Ruffman, T. & Slade, L. (manuscript). Emotion recognition and theory of mind in middle childhood: Relations with earlier measures of belief and emotion understanding.

We expect to have additional papers in preparation when we have completed fuller data analyses allowing us to relate the recent time points to earlier ones.

Publications arising across several time points include:

Ruffman, T., Slade, L., Devitt, K & Crowe, E. (2006). What mothers say and what they do: The relation between parenting, theory of mind, language and conflict/cooperation. *British Journal of Developmental Psychology*, *24*, 105-124.

Ruffman, T., Slade, L., Rowlandson, K., Rumsey, C. & Garnham, A. (2003). How language relates to belief, desire and emotion understanding. *Cognitive Development, 18*, 139-158.

Ruffman, T., Slade, L., & Crowe, E. (2002). The relation between children's and mothers' mental state language and theory of mind understanding. *Child Development, 73*, 734-751.

Ruffman, T. (2004). Children's understanding of mind: Constructivist but theory-like. *Behavioral and Brain Sciences, 27*, 120.

Slade, L. & Ruffman, T. (2005). How language does (and does not) relate to theory of mind: A longitudinal study of syntax, semantics, working memory and false belief. *British Journal of Developmental Psychology*, *23,* 117-141.

Selected presentations

Sullivan, S., Yuill, N. Ruffman, T. & Slade, L. (2007). Emotion recognition and Theory of Mind abilities in middle childhood: relation to earlier measures of belief and emotion understanding. Jean Piaget Society Conference on Developmental Cognitive Neuroscience, Amsterdam.

Yuill, N. & Coultas, J. (2007) The relation between emotion recognition and social experience in early adolescence. Jean Piaget Society Conference on Developmental Cognitive Neuroscience, Amsterdam.

Yuill,N., Sullivan,S., Ruffman, T. & Slade, L. (2007). Continuity from 3 to 11 Years in Children's Theory of Mind and Mental State Talk. European Society for Developmental Psychology, Jena, Germany.

Yuill, N. (2005, and 2007 update) Social understanding and mental states: the longitudinal study of mothers' conversations and children's understanding of mind. Educational Psychology Research Interest Group, East Sussex, UK.

- **Impacts**

We have generated considerable interest in education professionals for our findings about the role of early mother mental state talk in the development of children's social understanding. The main aim of the project was to look for these relations, rather than to investigate their potential for educating parents, but our results would provide useful information for studies into parent education: more work would need to be done on whether mental state use can be simply trained, or whether it might emerge from other means of support for parents talking to and interacting with their children.

- **Future Research Priorities**

It is clear that mothers' talk about mental states has an influence on children's social understanding. It would be useful to know how important this influence is in comparison

to other influences, other than those we have already looked at, such as language skills in mother and child. This would have practical applications. If mental state talk is an important contributor compared to other influences, it may be a trainable skill, and we have many concrete examples of its use in daily interaction. However, the question is what other mother characteristics might be responsible aside from mother MS talk. Thus far, at least at preschool ages, our findings suggest a range of potential confounds are not responsible for the mother MS talk – child ToM relation. This includes mother general style (e.g., warmth: Ruffman et al., 2006), mother SES and general talk (Ruffman et al., 2002), mother vocabulary and ToM (present study). It is not immediately clear what other variables might be important. The use of mother MS talk might therefore be a focus for the development of training for those caring for and working with children, an area of great current topicality. It would also be of great interest to see the consequences of good mental state talk in the development of adolescents and as the sample we have followed become parents and carers themselves, so as to look at intergenerational transmission of mental state capabilities.

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Sullivan, S., Ruffman, T. & Hutton, S. (2007) Age Differences in Emotion Recognition Skills and the Visual Scanning of Emotion Faces. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences 62:P53-P60.*

Taumoepeau, M. & Ruffman, T. (2006) Mother and Infant Talk About Mental States Relates to Desire Language and Emotion Understanding. *Child Development, 77,* 465-481.

Yuill, N., Sullivan, S., Ruffman, T. & Slade, L. (manuscript). Emotion recognition and theory of mind in middle childhood: Relations with earlier measures of belief and emotion understanding. University of Sussex.

Appendix 1: Table 1: Summary of measures at all time points in longitudinal study, with ages of children and sample sizes

	Time point 1 (2 visits) n=82 mean age = 3.01	**Time point 2** (1 visit) n=79 mean age = 3.41	**Time point 3** (1 visit) n= 72 mean age = 4.04
Language Tasks/IQ	(i) CELF: linguistic concepts (ii) CELF: sentence structure (iii) BPVS: vocabulary test (iv) WIPPSI: information subtest	(i) CELF: linguistic concepts (ii) WIPPSI: information subtest (iii) WIPPSI: comprehension subtest (iv) WIPPSI: non-verbal IQ subtest	(i) CELF: linguistic concepts (ii) BPVS: vocabulary test (iii) WIPPSI: non-verbal picture completion subtest (iv) WIPPSI: comprehension subtest
Questionnaires	(i) Parenting Style (Robinson et al) (ii) Temperament (Rothbart) (iii) Conscience (Kochanska) (iv) "How Feel" (Ruffman, 1999) (v) SES/Sibling (background measures)	(i) "EdGed": Real World Behaviour based on Vineland et al. (similar to SDQ) (ii) "How Feel" (Ruffman) (iii) SES/sibling (background measures)	(i) Parenting Style (Robinson et al) (ii) Temperament (Rothbart) (iii) Conscience (Kochanska) (iv) "How Feel" (Ruffman, 1999) (v) SES/Sibling (background measures)
Theory of Mind Tasks (incl. The TIM)	(i)False-belief translocation (ii) Emotion understanding (an affective perspective taking task) (iii) Desire reasoning (Wellman & Wooley) (iv)Desire action (Wellman &W) (v)Pretend Play Comprehension (taken from Harris & Kavanaugh) (vi)the TIM (vii) "naughty monkey" : puppets, video (viii) Pretend play production (Jarrold & Boucher) (viiii) the TIM	(i) False-belief translocation (ii) False-belief contents other (iii) Desire action (iv) Desire emotion (v) the TIM	(i) False belief translocation (ii) Translocation justification (iii) False-belief contents other (iv) Contents other justification (v) False-belief contents self (vi) Ambiguity (vii) Wicked desires (Yuill) (viii) the TIM

Play Observations	Free Play – dressing up and the use of functional toys: video footage.		Free Play with friend – functional (10 mins) and dressing-up (10 mins)
Conflict and Co-operation Tasks	Etch-A-Sketch: mother also child and child's friend who, together, have to draw a triangle and a square. Video footage.		Etch-A-Sketch

	Time point 4 (1 visit) n=54 **mean age = 9.12 years** **range = 7.98 to 10.74**	**Time point 5(1 visit) n=54** **mean age = 10.80 years** **range = 9.60 to 12.01**	**Time point 6(1 visit) n=57** **mean age=12.00** **range=10.90 to 13.29**
Language Tasks/IQ	(i) BPVS (child) (ii) PPVT (mother)	(i) BPVS (child)	(i)BPVS (child) (ii)PPVT (mother)
Questionnaires		(i) SDQ (ii) Rating task: parent rates clips of children being naughty: to be tied to the SDQ ratings.	(i) Cambridge Friendship Questionnaire 35 items for parent, rating friendship empathy, etc. (ii) Cambridge Behaviour Scale (Empathy) 60 items for parent (iii) Parent Coping Questionnaire 21 item parent coping style (iv) Child Coping Questionnaire – 6 stories rated as cognitive or non-cog. coping strategy

			reported (v) Child Harter Self Concept Questionnaire – 6 item (vi) Child self-efficacy questionnaire – 8 items
Theory of Mind Tasks/Emotion Tasks (incl. The TIM)	(i) the TIM (ii) Emotion Recognition (child): blank in context versus full faces, 6 emotions x 2 items (iii) Child eye task (BaronCohen)/28 (iv) Parent eye task (BaronCohen)/36 (v) Emotion recognition (parent): 6 emotions x 4 items (vi) Emotion recognition (parent): emotion matching task 6 emotions x 4/non-emotion matching task (24 items) (vii) Stories: 10 TOM stories: faux pas, sarcasm, display rules (child): (viii) Implicit emotion recognition task (child) 24 items	(i) the TIM (ii) Child eye task/28 (iii) Parent eye task/36 (iv) Emotion recognition (child): video task (Sullivan & Ruffman, 2002) (v) Emotion recognition (parent): video task/13 (vi) Trust task (child & parent)/18 (vii) Faux Pas task (child & parent): clips from The Office, explain faux pas vs control (5 items each, scored /3) (viii) Cartoons (parent) : Happe's mental and non-mental state cartoons each /12 (ix) Stories: new selection of 10 TOM, faux pas and sarcasm stories (child)	(i) the TIM (ii) Child eye task/28 (iii) Parent eye task/36 (iv) Parent emotion recognition (48 items) (v) Child Emotion recognition (48 items) (vi) Parent danger situations (/3) and faces (/30) (vii) Child danger situations and faces, as parent (viii) Parent Interpersonal Perception Task (10 video clips w questions) (ix) Child Interpersonal Perception Task (10 video clips w questions)
Conflict and Co-operation Tasks	Car Obstacle course: mum/child joint control of car on track. Coding criteria based on previous Etch-A-Sketch coding: comparable task as involves co-operation between mother and child.	Car Obstacle Course: as before, ratings /10 on affect, control, etc.	Jigsaw Task (mum/child joint solving jigsaw), coding criteria based on Etch-A-Sketch and car tasks
Status of data:	All coded, input, archived	All coded, input, archived	All coded, input, archived

N.B. Not all children had complete data for all tasks across time points and, therefore, the *n* in individual analyses varies across tasks and manuscripts.

Abbreviations:

CELF: Clinical Evaluation of Language Fundamentals.
BPVS: British Picture Vocabulary Scale (standard measure of child vocabulary)
PPVT: Peabody Picture Vocabulary Test (standard measure for adults)
WIPPSI Wechsler Preschool and Primary Scale of Intelligence
SDQ: Strengths and Difficulties Questionnaire (standard questionnaire, mother report on aspects of child behaviour, e.g. prosocial, emotionality)
Etch-a-Sketch: child's drawing toy used in task that requires coordinated action between two people
TIM: Thorpe Interaction Measure: a series of photos, mostly involving people and interactions, for mother to discuss with child. Mother and child speech is scored for use of various different types of mental state terms, e.g. beliefs, desires.
SES: Socio-economic status