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Infants' Style of Emotion Regulation with Their Mothers and Fathers: Concordance between
Parents and the Contribution of Fathers-Infant Interaction Quality

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Abstract

The concordance between infants' emotion regulation styles with different partners has not been consistently analysed nor have the relational correlates of such potential across-partners similarities. We explored these issues by assessing 10-month-olds' (59.6% boys) emotion regulation styles separately with mother and father and by evaluating mother-infant and father-infant interaction quality. The sample consisted of 50 low-risk families. Two home visits were conducted and similar procedures were adopted for each visit. Parent-infant interaction quality was assessed during daily routines and during free play; both parents independently completed a temperament questionnaire. Infant emotion regulation was assessed in a semi-structured problem-solving task: adaptive versus maladaptive (under and over-regulation) styles. As predicted, infants' emotion regulation with their mothers and fathers were related. However, only father-infant interaction quality predicted infants' emotion regulation concordance: lower interaction quality was associated with maladaptive concordance compared with non-concordance and higher interaction quality was associated with adaptive concordance compared with non-concordance. Our results support the claim that by the end of the first year of life, infants use similar emotion regulation styles with mother and father and point to father-infant interaction as an important correlate of emotion regulation across-parents.

Keywords: concordance, emotion regulation style, infant, mother, father, interaction quality, temperament

Infants' Style of Emotion Regulation with Their Mothers and Fathers:

Concordance between Parents and the Contribution of Father-Infant Interaction Quality

Emotion regulation is comprised of intrinsic (e.g., physiological) and extrinsic (e.g., social) processes associated with the activation of an emotion and its management over time (Cole, Martin, & Dennis, 2004; Gross & Thompson, 2007). These processes or strategies have an impact on the overall functioning of an individual, influencing the adaptive or maladaptive role of that emotional experience in a particular context (Cicchetti, Ganiban, & Barnett, 1991; Cole et al., 2004; Gross, 2014). Therefore, studying emotion regulation in infancy and its relational correlates, the general aim of this study, will allow future investigations to further our knowledge regarding normative and psychopathological developmental trajectories.

In infancy, several emotion regulation strategies have been identified (Bridges, Grolnick, & Connell, 1997; Eisenberg, Hofer, Sulik, & Spinrad, 2014; Kopp, 1989) such as self-oriented strategies—self-soothing (e.g., thumb sucking), self-distraction object oriented (e.g., playing with a toy), behavioural or attention avoidance (e.g., turning away from an alarming stimulus)—and other-oriented strategies—engaging the parent (e.g., engaging the parent in an activity away from the alarming stimulus) and comfort seeking (e.g., asking parents for help). As expected, there is considerable inter-individual variability in the strategies used by infants to regulate emotions (Eisenberg et al., 2014), and there is evidence that infants' emotion expression and regulation is dependent upon the level of emotional challenge caused by the situation or by the infants' attentional focus (Bridges & Connell, 1991; Bridges et al., 1997; Miller, McDonough, Rosenblum, & Sameroff, 2002). However, research focused on comparing infant strategy use during interactions with the mother and the father suggests some degree of intra-individual

congruency (Braungart-Rieker, Garwood, Powers, & Notaro, 1998; Bridges et al., 1997; Diener, Mangelsdorf, McHale, & Frosch, 2002; Ekas, Lickenbrock, & Braungart-Rieker, 2013).

Indeed, these studies show that infants tend to use the same strategies to regulate positive affect in different situations, and the same applies to negative affect (Braungart-Rieker et al., 1998; Bridges et al., 1997; Diener et al., 2002; Ekas et al., 2013). Researchers also report some similarities in the strategies that infants use with their mothers and fathers. For instance, Ekas et al. (2013) analysed 3-, 5-, and 7-month-olds' emotion regulation in the Still-Face Paradigm and found no differences between the mother versus father conditions. Again using the same paradigm, Braungart-Rieker et al. (1998) found no differences in 4-month-olds' self-comforting with each parent. However, infants exhibited more orientation (i.e., infants' gaze focused on the parents' face for more than 1s) towards fathers than towards mothers, and more object orientation (i.e., infants' gaze focused on an object for more than 1s) with mothers than with fathers. Bridges et al. (1997) studied 12½ to 14-month-olds in delay situations. They did not find any differences in overall strategy use with the mother or the father, although they found that boys displayed more physical self-soothing with their mothers than with their fathers. Finally, Diener et al. (2002) analysed 12-to-13-month-old infants' emotion regulation strategies in two competing demands tasks and found a correspondence between five of seven strategies used with the mother and the father. Taking into consideration the aforementioned across-parent consistencies in infants' emotion regulation, one might speculate that throughout the first year of life infants develop a style of emotion regulation that they use with relative stability.

Others have already noted that individual strategies for emotion regulation might start to become organised into patterns or styles as early as the end of the first year of life (Diener et al., 2002; Kopp, 1989). In the study presented above by Diener et al. (2002), the authors found that

they could group infants' emotion regulation strategies into meaningful styles of strategy use (i.e., distracters, self-soothers, multiple strategy users) and that infants exhibited consistency in their styles in two competing-demands tasks. However, because emotion regulation is still developing in the early years and is dependent upon the caregiver's extrinsic or hetero-regulation (Sroufe, 1997; Thompson, 2011), there are few studies analysing the emergence of emotion regulation styles and their consistencies across interaction partners. This was the first objective of this study: to explore the concordance between infants' emotion regulation styles exhibited with the mother and with the father.

In a different approach from that of Diener et al. (2002), Martins, Soares, Martins, Tereno, and Osório (2012) developed a coding system for three styles of emotion regulation—over-regulation, under-regulation and adaptive regulation—based on previous work on emotion regulation and its consequences for adaptation (Cole, Michel, & Teti, 1994; Hammen, Brennan, & Keenan-Miller, 2008; Keenan, 2000). Thus, two opposite styles of maladaptive emotion regulation—under-regulation and over-regulation—have been described (Cole et al., 1994; Keenan, 2000). Contrary to an adaptive style, in both maladaptive patterns, infants perseverate on using the same strategies to address any emotion activation, which precludes the necessary emotional flexibility to respond to changes in environment and to personal demands (Gross, 2014). Under-regulation is characterised by the intensification of emotions in different contexts, including heightened negative emotionality and vigilance, difficulty recovering from emotion arousal, and overdependence on others for regulation (e.g., overly relying on strategies such as engaging parent and comfort seeking) (Cole et al., 1994; Keenan, 2000; Sroufe, 1997). In contrast, over-regulation is defined by a minimisation of emotional expression leading to a constricted range of emotional experience associated with a lack of openness (e.g., less

emotional expression) and regulatory behaviours that rely mostly on the self (e.g., self-soothing, object-oriented self-distraction) (Cole et al., 1994; Main, 1990; Sroufe, 2000). Therefore, regarding the first aim of this study stated above, we aimed to specifically study the concordance of over-regulation, under-regulation and adaptive styles exhibited with the mother and with the father.

An important question arising from focusing on across-parent consistencies in infants' emotion regulation styles is as follows: what are the relational correlates of such stability? It is accepted that infants' emotion regulation develops within the patterns of arousal and affect modulation repeatedly experienced in early caregiving relationships, and strategies used by parents (or other adults) become integrated into the infant's repertoire of conscious and unconscious emotional regulation skills (Sroufe, 1997; Thompson, 2011). Mother- and father-infant interaction quality has already been shown to relate to infants' emotion regulation (Braungart-Rieker et al., 1998; Cabrera, Shannon, & Tamis-LeMonda, 2007; Hazen, McFarland, Jacobvitz, & Boyd-Soisson, 2010; Lunkenheimer, Kemp, & Albrecht, 2013; Shewark & Blandon, 2014). However, investigations have dedicated little attention to exploring how the quality of the interaction with either parent is associated with infants' emergent emotion regulation strategies and how those strategies are consistently used across contexts or interaction partners. Ekas et al. (2011) have already called upon the importance of considering the role of the child as well as parent-child interaction characteristics in any study of across-parent consistencies and divergences. Therefore, as the second objective of this research, we proposed to analyse the associations between mother-infant and father-infant interaction quality and infant emotion regulation exhibited across parents. To accomplish this goal, we gathered observational data regarding mothers' and fathers' interaction with the infant during daily routines and free

play. In each home visit, the infant's emotion regulation style was measured in a semi-structured problem-solving task.

In sum, this investigation had two main objectives. The first was to study the concordance between adaptive and maladaptive styles of infant emotion regulation with mother and father. Secondly, we aimed to analyse the relations between such concordance in emotion regulation styles and mother-infant and father-infant interaction quality.

Method

Participants

This study is part of an ongoing longitudinal project on child development that has been following 52 children from two-parent, middle to upper socioeconomic households where Portuguese was the first language. This paper focuses on 50 families assessed when infants (31 boys, 59.6%) were 10 months old ($M = 10.38$, $SD = 0.36$) because questionnaire data were missing from two families. Families were recruited from day childcare centres in Porto (Portugal). They were contacted by the director of the childcare centre who presented a letter with the research procedure and invited them to participate in the study. Mothers and fathers who decided to participate signed an informed consent. Mothers ranged in age from 24 to 45 years ($M = 33.45$, $SD = 4.76$), and fathers ranged in age from 21 to 44 years ($M = 33.68$, $SD = 4.60$).

Procedures

When the infants were 10 months of age, two home visits were carried out, one focused on the mother-infant dyad and the other focused on the father-infant dyad. The parent not involved in the video recording was asked to refrain from entering the room where the interaction took place. Both assessments occurred within two weeks, in a counterbalanced order. Prior to our initial home visit, parents were informed about who (mother or father) would be

participating first. On both visits, the same assessment protocol was followed. The parent was asked to individually fill out an infant temperament questionnaire and to provide sociodemographic information. Next, a 40-min interaction between the parent (mother or father) and the infant was video-recorded. During the first 20 minutes, the parent was asked to go about his/her normal routine, and in the following 10 minutes, the parent was asked to play as she/he wished with the child. These 30 minutes were used to assess the quality of parent-infant interaction as they provided a wider sample of what infants might be exposed to on a daily basis during routine and free play. In the final 10 minutes of the recording, the parents were asked to play with a shape sorter provided by the researcher to assess the infants' emotion regulation. A separate situation and assessment measure designed to elicit emotion and its regulation was chosen because daily routines and free play may not be the best sampling method for emotion regulation (Miller et al., 2002). We followed Miller's et al. results (2002) and developed a procedure that was object-focused (vs. face-to-face) and challenging/ teaching (vs. free play). The shape-sorting activity is recommended from 12 months, therefore posing moderate developmental challenges for 10-month-olds and requiring parental teaching. Task duration was set at 10 minutes, which further contributed to its challenging nature at this age. Stress was expected to emerge because infants would likely want to explore the game-pieces at will and not to insert them in the proper holes, conflicting with the parents' directives. Additionally, infants were expected to lose interest in the materials throughout the task, potentially increasing conflict with the parent. By using two distinct situations we also aimed to minimize contamination between the measure of parent-infant interaction quality and the measure of infants' emotion regulation.

Measures

Parent-Infant Interaction Quality. Mother- and father-infant interaction quality was coded using the third edition of the *Emotional Availability Scales* (Biringen, Robinson, & Emde, 1998) during the initial 30 minutes of observation. The Emotional Availability Scales have a multi-dimensional framework, with scales measuring the affect and behaviour of both the infant and parent, as it is thought that the way the child responds to the parent mirrors the interactive history of the dyad (Biringen, Derscheid, Vliegen, Closson, & Easterbrooks, 2014). For this reason it is sometimes analysed as a single variable, resulting from the sum of all scales (Licata et al., 2014).

Sensitivity (range 1-9) assesses the parent's capacity to read the child's emotional cues and be emotionally responsive to the child. Structuring (range 1-5) refers to the parent's ability to structure or scaffold the child's environment and play. Nonintrusiveness (range 1-5) assesses the degree to which the parent interferes with the child's autonomy. Nonhostility (range 1-5) refers to the parent's capacity to regulate one's negative emotions such as impatience, harshness, or malice. Child Responsiveness (range 1-7) is indicative of the infant's pleasure when interacting with the parent and how well he/she responds to parental bids and expressions. Child Involvement (range 1-7) refers to the degree to which the child invites or includes the parent into play and expresses affect in this context. All scales are ordinal, with higher scores representing higher quantity/quality of the characteristic involved. The 30-minute segment was scored as a whole, by assigning a single score on each different scale. A final score of *interaction quality* was created by summing the individual scores obtained on each scale. *Mother-infant interaction quality*, $\alpha = .891$, and *father-infant interaction quality*, $\alpha = .889$, had good internal consistency.

Mother-infant interactions were coded independently by four trained judges who had achieved reliability with the first author of the scales and who were blind to other measures and study objectives. Then, 48% randomly selected observations received double coding for reliability purposes. Inter-rater reliability, calculated using the Intraclass Correlation Coefficient, was found to be adequate across all measures of the mothers' emotional availability: sensitivity, ($r_i = .88$), structuring ($r_i = .92$), nonintrusiveness ($r_i = .77$), nonhostility ($r_i = .86$), child responsiveness ($r_i = .85$), child involvement ($r_i = .80$). Two previously trained judges, different from the set of judges who coded the mothers, scored the fathers. Again, 48% of randomly selected observations were double coded, and the inter-rater reliability achieved was good for sensitivity ($r_i = .95$), structuring ($r_i = .87$), nonintrusiveness ($r_i = .87$), nonhostility ($r_i = .88$), child responsiveness ($r_i = .88$), and child involvement ($r_i = .87$).

Infant Emotion Regulation Style. The *Shape Sorter Task* (Martins et al., 2012) assesses emotion regulation during parent-infant interaction at home using a semi-structured problem-solving task. The parent is given a shape sorter bucket and asked by the research assistant to teach the infant how to insert the pieces into the holes. It takes 10 min and is video-recorded for later scoring.

The infants are assigned to one of three emotion regulation styles, one adaptive and two maladaptive—over-regulation and under-regulation. The *adaptive style* of emotion regulation is coded when infants express some negative emotions associated with momentary disruption of the task but that is followed by the infant's shift to positive or neutral affect and renewed focus on the shape sorter. *Over-regulation* is assigned to infants who show a lack of expression of negative emotions throughout the duration of the task but are highly focused on the shape sorter. Finally, *under-regulation* is coded when infants express many negative emotions that disrupt the

task and there is little success in shifting the negative affect and refocusing on the shape sorter. Further details can be found in Martins et al. (2012).

After training with the first author, all mother-infant interactions were independently scored by four trained judges. For reliability purposes, 67% of the videotapes with the mother and 67% of the videotapes with the father were randomly selected and distributed to pairs of raters for double coding. We calculated the inter-rater reliability using the three categories (over-regulation, adaptive and under-regulation), Cohen's $\kappa_{\text{mother}} = .77, p < .001$ and Cohen's $\kappa_{\text{father}} = .82, p < .001$.

We were interested in analysing the infants' emotion regulation across parents: the style that each child exhibited with the mother and with the father. Hence, a new variable with three categories was created representing an increasing level of emotion regulation quality across situations: 1) maladaptive emotion regulation style with both parents (over-regulation or under-regulation), 2) adaptive emotion regulation style with one (emotion over-regulation or emotion under-regulation with one parent and adaptive with the other), 3) adaptive emotion regulation style with both parents.

Infant Temperament. The *Infant Characteristics Questionnaire* (ICQ; Bates, Freeland, & Lounsbury, 1979) assesses the parent's perception of the infant's difficult temperament, globally defined as an infant who cries a lot and is difficult to soothe (Bates et al., 1979). Mothers and fathers were asked to complete different questionnaires. We used the Portuguese translation (Pires, 1997) of the 6-month infant version (there is no 10-month version) following previous investigations (see DeGangi, Porges, Sickel, & Greenspan, 1993). It includes 17 questions, which ask the parents to rate the infant's behaviour on a 7-point scale from 1 (more optimal) to 7 (less optimal). The questionnaire has a good overall reliability, Cronbach's $\alpha = .75$ (Martins,

Martins, & Soares, 2006). In this investigation, we opted to use the average of the mothers' and the fathers' temperament perception score as they were positively correlated, $r = .43, p = .002$.

Results

Preliminary Analyses and Descriptive Statistics

Table 1 includes correlations between each scale assessing mother-infant interaction quality and each scale assessing father-infant interaction quality. We found that mothers' and fathers' sensitivity, nonintrusiveness and nonhostility were positively associated. Parents' structuring and none of the infants' scales with the mother and the father were correlated.

Taking into account that the parent-infant interaction measure used is multi-dimensional, focusing both on the adult and infant, we explored the intercorrelations between parents' and infants' scales within the same dyads (Table 1). Of special relevance, we found that mothers' sensitivity and structuring were positively correlated with infants' responsiveness and involvement displayed with the mother and that fathers' sensitivity and structuring were also correlated with both infants' scales displayed with the father (see Table 1 for the remaining correlations). Therefore, we opted to create a global measure of mother-infant and another of father-infant interaction quality (i.e., use the sum of all scales) and use them in the following analyses¹. We found a positive correlation between the mother-infant and the father-infant interaction quality, $r = .29, p = .039$ and the father-infant interaction quality was higher than that of the mothers', paired $t(49) = -4.01, p < .001$ (Table 2).

The descriptive statistics for the emotion regulation variables are presented in Table 3, and the statistics for the remaining study variables are presented in Table 2. The only significant result between sociodemographic and the study variables was a negative correlation between mother-infant interaction quality and infants' age (Table 2).

First Objective: Exploring the Concordance between Infants' Emotion Regulation with Mother and Father

Infants' emotion regulation styles displayed with their mothers were related to those shown with their fathers, $\chi^2(4) = 16.64, p = .002$ (Table 3 for frequencies). Thus, infants that presented one of the three styles of emotion regulation—over, under, or adaptive—with the mother had a higher than expected by chance probability of also displaying that style with the father. A positive association between emotion regulation styles exhibited with mothers and fathers was also found, $\chi^2(1) = 6.52, p = .011$, when using the two-category coding—*maladaptive* (over and under-regulation) versus *adaptive*.

Second Objective: Relations Between Parent-Infant Interaction Quality and Across-Parent Emotion Regulation

A multinomial logistic regression analysis, predicting emotion regulation styles with both parents—adaptive with both, maladaptive with both (emotion over-regulation or emotion under-regulation), and adaptive regulation with one (emotion over-regulation or emotion under-regulation with one parent and adaptive with the other)—was conducted with *adaptive regulation with one* as the reference category (Table 4). Difficult temperament and the mother-infant and father-infant interaction quality were included as predictors. We controlled for difficult temperament in our analyses as early affective responses (i.e., low thresholds for arousal; difficulties managing that arousal) may influence the repertoire of the child's emotional regulatory strategies influencing both the level and type of regulatory responses (Calkins & Hill, 2007). Table 5 depicts emotion regulation descriptives by the mother-infant and father-infant interaction quality and difficult temperament. The overall model fits the data well, $\chi^2(6) = 23.75$,

$p = .001$, and the Nagelkerke pseudo- R^2 was .43. Only the father-infant interaction quality had a significant impact on the model as ascertained by the likelihood ratio tests: difficult temperament, $\chi^2(2) = 2.66, p = .265$; mother-infant interaction quality, $\chi^2(2) = .52, p = .771$; father-infant interaction quality, $\chi^2(2) = 19.83, p < .001$. Two sets of parameter estimates are provided in Table 4 (maladaptive emotion regulation with both vs. adaptive with one; adaptive emotion regulation with both vs. adaptive with one). On one hand, *maladaptive emotion regulation with both* is more likely than *adaptive emotion regulation with one* when the father-infant interaction quality is lower. On the other hand, *adaptive emotion regulation with both* is more likely than *adaptive emotion regulation with one* when the father-infant interaction quality is higher.

Discussion

This investigation aimed to study 10-month-old infants' emotion regulation styles with two distinct partners – mother and father. We specifically explored the concordance between the styles exhibited in both interactions, and we additionally analysed relational correlates of such concordance.

Indeed, we found an association between the infants' emotion regulation styles with mother and father, demonstrating that 10-month-olds show a relative consistency in their emotion regulation strategies. This finding supports previous results attesting to similarities in infants' strategy use with both parents (Braungart-Rieker et al., 1998; Bridges et al., 1997; Diener et al., 2002; Ekas et al., 2013). This study adds to previous literature as it analysed concordance in terms of adaptive and maladaptive styles and not individual strategies.

To date, few empirical studies explored infants' emotion regulation style stability across-parents (see exception Diener et al., 2002), most likely because theory posits that infants are

highly dependent upon caregivers for emotion regulation (Sroufe, 1997; Thompson, 2011). This developmental framework, emphasising infants' reliance on parents for emotion regulation, may have guided researchers away from analysing concordance. However, from between 7 to 9 months of age, infants' repertoire of emotion regulation strategies is considerably expanded in association with advances in other psychological domains (Kopp, 1989). For instance, better motor development (e.g., grasping, crawling) will contribute to the development of self-soothing, self-distraction and avoidance regulatory strategies. Again, communication (e.g., pointing) and cognitive (e.g., anticipation) skills will allow infants to intentionally use parents to regulate their emotional states. In this sense, because infants are more equipped to address emotional arousal, they will have a more active role in achieving regulated states (Sroufe, 1997). Therefore, the concordance found in our study between emotion regulation styles with the mother and with the father may be explained, in part, by the infants' increasing capacity to exert an active role in emotion regulation, in the last quarter of the first year of life. Thus, although parents are a vital resource for emotion regulation, their involvement is increasingly directed by the infant. We consider that our result does not question the importance of hetero-regulation for infants but adds to it. Our results suggest that patterns of emotion regulation strategies begin to be discernible in the first year of life, and that these styles include parent-oriented strategies.

Another possible explanation for the concordance found in our sample is that fathers and mothers within each individual family may behave similarly (Brown, Mangelsdorf, Neff, Schoppe-Sullivan, & Frosch, 2009), influencing infants to display comparable emotion regulation styles across parents. Pointing in that direction, we found a positive moderately sized correlation between mother-infant and father-infant interaction quality. Nonetheless, additional results also show relevant differences between the dyads. For instance, mothers' and fathers'

structuring scores were not associated, infants' scales with mother and father were again not associated; father-infant interaction quality was higher (versus mother-infant), and most importantly, the quality of father-infant interaction predicted the infants' emotion-regulation style concordance whilst mother-infant interaction quality did not. Even so, we cannot rule out that across-parent concordance in emotion regulation styles may have been influenced by similarities in parenting styles or context of assessment (e.g., infants were assessed both times in their own homes).

In the same vein, higher levels of concordance may have been found because emotion regulation was assessed in a medium-stress situation: a problem-solving task with a shape sorter. In higher-stress situations (e.g., Strange Situation Procedure, Frustration Task), the regulatory demands would be well above infants' autonomous capacities and caregivers would be fundamental for their regulation. In the latter situation, one might speculate that lower concordance would be found. Supporting this view, Bridges et al. (1997) found that the level of distress caused by the situation influenced the types of emotion regulation strategies used by infants, while few differences were observed between the strategies used with the mother versus father present. In light of these questions, a limitation of this research can be identified. We used only medium-level stressors in our emotion regulation assessments, precluding our ability to test the relationships between the characteristics of the tasks, the regulatory demands they pose, and the concordance in emotion regulation. Future research should compare infants' emotion regulation across multiple situations, namely with different degrees of stress, e.g., interaction partners versus alone, etc.

Although seventy percent of the sample showed concordance in their emotion regulation styles with mothers and fathers, some did not. We hypothesize that at 10 months emotion

regulation styles are still unstable. First, emotion regulation continues to develop until late adolescence and young adulthood (Riediger & Klipker, 2014) and changes even in adulthood (Zimmermann & Iwanski, 2014). Therefore, during the early stages of emotion regulation development infants would achieve stability in their regulatory styles at different rates. Thirty percent of our sample, displaying non-concordance, may have lagged behind at the time of assessment. In addition, we believe that infants that achieved stability at this early age will continue changing their emotion regulation styles. Youths and adults use a more complex network of strategies that differs from the styles identified in infants in the present study.

Furthermore, non-concordance may have also resulted from the interplay of correlates. As referenced above, infants' regulatory capacities at 10 months may be susceptible to the influence of intrinsic (e.g., low thresholds for arousal) and contextual factors (e.g., interaction partner, characteristics of the situation). In fact, the quality of the father-infant interaction in the case of non-concordance is not as positive, as in the case of adaptive concordance, but not as negative, as in the cases of maladaptive concordance. One might speculate that intermediate levels in father-infant interaction quality may render the child more susceptible to the influence of other variables, leading to lower levels of concordance. One such variable could be infant temperament. In fact, because temperament is believed to influence children's emotion and behaviour regulatory skills and strategies (Calkins & Hill, 2007), we controlled this variable in the analyses. However, difficult temperament did not predict emotion regulation across partners. Additionally, apart from sociodemographic variables, no other parent characteristics were assessed. Taking into consideration this interpretative hypothesis and the results regarding temperament, it would be advisable in future investigations to include a broader range of assessments of infant characteristics and parental/contextual factors. This would further the

knowledge regarding the correlates of non-concordance, and of mother-father differences as discussed in the following paragraphs.

As there are few studies focused on emotion regulation concordance in infancy, there is limited investigation focused on the relationships between mother-infant and father-infant interactions and infants' style concordance across parents. We explored this issue and found that father-infant interaction quality predicted the concordance and non-concordance in infants' emotion regulation styles – a result that reinforces the relevance of studying fathers. For one, lower interaction quality predicted maladaptive concordance when compared with non-concordance. For the other, higher levels of father-infant interaction quality were predictive of adaptive concordance when contrasted with non-concordance. Although the relevance of the caregiving interactions for emotion regulation is supported (Thompson, 2011), most research has focused on mother-child interactions and fathers have been considerably less studied (Ekas et al., 2013; Morris, Silk, Steinberg, Myers, & Robinson, 2007). This result is all the more relevant when taking into account that research has attested to similarities in mother-infant and father-infant interaction quality in the same family (Brown et al., 2009). By including both interaction partners in the regression analyses (thus controlling for shared variance in mother and father behaviour) we were able to discern the unique contribution of father-infant interaction quality. In addition, and despite the considerable consensus that mother-child relationships decisively contribute to emotion-regulation development (Dunsmore, Booker, & Ollendick, 2013; Kopp, 1989; Sroufe, 1997), mothers' interaction quality did not predict emotion regulation across tasks in our investigation.

Interestingly, a few studies have already pointed to a predominant association between emotion regulation and father-child interaction (Diener et al., 2002; Hazen et al., 2010). Diener

et al. (2002) observed a concurrent association between infants' attachment (at 12 or 13 months) to fathers but not to mothers and emotion regulation styles during a competing demands task. In another study, fathers' low sensitivity at 8 months predicted children's emotion under-regulation at 24 months, whereas mothers' low sensitivity was only predictive of boys' emotion under-regulation (Hazen et al., 2010). Many believe that because fathers' play tends to be energetic, stimulating, and emotionally arousing, these interactions have a significant impact on children's development (Lamb, 2010; Paquette, 2004). Fathers' capacities to manage their children's emotional activation and maintain it within boundaries or if these are crossed, the way they facilitate returning to emotional organisation may be crucial experiences that will allow children to internalise strategies to deal adaptively with highly emotionally charged situations (Flanders et al., 2009; Lamb, 2010). In this vein, we might speculate that fathers' rough and tumble play may provide specific opportunities for the development of children's emotion regulation, distinct from those created by mothers (Diener et al., 2002; Flanders et al., 2009; Paquette, 2004). Fathers may be indeed important for the development of their children from early on, since in our study father-infant interaction quality was associated with infants' regulation style regardless of his presence. This opposes some views attesting to the mothers' pivotal role in infancy (see discussion by Lamb, 2010). In light of our results and increasing research on the fathers' importance for child development, policy makers should aim at giving equal opportunities to fathers and mothers to take care of their infants and children.

Also, if rough and tumble play is an important mechanism behind the development of across-parent concordance in emotion regulation styles, this investigation add to previous literature attesting to the importance of play for socioemotional and cognitive development (Leach, Howe, & Dehart, 2015). Furthermore, this may point to the importance of creating

medium to high arousing play situations, and not only low arousal situations (e.g., reading or low noise/movement role-play). It is likely that by accepting and regulating the strong emotional displays (either positive or negative) that result from high-arousal play, parents may foster their children's emotion regulation.

Methodological issues might also explain the absence of associations between mother-infant interaction quality and child emotion regulation across parents. As aforementioned, emotion regulation was assessed in a semi-structured play situation with a shape sorter. It is plausible that the task-demands on infants' emotion regulation fit the strategies that the infant had learned in previous father-infant interactions. As a result, we are left to wonder if this pattern of results would change if emotion regulation had been assessed in a non-play scenario.

Therefore, results of the present cross-sectional research must be interpreted with caution, and the role of mothers for emotion regulation must not be dismissed.

In summary, two main conclusions can be drawn from our investigation, that further the existing literature. Firstly, our within-subjects design – a strategy seldom used in the literature – showed that at 10 months infants already exhibit some stability in the emotion regulation style used across-parents. We also used assessments with mothers and fathers in the familial home featuring daily routines and play, which we hope contributes to the ecological validity of our findings.

Secondly, our evidence suggests that father-infant interactional quality is a relevant correlate of the emotion regulation style exhibited with mother and father. This is in itself innovative, contributing to the study of the fathers' role in the development of emotion regulation of infants, a largely secondary topic in the developmental literature. It must also be noted that our study was framed by recent perspectives on father research (Pleck, 2012) that

value studying fathers' influence on child development. Such perspectives herald a shift from assessments based only on the amount of time spent with their children (classic father involvement literature, e.g., time diaries), to a focus on the quality of the exchanges.

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Footnotes

¹ Another reason made us follow this analytic plan. All father scales were positively associated with increasing levels of adaptive emotion regulation concordance (Table 1) and inserting all of them in the regression analysis would present problems related with multicollinearity (high intercorrelation between the scales) and power (not enough participants for each predictor). Therefore we opted to sum them up.

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Table 1
Intercorrelations Between Mother-Infant and Father-Infant Interaction Quality and Associations with Infants' Emotion Regulation

	Mother							Father						
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Sensitivity	-													
2. Structuring	.81***	-												
3. Nonintrusiveness	.48***	.37**	-											
4. Nonhostility	.49***	.35*	.99***	-										
5. Child Respons.	.89***	.78***	.23	.24	-									
6. Child Involv.	.89***	.76***	.24	.24	.88*	-								
7. <i>Mother-Infant Interaction Quality^a</i>	.96***	.85***	.62***	.62***	.88*	.87***	-							
Father														
8. Sensitivity	.28*	.29*	.22	.21	.22	.25	.30*	-						
9. Structuring	.18	.15	.07	.06	.17	.18	.18	.79***	-					
10. Nonintrusiv.	.27	.12	.37**	.36*	.10	.18	.27	.37**	.24	-				
11. Nonhostility	.26	.18	.32*	.32*	.15	.21	.28	.42**	.47**	.42**	-			
12. Child Respons.	.16	.21	.11	.11	.16	.17	.19	.90***	.78***	.33*	.51***	-		
13. Child Involv.	.21	.27	.17	.17	.21	.23	.26	.84***	.75***	.23	.49***	.88***	-	
14. <i>Father-Infant Interaction Quality^a</i>	.27	.26	.23	.23	.21	.25	.29*	.93***	.86***	.48***	.62***	.95***	.91***	-

Infants' Emotion Regulation	.14	.21	.13	.11	.22	.31*	.24	.42**	.43**	.32*	.36*	.40**	.48***	.49***
Mother ^b	.10	.23	.08	.06	.14	.13	.15	.43**	.36*	.31*	.32*	.44**	.38**	.46**
Father ^b	.13	.24	.20	.17	.21	.26	.22	.52***	.46**	.37**	.41**	.50***	.52***	.57***
Mother and Father ^{c,d}														

Note. ^aParent-infant interaction quality = sum of scores on sensitivity, structuring, nonintrusiveness, nonhostility, child responsiveness and child involvement.

^bPoint-biserial correlations: 1 = adaptive emotion regulation, 0 = maladaptive emotion regulation (emotion over-regulation and emotion under-regulation).

^cInfants' emotion regulation with mother and father. The categories were designed to represent an increasing level of emotion regulation quality: 1 = maladaptive regulation with both parents, 2 = adaptive regulation with one parent, and 3 = adaptive regulation with both parents. ^dSpearman correlations.

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

Table 2
Descriptives and Intercorrelations Between Parent-Infant Interaction Quality, Difficult Temperament and Sociodemographics

	1.	2.	3.	4.	5.	6.	7.	8.
1. Infant Sex ^a	–	.07	.11	.17	–	.09	-.01	.22
Age ^b								
	<i>Min</i>	<i>Max</i>	<i>Range</i>	<i>M</i>	<i>DP</i>			
2. Infant	213	330	117	307.52	22.29			
3. Mother	24.98	43.57	18.59	33.49	4.86			
4. Father	21	44	23	33.73	4.64			
5. SES ^c	2	5	3	–	–			
Interaction Quality								
6. Mother-Infant	12	36	24	25.02	5.57		29*	.01
7. Father-Infant	16	36	20	28.42	4.38		–	-.03
8. Difficult temperament	29	57	29	45.20	6.43		–	–

Note. ^aAll correlations with sex are Point-biserial. ^bInfant in days, mother/father in years. ^cAll correlations with SES are Spearman correlations.

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

Table 3

Descriptive Statistics for Infants' Emotion Regulation

Emotion Regulation (problem-solving task)		<i>n</i> (%)		
		Displayed With Mother		
		Over-regulation	Adaptive regulation	Under-regulation
Displayed With Father		10 (20)	25 (50)	15 (30)
Over-regulation	13 (26)	4 (8)	5 (10)	1 (2)
Adaptive regulation	27 (54)	6 (12)	18 (36)	1 (2)
Under-regulation	10 (20)	3 (6)	4 (8)	8 (16)

Table 4

Parameter Estimates for Multinomial Logistic Regressions Predicting Across-Parent Emotion Regulation Styles^a

	B	SE	Wald	df	p	e ^B
Maladaptive with both parents vs. Adaptive regulation with one parent						
Difficult temperament	-.06	.07	4.05	1	.345	.94
Mother-infant interaction quality	-.04	.07	.89	1	.580	.96
Father-infant interaction quality	-.29	.14	.31	1	.039	.75
Adaptive with both parents vs. Adaptive regulation with one parent						
Difficult temperament	.06	.07	.79	1	.374	1.06
Mother-infant interaction quality	.02	.08	.05	1	.817	1.02
Father-infant interaction quality	.26	.12	4.80	1	.029	1.30

Note. ^aEmotion regulation displayed with both mother and father. For this analysis, N = 50. *Adaptive regulation with one parent is the reference category. Positive Bs indicate that the emotion regulation style scored higher on the variable in question compared to the reference category.*

Table 5

Descriptive Statistics for Across-Parent Infants' Emotion Regulation by Parent-Infant Interaction Quality and Difficult Temperament

Emotion Regulation Displayed with Mother and Father (problem-solving task) <i>n</i> (%)	Parent-Infant Interaction Quality (daily routine and free play) <i>M</i> (<i>DP</i>)		Difficult Temperament (questionnaire) <i>M</i> (<i>DP</i>)	
	Mother	Father		
Adaptive with both	18 (36)	26.39(5.05)	31.28(3.41)	46.25(6.26)
Adaptive with one	16 (32)	25.25(5.65)	28.44(3.74)	45.19(6.43)
Maladaptive with both ^a	16 (32)	23.25(5.89)	25.19(3.82)	44.03(6.82)

Note. ^aMaladaptive with both: emotion over-regulation or emotion under-regulation.