The Functions of Maternal Touch during Mother-Infant Face-to-Face and Still-Face Interactions: Relationship between Function of Touch and Infants' Affect

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ABSTRACT

The Functions of Maternal Touch during Mother-Infant Face-to-Face and Still-Face Interactions: Relationship between Function of Touch and Infants' Affect

Amélie D. L. Jean

Touch plays an essential role in mother-infant interchange, however investigations have focused primarily on the role of distal modalities of communication, such as affect and gaze. The present study was designed to investigate the functions of maternal touching during a Still-Face procedure between mothers and their fullterm 5 ½-month-old infants. The objectives were to (1) document how the overall duration, the types, and the functions of touch employed by mothers varied across both Normal periods, (2) clarify the impact of infants' and mothers' distress on the function and duration of touch provided to infants, (3) investigate the reciprocal relationship between functions of touch and infants' affect, and (4) examine how maternal regulatory behaviours provided in the transition period were predicted by infants' affect, and how they influenced the amount of *nurturing* touch during the Reunion Normal period. Maternal touch was systematically coded using the Caregiver Infant Touch Scale and the Functions of Touch Scale. Results indicated that mothers adapted the functions of touch they used across period, and according to infants' affect and distress level. Mothers used more *nurturing* function of touch when their infants were fretting or distressed, whereas they used more *playful* function of touch in order to get their infants smiling. Moreover, findings revealed that the transition periods played a critical regulatory role and

influenced subsequent maternal behaviour. Together, these results highlight mothers' ability to sensitively adjust the function of their touch according to their infants' affect, while at the same time underscoring the importance of touch as a channel of communication.

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Over the course of the first year of life, infants develop a pivotal relationship with their primary caregivers. This relationship is fundamental because it builds the foundation for future psychological development, and promotes emotional regulation and social understanding (Bornstein & Tamis-LeMonda, 1989; Bowlby, 1969). Typically, within mother-infant dyads, face-to-face interactions are a frequent social context (Cohen & Beckwith, 1976; Trevathan, 1981) through which infants learn about the rules of social engagement and communication (Dunham & Dunham, 1990; Kaye & Fogel, 1980). To date, studies addressing the quality and changes in dyadic communication have primarily focused on distal modalities, such as facial expressions and gaze (Field, Vega-Lahr, Scafidi, & Goldstein, 1986; Gianino & Tronick, 1988; Kaye & Fogel; Messinger, Fogel, & Dickson, 1999; Stevenson, Roach, & Leavitt, 1992). While certainly important, in order to acquire a comprehensive understanding of mother-infant communication, an investigation of proximal modalities of communication, such as touch, is necessary.

From the time the infant is born, touch has been demonstrated to be an important channel of communication between mothers and their offspring (de Chateau, 1976; Kaitz, Lapidot, Bronner, & Eidelman, 1992; Stack, 2001, 2004). Through early tactile experiences, the development of interactive dialogue between the dyad is fostered (Koester, Brooks, & Traci, 2000). Communication through touch might be a precursor to other forms, or facilitate, other means of communication (Stepakoff, 1999). Although touch is integral to the mother-infant communicative system, studies examining the specific roles of maternal touch and its influence on infants' affect and behaviour are sparse. Consequently, the goals of the present study were to clarify the functions of maternal touch during mother-infant face-to-face interactions as well as investigate the

reciprocal relationship between infants' affect and maternal touch.

Touch has been demonstrated to be an important component of mother-infant interactions, occurring between 55-99% of the time during face-to-face interactions (Jean, Stack & Fogel, 2006; Stack, 2001, 2004; Stack & Muir, 1990, 1992; Symon & Moran, 1987). It communicates security and tenderness, aids in the reduction of infants' stress and distress (Stack & Muir) while at the same time, promotes emotional regulation (Hertenstein & Campos, 2001; Weiss, Wilson, Hertenstein, & Campos, 2000). Typically, studies addressing the contribution of touch have measured the effect of its duration (Gusella, Muir, & Tronick, 1988) or its frequency (Herrera, Reissland, & Shepherd, 2004; Symons & Moran) during typical dyadic interactions. While these methods of analysis are important in establishing the incidence of touch, they do not provide us with an indication of the unique contributions of maternal touch during mother-infant exchanges.

One way to study the communicative properties of maternal touch is through the use of a modified Still-Face (SF) procedure where mothers are allowed to touch their infants (Stack & Muir, 1990; 1992), resulting in an isolation of touch from the other modalities. Typically, in a SF procedure mothers are asked to assume a neutral facial expression, make eye contact with their infant, remain still and silent, and refrain from touching their infant (Tronick, Als, Adamson, Wise, & Brazelton, 1978). Since the SF period is usually distressing for infants, its utilization permits the investigation of infants' and mothers' abilities to regulate infants' affect (Kogan & Carter, 1996; Weinberg & Tronick, 1996). Using a modified SF paradigm, Stack and Muir (1990) demonstrated that maternal touch could increase infants' positive affect, decrease negative affect, and

maintain gaze during the SF period, therefore reducing infants' distress. In a follow-up study, Stack and Muir (1992) established that active, rather than passive touching, was what lead to increased infants' smiling in the SF period, implying that it is not merely the presence or absence of touch being communicated to the infant, but the qualitative properties of that touch. In addition, Stack and LePage (1996) and Stack and Arnold (1998) confirmed that through touch alone, mothers could elicit specific infants' responses (e.g., increased smiling) and that infants were sensitive to subtle changes in their mothers' tactile stimulation. Results from these studies converge to suggest that maternal touch can serve different functions (e.g., *playful* and *nurturing*) and that the quality of touch, as opposed to its mere presence, is essential.

The aforementioned studies provide important and unique contributions to the study of touch, however, they are limited by the fact that they do not take into account qualitative components of touching, such as the types of touch used by mothers which are considered to be a better index of the communicative properties of touch (Hertenstein, 2002; Stack, 2001, 2004; Weiss, 1979). Different types of touch could communicate different meanings (Hertenstein; Stack; Tronick, 1995). For example, stroking might communicate safety while poking could communicate danger (Tronick). Consistent with this direction, several coding systems have been developed to examine different properties of touch (e.g., Feldman, Weller, Sirota, & Eidelman, 2002; Harrison & Woods, 1991; Moreno, Posada, & Goldyn, 2006; Polan & Ward, 1992; Weiss, 1992). Stack, LePage, Hains, and Muir (1996, 2006) developed the Caregiver-Infant Touch Scale (CITS) to measure eight types of touch and their qualitative components (speed, extent, intensity, location). During Stack et al.'s study (2006) using the CITS, mothers and their

5 ½ month-old infants participated in various modified SF interactions: SF + Touch, SF + Touch to maximize infant smiling, SF + Touch on one area on the body. Across instructional contexts, mothers employed various types of touch. For example, in order to maximize their infant's smiling, mothers used high levels of tickling and lifting, and low levels of passive touch. In a subsequent study, Arnold (2002) demonstrated that when asked to get their infants relaxed, mothers used more stroking. Taken together, these results suggest that specific types of touch are used in order to elicit a specific reaction from infants, inferring that touch serves various functions.

While these studies are clearly essential in demonstrating that different types of touch can serve various functions, a direct assessment of the types of functions of touch, as opposed to inferences on the basis of instructional context, is imperative to the understanding of the communicative properties of touch. Moreover, Hertenstein (2002) and Stack (2001, 2004) contend that examining how mothers' touch modulates infants' affect, and how in return, infants' affect influences mothers' tactile behaviour is also necessary. It is well established that during face-to-face interactions, mothers and infants are in a constant process of co-regulation whereby they are dynamically influencing each others' behaviours and emotions (Fogel, 1992; Gianino & Tronick, 1988). As well, touch has been demonstrated to be effective in regulating infants' behaviour and affect (Field, 1994; Jacobs, 2002; Moszkowski, 2004; Pelàez-Nogueras, Field, Hossain, & Pickens, 1996; Stack & Muir, 1990, 1992). However, what remains unknown is how different *functions* of touch are used in order to regulate and influence infants' affect and distress level. This examination is central to elucidating *how* mothers use touch to communicate with their infants, and the role of touch in behavioural regulation (Stack, 2001), while at

the same time it highlights mothers' sensitivity toward their infants' emotional displays.

In an attempt to investigate the influence of different functions of touch, Moreno et al. (2006) established that affectionate and stimulating touch influenced the co-regulation process between mothers and their 3 ½ month-old infants. Although their results provided evidence that different functions of maternal touch can influence the nature of the interaction, the focus of their investigation pertained to only two global functions of maternal touch. In addition, several fundamental questions regarding the roles of touch and its impact on infants' affect and attention remained unanswered. In particular, there is a need for a comprehensive and integrative observational measurement of functions of maternal touch. As pointed out by several researchers, in order to understand the communicative properties of touch, its evaluation should not be made in isolation, rather it should take into account the nonverbal and verbal behaviour that accompany each function of touch and the context in which each function occurs (Jones & LeBaron, 2002; Jones & Yarbrough, 1985; Hertenstein, 2002; Muir, 2002; Stack, 2001).

In the present study, a systematic observational measure was used to assess the types of functions of maternal touch while taking into consideration other modalities of verbal and non-verbal communication such as mothers' verbalizations and infants' affect and attention. The general objective was to investigate maternal touching during mother-infant face-to-face interactions. Specifically, the focus was on the (1) *functions* of maternal touch and on (2) the reciprocal relationship between function of maternal touch and infants' affect (smiling and fretting). To enable an examination of the *nurturing/regulatory* function of touch, as well as other functions such as *attention-*

getting and *playful*, the SF procedure was used since it has been shown to be distressing for infants (e.g., Bertin & Striano, 2006; Cohn & Tronick, 1983; Forbes, Cohn, Allen, & Lewinsohn, 2004; Gusella et al., 1988; Mayes & Carter, 1990; Stack & Muir, 1990, 1992; Toda & Fogel, 1993).

Although the SF paradigm presents numerous advantages for researchers, various methodological considerations were addressed in the present study. First, since the decrease in smiling and increase in fretting evident in the SF period have been shown to persist in the beginning of the subsequent interaction period (Carter, Mayes, & Pajer, 1990; Cohn, 2003; Field, Vega-Lahr, Scafidi, & Goldstein, 1986; Weinberg & Tronick, 1996), the co-regulation within the dyad as well as maternal regulatory behaviour (touching, verbalizations, gazing and affect) can be observed in the period following the SF period (Cohn). As in most SF studies, in the present study mothers were given procedural instructions at the end of each period, thus the reunion between mother and infant began during the transition period between each interaction period. Consequently, the transition periods are integral and were examined.

Second, while infants typically react in the same general way to the SF procedure, it has been demonstrated that infants' levels of distress during the SF period impact on subsequent maternal behaviours (Mayes, Carter, Egger, & Pajer, 1991). Specifically, Calkins, Hungerford, and Dedmon's (2004) findings indicated that an increase in infants' frustration resulted in a decrease in maternal physical stimulation. In addition, it has been suggested that the examination of mothers' experience of the SF is critical for a thorough understanding of the processes involved in mother-infant interaction following the SF period (Fogel, 1982; Mayes, et al.; Tronick, 2003). For example, Mayes et al. established

that following the SF procedure, mothers were more likely to report discomfort when their infants were distressed. In addition, mothers who experienced distress were more likely to make soothing comments and pick up their infants in the first few moments of the Reunion Normal period, thereby indicating that their reaction to the SF influenced the quality of subsequent interactions.

Consequently, in order to attend to the methodological considerations associated with the SF period, infants' and mothers' distress as well as maternal regulatory behaviours during the transition period were assessed. Moreover, the role of the transition period in the process of re-engagement and regulation during the Reunion Normal period was examined.

The present study

The present study was designed to examine the functions of maternal touching during face-to-face interactions between mothers and their fullterm 5 ½-month-old infants. The first objective was to document how 1) the duration, 2) the types and 3) the functions of touch employed by mothers varied across Normal periods of the SF procedure. The second objective was to clarify the impact of infants' and mothers' distress on the function and on the overall amount of touch provided to infants across interaction periods. The third objective was to examine the reciprocal relationship between functions of maternal touch (*playful* and *nurturing* functions) and infant's smiling and fretting. In light of results from previous studies and findings from our own laboratory, *playful* and *nurturing* function of touch were examined (Moreno et al., 2006; Moszkowski, Jean, & Stack, 2005; Weiss et al., 2000). Finally, the fourth objective pertained to maternal regulatory behaviours during the transition periods; in particular

how the amount of maternal regulatory behaviours was predicted by mothers' distress and infants' affect, and how it would influence the amount of *nurturing* touch provided in the Reunion Normal period.

Across both Normal periods, no differences were expected in the amount and types of touch provided to infants, however, changes were anticipated for the functions of touch. Specifically, mothers were expected to use more *attention-getting* and *playful* functions in the Normal period and more *nurturing* function of touch in the Reunion Normal period. The functions of touch were also hypothesized to be influenced by infants' and mothers' distress level. Specifically, given higher distress levels, the amount of nurturing touch was expected to increase. As well, mothers' distress was expected to influence the quality of maternal regulatory behaviours provided in the transition period.

With regard to the anticipated reciprocal influence between maternal touch and infants' affect, *playful* functions of touch and gazing at mothers' faces were expected to predict the amount of smiling in all the interaction periods. Since it has been shown that mothers' behaviour prior to the SF period influences infants' reactions during the SF (Carter et al., 1990; Stoller & Field, 1982; Tarabulsy et al. 2003; Tronick, Ricks, & Cohn, 1982), the positive consequences of *playful* touch provided in the first period were expected to carry-over to the subsequent periods. In addition, *nurturing* function of touch was expected to be related to infants' fretting. Furthermore, the *nurturing* function of touch, as well as maternal regulatory behaviour provided in the transition period, were expected to lead to decreased fretting in the Reunion Normal period. Moreover, more maternal regulatory behaviours were expected to occur during the transition period following the SF (T2) than following the first Normal period (T1). Finally, it was

predicted that the regulating behaviours provided in the transition period following the end of the SF period (T2) would influence the amount of nurturing touch provided in the Reunion Normal period.

Method

Participants

Mothers and infants were recruited from birth records from a major teaching hospital in the Montreal (Quebec, Canada) area. Mothers were contacted by telephone, explained the purpose of the study and asked to voluntarily participate. Forty-eight mothers agreed to participate in the project with their 5 ½-month-old-infants, however only 40 mother-infant dyads comprised the final sample. Eight mother-infant dyads were excluded from the current study based on various exclusion criteria such as mothers not following the instructions (n=1), infant's gaze obstructed (n=2), mothers touching their infants for less than 15% of the time during the first Normal period (n=2), mother-infant dyads taking a break between the SF and third period (n= 2), and excessive infant crying (n=1). The final sample consisted of 40 infants, (20 female and 20 male) with a mean age of 5 months and 12 days (SD = 7.58 days). All infants were normal, healthy full-term infants, having gestational ages ranging from 37 to 41 weeks. The mean age of the mothers was 30.63 years (range = 21- 41 years, SD = 5.15), with a mean level of education of 14.75 years (SD = 1.91). The majority of the sample was Caucasian (95%). Mothers' occupational status were classified in the following domains: Professional Specialty (35.0 %), Freelance art (15.0%), Unemployed (15.0%), Machine operators, assemblers, and inspectors (10.0%), Service workers (7.5%), Administrative support, including clerical (7.5%), Precision production, craft, and repair (2.5%), Handlers,

equipment cleaners, helpers and labourers (2.5%), Sales (2.5%), and Student (2.5%).

Apparatus

In order to record each interaction, a Video Camera (Sony Handycam) was mounted on a tripod and was located on the left side of the mother-infant dyad. Its focus was on the mothers' hands and the infants' bodies and faces. In order to obtain a clear picture of the mothers' facial expressions, a mirror was strategically placed behind the infant and in full view of the camera. Following the testing session, a time line was added to each 8 mm cassette using a Video Timer (FOR.J VTG-22). The coding of each behaviour was conducted using a Sony VTR/TV, and a remote control with a slow speed shuttle function which allowed for slow viewing of each video record. A stopwatch was used to time the duration of each period (2 minutes), and the beginning and end of each period was marked by the experimenter knocking on the wall.

Procedure

The present study was part of a longitudinal study in which participants were tested in their home at 5 ½ months of age. During the first visit, participants received information about the purpose and procedure of the study, and signed a consent form (Appendix A). The dyads were videotaped under two experimental conditions; a face-to-face SF procedure and a free play on the floor. The present study focused on the SF procedure which consisted of three 2-minute interaction periods: Normal, SF, and Reunion Normal periods, which were separated by two transition periods (T1 and T2) (see Figure 1). Infants were seated in a securely placed infant seat located on a flat surface (e.g. kitchen table) and mothers were asked to sit facing their infant at a distance of approximately 70 cm. Preceding the start of each period, the procedure was re-

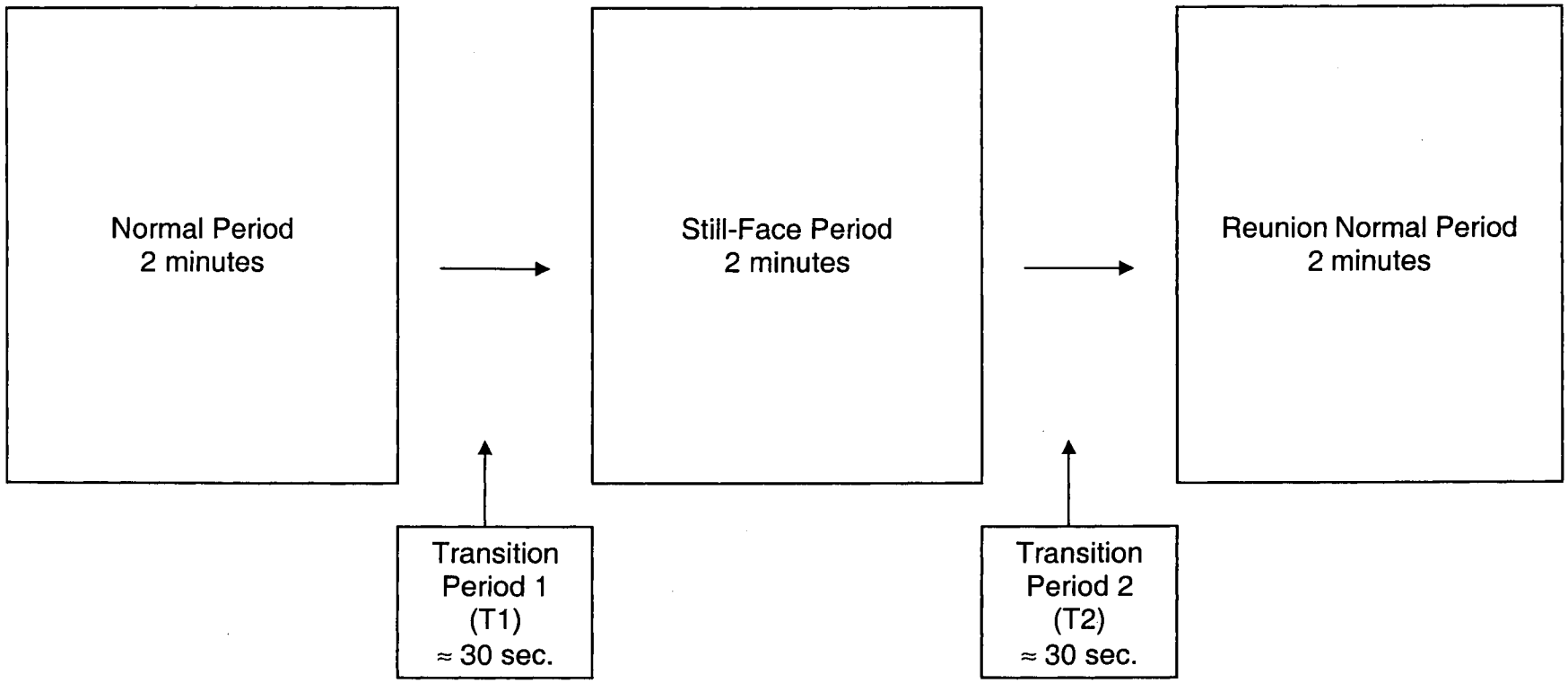

Figure 1. Procedure for the current study

explained to the mothers and instructions were given. In addition, mothers were advised that if at any time during the experiment their infants fretted for more than 20 seconds or if they wished to terminate a period for any particular reason the session would be interrupted and re-started at a subsequent time (n=3).

For the first and last period mothers were asked to play with their infants as they would normally do. For the second period, the SF period, mothers were asked to gaze at their infants while maintaining a neutral face, refrain from touching their infants and remain silent (Tronick et al., 1978). In order to ensure that all mothers followed the instructions for the SF period, all video records were viewed by the experimenter following testing. Each period lasted two minutes, and was separated by an interval (transition period) of about 30 seconds during which the experimenter gave the instructions for the subsequent period. During this transition period, the dyads were free to interact with each other. Following the testing session, mothers completed a demographic questionnaire and answered questions regarding their infant's developmental and medical histories (Appendix B).

Behavioural Coding, Dependent Measures

Each Normal period of interaction was coded for infants' (1) smiling, (2) fretting, (3) gaze, and (4) types and (5) functions of maternal touch. During the SF period, infants' (1) smiling, (2) fretting, (3) gaze at their mother's face, and (4) distress level were coded. Finally, during the intervals between each period, the transition periods, (1) mothers' regulatory behaviours (i.e. touching, talking to the infant, smiling or gazing at the infant), and (2) mothers' distress level were coded. Detailed operational definitions for each behaviour are located in Appendix C.

Infant's affect and attention. Infants' affect (smiling and fretting) and gaze at mothers' faces were coded using frame-by-frame analysis of the video records. Infant's smiling was operationally defined as an upturned mouth (either open or closed). Fretting was coded when the infant was crying or when his/her mouth was turned down or curled. Infant's gazing at mother's face was recorded when the infant looked at the mother's face. These infants' behaviours have been reliably used and coded in a number of studies (e.g., Arnold, 2002; Stack & Arnold, 1998; Stack & Muir, 1992).

Infants' and mothers' distress level. Subsequent to viewing the SF period, the experimenter coded for infants' distress level. While distress level was made up in part by infants' fretting, distress level and fretting were different. Both the duration of infants' fretting, negative vocalizations, and infants' motor behaviours (e.g., trying to get out of the chair, gesturing toward their mother) were used to determine infants' level of distress. Infants' level of distress was coded as either low, medium or high. Maternal distress level was coded as either present or absent. Its classification was based on the quality of mothers' verbal comments following the end of a period (e.g., "good it's over", "that was hard"). In addition, for maternal distress level following the SF period, mothers' verbalizations during the beginning of the reunion period (e.g., "mommy is back, it was hard") were also taken into consideration (Appendix C provides detailed coding criteria used to document infants' and mothers' distress level).

Maternal regulatory behaviours during the transition periods. An overall index of the quality of maternal regulatory behaviours during the interval between Normal and SF period (T1) and SF and Normal Reunion period (T2), was obtained by examining the

presence or absence of mothers' verbalization, smiling, and gazing, and the quality of maternal tactile behaviour (Appendix C provides a detailed observation of the coding criteria used to document maternal regulatory behaviours).

Types and functions of maternal touch. Maternal touch was coded using the Caregiver Infant Touch Scale (CITS) developed by Stack et al. (1996, 2006) which assesses the qualitative and quantitative components of touch. For each second of the interaction, the type of touch used by mothers was coded. The CITS consists of eight types of touch (static, stroke, pat, squeeze, tickle, shake, pull, other and no touch). In order to ensure that the observer would not be influenced or distracted by maternal verbalizations and infants' vocalizations, the sound was turned off during coding. For purposes of the current study and consistent with past research (e.g., Stack & Arnold, 1998; Stack & Muir, 1992) maternal touch was operationally defined as any physical contact between the mothers' hands and the infant lasting more than 0.5 sec (Appendix C provides a detailed observation of the coding criteria used to document mothers' types of touch).

The functions of touch were coded using the Functions of Touch Scale (FTS; Jean, Girouard, & Stack, 2005). The FTS is an observational coding measure which assesses the duration of nine functions of maternal touch (passive accompaniment, active accompaniment, nurturing, *playful*, attention-getting, accidental, utilitarian, harsh or negative touch, and unspecified touching functions). The coding is based on the qualitative and quantitative aspects of maternal touch as well as contextual information such as maternal affect and content of verbalization, and infants' affect and attention. The beginning and end of each touching event was defined by a change in the function of

touch, a change in the theme of the interaction (e.g., change in the verbal topic being discussed by the mother), or a change in the touching sequence (e.g., brief pause, change in the speed of touch). Following the identification of touching events, each event was coded using one of the nine functions of touch (Appendix C provides a detailed observation of the coding criteria used to document mothers' functions of touch).

Reliability

To establish inter-rater reliability, trained observers blind to the hypotheses of the study re-coded at least 15-20% of a random portion of the video records and the results were compared to the original coding. Intraclass reliability coefficients (Shrout & Fleiss, 1979) were conducted and were above $\underline{r} = .97$ for all infant measures (i.e., gaze at face, fretting, smiling). In addition, Kappa coefficients (Cohen, 1968; Hunter & Koopman, 1990) were used to assess the reliability of onset and offset times for each measure ($\underline{K} >$ .90 for all measures). For the CITS and TFS, Kappa coefficients were calculated for the agreement/disagreement regarding the type and function of touch ($\underline{K} =.87$ for types of touch, $\underline{K} = .92$) for function of touch. Finally, percent agreement reliability (agreements divided by total agreements plus disagreements) was calculated for infants' distress (87.50%) and mothers' distress (100.00%).

Results

The data obtained for the overall duration, the types and functions of touch, as well as infants' smiling, fretting and gazing were reduced to obtain the percent duration. In addition, since *harsh* or *negative*, and *accidental* functions of touch did not occur during the interactions, they were removed from subsequent analysis. Descriptive statistics were conducted to assess for the presence of outliers, and to verify the normality

of the distribution. When significant skewness or kurtosis was found, outliers were brought in according to the method described by Tabachnick and Fidell (1989), where the score is brought in to the next acceptable level and 1 is added to the score. As a result of bringing in outliers, there was no skewness or kurtosis in the data hence no transformations were required. For all the analyses, when ANOVAs revealed significant interactions, Šidāk pairwise comparisons were used to isolate the source of the significance (Šidāk, 1967). Furthermore, for all the significant ANOVAs, partial eta-squared (η_p^2) are reported as a measure of effect size (Olejnik & Algina, 2003). All the ANOVA tables are summarized in Appendix D. Figures and summary tables for hierarchical regressions are embedded in the text.

Still-face effect

Following descriptive statistics and before addressing the specific objectives of the current study, three one-way ANOVAs were conducted in order to assess for the presence of standard SF effects. The percent duration of infants' 1) smiling, 2) fretting, 3) gazing at mothers' faces were analyzed using 3 one-way repeated measures analyses of variance (see Appendix D, Tables 1, 2, 3). As illustrated in Figure 2, the results indicated that as expected for a Still-Face procedure, there was a significant decrease in smiling ($F(2, 78) = 61.06$, $\eta_p^2 = 0.61$, $p < .001$) and gazing at mothers' faces ($F(2, 70) = 15.38$, $\eta_p^2 = 0.31$, $p < .001$), and an increase in fretting ($F(2, 78) = 4.65$, $\eta_p^2 = 0.21$, $p < .01$) during the SF period. Of note, since infants' gaze was not coded for all infants, the analyses conducted with gaze consisted of a sample of 36 infants.

Objective 1: Description of maternal touch across interaction periods

In order to address the first objective which examined how the overall duration of

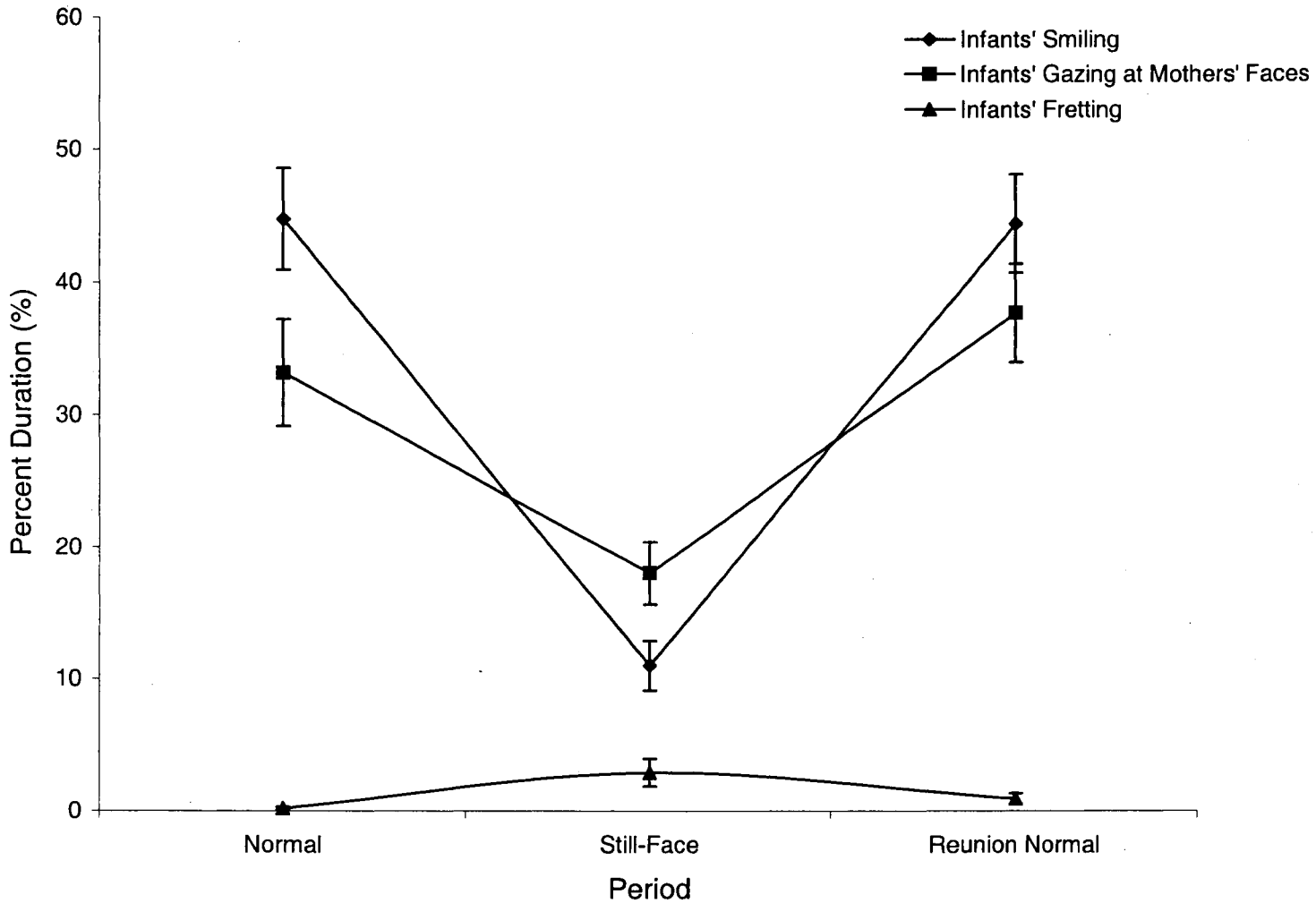

Figure 2. Percent duration of infants' smiling, fretting, and gazing at their mothers' faces across interaction periods. Standard errors are shown by vertical bars.

maternal touch, the types of touch and the function of touch used by mothers varied across the Normal periods of a SF procedure, a paired-samples t-test and two repeated measures ANOVAs were conducted: a 9 x 2 (Types of Touch x Period) for the percent duration of each type of touch and a 7 x 2 (Functions of Touch x Period) for the percent duration of each function of touch. All the analyses pertaining to maternal touch were carried out using infant's gender as a between-subjects factor. However, no significant results were found for gender, therefore it was excluded from subsequent analyses.

Overall duration. The total time that touch (overall duration) occurred during each Normal period was obtained by regrouping the types of touch from the CITS in order to form one total touch category. This analysis was conducted in order to ensure that differences obtained for types and functions of touch were not the result of an overall difference in the amount of touch provided across period. A paired-samples t-test revealed that there was no significant difference in the amount of touch provided to the infants across the two Normal periods, $t(39) = .12$, $p = .12$ (Normal period: $M = 81.04\%$, $SE = 2.53$; Reunion Normal: $M = 81.45\%$, $SE = 3.23$) indicating that mothers provided a consistent amount of touch throughout the Normal periods. Subsequent differences found for types and functions of touch were therefore not the result of an overall difference in the amount of touch provided to the infants across interaction periods.

Type of Touch. The repeated measures ANOVA revealed a significant main effect for Type of Touch, $F(8, 312) = 48.29$, $\eta_p^2 = .55$, $p < .001$ (see Appendix D, Table 4; Appendix E, Table 1). Specifically, mothers spent most time using *lifting* ($M = 31.48\%$, $SE = 2.43$), followed by "*no touch*" ($M = 18.77\%$, $SE = 2.29$), and *static* touch ($M = 17.94\%$, $SE = 1.69$), *tickling* ($M = 9.74\%$, $SE = 1.24$), *stroking* ($M = 6.92\%$, $SE = 0.79$),

grabbing (M = 5.23%, SE = 0.45), *shaking* (M = 3.67%, SE = 0.59), and finally "*other*" types of touch (M = 1.96%, SE = 0.37) and *patting* (M = 1.08%, SE = 0.29). No significant differences were found for the types of touch mothers used across periods.

Function of Touch. The repeated measures ANOVA revealed a significant main effect for the Function of Touch, $F(6, 234) = 47.21$, $\eta_p^2 = .55$, $p < .001$ (see Appendix D, Table 5). The functions that mothers spent the most time using were: *playful* (M = 28.67%, SE = 2.44), followed by *active* and *passive accompaniment* (M = 19.62%, SE = 1.84; M = 15.71%, SE = 1.80), *nurturing* (M = 5.29%, SE = 0.81), *attention-getting* (M = 4.78% SE = 0.81), *unspecified* function (M = 3.32%, SE = 0.55), and finally *utilitarian* (M = 1.34%, SE = 0.24).

A significant interaction between Function of Touch and Period was found, $F(6, 234) = 2.37$, $\eta_p^2 = .06$, $p < .05$ (see Appendix D, Table 5; Appendix E, Table 2). As illustrated in Figure 3, there was more *attention-getting* in the Normal compared to the Reunion Normal period (M = 6.67%, SE = 1.24; M = 2.88%, SE = 0.70). In addition, there was more *unspecified* function of touch in the Reunion Normal than in the Normal period (M = 4.13%, SE = 0.73; M = 2.52%, SE = 0.53). Of interest, a trend (p = 0.09) was observed for *nurturing* function of touch. More *nurturing* was observed in the Reunion Normal compared to the Normal period (M = 6.40%, SE = 1.24; M = 4.19%, SE = 0.77).

Objective 2: Influence of infants' and mothers' distress level on maternal touch

In order to address the second objective, which was to clarify the impact of infants' and mothers' distress levels on the function of touch provided to infants across interaction periods, a paired-samples t-test and two repeated measures ANOVAs were

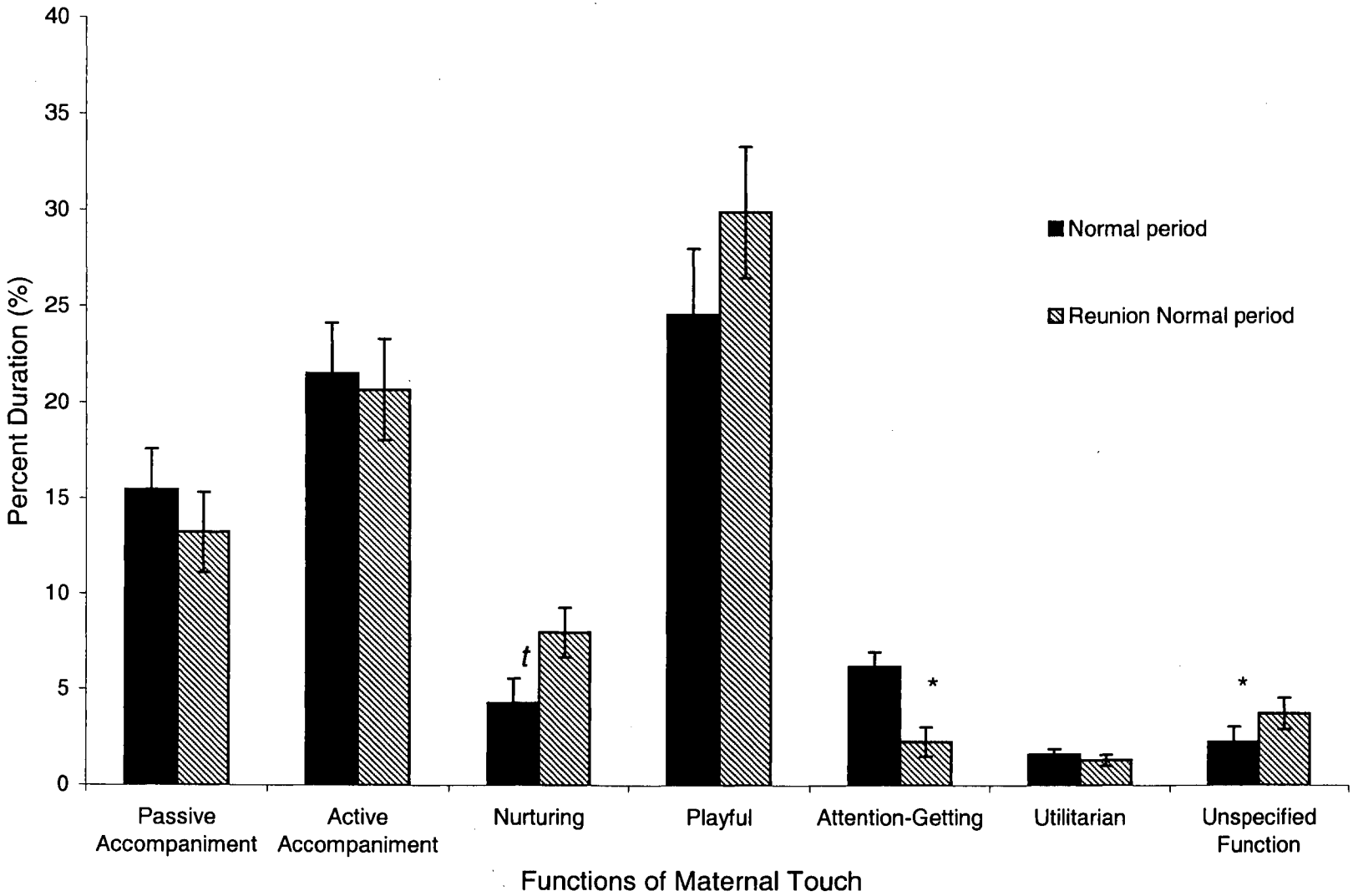

Figure 3. Percent duration of functions of maternal touch across interaction periods

conducted. Because of the low occurrence of infants' distress, the medium and high level of infants' distress were clustered together. To ensure that differences were not the result of an a priori difference in the overall duration of touch provided to infants or mothers exhibiting distress, the overall duration of touch was compared using two repeated measures ANOVAs. To investigate the influence of infants' distress level, a 2 x 2 (Period (Normal vs. Reunion Normal) x Infants' Distress level) repeated measures ANOVA was conducted to compare the overall duration of touch while a 7 x 2 x 2 (Function x Period x Infants' Distress level) repeated measures ANOVA was conducted to investigate the duration of each function of touch. For the duration of touch, the ANOVA was found to be non-significant, $F(1, 38) = 0.18$, $\eta_p^2 = .00$, $p = .97$ (see Appendix D, Table 6), indicating that mothers used the same amount of overall touch across both Normal periods regardless of infants' distress level. A significant interaction was found for Function of Touch and Distress level, $F(6, 228) = 2.33$, $\eta_p^2 = .06$, $p < .05$ (see Appendix D, Table 7; see Appendix F, Table 1), indicating that mothers used different functions of touch based on their infants' distress level. As illustrated in Figure 4, mothers used more *nurturing* touch when their infants exhibited high levels of distress compared to low level of distress ($M = 7.88\%$, $SE = 1.49$; $M = 4.31\%$, $SE = 0.92$). In addition, a trend ($p = .06$), indicated that with highly distressed infants, mothers used more *active accompaniment* function than with their low distressed infants ($M = 25.14\%$, $SE = 3.39$; $M = 17.54\%$, $SE = 2.02$).

To examine the changes in mothers' distress level following the Normal period as compared to following the SF period, a paired-samples t-test was conducted. The analysis revealed that there was a significant difference in mothers' distress levels across

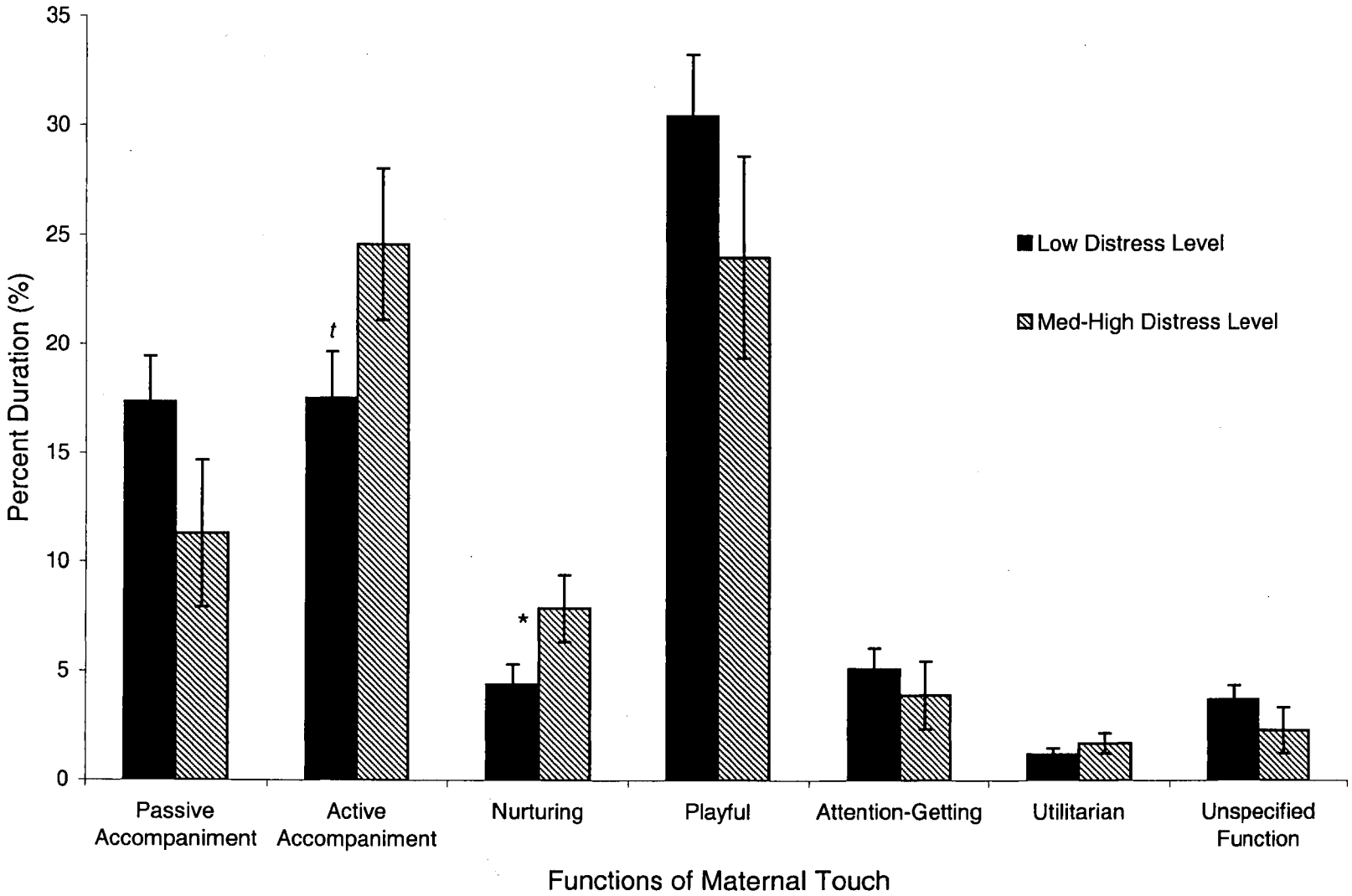

Figure 4. Percent duration of functions of maternal touch across infants' distress levels

period, $t(39) = -3.56$, $p < .001$. Mothers were found to be more distressed following the SF period, during the transition period and the beginning of the Reunion Normal period, compared to the end of the Normal period ($M = 0.57$, $SE = .08$, $M = 0.23$, $SE = .07$). To investigate the influence of mothers' distress level following the SF period, a 2 x 2 (Period x Mothers' Distress level) repeated measure ANOVA was used to compare the overall duration of touch while a 7 x 2 x 2 (Function x Period x Mothers' distress level) repeated measures ANOVA was used to investigate the duration of each function of touch. Both ANOVAs were found to be non-significant (duration of touch: $F(1, 38) = 2.35$, $\eta_p^2 = 0.05$, $p = .14$; function of touch: $F(6, 228) = 1.22$, $\eta_p^2 = 0.02$, $p = .29$ (see Appendix D, Table 8, 9; see Appendix F, Table 2), demonstrating that the overall touch and the functions of touch used by mothers were not affected by mothers' distress level.

Objective 3: The reciprocal relationship between functions of maternal touch and infants' smiling and fretting

To address the third objective, hierarchical regressions were conducted. To maximize power for the analyses, the number of predictors were kept to a maximum of four and only the functions of touch that correlated significantly with infants' smiling, fretting, gazing, distress level or maternal regulatory behaviours were entered. Intercorrelations between variables employed in the hierarchical regression can be found in Table 1.

Infants' smiling. Three hierarchical multiple regressions were used to investigate the contributions of maternal touch, specifically *playful* touch, and infants' gaze at mothers' faces to the prediction of infants' smiling. In the first step, *playful* function of touch in the Normal period was entered. For the hierarchical regression predicting

Table 1

Inter-correlations among variables included in hierarchical regression

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Infants' smiling in N	-	.48**	.52**	-.41**	-.05	-.16	.64*	.33*	.45**	-.05	-.20	.07	-.07	.15	.66**	.13	-.11	-.21	-.08	.15
2. Infants' smiling in SF	-	-	.37*	-.23	-.18	-.07	.24	.47**	.03	-.23	-.10	-.09	.04	.15	.38*	.03	-.18	-.16	-.07	.12
3. Infants' smiling in RN	-	-	-	-.21	-.30*	-.16	.39*	.23	.43**	-.28'	-.25	-.12	-.09	.05	.45*	.51**	.14	-.18	-.36*	-.10
4. Infants' fretting in N	-	-	-	-	.18	.13	-.24	-.00	.00	.14	.18	-.04	.37*	.29	-.24	.32*	.32*	.18	-.16	-.19
5. Infants' fretting in SF	-	-	-	-	-	.02	-.05	.08	.07	.61**	.31	.23	.30'	.41**	-.03	-.06	.03	.29'	.09	.43**
6. Infants' fretting in RN	-	-	-	-	-	-	-.10	.15	.05	.52**	.20	.06	-.00	.01	-.17	-.10	-.15	.57**	.20	-.16
7. Infants' gazing at mothers' face in N	-	-	-	-	-	-	-	.32	.60**	-.06	-.06	.12	.04	.04	.42*	-.82	-.19	-.30'	.11	.26
8. Infants' gazing at mothers' face in SF	-	-	-	-	-	-	-	-	.33*	.19	-.12	.23	.24	.44**	.34*	-.01	-.18	.16	-.16	.11
9. Infants' gazing at mothers' face in RN	-	-	-	-	-	-	-	-	-	.03	-.04	.08	-.04	.03'	.38*	.29'	.00	.13	-.21	-.13
10. Infants' distress level	-	-	-	-	-	-	-	-	-	-	.47**	.03	.15	.21	-.16	-.15	.02	.40*	.23	.28
11. Mothers' distress in T1	-	-	-	-	-	-	-	-	-	-	-	.10	.12	-.00	.02	-.07	.00	.02	.26	.37*
12. Mothers' distress in T2	-	-	-	-	-	-	-	-	-	-	-	-	.38*	.03	.08	-.22	-.00	.09	.21	.18
13. Maternal regulatory behaviour in T1	-	-	-	-	-	-	-	-	-	-	-	-	-	.26	.09	-.01	.09	.05	.03	.15
14. Maternal regulatory behaviour in T2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.09	.30	.16	.33*	-.06	.09
15. Playful function of touch in N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.33*	.00	-.18	-.03	.16
16. Playful function of touch in RN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.55**	.11	-.46**	-.32*
17. Nurturing function of touch in N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.27	-.15	-.21
18. Nurturing function of touch in RN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.04	-.14
19. Active accompaniment in N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.47**
20. Active accompaniment in RN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note. $^{'}p < .10$, $*p < .05$, $**p < .01$ N= Normal period SF= Still-face period RN= Reunion Normal T1= transition between N and SF T2= transition between SF and RN

smiling in the Reunion Normal period, *playful* function of touch in the Reunion Normal period was entered in the second step. Since *playful* and *active accompaniment* function of touch are made up of the same types of touch but are distinguished by other maternal behaviours (e.g., verbalization, gesture), *active accompaniment* was in the next step in order to control for the effects of that variable in predicting smiling in both Normal periods. In the last step, infants' gaze at their mothers' faces was entered.

In the first regression, *playful* and *active* accompaniment function of touch and gazing at mothers' faces during the Normal period were used as predictors of infants' smiling and accounted for 59.90 % (56.20% adjusted) of the total variance. When maternal *playful* function was entered in Step 1, the model reached significance (*Beta* = .64, $p < .001$) and accounted for 41.35% of the variance. In step 2, the model remained significant, however, *active accompaniment* function did not emerge as a significant predictor. *Playful* function of touch remained significant (*Beta* = .64, $p < .001$) and accounted for 40.96% of the variance. In the last step when gazing at mothers' faces was entered, the model was still significant. *Playful* function of touch remained significant (*Beta* = .44, $p < .001$) and accounted for 16.00% of the variance, while infants' gazing accounted for 17.98% of the variance (*Beta* = .47, $p < .001$) (Table 2). These findings indicate that the overall amount of smiling in the Normal period was predicted by the *playful* touch provided by mothers as well as infants' gazing at their mothers, however it was not predicted by the use of *active accompaniment* function of touch.

The second regression examined *playful* function of touch in the Normal period and gazing at mothers' faces during the SF as predictors of infants' smiling during the SF period and accounted for 25.80 % (21.40% adjusted) of the total variance. When maternal

Table 2

Summary of Hierarchical Regression Analysis for Variables Predicting Infants' Smiling in the Normal Period

Variables	ß	sr^2	t	R^2_{ch}	F_{ch}
Step 1				0.42	24.08***
Playful (N)	0.64	0.41	4.91***		
Step 2				0.01	0.29
Playful (N)	0.64	0.40	4.82***		
Active accompaniment (N)	- 0.07	0.01	- 0.55		
Step 3				0.18	14.32**
Playful (N)	0.44	0.16	3.56**		
Active accompaniment (N)	- 0.14	0.01	- 1.19		
Gaze at mothers' faces (N)	0.47	0.17	3.79**		
	R=.77	R^2 adj.=.56		F=15.95	

* $p < .05$, ** $p < .01$, *** $p < .001$

Note: N= Normal period

playful function was entered in Step 1, the model reached significance (*Beta* = .35, p <.05) and accounted for 12.30% of the variance. Infants receiving more *playful* touch in the Normal period smiled more in the SF period. In step 2, when gazing at mothers' faces was entered, the model was still significant. However, *playful* function of touch was no longer significant. Gazing at mothers' faces accounted for 13.46% of the variance, indicating that the more infants looked at their mothers' faces during the SF, the more they smiled (*Beta* = .39, $p < .05$). These findings suggest that *playful* function of touch in the Normal period did not impact infants' smiling in the SF period when gaze at mothers' face was controlled for (Table 3).

The third regression examined *playful* function of touch in the Normal period, *playful* and *active accompaniment* function, and gazing at mothers' faces during the Reunion Normal period as predictors of infants' smiling in the Reunion Normal period and accounted for 39.00 % (31.10% adjusted) of the total variance. When maternal *playful* function in the Normal period was entered in Step 1, the model reached significance (*Beta* = .46, $p < .01$) and accounted for 21.00% of the variance. In step 2, when *playful* function in the Reunion Normal period was entered, the model was still significant. *Playful* function of touch in the Normal period remained significant (*Beta* = .33, $p < .05$) and accounted for 9.36% of the variance. *Playful* touch in the Reunion Normal period, accounted for 12.8% of the variance (*Beta* = .38, $p < .05$). In Step 3, the model was still significant, however the addition of *active accompaniment* did not emerge as a significant predictor. *Playful* function of touch in the Reunion Normal period remained significant (*Beta* = .41, $p< 0.01$) and accounted for 12.67% of the variance, while a trend was found for *playful* function in the Normal period (*Beta* = .31, $p < 0.06$)

Table 3

Summary of Hierarchical Regression Analysis for Variables Predicting Infants' Smiling in the SF Period

Variables	ß	sr^2	t	R^2_{ch}	F_{ch}
Step 1				0.12	4.80*
Playful (N)	0.35	0.12	2.19*		
Step 2				0.14	5.99*
Playful (N)	0.22	0.04	1.38		
Gaze at mothers' faces (SF)	0.39	0.13	2.45*		
	R=.51	R^2 adj.=.21		F=5.75	

* $p < .05$, ** $p < .01$, *** $p < .001$

Note: N= Normal period, SF= Still-Face period

accounting for 7.50% of the variance. In the last step, gazing at mothers' faces did not emerge as a significant predictor, however *playful* function of touch in the Reunion Normal period remained significant (*Beta*= .37, $p< .05$) accounting for 10.11% of the variance. The amount of infants' smiling in the Reunion Normal period was predicted by mothers' *playful* touch (*Beta* = .38, $p < .05$) in the same period (Table 4).

Infants' fretting. Three hierarchical multiple regressions were used to investigate the relationship between *nurturing* function of touch, maternal regulatory behaviour in the transition period, and gazing at mothers' faces as predictors of infants' fretting. Since the beginning of a procedure can be stressful for infants, the relationship between infants' fretting and *nurturing* function of touch was investigated prior to the SF period. This investigation also allowed for a better understanding of the relationship between *nurturing* function of touch and infants' fretting during the Reunion period, a period in which emotional regulation and re-engagement occur subsequent to the SF period (Kogan & Carter, 1996; Weinberg & Tronick, 1996).

In the first step, *nurturing* function of touch in the Normal period was entered. For the regressions predicting infants' fretting in the SF and in the Reunion Normal periods, maternal regulatory behaviour was entered as a second step. In the regression predicting fretting in the Reunion Normal period, the *nurturing* function of touch was entered in the third step. Finally, for all three regressions, gazing at mothers' face was entered in the last step.

For the first hierarchical regression, *nurturing* function of touch and gazing at mothers' face during the Normal period were used to predict infants' fretting in the Normal period. In the first step, *nurturing* function was entered and gazing at mothers'

Table 4

Summary of Hierarchical Regression Analysis for Variables Predicting Infants' Smiling in the Reunion Normal Period

Variables	ß	sr^2	t	R^2_{ch}	F_{ch}
Step 1				0.21	9.02**
Playful (N)	0.46	0.20	3.00**		
Step 2				0.13	6.40*
Playful (N)	0.33	0.93	2.16*		
Playful (RN)	0.38	0.12	2.53*		
Step 3				0.00	0.20
Playful (N)	0.31	0.75	1.90^t		
Playful (RN)	0.41	0.35	2.48*		
Active accompaniment (RN)	0.07	0.00	0.45		
Step 4				0.04	2.42
Playful (N)	0.23	0.03	1.38		
Playful (RN)	0.37	0.10	2.26*		
Active accompaniment (RN)	0.08	0.00	0.52		
Gaze at mothers' faces (RN)	0.24	0.04	1.56		
	R=.62		R^2 adj.=.31	F=4.95	

* $p < .05$, ** $p < .01$, *** $p < .001$

Note: N= Normal period, RN= Reunion Normal period

face was entered in the second step. The overall model accounted for 13.50% (8.20% adjusted) of the total variance. Only *nurturing function* of touch entered in Step 1 emerged as a trend in the prediction of infants' fretting (*Beta* = .32, $p < .06$) accounting for 9.98% of the total variance, indicating that the amount of nurturing touch provided by mothers was related to infants' fretting (Table 5).

The second hierarchical regression investigating infants' fretting in the SF period was not significant. This findings indicate that the amount of *nurturing* touch provided in the Normal period, maternal regulatory behaviour in the transition period, and gazing at mothers' face in the SF period were not significant predictors of infants' fretting in the SF period (Table 6).

To predict the duration of infants' fretting in the Reunion Normal period, mothers' use of *nurturing* function of touch in the Normal and in the Reunion Normal periods and mothers' regulatory behaviour during the transition following the SF were used as predictors. In step 1, *nurturing* touch in the Normal period was entered. In step 2, maternal regulatory behaviour following the SF period was entered. In Step 3, *nurturing* touch in the Reunion Normal period was entered. In Step 4, infants' gazing at their mothers' faces was entered. The overall model accounted for 49.30 % (42.80% adjusted) of the total variance. In step 3, *nurturing* function of touch in the Normal Period entered in Step 1, accounted for 8.17% of the variance. The more mothers used *nurturing* touch in the Normal period, the less infants fretted in the Reunion Normal period (*Beta* = -.29, $p < .05$). In Step 3, the *nurturing* function of touch in the Reunion Normal period accounted for 48.16% of the variance. The more infants fretted in the Reunion Normal period the more mothers used *nurturing* of touch (*Beta* = .75, $p < .001$) (Table 7).

Table 5

Summary of Hierarchical Regression Analysis for Variables Predicting Infants' Fretting in the Normal Period

Variables	ß	sr^2	t	R^2_{ch}	F_{ch}
Step 1				0.10	3.78^t
Nurturing (N)	0.32	0.09	1.94^t		
Step 2				0.04	1.32
Nurturing (N)	0.28	0.07	1.70		
Gaze at mothers' faces (N)	- 0.19	0.03	- 1.15		
	R=.37	R^2 adj.=.08		F=2.57	

$^* p < .05$, $^{**} p < .01$, $^{***} p < .001$, $t < .10$

Note: N= Normal period

Table 6

Summary of Hierarchical Regression Analysis for Variables Predicting Infants' Fretting in the SF Period

Variables	ß	sr^2	t	R^2_{ch}	F_{ch}
Step 1				0.00	0.01
Nurturing (N)	0.02	0.00	0.11		
Step 2				0.00	0.07
Nurturing (N)	0.01	0.00	0.06		
Gaze at mothers' faces (N)	- 0.05	0.00	- 0.26		
Step 3				0.08	2.80
Nurturing (N)	- 0.01	0.00	- 0.07		
Gaze at mothers' faces (N)	- 0.06	0.00	- 0.36		
Maternal Regulatory Beh. (T1)	0.28	0.08	1.67		
Step 4				0.00	0.03
Nurturing (N)	- 0.01	0.00	- 0.05		
Gaze at mothers' faces (N)	- 0.07	0.00	- 0.39		
Maternal Regulatory Beh. (T1)	0.28	0.07	1.54		
Gaze at mothers' faces (SF)	0.04	0.00	0.18		
	R=.29	R^2 adj.=-.04		F=.71	

* $p < .05$, ** $p < .01$, *** $p < .001$

Note: N= Normal period, SF= Still-Face period, T1= transition between N and SF

Table 7

Summary of Hierarchical Regression Analysis for Variables Predicting Infants' Fretting in the Reunion Normal Period

Variables	ß	sr^2	t	R^2_{ch}	F_{ch}
Step 1				0.02	0.73
Nurturing (N)	- 0.15	0.02	- 0.85		
Step 2				0.00	0.03
Nurturing (N)	- 0.15	0.02	- 0.86		
Maternal Regulatory Beh. (T2)	0.03	0.00	0.17		
Step 3				0.48	29.75*
Nurturing (N)	- 0.30	0.08	- 2.28*		
Maternal Regulatory Beh. (T2)	- 0.20	0.03	- 1.46		
Nurturing (RN)	0.75	0.47	5.45***		
Step 4				0.00	0.01
Nurturing (N)	- 0.30	0.08	- 2.22*		
Maternal Regulatory Beh. (T2)	- 0.20	0.03	- 1.41		
Nurturing (RN)	0.75	0.47	5.36***		
Gaze at mothers' faces (RN)	0.01	0.00	0.10		
	R=.70		R^2 adj.=.43	F=7.54	

* $p < .05$, ** $p < .01$, *** $p < .001$, $t < .10$

Note: N= Normal period, SF= Still-Face period, RN= Reunion Normal period, T2= transition between SF and RN

Objective 4: The influence of the transition period on the subsequent regulatory role of maternal touch

Predicting maternal regulatory behaviours in the transition period. The fourth objective of the present study was to investigate the role of maternal regulatory behaviour provided in the transition period, T1 and T2. Specifically, how infants' affect and gaze at their mothers' faces, and mothers' distress level predicted maternal regulatory behaviour during the transition period. In addition, to investigate the impact of maternal regulatory behaviour on the amount of *nurturing* touch provided to infants in the Reunion Normal period, a path analysis was conducted.

To examine the amount of regulatory behaviour (i.e. touching, gazing, smiling and talking to their infants) provided to the infants during the transition periods following the Normal and SF periods a paired-samples t-test was conducted. The analysis revealed that there were no significant differences in maternal regulatory behaviours provided to infants following each period, $t(39) = -.26$, $p = .09$.

Two hierarchical multiple regressions were used to evaluate the contribution of infants' smiling, fretting, and gazing, and mothers' distress level to the prediction of maternal regulatory behaviours during the two transition periods. Infants' fretting was entered in the first step, followed by infants' smiling in the second step which was used as a control variable. In the third step, infants' gaze at mothers' faces was entered and finally, mothers' distress level was entered in the final step. The first regression predicting the maternal regulatory behaviour provided to the infant during T1 accounted for 16.50% (5.70% adjusted) of the total variance. Only infants' fretting entered in Step 1 emerged as a significant predictor (*Beta* = .42, $p < .05$) accounting for 14.59% of the

total variance. The more infants fretted in the Normal period, the more maternal regulatory behaviour mothers provided in the subsequent transition period (Table 8).

The second hierarchical regression predicted the amount of maternal regulatory behaviour provided in T2 and accounted for 38.40% (30.40%) of the total variance. When infant's fretting was entered in Step 1, the model reached significance (*Beta* = .39, $p < .05$) and accounted for 14.89% of the variance. In Step 2, when infants' smiling was entered, the model was still significant. Fretting remained significant (*Beta* = .42, $p <$ .05) and accounted for 16.89% of the variance, however smiling did not emerge as a significant predictor of maternal regulatory behaviour. In Step 3, when gazing was entered, the model remained significant. Fretting accounted for 11.09% of the variance (*Beta* = .34, $p < .05$) Gazing at mothers' faces accounted for 14.00% of the variance (*Beta* = .43, $p < .05$). When infants were fretting and gazing at their mothers' faces during the SF period, mothers tended to use more regulatory behaviours in the transition period following the SF period (Table 9).

Model predicting the duration of nurturing functions in the Reunion Normal period. In order to test the fit of a conceptual model of the factors predicting the overall duration of *nurturing* touch in the Reunion Normal period, an exploratory path model was conducted using EQS structural equation modeling software (Bentler, 1995). Due to the participant-to-path ratio demanded by structural equation modeling, only the most highly correlated and theoretically relevant predictors were included in the following model. The fit of the overall model was good: CFI= 1.00, RMSEA= 0.00 and $\chi 2$= 0.02 (2, $n = 40$), $p = .99$. As depicted in Figure 5, infants' fretting in the SF period was significantly linked to *nurturing* touch through maternal regulatory behaviours provided

Table 8

Summary of Hierarchical Regression Analysis for Variables Predicting Maternal Regulatory Behaviours during the Transition Period between the Normal and the SF Periods

Variables	ß	sr^2	t	R^2_{ch}	F_{ch}
Step 1				0.15	5.83*
Infants fretting (N)	0.38	0.14	2.41		
Step 2				0.01	0.38
Infants fretting (N)	0.43	0.15	2.43*		
Infants smiling (N)	0.11	0.01	0.62		
Step 3				0.01	0.33
Infants fretting (N)	0.42	0.14	2.39*		
Infants smiling (N)	0.03	0.00	0.13		
Gaze at mothers' faces (N)	0.12	0.01	0.58		
Step 4				0.00	0.02
Infants fretting (N)	0.42	0.14	2.32*		
Infants smiling (N)	0.03	0.00	0.15		
Gaze at mothers' faces (N)	0.12	0.01	0.55		
Mothers' distress (T1)	0.02	0.00	0.14		
	R=.40		R^2 adj.=.06	F=1.53	

* $p < .05$., ** $p < .01$, *** $p < .001$, $t < .1$

Note: N= Normal period, SF= Still-Face period, T1= transition between N and SF

Table 9

Summary of Hierarchical Regression Analysis for Variables Predicting Maternal Regulatory Behaviours during the Transition Period between the SF and the Reunion Normal Periods

Variables	ß	sr^2	t	R^2_{ch}	F_{ch}
Step 1				0.15	5.96*
Infants fretting (SF)	0.39	0.14	2.44		
Step 2				0.03	1.17
Infants fretting (SF)	0.42	0.16	2.60*		
Infants smiling (SF)	0.17	0.02	1.08		
Step 3				0.14	6.61*
Infants fretting (SF)	0.34	0.11	2.28*		
Infants smiling (SF)	- 0.04	0.00	- 0.24		
Gaze at mothers' faces (SF)	0.43	0.14	2.57*		
Step 4				0.07	3.26^t
Infants fretting (SF)	0.38	0.13	2.58*		
Infants smiling (SF)	- 0.13	0.01	- 0.73		
Gaze at mothers' faces (SF)	0.53	0.19	3.11**		
Mothers' distress (T2)	- 0.28	0.06	- 1.81^t		
	R=.62	R^2 adj.=.30		F=4.83	

* $p < .05$, ** $p < .01$, *** $p < .001$, $t < .10$

Note: N= Normal period, SF= Still-Face period, RN= Reunion Normal period, T1= transition between N and SF, T2= transition between SF and RN

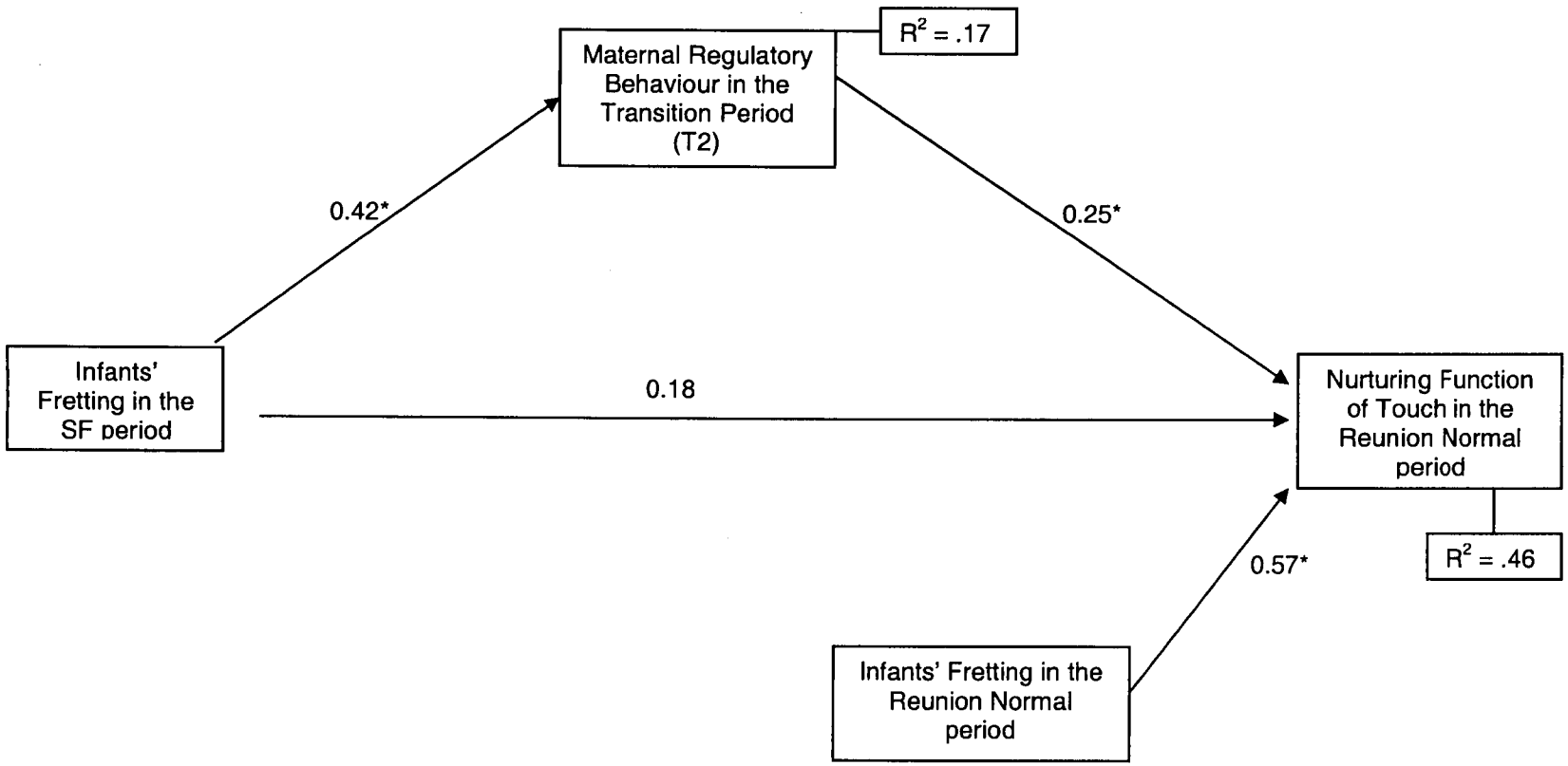

Figure 5. Structural equation model predicting *nurturing* function of touch in the Reunion Normal period (n = 40 dyads). $\chi 2$=0.02, p = 0.99, CFI=1.00, RMSEA= 0.00, Standardized EQS parameter estimates are presented next to paths. *p < .05.

in the transition period (β = .42). In addition, infants' fretting in the Reunion Normal period lead to increased *nurturing* function of touch (β = .57). In general, while the direct pathway from fretting in the SF period to *nurturing* function of touch was not significant, the indirect path was; maternal regulatory behaviours provided in the transition period as well as fretting during the Reunion Normal period explained the amount of *nurturing* touch in the Reunion period.

Discussion

The main objective of the present study was to describe the functions of maternal touch during face-to-face interaction between mothers and their 5 ½ month old infants. In general, the results supported the hypotheses. Interestingly, while mothers were consistent in the duration and in the types of touch they provided to their infants throughout the interaction periods, the duration of functions of touch varied across both Normal periods of the SF. In addition, specific functions of touch were found to influence infants' affect. In particular, *playful* function of touch in both Normal periods was shown to predict infants' smiling, while *nurturing* function of touch predicted infants' fretting. Furthermore, infants' distress level, and not mothers' distress, influenced the function of touch and the regulatory behaviours employed by mothers. Finally, the transitions between periods were revealed to be critical for maternal regulation of infants' affect. In turn, maternal regulatory behaviours provided during the transition period following the SF period influenced the nature of maternal touch in the Reunion Normal period.

In line with prior research, the amount of touch was found to be consistently high across periods of mother-infant interaction (Arnold, 2002; Jean et al., 2006; Kisilevsky, Stack, Muir, 1991; Stack & Muir, 1990; 1992; Stack & LePage, 1996; Weiss, Wilson, St.

John Seed, & Paul, 2001), supporting the cumulative evidence that touch is an important communication channel between the dyad. Moreover, mothers' tactile behaviour was found to be composed of diverse types of touch, ranging from passive (e.g., static) to very active (e.g., lifting, tickling). The stability in the duration and types of touch utilized by mothers throughout the interaction periods provides evidence that the perturbation caused by the SF period did not impede the quality of these touching behaviours; the duration of touch remained high while the types of touch continued to be diverse. In contrast, prior studies have reported variations in duration or types of touch across interaction periods (Arnold, 2002; Jean et al., 2006; Polan & Ward, 1992; Stack & Arnold, 1998; Stack & LePage, 1996). However, these studies compared the quality of maternal touch across situational context (e.g., play, feeding) or across instructional context (i.e., modified SF), instead of within the same context. Consequently, results from these studies are not surprising since, as Jones and Yarbrough (1985) have proposed across context, the same type of touch may have a different meaning. Hence, investigators have suggested that to obtain a holistic understanding of the communicative properties of touch, there is a need for a measure of touch that takes into consideration contextual factors as well as other verbal and nonverbal behaviour (Hertenstein, 2002; Jones & LeBaron, 2002; Jones & Yarbrough, 1985; Muir, 2002; Stack, 2001).

The Functions of Touch Scale (Jean et al., 2005) was created to address this need. Its coding examined the function of maternal touch while taking into account various means of verbal and non-verbal communication as well as infants' and mothers' behaviour. The results of the present study provide evidence that an integrated approach to the measurement of touch adequately portrays subtle changes in maternal touch

following changes in infants' affect. Specifically, the increase in *attention-getting* function of touch observed in the first Normal period may reflect mothers' attempts to socially engage their infants following the beginning of a new interaction period. This assertion coincides with Gusella et al.'s (1988), and Kaye and Fogel's (1980) findings that mothers employed touch as a mean to attract and maintain infants' attention. In conjunction with prior research, this finding signifies that touch is frequently employed by the caregiver as a strategy to sustain or recapture infants' declining attention (Arnold, 2002; Field, 1977; Symon & Moran, 1987). Additionally, the increase in *unspecified* function of touch observed in the Reunion Normal period supports the notion that increased brief contacts between mothers and infants is an indication of the proximity between the dyad (Polan & Ward, 1992). Moreover, the increase in *nurturing* function of touch in the Reunion Normal Period underscores the regulatory role of maternal touch. Consistent with this interpretation, Arnold demonstrated that in order to calm and relax their infants, mothers used more nurturing types of touch than any other form of active touch. Conjointly, these findings imply that following a period of maternal unresponsiveness, mothers adjusted their tactile behaviour to produce a more proximal and nurturing interaction thereby facilitating the re-engagement and co-regulatory processes.

In order to conclude that the function of touch plays a communicative role in bi-directional exchanges, it is essential to demonstrate that touch influences infants' affect, and in return, infants' affect influences maternal touch. The present findings revealed that the amount of *nurturing* function was related to infants' fretting and distress level, thus, underscoring the calming and regulatory role of *nurturing* function of touch (Moreno et

al., 2006; Weiss, et al., 2000). Similarly, van den Boom and Hoeksma (1994) established that while interacting, mothers and their highly irritable infants spent most of their time trying to alleviate infants' distress which resulted in a decrease in overall physical stimulation. Since touch has been shown to be calming and soothing for the infant, it can be advanced that it is an integral part of the dyadic co-regulation process (Tronick, 1989).

With regard to the *playful* function of touch and its influence on infants' smiling, as expected, *playful* function as opposed to *active accompaniment* was shown to predict infants' smiling across all interaction periods. Similarly, other studies have established that *playful* types of touch, such as infant lifting and tickling (Blehar, Lieberman, & Ainsworth, 1977; Moszkowski et al., 2005; Stack, et al., 2006) lead to an increase in infants' smiling. However in the present study, *active accompaniment* touch, which consists of the same types of touch as *playful* touch but used during a non-playful context, did not lead to smiling. Therefore, it was not solely the impact of highly active types of touch that led to smiling but the combination of active touch and maternal playful behaviours (e.g., singing, game playing). Likewise, Brossard and Decarie (1968) demonstrated that touch alone resulted in less smiling than touch accompanying auditory and visual stimulation and, although active touch has been shown to mediate the effect of the SF (Stack & Muir, 1992), infants' smiling was highest when mothers were allowed to employ all modalities of communication. Interestingly, an increase in *active accompaniment*, as opposed to an increase in *playful* function of touch, was observed for distressed infants. This increase in *active accompaniment* for distressed infants indicates that instead of engaging their infants in game-like behaviour, which is typical of a *playful* touch, when infants exhibited distress, mothers talked and soothed their infants while

using active types of touch. Taken together, these results provide evidence that the measurement of types of touch is not sufficient for a complete description of tactile communication.

Although these findings highlight the relationship between maternal touch and infants' affect, investigating the impact of maternal touch on the quality of future infants' affect was found to be enlightening. In accordance with past studies demonstrating that earlier maternal behaviours influence infants' reactions to the SF (Carter et al., 1990; Stoller & Field, 1982; Tarabulsy et al. 2003; Tronick et al., 1982), *playful* and *nurturing* functions of touch were found to positively impact infants' affect in subsequent periods.

Taken together, these results demonstrate mothers' abilities to attune their tactile behaviour according to their infants' affect and level of distress, thereby providing further support for mothers' sensitivity toward their infants' emotional displays, while at the same time validating the importance of measuring the function of maternal touch. In addition, findings confirmed the existence of a reciprocal influence between infants' affect and mothers' touch. By observing that a change in their affect leads to a contingent change in their mothers' regulatory behaviours, infants may discover that they have control over the interaction, leading in turn to an increased sense of self-efficacy and self-awareness (Bigelow, 2001; Gable & Isabella, 1992; Gergely & Watson, 1996, 1999).

In order to increase our understanding of the bi-directional influence between infants' affect and mothers' behaviour, and to appreciate the process of emotional regulation following the SF, the quality of maternal regulatory behaviours during the transition period was uniquely investigated. Its examination was revealed to be invaluable for an understanding of the influence of the SF on subsequent mothers' and infants'

behaviour. The results indicated that infants' fretting during the Normal and SF periods and gazing in the SF period, as opposed to infants' smiling and maternal distress, predicted the amount of maternal regulatory behaviours during these brief interaction periods. This would suggest that the transition period is used to regulate infants' negative affect rather than to reinforce infants' smiling or regulate mothers' own distress. Interestingly, although infants exhibited increased fretting during the SF, mothers used a consistent amount of regulatory behaviours throughout both transition periods. The absence of observed difference across transition periods might reflect a need for a coding system that would take into account the qualitative and quantitative components of maternal smiling, gazing, and verbalization as opposed to only measuring the presence or absence of these behaviours. With such a system, a more sophisticated description of the regulatory behaviours provided to infants would be obtained.

An enhanced understanding of the role of the transition period was obtained by examining its influence on later maternal behaviour. Through a path analysis, the influential regulatory role of the transition period was confirmed. Specifically, the quality of mothers' regulatory behaviour in the transition period, as opposed to the amount of infants' fretting during the SF period, influenced the amount of nurturing touch provided to the infant in the following period. Results from the present study bring to light the importance of investigating the transition period while using the SF procedure. In the past, the regulatory role of these periods and their influence on subsequent behaviour has been omitted. By neglecting to consider the transition period in the present study, crucial information regarding the process of dyadic co-regulation would have been lost. In addition, since infants received regulatory behaviour in the transition period prior to the

Reunion Normal period, the omission of its examination could lead to a misinterpretation of the impact of the SF on subsequent maternal and infants' behaviours.

Together, results from this study confirm the value of examining the qualitative properties of the transition period as well as investigating infants' reactions to the SF (Calkins et al., 2004; Jamieson, 2004; Mayes et al., 1991). Inferring that all infants react the same way may result in invalid conclusions and a lack of generalizability. While the analysis of infants' distress was revealed to be essential for a more complete comprehension of tactile communication, the results obtained for the contribution of maternal distress were not as noteworthy. Although mothers were found to be more distressed following the SF period, their distress level appeared to have no impact on their subsequent regulatory and tactile behaviours. This result is discrepant from Mayes et al.'s (1991) findings indicating that mothers experiencing distress were more likely to make soothing comments and pick up their infants following the SF. However, in their study, the assessment of mothers' distress was achieved through an interview, whereas in the present study, it was coded as either present or absent based on the quality of mothers' verbalizations following the end of the SF and the beginning of the Normal Reunion period. For a better understanding of the role of mothers' experience during the SF procedure, a more comprehensive assessment of distress is warranted. In addition, maternal distress could have influenced other modalities of communication (e.g., smiling, verbal content) occurring during the Reunion Normal period, however these were not assessed in the present study.

The present study was designed to provide a description of maternal function of touch during a face-to-face SF procedure between mothers and their 5 ½ month-old

infants. While past research has focused on the duration of touch and the investigation of the types of touch, the present study directly assessed the function of maternal touch. Its examination integrated verbal and nonverbal maternal behaviours, as well as contextual factors. This analysis was found to be crucial in understanding the communicative role of touch. Since prior research has demonstrated that the quality of maternal touch changes across infants' age and contexts (Arnold, 2002; Jean et al., 2006; Stack & Muir, 1990), an investigation of the function of touch over the first 6 months of life and across various interaction contexts (e.g., play, feeding) would provide valuable information on the quality of mother-infant relationships. Moreover, until now, most studies have investigated maternal touch while neglecting the indispensable contributions of paternal touch. Yet, fathers are sensitive and important partners in the development of children's emotional regulation and control (Gottman, Katz, & Hooven, 1997). To date, no studies have examined how paternal touching, specifically the quality of different functions of touch, influences infants' affect and regulatory behaviours. Examining how maternal and paternal touch modulates infants' emotional displays is necessary to obtain greater knowledge regarding parents' contributions toward the development of infants' social competence and to elucidate how parents use touch to communicate with their infants.

In summary, findings from the present study indicate that touch is integral to mother-infant interaction and emphasize the dynamic and communicative quality of maternal touch. Specifically, mothers were found to be sensitive to changes in infants' affect and attention which was reflected by changes in the function of touch utilized by mothers. Conjointly, the reciprocal influence of different functions of touch and infants' smiling and fretting was investigated. Findings suggest that *playful* function of touch lead

to an increase in infants' smiling while infants' fretting lead to an increase in *nurturing* function. Consistent with previous studies (de Chateau 1976, Weiss et al., 2000), the quality of mothers' tactile behaviour, namely the amount of *playful* and *nurturing* function, was also found to positively impact the nature of subsequent interactions. These findings suggest that mothers are aware of the impact of qualitative changes in their touching (Arnold, 2002) and that the quality of maternal touch affects current and future dyadic interactions. Moreover, the present study was the first to establish that infants' distress level in the SF, as opposed to mothers' distress, influences the functions of touch utilized by mothers during normal interactions. This result underscores the importance of studying differences in infants' reactions to the SF period. Moreover, the present study was the first to investigate the transition periods, and clearly demonstrated that mothers use these short transitions to regulate their infants. The amount and quality of regulatory behaviours provided to infants during the transition period were found to influence mothers' tactile behaviour during the Reunion Normal period. Together, these results contribute toward a greater understanding of how mothers and infants communicate and how touch and its functions play a role in their communication.

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Appendix A

Consent Form

Consent Form

Mother-Infant Interactions

This study is designed to look at infants' responses during social interaction and to study the different types of interaction used by caregivers and their role in social exchange.

I understand that my baby and I will participate in a study lasting approximately 60 minutes. In the first part, my baby will be seated in an infant seat directly facing me. The procedure will consist of several interaction periods, each lasting two to three minutes in length, during which time I will be asked to interact in different ways with my baby. During some periods I will be asked to interact with my baby as I normally do, while in others I will be asked to pose a neutral, still facial expression and remain silent for a brief period. There will be brief breaks separating the interaction periods. In the second part, my baby and I will play together on a carpeted floor for approximately 8 minutes in a designated area, during which time I will be asked to play with my baby as I normally would at home. Under no circumstances will any manipulation be harmful to my baby. Finally, I will be asked to complete several brief questionnaires.

The entire session will be videotaped so that at a later point my baby's responses may be scored. However, these recordings are kept in the strictest confidence and are not shown to others without my permission.

I understand that my participation in this study is totally voluntary. I know that I may withdraw at any time and for any reason. I also understand that I may request that the videotape recording of my baby be erased. In the event that the results of the study are published, my name and the name of my baby will be kept confidential. I am also aware that I may be asked to participate again when my baby is 12 and 18 months of age.

In the event that I have any unanswered concerns or complaints about this study, I may express these to Dr. Dale Stack (848-2424, ext. 7565), Dr. Lisa Serbin (848-2424, ext. 2255) or Dr. Alex Schwartzman (848-2424, ext. 2251) of the Psychology Department at Concordia University. In addition, the patient representative of the Jewish General Hospital is Mrs. Laurie Berlin (340-8222, ext. 5833). She can be contacted should I have any questions regarding my rights as a research volunteer.

Thank you for your cooperation.

I, _____, do hereby give my consent for my baby _____ to participate in a study conducted by Dr. Dale Stack at Concordia University, and with the cooperation of the Jewish General Hospital. A copy of this consent form has been given to me.

Parent's signature on behalf of child: _____ Date: _____

Parent's signature: _____ Date: _____

Witness: _____ Date: _____

October 1997

Appendix B

Demographic Questionnaire

Mother-Infant Interaction
(Revised, August 28, 1997)

Demographic Information

Order:

Study #: _____
Infant #: _____
Test Date: _____

Infant's Name: _____

D.O.B.: _____ E.D.O.B.: _____
Age: _____ Sex: _____

Mother's Name: _____ Age: _____

Lang. 's Spoken: _____

Father's Name: _____ Age: _____

Lang.'s Spoken: _____

Ethnic origin: _____

Phone #: _____

Address: _____
_____

Birth Weight: _____ Length of Labour: _____

Preg. Complications and Delivery Status: _____
_____

Medical History: _____
_____
_____

Breast fed: _____ Bottle fed: _____

Siblings:	Age	Sex
	_____	_____
	_____	_____
	_____	_____

Mother's Occupation: _____ Education: _____

Father's Occupation: _____ Education: _____

Mother's Recent Work History (full/part-time/home):

_____

Father's Work History (full/part-time/home):

_____

Hours spent with infant all day:

Mother: all day 3 / 4 1 / 2 1 / 4 < 1 / 4

Father: all day 3 / 4 1 / 2 1 / 4 < 1 / 4

Caretaking History (# of caretakers, day / homecare, hours, since when) :

_____

_____

Comments: _____

_____

_____

Would you be interested in participating in future studies conducted at the Centre for Research in Human Development (CRDH) ? _____

In 6 months: _____ In 12 months: _____

Date: _____

Appendix C

Operational Definitions

Summary of the Caregiver-Infant Touch Scale (CITS) Stack, LePage, Hains, & Muir (1996)

The Caregiver-Infant Touch Scale (CITS) was developed to measure touch in social contexts during parent-infant play, and to examine changes in social interactions across age. It measures qualitative and quantitative changes in tactile stimulation across age and caregiver, and as a function of different contexts and conditions.

Coding of the CITS

Touching is defined by a contact between the mother and her infant lasting for at least 0.5 second. Since coding is takes place for each second of the interaction, a type of touch is coded for each second.

Given that the coding of the CITS examines only at maternal touching behaviour, the volume of the video rig should be turned off to avoid bias from contextual cues.

If the tactile contact was initiated by the infant, and the mother remained passive, then mother's touch is not coded.

Categories of Types of Touch

1. Static touch :

- Static touch generally consists of any type of touch without movement. In its most typical form, the caregiver's hand(s) rest flatly on (or under) a part of the infant's body. It is also considered static touch when the hands or fingers are encircling or enclosing any part of the limb (e.g., holding the infants' hands or feet in the air; holding the infant's waist or torso; hugging the infant).

2. Stroke / Caress/ Rub/ Massage:

- Using the hand or finger, with lateral or flat movements that are soft, light, gentle, and slow. The hand is passed gently along the surface of the skin. Rub is described as a hard touch, with a back and forth or circular motion over the same areas, with the hand not leaving the skin. The hands move with firm pressure over the surface of skin. For example, the mother's hand is moving across the infant's skin creating friction on the infant. Massage is a rubbing motion that covers a larger surface area than rub. Predominantly it is over a greater area of the body. Hands do not leave the skin and it is less hard / rough than a rub.

3. Pat / Tap:

- Pat is comprise of an up and down motion in which most of the hand (palm) is used; slightly sweeping, unidirectional movements. Tap is a Focal, light, quick movement using mainly the fingertips. Gentle up-down motion on the infant's body.

4. Squeeze / Pinch / Grasp:

- Pinch is operationalized as using all or part of hand or fingers changing from a hold to a firmer grip. A squeeze is more intense movements that cover a larger area while a pinch usually involves only the fingers and covers a much smaller area.

5. Tickle/ Finger-walk / Prod / Poke / Push:

- Tickle is alternately flexing and extending the tips of the fingers with movements typically associated with tickling. It is important to note that tickle involves a bent finger, often using the tip of the finger, and covers a smaller area than stroke / caress. Finger- walk is operationalized as using bent fingers, and moving fingers in an imitation walking motion across a part of the infant's body.

- Prods usually involve the use of the index finger (but not always) or first two fingers, extended, motioning inwards towards the infant and putting pressure on a very small area. Often a forward and backward repetitive movement. Push more often uses the entire hand and is not normally repetitive. A push is often swift and short in duration.

6. Shake / Wiggle:

- Shake is operationalized as moving a part of infant (sometimes the entire infant) in a rapid motion side-to-side. A wiggle is gentler and focuses on a smaller part of the infant such as the nose or a toe and is sometimes a less rapid movement.

7. Pull / Lift / Flexion / Extension / Clap:

- A pull is the caregiver holding a limb or part of a limb and bringing limb towards her. A lift and flexion would be when the caregiver lifts and moves the infant's limb(s) away from infant's torso. A clap is when infant's hands or feet are being clapped together.

8. Other:

- Any types of touch that cannot be classified in any one of the identified categories. This category mainly includes types of touches that occur in a utilitarian/instrumental context such as wiping the infant's nose or mouth, adjusting the infant's posture (as opposed to a simple lift of the infant body in the context of play) or clothing. However, other touches that are used in a social context such as kissing, blowing, touching with a toy, rocking and bouncing, are coded in this category.

0. No touch :

- If no touch occurred or if the mother is not touching the infant for more than 0.5 seconds a line should be drawn across the cells of the particular second. However, if

the mother is touching the infant for less than 0.5 seconds but is using a type of touch that rarely occurs of when it does occur, it generally last less than 0.5 seconds, coded for that type of touch. In the case where the caregiver's touch is unintentional (i.e., the infant is initiating the touch), again code for no touch and specify the situation.

Coding Decision :

Dominant touch:
One hand: Between two types of touch, if one touch takes up more than 50% of that second it should be this touch that is coded. Similarly, if the two touches are equal in duration, the one that covers a larger surface of the infant's body or that is more intense should be coded.

Two hands: Assuming there is touching initiated by both hands, the more active touch is coded as the dominant touch.

Functions of Touch Scale (FTS)

Jean, Girouard, & Stack (2005)

The Functions of Touch Scale (FTS) was designed to measure the functions or roles of maternal touch during mother-infant face-to-face interaction. The coding is based on the qualitative and quantitative aspects of maternal touch as well as contextual information such as maternal affect and content of verbalization, and infants' affect and attention. This coding scheme complements the Caregiver-Infant Touch Scale (CITS; Stack, LePage, Hains, Muir), which measure the qualitative and quantitative components of maternal touch.

Coding of the FTS

The function of maternal touch is coded when the mother is touching her infant. If the tactile contact was initiated by the infant, and the mother remained passive, then mother's touch is not coded.

Maternal Function of touch is coded through event-coding. As a result, the first step of the coding is to determine the beginning and end of each touching event. The second step consists of determining the function of touch for each event.

Given that the coding of the FTS takes into consideration contextual information such as maternal affect and content of verbalization, and infants' behaviours and affects, the volume of the video rig should be turned on.

Definition of a coding event

A coding event is defined by a change in the function of touch, a change in the verbal topic being discussed by the mother, or a change in the touching sequence (e.g., pause, change in the speed of touch). Therefore it is important to listen to what the mother is saying since it provides an indication of changes in touching event.

If the mother is not touching her infant for more than 3 seconds, then the touching event is considered terminated.

Hints:

- If mothers is singing a song as part of a game or playing a touching game with the infant, the entire song/game is part of one touching sequence. However, if there is a significant pause and the mother is changing the game, beginning a new song, or restarting the same song, a new touching event is coded

Functions of Maternal Touch

1. Passive accompaniment
2. Active accompaniment

3. Nurturing
4. Playful
5. Attention-getting
6. Accidental
7. Utilitarian
8. Harsh
9. Unspecified function of touch

1-Passive accompaniment

- This category is used when the maternal touch serves as an accompaniment to another modality of communication. The focus is not on the touch, but on the other modalities.

- The tactile behaviour of the mother is passive, or used in order to provide support (holding) to the infant. Generally, there is not a lot of movement, but some brief, slow active movement might be present.

- Any type of touch on the CITS can be included

- The mother is generally speaking to the infant or she is letting the infant lead the interaction (i.e. respecting what the infant is doing). For example, the infant might be looking around the room and the mother is passively touching his/her legs.

Coding Note: If the mother is singing, a behaviour that is typically found with playful function of touch, code the function of touch as passive accompaniment if her touching behaviour is passive rather than active.

2-Active accompaniment

- This category is used when the maternal touch serves as an accompaniment to another modality of communication. The focus is not on the touch, but on the other modalities.

- The tactile behaviour of the mother is active. Generally, there is a lot of movement, and the touching tends to be repetitive and very structured.

- The mother is generally speaking to the infant. Compared to playful function of touch, there is *no game aspect* for this function.

Coding Note: During one event, there might be some passive and active accompaniment touch that occurs. If there is more active touch, code it as active accompaniment.

3-Nurturing

- The tactile behaviour of the mother is very soothing, and the touching is slow.

- The mother is typically kissing, and stroking her infant in an attempt to demonstrate

affection to her infant or regulate infant's negative affect.

- The mother is generally speaking in a soft tone of voice, and/or she is acknowledging her infant's emotion or behaviour (e.g., "you are crying", "that was hard for you").

4-Playful (dynamic)

- Mother's touch is very active, playful, dynamic, and fast paced. Typically the goal is to make the infant smile and laugh. It is not only the presence of active types of touch that is important, but there is a playful aspect to the touching event that is clearly evident.

- Compared to active accompaniment, the focus is on mother's touch

- Often accompanied by mother singing, game playing, making some noises, motherese (not normal conversation style).

Coding Note: If the mother is singing and she is using passive/static touch it should be coded as passive accompaniment

5-Attention getting

- This category is used when the mother is using touching in order to get her infant's attention.

- This tactile behaviour is often accompanied by similar maternal getting strategies, such as naming the name of the infant, making noises with her mouth to get infant's attention.

- Typically, mother is looking at the infant, and trying to gain attention

Coding Note: Mothers needs to be actively touching the infant as opposed to only verbalizing the name of the infant while passively touching the infant.

6-Accidental

- Maternal tactile behaviour is very brief, unintentional and fortuitous.

- No specific maternal behaviour accompanies this function of touch

7-Utilitarian

- This category of touch is used in order to accomplish a specific instrumental task such as removing infant's hands from his/her mouth, or fixing the infant's clothes.

- The mothers' behaviours are directed toward a specific goal. Typically, she is speaking to the infant (e.g., describing what she is doing to him/her).

Coding Note: This category can be comprised of more than the "other" type of touch of the CITS, for example, grabbing can be in this category

8-Harsh, negative

- This category is used when mother's touch is controlling and intrusive.

- There might be some harsh maternal behaviour toward the infant such as poking or pinching.

9- Unspecified function of touch

- This category of touch is used when brief maternal touching has no specific function, hence the mother seems to be touching for touching.

- The primary focus is on touch, therefore it is different from passive or active accompaniment.

Infants' and Mothers' Distress Levels

Infants' Distress Level

- Infants' distress level during the Still-Face period was coded into three categories:
    - High: Infant is fretting/crying (usually the infant is quite loud and his face is red) for an extended amount of time. Infant is squirming in the seat, trying to get out and gesturing toward his/her mother.
    - Medium: Infant has bouts of fretting/crying, or does not begin fretting/crying until the middle or end of the period. Infant may be squirming in the seat at times and may gesture to his/her mothers.
    - Low: infant is mildly upset, or fretting/crying sporadically.

Mothers' Distress Level

- Mothers' distress level following the end of the Normal and Still-face periods was coded as either present or absent.
- The decision is based on mothers' behaviour and verbalization content during the transition period and during the first 15 seconds of the Reunion Normal period.

Present:

- Mothers' verbalization are negative such as "good it's over", "that was hard", "mommy is back, it was hard"

Absent:

- Absence of mothers' verbalization, or positive or neutral verbalization such as "you were so good", "you were looking at the camera", "let's have fun together"

Maternal regulatory behaviours during the transitions between periods

The coding of maternal regulatory behaviours during the transition periods following the Normal and the Still-Face period is based on the presence and quality of maternal regulatory behaviours.

It is coded on a scale of 0 to 7 (0: no maternal regulatory behaviours, and 7: high amount of maternal regulatory behaviours)

The total score is derived from:

1) Is the mother talking to her child: no (0), yes (1)

2) Is the mother gazing at her child: no (0), yes (1)

3) Is the mother smiling at her child: no (0), yes (1)

4) Quality of maternal behaviour

0 points:	No touching
1 point:	Touching lasts less than 50% of the transition period and includes mostly utilitarian touching behaviours (e.g., removing socks, wiping baby's face)
2 points:	Touching lasts less than 50% of the transition period and includes diverse types of touch such as the presence of nurturing types of touch
3 points:	Touching lasts more than 50% of the transition period and includes mostly utilitarian touching behaviours (e.g., removing socks, wiping baby's face)
4 points:	Touching lasts less than 50% of the transition period and includes diverse types of touch such as the presence of nurturing types of touch

Total quality of maternal regulatory behaviour is then calculated to obtain an index with a score from 0 to 7 depending on the presence or absence of mothers' verbalization, smiling, and gazing, and quality of tactile behaviour.

Appendix D

ANOVA Summary Tables

Table D-1

Analysis of Variance for Infants' Smiling

Source	*df*	*F*	η_p^2
	Within Subjects		
Period (P)	2	61.06***	0.61
Error	78	(246.03)	

Note. Values enclosed in parentheses represent mean square errors.
*$p < .05$, **$p < .01$, ***$p < .001$

Table D-2

Analysis of Variance for Infants' Fretting

Source		*df*	*F*	η_p^2
		Within Subjects		
Period (P)		2	4.65*	0.21
Error	78	(16.98)		

Note. Values enclosed in parentheses represent mean square errors.
*$p < .05$, **$p < .01$, ***$p < .001$

Table D-3

Analysis of Variance for Infants' Gazing at Mothers' Faces

Source	*df*	*F*	η_p^2
	Within Subjects		
Period (P)	2	15.38***	0.31
Error	70	(248.02)	

Note. Values enclosed in parentheses represent mean square errors.
*$p < .05$, **$p < .01$, ***$p < .001$

Table D-4

Analysis of Variance for Duration of Types of Maternal Touch

Source	*df*	*F*	η_p^2
	Within Subjects		
Period (P)	1	2.89	0.07
Error	39	(2.68)	
Touch (T)	8	42.29***	0.55
Error	312	(168.30)	
P x T	8	1.02	0.03
Error	312	(79.99)	

Note. Values enclosed in parentheses represent mean square errors.
*$p < .05$, **$p < .01$, ***$p < .001$

Table D-5

Analysis of Variance for Duration of Functions of Maternal Touch

Source	*df*	*F*	η_p^2
	Within Subjects		
Period (P)	1	0.27	0.00
Error	39	(37.98)	
Function (F)	6	47.10***	0.55
Error	234	(178.42)	
P x F	6	2.37*	0.05
Error	234	(75.55)	

Note. Values enclosed in parentheses represent mean square errors.
*$p < .05$, **$p < .01$, ***$p < .001$

Table D-6

Analysis of Variance for Duration of Maternal Touch across Infants' Distress Level

Source	*df*	*F*	η_p^2
	Between Subjects		
Infants' Distress (ID)	1	0.18	0.00
Error	38	(426.82)	
	Within Subjects		
Period (P)	1	0.00	0.00
Error	38	(261.75)	
P x ID	1	0.18	0.00

Note. Values enclosed in parentheses represent mean square errors.
$^*p < .05$, $^{**}p < .01$, $^{***}p < .001$

Table D-7

Analysis of Variance for Duration of Functions of Maternal Touch across Infants' Distress Level

Source	*df*	*F*	η_p^2
	Between Subjects		
Infants' Distress (ID)	1	.385*	0.01
Error	38	(69.67)	
	Within Subjects		
Period (P)	1	0.41	0.01
Error	38	(38.82)	
Function (F)	6	37.80***	0.49
Error	228	(172.54)	
P x F	6	2.41*	0.06
Error	228	(76.22)	
P x ID	1	0.14	0.00
F x ID	6	2.33*	0.06
P x F x ID	6	0.66	0.02

Note. Values enclosed in parentheses represent mean square errors.
*$p < .05$, **$p < .01$, ***$p < .001$

Table D-8

Analysis of Variance for Duration of Maternal Touch across Mothers' Distress Level

Source	*df*	*F*	η_p^2
	Between Subjects		
Mothers' Distress (MD)	1	0.23	0.23
Error	38	(426.26)	
	Within Subjects		
Period (P)	1	0.12	0.00
Error	38	(246.63)	
P x MD	1	2.35	0.05

Note. Values enclosed in parentheses represent mean square errors.
*$p < .05$, **$p < .01$, ***$p < .001$

Table D-9

Analysis of Variance for Duration of Functions of Maternal Touch across Mothers' Distress Level

Source	*df*	*F*	η_p^2
	Between Subjects		
Mothers' Distress (MD)	1	0.26**	0.01
Error	38	(69.67)	
	Within Subjects		
Period (P)	1	0.53	0.01
Error	38	(37.28)	
Function (F)	6	45.74***	0.55
Error	228	(180.10)	
P x F	6	2.69*	0.07
Error	228	(75.13)	
P x MD	1	1.70	0.04
F x MD	6	0.64	0.02
P x F x MD	6	1.22	0.03

Note. Values enclosed in parentheses represent mean square errors.
*$p < .05$, **$p < .01$, ***$p < .001$

Appendix E

Means and Standard Deviations for Types and Functions of Touch

Across Interaction Periods

Table E-1

Means and Standard Deviations for the Percent Duration of Type of Touch across Interaction Periods

Period	Normal	Reunion Normal
Types of Touch		
No Touch	19.15 (15.96)	18.38 (20.49)
Static	18.33 (12.00)	17.54 (12.26)
Sroking	7.03 (5.44)	6.79 (6.60)
Patting	1.19 (2.18)	0.96 (1.78)
Grabbing	5.13 (3.02)	5.32 (3.41)
Tickling	10.48 (10.48)	9.01 (6.88)
Shaking	4.06 (4.29)	3.28 (4.16)
Lifting	28.81 (18.40)	34.14 (19.43)
Other	1.65 (2.29)	2.27 (2.96)

Table E-2

Means and Standard Deviations for the Percent Duration of Function of Touch across Interaction Periods

Period	Normal	Reunion Normal
Functions of Touch		
Passive Accompaniment	16.42 (13.76)	14.98 (12.23)
Active Accompaniment	20.46 (12.08)	18.79 (15.02)
Nurturing	4.18 (4.84)	6.40 (7.85)
Playful	26.00 (18.41)	31.29 (19.34)
Attenion-Getting	6.67 (7.81)	2.88 (4.44)
Utilitarian	1.45 (2.37)	1.23 (1.61)
Unspecified Functions	2.51 (3.33)	4.12 (4.59)
Lifting	28.81 (18.40)	34.14 (19.43)
Other	1.65 (2.29)	2.27 (2.96)

Appendix F

Means and Standard Deviations for Functions of Touch across Infants' and Mothers' Distress Levels

Table F-1

Means and Standard Deviations for the Percent Duration of Touch and Function of Touch across Interaction Periods and Infants' Distress Level Following the Still-Face Period

Distress Level	Low (n= 29)		High (n=11)	
Period	Normal	Reunion Normal	Normal	Reunion Normal
Touch	82.21 (18.72)	81.50 (16.32)	79.45 (25.27)	79.82 (15.85)
Functions of Touch				
Passive Accompainement	17.60 (13.29)	17.13 (12.69)	13.30 (15.15)	9.31 (9.14)
Active Accompainement	18.8 (11.83)	16.26 (11.74)	24.81 (12.89)	25.45 (20.65)
Nurturing	4.13 (5.20)	4.49 (5.05)	4.31 (3.94)	11.44 (11.45)
Playful	27.87 (18.36)	33.02 (16.94)	21.21 (18.49)	26.74 (24.98)
Attention-Getting	6.51 (7.92)	3.59 (4.92)	6.81 (7.87)	0.98 (1.89)
Utilitarian	1.26 (2.08)	1.12 (1.61)	1.97 (3.08)	1.51 (1.65)
Unspecified Functions	2.82 (3.25)	4.59 (4.86)	1.69 (3.57)	2.89 (3.73)

Table F-2

Means and Standard Deviations for the Percent Duration of Touch and Function of Touch across Interaction Periods and Mothers' Distress Level Following the Still-Face Period

Distress Level	Low (n= 17)		High (n =23)	
Period	Normal	Reunion Normal	Normal	Reunion Normal
Touch	76.61 (20.18)	83.28 (16.28)	84.31 (11.48)	80.10 (23.27)
Functions of Touch				
Passive Accompainement	16.23 (14.13)	14.90 (7.94)	16.56 (13.81)	15.04 (14.81)
Active Accompainement	17.59 (11.62)	15.63 (10.97)	22.58 (12.22)	21.21 (17.29)
Nurturing	4.22 (4.82)	5.55 (6.06)	4.17 (4.96)	7.03 (9.03)
Playful	24.46 (21.32)	36.08 (16.20)	27.27 (16.33)	27.75 (21.02)
Attention-Getting	6.61 (7.32)	3.07 (4.53)	6.71 (8.28)	2.74 (4.47)
Utilitarian	1.71 (2.43)	1.42 (1.83)	1.27 (2.36)	1.09 (1.45)
Unspecified Functions	2.71 (3.74)	4.34 (5.12)	2.37 (3.08)	3.96 (4.29)