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BEHAVIOUR OF MOTHERS AND INFANTS WITH AND WITHOUT DOWN SYNDROME DURING THE 'STILL-FACE' PROCEDURE

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Abstract

There has been limited study of how the constitutional characteristics of infants with Down Syndrome (DS) influence the patterning of their relations with caregivers. To assess natural and 'perturbed' interactions between infants with DS and their mothers, we tested 10 six-month-old infants with DS and 20 typically developing (TD) four-month-old infants of similar mental age. Participants were videotaped with their mothers in a natural face-to-face interaction, a brief period when the mothers adopted a still-face, and a subsequent re-engagement phase. There was little to distinguish the infants in the initial phase of natural interaction, but the mothers of infants with DS were more likely to show 'assertive warmth', and unlike in the case of mothers of TD infants, high maternal directiveness tended to be associated with lower levels of infant looking and lack of fussing. During the still-face episode, infants of both groups showed reduced looking and smiling, though infants with DS tended to show lower levels of fussing and fewer of this group showed fussing in the re-engagement phase. Therefore DS infants were somewhat similar to TD infants of comparable mental age in being responsive to the still-face procedure, but showed indications of group differences in intense emotional reactivity.

Infants with DS show general delays in cognitive development and specific differences in motor functioning, phonological short-term memory, and aspects of language (see Chapman & Hesketh, 2000). They also have specific difficulties in controlling their attention compared to typical infants, showing longer overall durations of looking at attractive static stimuli, but having difficulties in maintaining attention to dynamic events (see Gunn, Berry & Andrews, 1982, Krakow & Kopp, 1982; Karrer, Karrer, Bloom, Chaney & Davis, 1998; Miranda & Fantz, 1973; Zelazo & Stack 1997). Furthermore, while reported to be highly sociable, infants with DS are often 'dampened' in their emotional responsiveness (Emde, Katz & Thorpe, 1978). A key area of investigation is the extent to which differences in the responsiveness of these infants lead to differences in the quality of interactions with their mothers, and how this impacts on subsequent social and language development. More detailed investigations of these processes may help reveal potential strategies for intervention.

To explore these issues we employed the 'still-face' procedure of Tronick, Als, Adamson, Wise, and Brazelton (1978; Tronick, 2003) to assess the nature of to-and-fro exchanges between DS infants and their mothers, and infants' reactions when mothers ceased to be responsive. The procedure involves an initial phase during which styles of interaction can be assessed, a still-face phase during which the mothers adopt an unresponsive stance, and a recovery phase during which the mother and infant re-engage in interaction. The responses that typical infants show over the three phases demonstrate they are able to regulate their own attention and affect in social interactions and have developed expectations about their mother's behaviour. In the still-face phase typical infants will try and engage their mothers. When this fails they show reduced levels of smiling and looking and an increase in negative affect and self-comforting behaviours (Adamson & Frick, 2003; Toda & Fogel, 1993). During the re-engagement phase, typical infants show 'wariness' and do not immediately return to the same levels of looking and smiling and may continue to fuss (Kogan & Carter, 1996).

There have been relatively few studies of the responses of infants with DS to still-face scenarios. Berger & Cunningham (1981, 1986), in the home, studied the responses of five infants with DS, up to six months of age, during two-minute periods of mother-infant interaction and maternal immobility. Although infants with DS showed different durations of eye-contact when compared with typical infants of the same CA, they did show less looking to their mothers' immobile face than their mobile face from four months onwards. Smiling, however, was little affected compared to controls and the amount of smiling during the mobile condition was less. Thus, while infants with DS seem to be affected by the still-face

episode they may have different emotional responses. These results are compatible with those from a study by Carvajal & Iglesias (1997) who examined smiling during a still-face episode and found that infants with DS showed a small and non-significant reduction during the passive phase.

Legerstee & Bowman (1989) examined the looking and smiling responses of eight infants with DS from 8 through to 48 weeks of age during episodes with mother, a stranger, and a puppet. From around four months of age (two months later than TD infants), infants with DS showed significantly less smiling (around 18-22 weeks) during episodes of adult passivity (but not for the contingent puppet), and from five months of age (22-24 weeks) infants with DS showed clear gaze aversion. So, at least from four months onwards, there is some evidence that maternal passivity has an effect on the looking behaviour of infants with DS and, although delayed in onset, infants with DS appear to develop expectations about contingent interactions with people despite their attentional problems. However there are also indications that the still-face procedure may have a lessened impact on the emotional state of infants with DS.

The first aim of this study was to explore more fully the responses of infants with DS to the still-face procedure. No study of infants with DS has simultaneously reported infant looking, smiling and fussing, nor looked at continuities and carry-over effects over the three phases of the procedure. The second aim was to examine the relationships between infant and maternal behaviour. There is reason to believe that interactional styles adopted by mothers of infants with DS may differ in some respects from that of typical mothers. Mothers of toddlers with DS have been reported to work harder to attract the attention of their infants, and are more likely to show high levels of affect and be more directive when engaging in triadic interactions (Buckhalt, Rutherford & Goldberg, 1978; Cielinski, Vaughn, Seifer & Contreras, 1995 Legerstee, Varghese, and van Beek, 2002). We wished to see if this style was also evident in these younger infants with DS during face-to-face interactions and to examine the extent to which this style might be acting as a ‘buffer’ and compensating for infants’ atypical patterns of attentiveness or passivity (Jasnow, Crown, Feldstein et al., 1988).

Our first hypothesis was derived from the evidence already cited, and partly from a view of the structure of intersubjective engagement. As the still-face constitutes a significant disruption in the patterned interactions that typically accompany intersubjective experience; and since caregivers report relatively little impediment in achieving psychological engagement with infants with DS (although possibly requiring more ‘effort’), we considered it consistent with findings from earlier studies that they would respond to a disengagement of

this kind in a meaningful way. However we also recognised that infants with DS may be somewhat atypical in their emotional intensity and may show ‘dampened’ emotional responsiveness.

Therefore, we predicted that 6-month-old infants with DS would be like 4-month-old typically developing infants in showing reduced looking to a still-face episode (in line with Berger & Cunningham, 1981). Despite variable evidence to date (Berger & Cunnigham, 1986; Carvajal & Iglesias, 1997; Legerstee & Bowman, 1989), we also tentatively predicted that levels of smiling would reduce during the still-face phase. However we predicted that more intense emotional responses (i.e. fussing) would be less evident, and that the carry-over emotional impact of the SF phase may be less among infants with DS than typical infants.

Our second hypothesis was that, as a reflection of adjustments to their infants’ less organized attentiveness and/or less intense emotional engagement, the mothers of infants with DS would be likely to use styles of interaction that are more ‘directive’ (to help regulate poor infant attention), and ‘warmer’ (to emotionally engage their infant). This would be evident in the phases of natural interaction prior to and following the still-face and would be compatible with reports of positive but more directive styles of interacting in mothers of toddlers with DS. This would also lead us to expect some specific associations between maternal style and measures of infant behaviour for infants with DS, with levels of maternal warmth being positively associated with infant smiling and looking and with higher directiveness being associated with lower levels of infant attention and emotional reactivity.

Method

Participants

Ten infants with DS aged six months and 20 typically developing infants aged four months participated in the still-face assessment, together with their mothers (see Table 1 for participant details). The demographic characteristics of the mothers of each group of infants were closely similar, being comparable in age, ethnicity, relationship status, socioeconomic status (SES) and maternal qualifications.

Participants’ age of testing was selected so that the infants with DS would be comparable in general developmental level to the TD infants as predicted by norms provided by Rauh et al (1996). We also assessed developmental level using selected items from the

Mental facet of the Bayley II scales (Bayley, 1993) and the groups did not differ significantly in the number of items passed (t-test, ns).

Procedure

We used a standard still-face procedure. Infants were placed in a baby car-seat on a raised surface in front of their mothers. A mirror was placed behind the baby so a camera could capture the faces of infants and mothers on videotape. Mothers were asked to play with their infants, and told that after around three minutes, signalled by a knock from the adjacent room, they should hold a passive face and cease interacting. They were told that on a second signal they should resume interacting, but if they felt compelled to interact before this point – if, for example, the infant seemed distressed- then this was fine. The still-face period lasted for up to ninety seconds, and the re-engagement period for approximately two minutes. The still-face phase was cut short either by the experimenter or mother for one infant with DS and four TD infants because of fussing. During the re-engagement period one mother of a TD infant took the baby out of the seat to give comfort. For this case data for the final phase was disgarded. There were no differences between groups in the mean duration of the three phases.

Coding of videotapes of maternal behaviour

For both interaction phases, two experienced researchers blind to the experimental hypotheses rated mothers on ordinal scales of directiveness and warmth (Table 2). There was good agreement between the two raters: average measure intraclass correlations for initial interaction were, for maternal directiveness, .70, for warmth, .68, for re-engagement phase, directivness, .79, warmth, .65.

To determine the duration of each look, smile and fuss, a further ‘blind’ trained rater coded the tapes. A reliability check was made on these data by another blind coder for five infants with DS and ten TD infants. Correlations between the two coders in their records of the amount of time infants spent looking, smiling and fussing were large and significant (all $p < .001$): for proportion of looking in phase 1, 2 & 3 respectively, .83, .91, .83; smiling, .91, .96, .84; fussing, .83,.90, .85; for number of looks in phase 1, 2 and 3 respectively, .84, .83, .74, for smiles, .92, .98, .79 and for fusses, .77, .75, .68.

Results

For the main analysis we calculated the proportion of time infants spent looking, smiling and fussing during each phase. We first examined consistency in infant behaviour across the phases of the procedure. Both infants with DS and TD infants showed high consistency in looking and smiling, with substantial correlations between the two phases of interaction (e.g., correlations of levels of looking in the initial v re-engagement phase for infants with DS, *rho* = .79, p<.01, for TD infants, *rho* = .78, p<.01).

We shall now address the predictions in turn.

Infants' responses to the still-face

The group means of number and proportion of looking, smiling and fussing during each phase are presented in Table 3 and illustrated in figure 1.

To explore responses to the still-face we undertook three separate mixed model analyses of variance with Phase (initial, still-face, re-engagement) and Group (DS,TD) as the within- and between-subjects factors and with proportions of time spent looking, smiling and fussing as the three dependent variables.

For all three measures there was a significant effect of Phase but no significant main effects of Group and no Group-by-Phase interactions (see Table 3). Note that power analysis revealed that for fussing a three fold increase in the sample would be sufficient to establish the significance of the group and interaction effects, but that for smiling and looking these effects would not be significant even for very large samples.

For both groups there was a significant change in behaviour over the three phases. More specifically, for all three behavioural measures, within-subjects contrasts revealed that the quadratic (U shape) effect accounted for the most variance. These effects were large for smiling and looking and medium for fussing (Cohen, 1988).

Thus both groups showed 'classic' still-face effects, at least in terms of looking and smiling with a suggestion of differential responding for fussing. Follow-up related t-tests (see table 3) revealed that there was a significant reduction in looking and smiling to the still-face for both groups. However, a significant increase in fussing was only found among the TD infants. Comparisons of effect sizes (see table 3) suggests that in terms of infant looking, the still face procedure had a larger effect on DS than on TD infants, but for fussing the TD infants showed a larger effect (d =.99 versus .46). Note from table 3 that, although the proportion of time spent looking were similar in the two groups in each phase, infants with

DS made more discrete looks during the initial interaction (t = 2.02, df = 28, p =.054, 2-tailed).

Carry-over effects

We also compared levels of behaviour in the initial and re-engagement phases to examine carry-over effects. While TD infants showed a significant increase in fussing and a reduction in smiling, with no change in looking, infants with DS showed no change in their levels of fussing and smiling from initial to reengagement phases, but did show lower levels of looking. It is also of note that while a similar proportion of infants in each group fussed during the still face phase (DS: 60%, TD 65%), in the re-engagement phase, only three (30%) of the infants with DS showed fussing compared with 14 (70%) of the TD infants (including the TD infant who was removed from the chair). Thus using non parametric analysis we find a significant association between diagnosis and prevalence of fussing in the re-engagement phase (Chi-squared = 4.34, p = .04).

Maternal style

Mothers of infants with DS showed higher levels of warmth and were more directive than TD mothers during both the initial and recovery phases (see table 4) A Group (DS, TD) by Phase (initial, recovery) by Scale (warmth, directiveness) mixed-model analysis of variance revealed a significant group main effect with no significant Phase or Scale main effects and no interactions.

As predicted, both groups demonstrated positive correlations between maternal warmth during the initial interaction and infant looking and smiling (see table 4), although remember that the overall level of warmth was higher in mothers of infants with DS. Only the TD group showed a significant negative correlation between maternal warmth and infant fussing. For maternal directiveness the groups presented consistently different profiles. Only the DS group showed strong, significant negative relationships between maternal directiveness during the initial interaction phase and infant looking and fussing, with those infants with DS who looked less and fussed less having mothers who were rated as more directive. Note that maternal directiveness was not associated with infant smiling for either group.

Discussion

Our main finding concerned infants' responses to the still-face period itself. The infants with DS showed a significant and substantial reduction in the proportion of time spent looking and smiling during this phase. While one must remain cautious in interpreting the results, given the small sample sizes and corresponding lower power, the groups of infants with DS and TD infants showed very similar patterns of responding in terms of the time spent looking and smiling and in the relative reduction in looking and smiling. Indeed the reductions in smiling (to 4% of initial level) and looking (to 30%), were similar to those reported in studies of TD infants across a range of ages (see Muir and Lee, 2003). Thus our prediction was borne out, with infants with DS registering and reacting to an interruption of their engagement with a caregiver. Our findings mirrored those of Legerstee & Bowman (1989) but conflicted with those of Berger & Cunningham, (1986) and Carvajal & Iglesias (1997) who reported no significant effect for smiling for infants with DS of a similar age.

Also consistent with our predictions, there were indications of differences in the patterning of more intense emotional responses in the two groups. Infants with DS spent notably less time fussing during the still face period compared to the TD infants (12% v 31%). Also, proportionately fewer infants with DS demonstrated fussing during the re-engagement phase (3 of 10 versus 14 of 20). Therefore, while larger sample sizes are needed to fully establish this effect using parametric statistics, there was suggestive evidence that, either as a reflection of constitutional factors such as differences in baseline arousal or intensity of emotional responsiveness, and/or as an implication of maternal styles of relatedness, infants with DS manifest fewer signs that a brief perturbation in interaction impacts upon them emotionally.

The study also provided evidence that mothers of infants with DS were similar to mothers of older toddlers with DS (Buckhalt, Rutherford & Goldberg, 1978; Cielinski, Vaughn, Seifer & Contreras, 1995), and tend to adopt a relatively directive and warm style in face-to-face interactions. While this finding needs to be considered in relation to the laboratory context, the data suggest a functional relationship between the behaviour of mothers and infants with DS. Not only did the mothers of infants with DS show higher levels of warmth and directiveness, their ratings of directiveness showed a sizeable negative correlation with infant looking and fussing, whereas no correlation was found for mothers of TD infants.

Of note is that while during the initial period of natural face-to-face interaction, the two groups of MA-comparable infants spent a similar proportion of time looking towards the mother and smiling, the infants with DS tended to make more discrete looks and, correspondingly, each of these were of a shorter duration (a pattern noted by Berger and Cunningham, 1981, with young DS infants). This different attentional profile may reflect underlying differences in the neurology of these infants (see Zelazo & Stack, 1997), and could be critical in shaping the developing relationships between infants with DS and their caregivers. While the specificity of this pattern of looking requires further study in relation to CA-comparable control infants, it may be a critical casual factor in determining the interactional styles of mothers of infants with DS.

One possible interpretation is that because their infants tend to make more discrete looks of shorter durations and show lower baseline emotional reactivity, mothers respond by being more directive and warm. This compensatory pattern of maternal behaviour in turn could be responsible for ‘normalising’ the overall amount of time infants with DS spent looking and smiling to the mothers during the initial and reengagement phases. This may have allowed the still-face effect to be more apparent on these measures than in previous studies. However, the extent to which the still-face response of infants with DS is equivalent to that of TD infants in terms of psychological engagement remains to be established.

One could speculate that more directive maternal behaviour may afford fewer opportunities for infants to use negative affect in a communicative context which could inhibit infants’ sense of agency in to-and-fro interactions and actually further reduce their emotional activity. Consequently, the SF response of infants with DS could be more parsimoniously characterised as a response to the removal of the affect-laden contingency rather than the break in social engagement. Note, however, that Legerstee & Bowman (1989) found that infants with DS show a differential response to a human still-face scenario compared to one using a contingent puppet, suggesting that for infants with DS there is something ‘special’ about a break in human interaction.

It is of interest to consider whether similar patterns of behaviour would be anticipated in mothers and infants with other intellectual difficulties (IDs) who may also have reduced attentional resources. While one could indeed anticipate that mothers of these infants would adapt a compensatory style, many children with IDs of unknown origin are not diagnosed until later, so this is difficult to establish empirically. Furthermore, it can not necessarily be assumed that the styles adopted by these mothers would be identical, as an earlier diagnosis

may itself differentially influence the expectations and behaviour of mothers of infants with DS.

Finally, we consider the possible longer-term implications of these findings. Both social and cognitive development are shaped by a complex interaction between constitutional and environmental factors. Thus adopting a warm and directive maternal style may have valuable short-term consequences for infants with DS in the middle of the first year and any intervention at this point may not be helpful. However, the longer-term implications of this 'assertive warmth' style for the promotion of functionally adaptive infant-initiated triadic interactions in the second year could be less positive (Legerstee, Varghese, & van Beek, 2002; Marfo, Dedrick, & Barbour, 1998). Infant-led triadic interactions allow infants to develop intentional communication abilities and opportunities for this may be reduced if mothers continue to maintain high levels of affect and directiveness.

References

Adamson, L.B. & Frick, J.E. (2003). The still face: A history of a shared experimental paradigm. *Infancy, 4,* p451-473

Bayley, N. (1993). *BSID-II*. New York: Psychological Corporation.

Berger, J., & Cunningham, C. (1981). The development of eye contact between mothers and normal versus Down's syndrome infants. *Developmental Psychology, 17,* 678-689.

Berger, J., & Cunningham, C. C. (1986). Aspects of early social smiling by infants with Down's syndrome. *Child: Care, Health & Development,* 12(1), 13-24.

Buckhalt, J. A., Rutherford, R. B., & Goldberg, K. E. (1978). Verbal and nonverbal interaction of mothers with their Down's syndrome and nonretarded infants. *American Journal of Mental Deficiency, 82,* 337-343.

Carvajal , F. & Iglesias, J. (1997). Mother and infant smiling exchanges during face-to-face interaction in infants with and without Down syndrome. *Developmental Psychobiology, 31,* 277-286.

Chapman, R. S., & Hesketh, L. J. (2000). Behavioral phenotype of individuals with Down syndrome. *Mental Retardation And Developmental Disabilities Research Reviews, 6(2),* 84-95.

Cielinski, K. L., Vaughn, B. E., Seifer, R., & Contreras, J. (1995). Relations among sustained engagement during play, quality of play, and mother-child interaction in samples of

children with down- syndrome and normally developing toddlers. *Infant Behavior & Development, 18*, 163-176.

Cohen, J. (1988) *Statistical power analysis for the behavioural sciences.* Hillsdale, New Jersey: Erlbaum

Emde, R.N., Katz, E.L. & Thorpe, J.K. (1978) Emotional expression in infancy: Early deviations in Down Syndrome. In M. Lewis & L.A. Rosenblum (Eds.) *The Development of Affect.* London: Plenum.

Gunn, P., Berry, P., & Andrews, R. (1982). Looking behavior of Down syndrome infants. *American Journal of Mental Deficiency, 87*, 344-347.

Jasnow, M., Crown, C.L., Feldstein, S., Taylor, L., Beebe, B., & Jaffe, J. (1988). Coordinated interpersonal timing of Down-syndrome and non-delayed infants with their mothers: Evidence for a buffered mechanism of social interaction. *Biological Bulletin, 175,* 355-360.

Karrer, J. H., Karrer, R., Bloom, D., Chaney, L., & Davis, R. (1998). Event-related brain potentials during an extended visual recognition memory task depict delayed development of cerebral inhibitory processes among 6-month-old infants with Down syndrome. *International Journal of Psychophysiology, 29*(2), 167-200.

Kogan, N. & Carter, A.S. (1996). Mother-infant re-engagement following the still-face: the role of maternal emotional availability in infant affect regulation. *Infant Behaviour and Development, 19*, 359-370.

Krakow, J.B., & Kopp, C.B. (1982). Sustained attention in young Down syndrome children. *Topics in Early Childhood Special Education, 2,* 32-42.

Legerstee, M., & Bowman, T. G. (1989). The development of responses to people and a toy in infants with Down syndrome. *Infant Behavior and Development, 12*, 465-477.

Legerstee, M., Varghese, J, & van Beek, Y. (2002). Effects of maintaining and redirecting infant attention on the production of referential communication in infants with and without Down syndrome. *Journal of Child Language, 29,* 23-48.

Marfo, K., Dedrick, C., & Barbour, N. (1998). Mother-child interactions and the development of children with mental retardation. In J. Burack, R. Hodnapp, & E. Zigler (Eds.), *Handbook of mental retardation and development* (pp. 637-668). New York: Cambridge University Press.

Miranda, S. B., & Fantz, R. L. (1973). Visual preferences of Down's syndrome and normal infants. *Child Development, 44*, 555-561.

Muir, D. & Lee, K. (2003) The still-face effect: methodological issues and new applications. *Infancy 4(4),* 483-491

Rauh, H., Schellhas, B., Goeggerle, S., & Muller, B. (1996). Diachronic Developmental Assessment of Mentally Handicapped Young Children. In M. Brambring, H. Rauh, & A. Beelmann (Eds.), *Early childhood intervention: Theory, evaluation and practice. Berlin, New York: de Gruyter.* pp128 to 154

Toda, S. & Fogel, A. (2003) Infant response to the still-face situation at 3 and 6 months. *Developmental Psychology, 29* 532-538

Tronick, E. Z (2003). Things still to be done on the still-face effect. *Infancy, 4,* 475-482

Tronick, E. Z., Als, H., Adamson, L., Wise, S. & Brazelton, T.B. (1978). The infant's response to entrapment between contradictory messages in face-to-face interaction. *Journal American Academy of Child Psychiatry, 17(1),* 1-13.

Zelazo, P. R., & Stack, D. M. (1997). Attention and information processing in infants with Down syndrome. In J. A. Burack & J. T. Enns (Eds.), *Attention, development and psychopathology* (pp. 123-146). New York: Guilford Press.

Table 1: Characteristics of infants and their mothers

	Infant				Mother				
Diagnosis	N (first born)	Mean Age in days (SD)	Gender	Mean Developmental age in months (SD)	Mean age in years (SD)	Ethnicity	Relationship status	Higher SES of father or mother†	Mothers's Qualifications‡
Down syndrome	10 (5)	193.3 (9.1)	6male 4 female	3.7 (.9)	31.3 (6.0)	6 = white European 1= Indian-Asian 1= Afro-Carribean 2= mixed race	Partner = 7 Single = 3	II = 5 IIIN = 4 IIIM = 1	None = 1 GCSE = 1 Vocational = 5 A' level = 1 Degree = 2
Typically developing	20 (12)	130.2 (8.8)	12 male 8 female	3.3 (.8)	29.3 (4.9)	14 = White European 2= Indian-Asian 4= Afro-Caribbean	Partner = 17 Single = 3	II = 12 IIIN = 5 IIIM = 2 Other = 1	None = 0 GCSE = 4 Vocational = 10 A' level = 4 Degree = 2

† II = managerial/technical, IIIN skilled non-manual, IIIM = skilled manual.

‡ GCSE : UK age 16 school leaving qualifications, Vocational: school or post-school semi-skilled vocational training, A'level: UK advanced, age 18, school/college qualification, Degree: Bachelors level or above UK university degree qualification.

Table 2: Five point scales used to rate qualities of maternal behaviour

Scale	Instructions to coders
Directiveness	By directiveness we mean a style of engagement in which the mother tends to take charge, structure the interaction, make suggestions, corrects or shapes what the infant does or experiences, and otherwise tends to take command of the interaction. This may entail a degree of forcefulness and assertiveness and is likely to introduce new directions to the encounter. The style contrasts with the kind of stance in which the mother makes great effort to follow the infant, encourage and support the infant's initiatives, and avoid imposing an agenda on what transpires. A score of 5 captures a mother who is very directive, taking charge of much that transpires with her infant, imposing an agenda. A score of 3 would apply to a mother who plays some role in structuring what happens, might sometimes take the initiative but also follows her infant. A score of 1 would indicate a mother who at all points follows her infant's lead and or provides very little by way of modifying what the infant appears to be doing or trying to do, or introducing new topics or directions
Warmth	We would also like you to rate maternal 'warmth' by which we mean expressions of positive feeling towards the infant. A score of 5 captures a mother who is clearly very emotionally engaged with (and full of positive feeling towards) her infant. A score of 3 would indicate a mother who is positive in a somewhat more subdued way. A score of 1 would indicate a mother who shows no warmth, and perhaps also hostility or other negative feelings.

Table 3: Numbers and proportions of infant looking, smiling and fussing during each phase

Infant measures		Interaction		Still face		Re-engage		Main effects and interactions for analysis of % time	Tests of simple effects on % time
		n	% time	n	% time	n	% time		
Looks	DS	15.4	45.2	6.5	16.8	9.8	32.1	Group effect, F (1,27) =.004, p =.95, partial Eta-squared = .0 Phase quadratic contrast, F(1,27) = 21.8, p <.001, partial Eta-squared = .45 Group-by-phase interaction , F(2,54) = .53, p = .58, partial Eta-squared =.02	• Decrease phase 1 to 2 DS related-t = 4.8, p < .01; d= 1.5; TD related-t = 3.7, p < .01, d = .83 • Increase phase 2 to 3 DS related-t = 2.76, p <.05, d = .87; TD, ns, d =0.38 • Decrease phase 1 to 3 DS related-t = 3.14, p <..05; d =.99; TD, ns d = 0.43
		(8.3)	(22.5)	(4.3)	(15.1)	(4.3)	(24.8)		
	TD	9.7	42.3	5.5	22.1	8.2	31.7		
		(5.7)	(31.7)	(3.0)	(21.6)	(6.5)	(27.5)		
Smiles	DS	6.7	15.6	0.5	0.7	3.6	6.2	Group effect, F (1,27) =.004, p =.95, partial Eta-squared = .0 Phase quadratic effect, F(1,27) = 20.19, p<.001, partial Eta-squared = .43 Group-by-phase interaction , F(2,54) = .03, p = .97, partial Eta-squared =.001	• Decrease phase 1 to 2 DS related-t = 2.7, p < .05 , d= .79; TD, related-t = 4.2, p < .01, d= .93 • Increase phase 2 to 3 DS, ns, d = .63; TD related-t = 2.03, p <.05, d= .54 • Decrease phase 1 to 3 DS, ns; d = .69; TD related-t = 4.05, df = 18, p <.01, d = .93
		(4.2)	(17.9)	(1.0)	(1.4)	(4.3)	(8.5)		
	TD	6.5	15.4	0.6	1.1	1.8	5.7		
		(5.5)	(16.4)	(0.9)	(2.4)	(2.3)	(8.9)		
Fusses	DS	0.3	0.5	1.5	11.6	0.9	6.3	Group effect, F (1,27) =.2.28, p =.10, partial Eta-squared = .095 Phase quadratic effect, F(1,27) = 6.34, p =.018, partial Eta-squared = .19 Group-by-phase interaction , F(2,54) = .99, p = .37, partial Eta-squared =.036	• Increase phase 1 to 2 DS, ns; d = .46; TD, related-t = 4.8=4, p < .01, d = .99 • Decrease phase 2 to 3 No significant change for either group, DS, d = .19; TD =.22 • Increase phase 1 to 3 DS, ns, d = .47 ; TD, related-t = 2.45, df = 18, p <.05 , d = .56
		(0.7)	(1.2)	(1.8)	(25.2)	(1.5)	(12.2)		
	TD	1.2	3.6	2.3	30.8	1.1	20.5		
		(1.6)	(6.7)	(2.3)	(31.0)	(1.0)	(33.7)		

(standard deviations in parenthesis)

†Note that p values been adjusted for each set of t-tests.

Table 4: Mean ratings of maternal directiveness and warmth and correlations with infant behaviour during the initial interaction phase

		Phase				
		Interaction	Re-engage	Correlations with infant behaviour in initial interaction (Spearman's *rho*)		
Maternal ratings†		Mean (SD)	Mean (SD)	%looking	%smiling	%fussing
Warmth	DS	4.1 (1.0)	4.0 (1.1)	.46	.57*	.22
	TD	3.8 (1.2)	3.6 (1.1)	.46*	.66**	-.41*
Directiveness	DS	4.3 (.8)	4.5 (.7)	-.55*	-.19	-.54*
	TD	3.6 (1.2)	3.5 (1.1)	-.07	.03	-.04

†Group main effect $F(1,27) = 5.31$, $p = .03$, partial Eta-squared= .16

* p<.05; ** p<.01, 1-tailed

Figure 1: Percentage time spent looking to mother, smiling and ‘fussing’ during each phase for each group of infants