EMOTION REGULATION IN CHILD-MOTHER DYADS: A PSYCHOBIOLOGICAL APPROACH

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Tese submetida como requisito parcial para obtenção do grau de

Doutoramento em Psicologia

(Psicologia do Desenvolvimento)

2010

Tese apresentada para cumprimento dos requisitos necessários à obtenção do grau de Doutor em Psicologia na área de especialização de Desenvolvimento realizada sob a orientação da Prof. Doutora Manuela Veríssimo e do Professor Doutor Rui Oliveira, apresentada no ISPA-Instituto Universitário no ano de 2010, conforme o despacho do Decreto-Lei nº 221/2009 de 8 de Setembro do Diário da República.

O presente trabalho foi financiada pelo PROGRAMA OPERACIONAL DE POTENCIAL HUMANO (POCI 2010) DO QREN PORTUGAL da Fundação para a Ciência e Técnologia (SFRH / BD / 23365/2005)

AKNOWLEDGEMENTS

I would like to express my profound gratitude to all the people and institutions involved in this project:

To all the children and mothers, as well as their families, that so kindly participated in this study. Thank you so much for your generosity, honesty and courage in opening the doors of your homes and allowing me to share a little bit of your private worlds.

To Prof. Manuela Veríssimo (Phd) and Prof. Rui F. Oliveira (Phd). Thank you for your knowledgeable supervision during this project, for granting me the resources necessary to develop it and for all the opportunities in science that enriched my professional career. Mostly, thank you so much for the creative freedom to pursue my own ideas, which is so important to me.

To Prof. António José dos Santos (Phd), for suggesting me to study emotion regulation during one of our conversations five years ago. Without your inspiration I would not be here today.

To all the members of the Developmental Psychology research line (UIPCDE), at ISPA, who contributed to this work, particularly, Ana Rebelo, Filipa Silva, Ligia Monteiro, Marilia Fernandes, Nuno Torres, Orlando Santos, Paula Machado and Teresa Rolão for your fantastic team-work spirit in helping me to collect and score all the data. Without your precious and intelligent help this project could not have been done. This work is also yours.

To Ana Rebelo and Marilia Fernandes. Thank you so much for being there from the start, when everything was still shapeless and all we could count was our faith in this project. I am so grateful to you both for your readiness in helping me at whatever time and place it was needed. Your warm smiles while doing it will be remembered.

To Filipa Silva. Thank you so much for your constant interest and curiosity in my work since the beginning. Your questions, always accompanied by a warm smile were very precious during the hardest times.

To all my colleagues at the Integrative Behavioural Biology Lab (UIEE) at ISPA, particularly, Ana Sofia, Ana Catarina, Carla Polastri, David Gonçalves, Eduarda Cabral, Fábio Valério, Gonçalo Oliveira, Leonor Galhardo, Magda Teles, Margarida Carvalho, Marta Soares, Mattia Baruzzo, Miguel Simões, Olinda Almeida, Rita Gomez, Tania Oliveira, Silvia Costa. Thank you so much for opening your minds and your hearts to me during these years.

Your generosity was felt both intellectually and emotionally. Thank you for teaching me so many things, for inspiring me and for allowing yourselves to be inspired back by our exchange of ideas and backgrounds.

To Tania Oliveira, for your precious help and knowledge during the course of this work, but mostly, for your growing friendship along these 10 years! Yes, it has been this long! Thank you for your honest concern and appreciation.

To Margarida Carvalho, for being such a great and enthusiastic friend from the beginning. A wonderful surprise. Thank you so much for teaching and inspiring me to reach new genetic heights during the course of our friendship! Working with a smile is always wonderful.

To David Gonçalves, for your intelligent and generous remarks, comments and suggestions at the final stage of this work. Mostly, thank you for 10 years of friendship, for inspiring me with our conversations and for your endless and sweet patience towards the girl that never shuts up!

To Alexandre Fernandes. What can I say? Thank you for being a great friend, always present when needed in the good and bad moments of this work and life. Most of all, thank you for inspiring me to be a good person and an honest professional. I am so grateful for all the teachings and endless reviews you have done to this work. I can only hope that our friendship continues for many years, both personally and professionally.

To Vera and Ricardo. Thank you for being the greatest friends! I am so grateful for your presence in my life, for being my secure bases during rocky times and for understanding my absence during the last year, while finishing this project. Let’s go party again!

To Humberto, for being such a rock in my life. Thank you for always being there.

To Rosa Roque, for your inconditional love during the course of this work. Without you this project would still be an idea. Thank you for always supporting me and being ready when I most needed it.

To my family, Daniel, Rosa, Eunice and Lucas. Thank you for your unconditional support and love through out my life. Thank you for your endless faith in me, even when I fall down.

To Santa Casa da Misericórdia de Cascais and O Mundo do Era Uma Vez daycare center, particularly, to Vanda and Olga for being so generous and accepting when all the other doors where shut.

To Fundação para a Ciência e Tecnologia for granting me the financial support needed to develop this work.

Finally, thank you to all the people I have come across during my life, with whom I shared smiles and stimulating conversations that have inspired me to make new questions everyday.

Palavras-chave:

Regulação emocional; vinculação; temperamento; actividade adrenocortical

Key words:

Emotion regulation; attachment; temperament; adrenocortical activity

Categorias de Classificação da tese

(PsycINFO Classification Categories and Codes):

2800 Developmental Psychology

2840 Psychosocial & Personality Development

RESUMO

Este trabalho tem como objectivo o estudo da regulação emocional em díades mãe-criança, sob uma perspectiva psicobiológica, ou seja, a análise das relações entre processos internos (temperamento e actividade adrenocortical) e externos (representações de vinculação maternas e comportamentos de base segura das crianças), durante diferentes contextos situacionais (medo, afecto positivo, frustração/raiva) e sociais (constrangimento e envolvimento maternos). Cinquenta e cinco crianças entre os 18 e os 26 meses da idade e respectivas mães participaram neste estudo. As estratégias comportamentais de regulação emocional, a expressividade e intensidade emocionais das crianças foram estudadas através do Paradigma de Regulação Emocional (Diener, & Mangelsdorf, 1999 a, b). Os comportamentos de base segura das crianças e as representações de vinculação das mães foram avaliadas através do "Attachment Behavior Q-Set" (Waters, 1995) e pelas Narrativas de Representação da Vinculação em Adultos (Waters, & Rodrigues-Doolabh, 2004), respectivamente. O temperamento das crianças foi avaliado através do "Bate's Infant Characteristics Questionnaire" (Bates, Freeland, & Lounsbury, 1979; adaptação portuguesa por Soares, Rangel-Henriques, & Dias, 2009). Finalmente, as respostas adrenocorticais das crianças e das mães foram avaliadas através de amostras de saliva e analisadas através de ensaios de luminoimunoiscência (LIA). Os resultados revelaram que, de um modo geral, as estratégias comportamentais das crianças variaram, significativamente, em função do contexto situacional (as crianças exibiram mais estratégias durante os episódios de afecto positivo e frustração/raiva, em comparação com os de medo) e envolvimento materno. A expressividade emocional das crianças variou em função do contexto situacional (as crianças exibiram maior expressividade emocional, positiva ou negativa, durante os episódios de medo e frustração/raiva e menos durante os de afecto positivo) e de interacções entre a expressividade emocional e o envolvimento materno. A intensidade emocional revelou variações em função de uma interacção entre o contexto e o envolvimento materno. As estratégias comportamentais e a expressividade emocional das crianças também se diferenciaram significativamente em função da qualidade da relação de vinculação às mães. As representações maternas sobre a vinculação além de serem predictoras dos comportamentos de base segura das crianças crianças, também influenciaram significativamente a expressividade e a intensidade emocionais destas. As respostas adrenocorticais das crianças e das mães variaram significativamente, em função da qualidade de vinculação das crianças. As representações maternas sobre a vinculação influenciaram significativamente os níveis de cortisol das mães, assim como os das crianças (de um modo marginal). A qualidade do temperamento das crianças revelou associações significativas com as estratégias comportamentais e com as respostas adrenocorticais das crianças e das mães. Os resultados são discutidos, analisando possíveis implicações, limitações e futuras linhas de investigação.

Palavras-chave: regulação emocional, vinculação, temperamento, actividade adrenocortical.

SUMMARY

This work studies emotion regulation in child-mother dyads from a psychobiological perspective, particularly, the study of the relationships between internal (temperament and adrenocortical activity) and external processes (mothers' attachment representations and children's secure base behaviours), during different situational (fear, positive affect, frustration/anger) and social (mother constrained and involved) contexts. Fifty-five children between 18 and 26 months of age and their mothers participated in this study. Children's emotion regulation behavioural strategies, emotional expressiveness and intensity were studied through the Emotion Regulation Paradigm (Diener, & Mangelsdorf, 1999 a, b). To assess children's secure base behaviours and mothers' attachment representations the Attachment Behaviour Q-Set (Waters, 1995) and the Adult Attachment Representation Narratives (Waters, & Rodrigues-Doolabh, 2004) were used, respectively. Children's temperament was evaluated by the The Bate's Infant Characteristics Questionnaire (ICQ), (Bates, Freeland, & Lounsbury, 1979; portuguese adaptation by Soares, Rangel-Henriques, & Dias, 2009). Finally, children's and mothers' adrenocortical activity were assessed from salivary cortisol and analyzed through luminoimmunoassay (LIA) kits. Results revealed that overall, toddlers' regulatory strategies varied as function of emotion-eliciting context (children exhibited more strategies during positive affect and frustration/anger episodes and less during fear episodes) and maternal involvement. Toddlers' emotional expressiveness varied as function of emotion-eliciting context (children exhibited more emotional expressions either negative or positive, during fear and frustration/anger episodes and less during positive affect episodes) and as result of interactions between emotional expressiveness and maternal involvement. Emotional intensity varied as function of an interaction between context and maternal involvement. Children's behavioural strategies and expressiveness also differed significantly as function of attachment security to their mothers. Mothers' attachment representations not only predicted their children's secure base behaviours, but also influenced their expressiveness and emotional intensity, in a significant way. Children and mothers' adrenocortical responses were significantly influenced by children's attachment security. Mothers' personal attachment representations influenced significantly their own cortisol responses, as well as their children's (in a marginal significant way). Children's temperament quality showed significant associations with toddlers' behavioural strategies and children and mothers' adrenocortical activities. Possible implications, limitations and future research lines and discussed.

Keywords: emotion regulation, attachment, temperament, adrenocortical activity.

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INTRODUCTION

The term emotion designates an adaptive and multifaced reaction of the organism, which coordinates the individual's necessities with the environment's demands, in order to increase adaptation (Thompson, 1994). This reaction involves multiple processes, such as neurophysiological activation; cognitive evaluation; attention; information processing; interpretation of internal emotional cues; access to coping strategies and selection of adaptive response behaviours (Thompson, 1994).

The study of emotion regulation has become an increasing popular topic in psychological literature in the last years (Gross, 2007; Fox, 1994; Cole, Martin, & Dennis, 2004), since it presents an integrating psychobiological perspective of how emotions organize and facilitate other processes (e.g., cognition, social relationships) and strategic behaviours, that allow individuals to overcome obstacles, solve problems and maintain well-being, since early infancy (Cole, Martin, & Dennis, 2004). However, the scientific validity of emotion regulation is still under construction, due to a lack of precision concerning the phenomenon under study (are emotions regulated or regulators?), and a lack of agreement around the methodologies of study (Fox, 1994). Moreover, the idea that emotions interfere with analytic cognitive processing, has also slowed progress in this domain (Fox, 1994).

Recently, the study of emotions and emotion regulation has been understood from a functionalist point of view, which seems to present an integrative solution for these questions. From this perspective, emotions are considered as organizing behaviours, used in service of particular immediate or long term goals that serve individual developmental trajectories. In this sense, emotions are not only regulated responses, but also regulators of social interactions (Campos, Campos, Mumme, Kermoian, & Campos, 1994; Fox, 1994; Cole, Martin, & Dennis, 2004). Emotion regulation is no longer seen as the reduction of negative affect, but the regulation of distress by maintaining, enhancing or diminishing emotional arousal, including positive one, according to the environment's demands and one's goals. Emotion regulation may, then, help individuals to organize cognitive processes and to adjust themselves to the characteristics of particular contexts. In this sense, a functionalist study of emotion regulation provides a frame for the study of emotions' role across multiple contexts, either internal, or external, such as dyadic interaction and family processes (Fox, 1994).

This perspective of emotions having an organizing function, also provides a link to the study of developmental psychopathology, since it sets a framework to study the variety of contexts within which particular responses are adaptive or maladaptive (Fox, 1994; Campos, Campos, Mumme, Kermoian, & Campos, 1994; Fox, 1994). Therefore, the study of early

social experience (e.g. attachment relationships), bio-behavioral dispositions (temperament) and multiple emotional contexts is very important in the study of emotion regulation, since they shape the response patterns and strategies that individuals develop to cope with different developmental challenges, since early childhood. Moreover, incorporating the study of emotions across multiple contexts, also help us to understand better the true nature and purpose of emotions and emotional patterns, since emotional responses that might in one context be viewed as dysregulated, may be functionally adaptive to socially insensitive and disorganized environments (Fox, 1994; Campos, Campos, Mumme, Kermoian, & Campos, 1994).

The study of the sources of individual differences in emotion regulation becomes crucial in conceptualizing how the process of developing regulatory strategies occurs. To undertake this task, a number of steps should be taken into account (Calkins, 1994). First, it is important to identify the internal (e.g., temperament; cognitive traits; biological/neuroregulatory systems) and external (e.g., interactive caregiving styles; attachment relationship) processes to the individual, as well as the reciprocal relationships between them, that may lead to the development of particular emotional regulatory responses/patterns. Second, it is important to study these questions since early childhood, in order to unravel during which developmental periods and how, these processes exert their influence. Third, the relative strength of the association between the processes must be reported (Calkins, 1994).

The study of attachment relationships, namely, children's secure base behaviours and the parents' own original attachment representations becomes very important in understanding the development of emotion regulatory processes, since there has been an acknowledgement that internal working models of initial attachment relationships are transformed into more complex symbolic and cognitive representations that influence the child's perception of effectiveness and control over events, that continue to exert its influence across development, into adulthood (Cassidy, 1994; Bretherton, 1990; Waters, Vaughn, Posada, & Kondo-Ikemura, 1995; Waters, & Cummings, 2000; Fox, 1994). The assessement of parent's own attachment history is crucial in understanding children's emotional regulatory efforts, since attachment relationships' follow a trans-generational pattern, characterized by a strong association between the parents' attachment representations and their children's attachment relationship quality (Main, Hesse, & Kaplan, 2005; Grossmann, Grossmann, Fremmer-Bombik, Kindler, Scheuerer-English, & Zimmerman, 2002; Steele, Steele, &

Fonagy, 1996; van IJzendoorn, 1995; Veríssimo, Monteiro, Vaughn, Santos, & Waters, 2005; Monteiro, 2007).

Research findings have demonstrated the importance of early social relationships as regulators of children's behaviours, but also of biological change and development (Hofer, 1994; Field, 1994; Fox, 1994). The importance of early relationships as regulators at the biological level was anticipated by Bowlby (1969/1982; 1973; 1980), but it has not been investigated enough by developmental psychologists (Fox, 1994). The study of individual differences in children's neuroregulatory systems is very important, since the physiological reactivity to particular emotional contexts may be displayed in a behaviourally different way across infants, which may have important implications for the development of particular emotional regulatory skills, for various reasons. First, infants who experience extreme physiological distress in response to certain contexts, may become too disrupted to allow the development of internal and effective strategies (Calkins, 1994; Fox, & Calkins, 1993). Second, physiologically distressed children may affect a caregiver's response, by incapacitating the parent to respond in a contingent way all the times, given the frequency of distress (Calkins, 1994; Calkins, & Fox, 1992).

The development of certain emotional behavioural patterns in response to multiple contextual demands, have particular significant impacts on neuroregulatory systems, which can either be health protective or damaging (Stansbury, & Gunnar, 1994; Dawson, 1994; Fox, 1994; Porges, Doussard-Roosevelt, & Maiti, 1994). Researchers interested in the physiological correlates of emotion have been studying different systems, namely, the frontal electroencephalographic system (Dawson, 1994); dynamic cerebral processes (Fox, 1994); vagal tone (Porges, Doussard-Roosevelt, & Maiti, 1994) and adrenocortical activity (e.g., hypothalamic-pituitary adrenal axis, HPA), (Stansbury, & Gunnar, 1994; Spangler, & Schieche, 1998; Spangler, & Grossman, 1993; Schieche, & Spangler, 2005).

The research done in this domain uses a common approach to understand this complex interplay between social relationships and biology, which consists of several steps (Fox, 1994). First, there is an attempt to describe the biology of the different parts that form neuroregulatory systems, how they interact with each others, as well as with other physical systems in the body. Second, there is an effort in understanding the range of naturally occurring variability of the systems when they are not challenged, by collecting basal levels concentrations, which give scientists important information about the individual's potential of response and degree of organization of the systems (e.g., the threshold from which they may

respond). Third, investigators are also concerned with the systems' responses to challenge, observing possible significant differences from basal levels and the direction of that change. Fourth, each physiological response is associated to the subject's behaviour, attempting to link emotion regulation behavioural strategies to physiology, particularly, in preverbal infants studies, where self-reports are unavailable. Finally, scientists are interested in the systems' responses across development, (since not all responses are present or complete at birth), as they try to understand the reciprocal relationships with behaviour (Fox, 1994).

The use of a psychobiological model in the study of emotion regulation, which takes into consideration external processes to the child (e.g., early social relationships), as well as internal ones (bio-behavioral dispositions, e.g., temperament and neuroregulatory functioning), but mostly, the interactions that occur within them, is crucial in recognizing the elements that lead to children's biopsychosocial health and well being, as well as to which socio-political measures should be implemented in case of maladjustment and poor health (Field, 1994).

This work contributes in numerous ways, to a better understanding of early emotion regulation and typical socio-emotional development. This was achieved by using a more complete methodological approach, that not only allows for "independent assessment of activated emotion regulatory strategies" (Cole, Martin, & Dennis, 2004), but also, the "comparison of emotion and regulatory phenomena in contrasting conditions" (Cole, Martin, & Dennis, 2004), by manipulating either the situational context (fear, positive affect, anger), or the social one (mothers' constrained and involved behaviour). The use of multiple methodological directions is very important, since it increases rigor, debate, critical analysis and the viability of emotion regulation as a scientific construct (Cole, Martin, & Dennis, 2004). This work is composed by 3 empirical studies:

The *first* one tries to understand the importance of emotion-eliciting context (fear, positive affect, frustration/anger) and mother's behaviour (constrained and involved) on toddlers' emotion regulation behavioural strategies, emotional expressiveness and intensity. Children's behavioural regulatory strategies are compared during moments of mothers' constrained and involved behaviour, as well as in different situational novel contexts, two of them challenging and one positive. An increase of children's regulatory strategies during mothers' involvement periods is expected, since social support, particular the caregiver's, expands one's personal control over the environment and over one's internal emotional state, by providing distraction, supporting attention regulation and exploration, which creates a

powerful context where new regulatory strategies can be learned (Diener, & Mangelsdorf, 1999; Schieche, & Splangler, 2005; Stansbury, & Gunnar, 1994). Children are also expected to show more positive affect expressions when the mothers' behaviour is involved, than when it is constrained (Diener, & Mangelsdorf, 1999). Significant differences in children's behavioural strategies between situational contexts are also anticipated, given the functionalist characteristic of emotions (Campos, Campos, Mumme, Kermoian, & Campos, 1994; Diener, & Mangelsdorf, 1999).

The *second study*, tries to understand the relationships between attachment (children's secure base and mothers' attachment representations), temperament and toddlers' behavioural strategies, expressiveness and intensity during different emotion-eliciting contexts. To our knowledge no studies concerning the relationship between mothers' personal attachment representations and their children's regulatory behaviours has been done. It seems very interesting to study attachment's trans-generational phenomenon, applied to children's emotion regulation system. We expect both children and mothers' attachment experiences, as well as children's temperament quality, to influence significantly children's emotion regulation, both behaviourally, as in terms of their expressiveness.

Finally, the *third study* examines adrenocortical responses in different situational contexts in mother-child dyads, and possible relationships with attachment (children's secure base and mothers' attachment representations) and children's temperament. This study is important in understanding the reciprocal and psychobiological relationships between emotion regulation and adrenocortical activity, in the context of child development, stress and health care research. We tried to assess these issues, by addressing which emotions (fear, positive affect, frustration/anger) are related to the HPA axis activation in response to everyday life events in children and mothers, and which behavioural strategies mediate this response, in naturalistic settings. Moreover, to our knowledge no studies have been done concerning mothers' adrenocortical responses after being exposed to their children's emotional episodes or the relationships between their personal attachment representations and their cortisol responses or their children's. It is our objective to unravel these issues.

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CHAPTER 1

IMPORTANCE OF EMOTION-ELICITING CONTEXT (POSITIVE AND NEGATIVE) AND MOTHER'S BEHAVIOUR (CONSTRAINED AND INVOLVED) ON TODDLERS' EMOTION REGULATION BEHAVIOURAL STRATEGIES, EMOTIONAL EXPRESSIVENESS AND INTENSITY

ABSTRACT

This study investigated the importance of emotion-eliciting context (positive and negative affect) and mother's behaviour (constrained and involved) on toddlers' emotion regulation behavioural strategies, emotional expressiveness and intensity. Fifty-five children between 18 and 26 months of age and their mothers participated in this study. Children were exposed to three episodes, one positive and two negative (fear, frustration/anger) at naturalistic settings. Mothers' behaviour was constrained during the first part and involved in the second part of the episodes. Overall, toddlers' regulatory strategies varied as function of emotion-eliciting context (children exhibited more strategies during positive affect and frustration/anger episodes and less during fear episodes) and maternal involvement. Toddlers' emotion expressiveness varied as function of emotion-eliciting context (children exhibited more emotional expressions either negative or positive, during fear and frustration/ anger episodes and less during positive affect episodes) and as a result of interactions between emotional expressiveness and maternal involvement. Emotional intensity varied as function of an interaction between context and maternal involvement.

Keywords: Emotion regulation, positive and negative affect-contexts, maternal involvement, expressiveness, intensity

INTRODUCTION

Emotion regulation is a biopsychosocial behavioural system responsible for the modulation of emotional reactions, including its inhibition, activation or graded modulation (Rothbart, & Sheese, 2007). This system involves changes in latency, rise time, magnitude and duration of responses in behaviour, experience and physiology, depending on an individual's goals (Gross, & Thompson, 2007; Thompson, & Meyer, 2007). Emotion regulation may involve the inhibition or the maintenance and enhancement of emotion, either positive or negative, according to the demands of the situation. This means that emotion regulation includes not only the inhibition of negative affect, but the maintenance and enhancement of positive affect, or vice-versa, if it suits one's goals and the characteristics of the context (Thompson, 1994; Gross, & Thompson, 2007). Regulating emotions is fundamental in having access to a greater number of adaptive behaviours and promoting appropriate and flexible responses (Denham, 1998; Fox, 1994). On the contrary, emotional dysregulation refers to an inability to change the time, intensity and recovery of emotional experiences and difficulties in altering an undesirable affective state or maintaining a desirable one, which causes problems in social adaptation and relationships (Cole, Michel, & Teti, 1994). Moreover, emotional dysregulation also implies the use of emotion in maladaptive ways, such as aggressive and oppositional behaviours or conduct-disorders, in the case of dysregulated anger (Berkowitz, 1962; Dunn, Lochman, & Colder, 1997), drug-use as a result of emotional distress (Swaim, Oetting, Edwards, & Beauvais, 1989) or antisocial behaviour, substance use and family conflict (Kosson, Steuerwald, Newman, & Widom, 1994). Thus, emotion dysregulation results in having fewer regulatory strategies and the inability to make decisions regarding appropriate conduct in multiple contexts (Denham, 1998; Fox, 1994), being related with psychopathological symptoms or deviant developmental trajectories in childhood and adolescence (Cole, Michael, & Teti, 1994; Maughan, & Cicchetti, 2002).

Research evidence has shown that across development, emotion regulation has a tendency to increase rapidly and emotional negativity to decrease over the course of time, particularly during childhood (Blandon, Calkins, Keane, & O'Brien, 2008). Recent findings from developmental neuroscience suggests that these findings may be due, in part, to children's increasing cognitive abilities, such as language, greater capacity to plan and control behaviour and maturation of the prefrontal cortex and the anterior cingulated cortex, associated with emotion regulation processes (Ochsner, & Gross, 2005; Ochsner, Bunge,

Gross, & Gabrieli, 2002; Fox, 1994). Changes in children's social context also enhances rapid changes in children's emotion regulation. The entrance in preschool sets in an important developmental transition, characterized by peers interaction and greater demands on autonomy, self-control in social interactions and regulation of emotions (Rimm-Kaufman, & Pianta, 2000).

In order to understand emotion regulation, researchers have been studying, primarily, the internal and external sources of regulation, during the stages of infancy and childhood. Initially, the role of the caregiver is extremely important in regulating the child's physiological and emotional arousal states, either by providing the means for the child's physical survival and well being (food, shelter, clothing, physical soothing), or through more complex interactions (caregiving styles or explicit training, like discipline, modelling, reinforcement), which teach the child how to manage stress, frustration and how to control impulses (Calkins, 1994). This process of external regulation through the parents support is progressively internalized by the child and becomes a source of self-regulation, particularly, when sensorimotor behaviour and locomotion are developed and social referencing skills are acquired. These new advances in development allow the child to control physical and emotional proximity to the caregiver and people in general, and to guarantee the access to new sources of information. Emotional arousal may facilitate, inhibit or disrupt behaviour. During infancy and childhood, children gradually develop different emotion regulation strategies that they use in particular stressful and arousing situations (Calkins, 1994).

The functionalist perspective

Emotion regulation, as the name determines, regulates emotions. The term emotion designates an adaptive and multi-faced reaction of the organism, which coordinates the individual's necessities with the environment's demands, in order to increase adaptation and the chances of survival. This reaction involves multiple processes, such as neurophysiological activation; cognitive evaluation; attention; information processing; interpretation of internal emotional cues; access to coping strategies and selection of adaptive response behaviours (Thompson, 1994). On the other hand, some functionalist authors (Campos, Mumme, Kermoian, & Campos, 1994) defend that emotion regulation is not concerned with evolutionary survival, but with the relationship between emotion and a person's immediate or long term objectives. The functionalist approach to emotion regulation is that of a dynamical system which main purpose is to accomplish one's goals. This is done by allowing the individual to experience a variety of emotions, positive and negative, in a flexible and

sufficiently controlled way, which helps the establishment of inter-personal relationships; pro-social initiatives; assertiveness, etc, according to the social and cultural demands of the context and the individual's objectives. In this sense, the functionalist perspective is a relational one, where emotion can only be understood by examining the individual and the environmental events as a whole and not as separate entities (Campos, Mumme, Kermoian, & Campos, 1994). Functionalists propose four ways in which environmental events become significant and, by consequence, generate emotion: (1) events felt as personal goals; (2) social signaling by others or emotional contagion; (3) events which produce hedonic stimulation (sights, sounds, smells and tactile stimulation which produces sensations of pleasure or pain); (4) events that evoke schematic processes (past memories, internal working models) (Campos, Mumme, Kermoian, & Campos, 1994).

Regulation of positive and negative emotions: positive affect, fear and frustration/anger

According to a functionalist perspective the effectiveness of behavioral strategies depends on the goals of the situation. In the study of anger regulation with a sample of young boys (Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002), decreases in anger were associated with three strategies: shifting attention away from sources of frustration, passive waiting and seeking information. Focusing on the frustrating event was associated with increases in anger intensity.

During fear episodes, strategies such as withdrawal (Buss, & Goldsmith, 1998) avoidance and fussing to mother (Diener, & Mangelsdorf, 1999a), showed a minimizing effect. On the other hand, strategies such as approach and interaction with the stimulus (Buss, & Goldsmith, 1998), as well as playing with the stimulus (Diener, & Mangelsdorf, 1999a), showed maintenance effects. When it comes to differences between the regulation of fear and frustration/anger episodes, research suggests that children tend to use more regulatory strategies during frustration/ anger contexts, than during fear episodes, probably because the frustration object is unattainable and children try more strategies in a repeated way in order to get it back, whereas this is unnecessary during fear episodes (Diener, & Mangelsdorf, 1999a).

Finally, in the literature there is a lack of attention to positive affect in the study of emotion regulation. To our knowledge, few studies (Beauregard, Levesque, & John, 2001; Kim, & Hamann, 2007; Giuliani, McRae & Gross, 2008), have studied the regulation of positive affect. However, none was done in children. Research on the regulation of positive affect is essential, particularly, the study of strategies that maintain and increase the

experiences of positive emotions, since cultivating them may be particularly important for building resilience to stressful events (Tugade, & Fredickson, 2007). The study of emotional processes during toddlerhood is especially important, given children's emerging ability to handle emotions and behavior and their entrance in the social world of peers, where their capacity for cooperative social play will be tested (Kopp, 1989; Thompson, 1994; Calkins, Gill, Johnson, & Smith, 1999).

According to a functionalist approach (Campos et al., 1994), maintaining or enhancing positive affect is as important as inhibiting negative affect, if it is according to one's immediate or long term goals. However, no studies have been done to show if there are any differences in the number of regulatory strategies exhibited during positive affect episodes, compared to negative affect ones. According to learning and operant conditioning theories, behaviours are strengthened by the consequence of experiencing a positive condition, but also by the consequence of stopping or avoiding a negative one (Malott, & Trojan, 2008), which also suggests that there might be no differences in the frequency of regulatory strategies exhibited during positive and negative emotion-eliciting contexts.

The role of mother's involvement

Parental behaviour towards children's emotions plays an important part in the development of children's emotional self-regulation. External support from caregivers is fundamental, as infants and toddlers start to understand the causes of emotional distress and learn to associate caregivers with the possibility to change their negative states and facilitate the implement of effective behavioural strategies (Kopp, 1989). The behavioural strategy used most frequently in 5 and 10 month-old infants seems to be self-soothing, particularly, during periods of decreasing arousal, when compared to periods of increasing or unchanging arousal (Stifter, & Braungart, 1995). Children's self-soothing strategies seem to decrease with age (Rothbart et al., 1992; Grolnick et al., 1996) and their ability to use objects and interactive strategies appears to increase (Grolnick et al., 1996; Mangelsdorf, Shapiro, & Marzolf, 1995; Rothbart et al., 1992). Mangelsdorf et al. (1995) reported that 12 and 18 month-old infants engaged in more self-distraction and behavioural avoidance than 6 month-olds and that 12 month-olds showed more self-soothing (thumb-sucking, hair twirling), than 18 month-olds. At the end of the first year, the most important advance in emotion regulation is its social interactive aspects. Infants are able to send specific cues to their caregivers in order to manipulate their behaviour, seeing them as a source of support (Kopp, 1989). Children between 18 and 24 months, use different behavioural strategies as a function of maternal

involvement, in situations of fear and anger. They use distraction strategies more frequently during delay situations, when an adult is available and involved (Grolnick, Bridges, & Connell, 1996). They also engage, social reference their mothers, play with the stimulus and express more positive affect than negative affect during mother involved periods, than during constrained ones (Diener, & Mangelsdorf, 1999a).

Research work shows that children elicit the caregiver's support increasingly with age: older infants orient towards their mothers more often than younger children and are less likely to focus on other aspects of the environment (Rothbart, Ziaie, & O'Boyle, 1992). Children engage in directing, information seeking and social referencing of mothers more often at 18 months, than they did at 12 months (Parritz, 1996).

Objectives

The objective of this work was to study the importance of emotion-eliciting context (positive affect and negative affect) and mother's behaviour (constrained and involved) on toddlers' behavioural strategies, emotional expressiveness and intensity. Even though some research has been done on toddlers' behavioural strategies during negative affect contexts and on associations with maternal involvement and emotional expressions (Diener, & Mangelsdorf, 1999a), to our knowledge no work has been done on toddlers' behavioural strategies and expressiveness during positive affect contexts or looked at the influence of emotional-eliciting context and maternal involvement on children's emotional intensity. Moreover, this work was developed at naturalistic-settings (children's homes) and not at the laboratory, which may provide important insight to the understanding of children's emotion regulation during daily-life events, outside more controlled settings. Our goals were two-fold. First, we sought to explore relations among regulatory behavioural strategies, maternal involvement and positive and negative affect (fear, frustration/anger) emotion-eliciting contexts. We hypothesized that: (a) toddlers' behavioural strategies will vary as function of emotion-eliciting context. In particular, children are expected to show more behavioural strategies during frustration/anger episodes, than during fear contexts (Diener, & Mangelsdorf, 1999a), but no differences are expected to be found between positive affect episodes and negative affect ones, either fear or anger. This hypotheses is support by the assumption that emotion regulation seems to be related either with the inhibition of negative affect, or the maintenance of positive emotions, according to one's goals (Thompson, 1994; Campos, et al., 1994) and that both positive and negative experiences strengthen and reinforce behaviour (Malott, & Trojan, 2008); (b) Toddlers' behavioural strategies will vary as function

of maternal involvement and that children will show more behavioural strategies during mother involved periods, than during mother constrained ones during fear episodes (as a way to get comfort) and more strategies during mother constrained periods, than during mother involved ones, during frustration anger episodes (as a way to get the toy back and play), according to their context-specific goals (Campos, et al., 1994). During positive affect episodes, children are expected to show no differences in the number of strategies used in mother constrained and involved periods, given that in both moments the desired object is always present and represents a source of pleasure, even if the mother is emotionally unavailable.

The second aim was to examine the links among toddlers' emotional expressiveness and emotional intensity, maternal behaviour (constrained and involved) and context (positive and negative). We expected that: (a) Toddlers' emotional expressiveness and intensity will show no differences as function of emotion-eliciting context, since both aspects (similarly to behavioural strategies) may be used by children as a way to signal their mothers' about their needs and goals, that is, to play during positive affect episodes or to be sooth during negative affect ones; (b) Toddlers' emotional expressiveness will vary as function of maternal involvement. In particular, children are expected to exhibit more emotional expressions, particularly positive affect ones, during mother involved periods, than during mother constrained ones, as a result of the social interactive aspects of emotion regulation, developed at the end of the first year (Kopp, 1989); (c) Toddlers' emotional intensity will vary as function of maternal involvement. Children are expected to exhibit more emotional intensity during mother constrained periods, than during mother involved ones, as a way to call mothers' attention to their immediate needs (Campos, et al., 1994), either to diminish distress or to play.

METHODS

Participants

Fifty-five mother/child dyads (27 boys and 28 girls), all Caucasian, from bi-parental families participated in the study. Children were between 18 and 26 months of age (*M*=21.35; *S.D.*=1.91). Twenty seven were firstborn and 28 had siblings. They started attending day-care between 6 and 24 months (*M*=7.53; *S.D.*=4.81) and spent 7-11 hours (*M*=6.96; *S.D.*=2.64) in day-care each weekday. Mothers' age ranged from 25-43 years (*M*=33.64; *S.D.*=4.10) and

fathers' age from 26-55 years old (*M*=35.71; *S.D.*=5.73). Mothers' level of education ranged from 5 -19 years (*M*=14.87; *S.D.*=3.38) and fathers' from 4-19 years (*M*=13.71; *S.D.*=3.60). Ninety four percent of mothers were employed outside the home. Participants represented a range of socioeconomic status backgrounds, as reflected by parental education and were recruited from public and private daycare centers.

Measures

Emotion regulation paradigm: fear, positive affect, frustration/anger

The emotion regulation paradigm (Diener, & Mangelsdorf, 1999a), measured the behavioural strategies, emotional expressiveness and intensity exhibited by children during three episodes: positive affect, fear and frustration/anger, elicited by presenting the children three different toys. Each episode lasted for six minutes and had two distinct moments of three minutes each: (1) *mother constrained period* (mothers were instructed to refrain from initiating interaction with their children. If their children made bids for attention, mothers were instructed to respond to them with brief statements about the stimuli presented in each episode: "It's the dinosaur/piano/bear"); (2) *mother involved period* (mothers were instructed to be at ease with the child and the toy. Free behaviour was allowed, whatever they felt it was appropriate, according to their sensitivity). During the mother constrained period, if children showed 30 seconds of sustained high-intensity distress, mothers were instructed to become involved. If this situation happened during the mother involved periods, the episode was terminated. During fear contexts, four children exhibited 30 seconds of sustained high-intensity distress (three children during mother constrained periods and one during mother involved ones). During frustration/anger episodes, nine children expressed high-intensity distress (eight children during mother constrained periods and one during mother involved periods). No sustained high-intensity distress was exhibited during positive affect episodes. All the episodes were videotaped.

Emotional stimuli

All stimuli used in this work were previously tested in a pilot test, which showed a varying emotional intensity in most children. In Diener and Mangelsdorf's original study (1999a) a battery-operated bouncing stuffed octopus that moved and made sounds was used to elicit fear and a large stuffed animal Big Bird was used during the frustration/anger episodes. However, after pilot testing we observed that stuffed animals caused no reaction in the

children of this study. On the contrary, legos inside a movable toy did cause a high level of interest, enthusiasm and exploration. Therefore, during the frustration/anger episode, we presented children with a movable box with wheels, shaped in the form of a yellow bear, which contained coloured lego pieces inside. After the experimenter felt that the child was involved with the toy (two minutes on average), the experimenter took the toy away firmly and placed it out of reach but within the child's sight. The first moment of this episode only started after the removal of the object, even though the mother's behaviour was already constrained during the child's initial exploration. During fear episodes, a dinosaur toy with similar characteristics (elements of novelty, unpredictability and intrusiveness) to the battery-operated bouncing stuffed octopus present in Diener and Mangelsdorf work (1999a) was used to elicit fear. Finally, during the positive affect episode, children were given a toy piano that played music and created musical rhythms, similar to the one used by Diener and Mangelsdorf (1999a). Similar procedures for fear and frustration/anger episodes (but with different stimuli) were used in other studies (Diener, & Mangelsdorf, 1999a; Buss, & Goldsmith, 1998; Grolnick, Bridges, & Connell, 1995; Stifer, & Braungart, 1995).

Children behavioural strategies

Toddlers' behavioural strategies were divided into four domains (Diener, & Mangesdorf, 1999b): (1) *mother-related strategies* (proximity/contact seeking to mother; directing mother; fuss to mother; help seeking; information seeking; social referencing/looks to mother; engagement of mother); (2) *disengagement of attention strategies* (passive disengagement; distraction toward other object or person/active disengagement; leavetaking; avoidance); (3) *dealing with the stimulus strategies* (playing/exploring; resistance/control; labeling; problem solving; proximity to stimulus); (4) *redirection of action strategies* (tension release; self-soothing). During the course of our study, another set of behaviours was observed, besides the ones proposed by Diener and Mangelsdorf (1999b). This one was coded under the name of "stranger", because it was characterized by behaviours directed at the strangers (experimenters) in the room during the sessions and it was placed in the "redirection of action strategies" domain (see appendix A).

Children's behavioural strategies were coded dichotomously on an occurrence/ non occurrence way, in 15 seconds intervals (1-occurrence; 0-non occurrence). Each three minute period had twelve 15 seconds intervals. The results for each strategy were summed for a total score. The possible range for each behaviour was zero to 12, for each three minute period. If an episode was terminated because of child distress, scores were prorated on the basis of the

number of intervals completed, by dividing the sums of the scores by the number of intervals completed and multiplying 12 (the total number of intervals possible) (Diener, & Mangelsdorf, 1999b).

Emotional expression

The predominant emotional expression showed by children during the three episodes was also coded. *Fear* was scored when the child expressed at least one of these facial features: eyebrows raised or drawn together; eyes wide; mouth open, corners straight back. *Positive affect* was scored when the child smiled or produced a positive vocalization (laugh). *Anger* was coded when the child showed at least one of the following: brows pulled back down or together; raised cheeks; straight or angular mouth or tight lips. A score of *neutral* was given when the child did not express any of these emotions and showed a neutral expression. The neutral scores were not included in the analysis. Children's emotional expressions (1-positive; 2-anger/frustration; 3-fear; 4-neutral) were coded during the 15 seconds intervals.

The intensity of emotion was scored in a scale of one to three points (1- low intensity; 2- medium intensity; 3-high intensity). If the child expressed more than one emotion during the time intervals used for coding, the most intense emotion was coded as the predominant one. Intensity of child's emotion rated from low to high intensity. High intensity emotion could be expressed by facial affect, body postures, gestures and movements or full intensity vocalizations (e.g., laughter for positive affect; crying or screaming for negative affect). Low intensity affect seemed mild and would be more ambiguous than high intensity one (Diener, & Mangelsdorf, 1999b).

Separate pairs of coders, blinded to the hypotheses, coded the three episodes. Inter-rater reliability was calculated using Cohen's Kappas (fear=.73; positive affect=.84; frustration/anger=.70). This coding system is similar to those used in other studies of children coping strategies (Diener, & Mangelsdorf, 1999b; Buss, & Goldsmith, 1998; Calkins, & Jonhson, 1998; Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996; Parritz, 1996).

Procedures

Mothers became aware of this work through an informed consent, left at their children daycare. The emotion regulation episodes were videotaped in different days, usually during a period of two weeks, with a minimum of two days apart, from each session, in order to avoid any emotional contamination from one episode to the other and to guarantee that each episode

only aroused one emotion at the time. They all started at the same time (18:30). The time chosen to start the experiments was late afternoon, because 94% of the mothers worked outside the home and finish their shift around 17:00. The episodes were videotaped at the family's house, always in the living room, because it present itself as the most spacious and neutral place of the house, without any other toys that could serve as a distraction from the stimuli. During the sessions only the child, the mother and two experimenters were present in the room. The stimuli were placed in the center of the room, to allow children to explore freely. The three episodes were videotaped in a balanced way in order to control any order effect over the results.

RESULTS

Preliminary analyses

First, we tested if the emotional manipulations were effective and if the target emotion was expressed more frequently in the correspondent episode, than the other emotions in a significant way. A repeated measures MANOVA was conducted. When the results were significant, relevant differences were tested with planned contrast estimates analyses. Two within-effects levels were used: emotional expression (fear, positive affect and frustration/anger facial expressions) and episode (fear, positive affect, frustration/anger). Child gender served as between-effect or independent variable. The analysis revealed significant main effects for episode (F (2, 106) = 37.94, $p < .001$) and emotional expression (F (2, 106) = 7.35, $p < .001$). A significant interaction between episode and emotional expression was also found (F (4, 212) = 80.36, $p < .001$). No child gender effects were found.

Planned contrast estimates analyses revealed that independently of the mothers' behaviour, during fear episodes (see table 1) children showed significantly more fearful expressions, than positive affect (t (53) = 2.38, $p < .05$) and more fear than frustration/anger expressions (t (53) = 10.23, $p < .001$). During positive affect episodes, they showed significantly more positive affect expressions, than fearful ones (t (53) = 6.19, $p < .001$) and more positive affect than frustration/anger expressions (t (53) = 7.34 $p < .001$). Finally, during the frustration/anger episodes children expressed significantly more frustration/anger faces, than positive affect ones (t (53) = 7.98, $p < .001$) and more frustration/anger expressions than fearful ones (t (53) = 19.48, $p < .001$). Thus, the manipulations were effective and the stimuli elicited the emotion they were designed to evoke.

Table 1

Means and standard errors for children's emotional expressions (fear, positive affect, frustration/anger), during episodes of fear, positive affect and frustration/anger

Episode	Emotional expression	M	S.E.
fear	positive affect expression	3.91	0.58
	frustration/anger expression	0.30	0.09
	fear expression	6.50	0.57
positive affect	positive affect expression	4.93	0.52
	frustration/anger expression	0.71	0.16
	fear expression	0.81	0.24
frustration/anger	positive affect expression	2.31	0.26
	frustration/anger expression	6.13	0.31
	fear expression	0.00	0.00

Next, we tested child age effects on emotion regulation four types of strategies. Significant correlations between child age and "mother related" (r = 0.32, p < .05) and "dealing with stimulus" strategies (r = -0.35, p < .05) were found during frustration/anger episodes. No significant correlations were found in positive affect or frustration/anger episodes.

Main effects of emotion-eliciting context and mothers' involvement on toddlers' behavioural strategies

A repeated measures MANOVA was conducted and three within-subject levels were used: episode (fear, positive affect, frustration/anger); maternal condition (constrained and involved) and the 19 strategies. Child gender was used as between-effects factor or independent variable. Significant main effects were found for emotion regulation strategies (F (18, 954) = 165.13, p < .001); episode (F (2, 106) = 36.19, p < .001) and maternal condition (F (1, 53) = 26.87, p < .001).

Table 2

Means and standard errors for children's four types of emotional regulation strategies as function of episode (fear, positive affect, frustration/anger) and maternal involvement (constrained and involved)

	Fear				Positive Affect				Frustration/anger			
Strategy type	Constrained		Involved		Constrained		Involved		Constrained		Involved	
Mother-related	M	S.E.	M	S.E.	M	S.E.	M	S.E.	M	S.E.	M	S.E.
proximity to mother	8.74	0.58	9.62	0.47	8.08	0.51	9.60	0.46	8.55	0.55	9.59	0.38
directing mom	0.74	0.25	0.92	0.21	0.68	0.18	0.64	0.19	3.86	0.55	3.43	0.43
fussing to mother	2.02	0.34	2.18	0.36	0.24	0.09	0.33	0.17	2.53	0.53	0.68	0.26
helpseeking	0.11	0.07	0.03	0.02	0.05	0.03	0.07	0.03	2.86	0.51	1.84	0.34
information seeking	0.08	0.05	0.07	0.04	0.04	0.02	0.13	0.08	0.42	0.24	0.28	0.16
social referencing	4.13	0.41	5.13	0.39	5.54	0.45	6.26	0.46	6.75	0.47	6.48	0.45
engaging mother	1.59	0.36	1.01	0.25	3.36	0.44	5.09	0.44	5.08	0.53	5.40	0.44
Disengagement of attention												
passive disengagement of attention	0.80	0.21	0.67	0.23	4.33	0.41	3.21	0.38	3.79	0.43	1.28	0.28
distraction	0.24	0.11	0.71	0.23	1.57	0.35	1.70	0.40	2.88	0.48	1.44	0.36
leavetaking	0.07	0.04	0.09	0.05	0.00	0.00	0.22	0.14	0.45	0.18	0.24	0.12
avoidance	2.13	0.28	3.92	0.45	0.91	0.23	1.57	0.37	2.36	0.50	1.91	0.35
Dealing with the stimulus												
playing with stimulus	0.47	0.21	2.15	0.44	8.16	0.58	8.12	0.53	-	-	-	-
resistance/control	0.04	0.03	0.16	0.07	0.00	0.00	0.09	0.07	-	-	-	-
labeling	1.41	0.31	2.19	0.35	0.27	0.16	0.11	0.06	0.25	0.15	0.20	0.16
problem solving	0.43	0.22	1.02	0.27	0.58	0.20	1.22	0.34	0.21	0.10	0.77	0.32
proximity to stimulus	3.00	0.60	7.27	0.58	9.39	0.50	10.13	0.38	1.92	0.46	8.80	0.46
Re-directed action												
tension release	1.60	0.34	1.23	0.30	0.17	0.08	0.40	0.14	1.54	0.41	0.47	0.23
self-soothing	6.19	0.71	5.29	0.70	4.29	0.70	2.85	0.60	4.48	0.69	3.51	0.67
stranger	0.50	0.18	0.59	0.16	4.02	0.45	3.03	0.43	0.63	0.18	0.25	0.10
Total	1.80	0.08	2.33	0.07	2.72	0.06	2.88	0.07	2.56	0.12	2.81	0.09

During fear episodes (see table 2) planned contrast estimates analyses revealed that children exhibited more playing with stimulus strategies during mother involved periods, than during mother constrained ones (t (53) = 4.04, $p < .001$). They also looked for more proximity to the stimulus during mother involved periods, than during constrained ones (t (53) = 7.78, $p < .001$). In total, in fear episodes (see table 2) children exhibited significantly more strategies during mother involved periods, than during the mother constrained ones (t (53) = 5.76, $p < .001$).

During positive affect episodes (see table 2) children engaged their mothers more during mother involved periods, than during constrained ones (t (53) = 3.68, $p < .001$). They passively disengaged their attention more during mother constrained periods, than during involved ones (t (53) = 2.96, $p < .001$). Children self-soothed themselves more when their mothers where constrained, than when their mothers where involved (t (53) = 3.10, $p < .001$). Finally, children showed more behaviors towards the strangers when their mothers' behaviour was constrained, than when it was involved (t (53) = 2.72, $p < .001$)

During frustration/anger episodes (see table 2) children exhibited more fussing to mother behaviours during mother constrained periods, than during mother involved ones (t (53) = 4.05, $p < .001$). They engaged in more passive disengagement of attention strategies when their mothers were constrained, than when their mothers where involved (t (53) = 5.33, $p < .001$). Children distracted themselves more from the stimulus, during mother constrained periods, than during mother involved ones (t (53) = 2.73, $p < .001$). They exhibited more proximity to stimulus behaviours when the mothers were involved, than when they were constrained (t (53) = 11.13, $p < .001$). Children also released more tension during the mother constrained periods, than during mother involved ones (t (53) = 2.61, $p < .01$). Playing with stimulus and resistance/control strategies were taken out of this analysis because during the mother constrained period, the toy was taken away from the child to a place where they could see it, but could not touch it.

In total (see table 3), independently of mothers' involvement, children showed more strategies during positive affect episodes, followed by frustration/anger and by fear episodes. However, planned contrast estimates analyses revealed that significant differences only occurred between fear and positive affect episodes (t (53) = 10.47, $p < .001$) and between fear and frustration/anger episodes (t (53) = 6.10, $p < .01$), but not between positive affect and frustration/anger episodes.

Table 3

Means and standard errors for children's emotional regulation strategies as function of episode (fear, positive affect, frustration/anger) and maternal involvement (constrained and involved)

	Constrained		Involved		total	
Episode	M	S.E.	M	S.E.	M	S.E.
fear	1.80	0.08	2.33	0.07	2.07	0.06
positive affect	2.72	0.06	2.88	0.07	2.80	0.06
frustration/anger	2.56	0.12	2.81	0.09	2.68	0.09

Interactions between emotion-eliciting context and maternal involvement on toddlers' emotion regulation strategies

In order to examine possible interactions between emotion- eliciting context and maternal involvement on toddlers' emotion regulation strategies, a repeated measures MANOVA was conducted. A significant interaction strategies x episode x maternal condition (F (36, 1908) = 9.55, $p < .001$) was found.

Main effects of emotion-eliciting context and mothers' involvement on toddlers' emotional expressiveness

A repeated measures MANOVA was conducted in order to examine any significant differences in children's emotional expressiveness. We used three within-effects levels: emotional expressions (fear, positive affect and frustration/anger); episode (fear, positive affect, frustration/anger) and maternal condition (constrained and involved). Child gender was used as a between-effect factor. The analysis revealed significant main effects for emotional facial expressions (F (2, 106) = 7.35, $p < .001$) and episode (F (2, 106) = 37.94, $p < .001$). No child gender effects were observed.

In total, independently of mothers' behaviour (see table 4) children showed significantly more expressions (positive and negative) during fear episodes, than during positive affect (t (53) = 8.69, $p < .001$) and frustration/anger episodes (t (53) = 5.23, $p < .001$). They also exhibited significantly more expressions during frustration/anger episodes, than during positive affect ones (t (53) = 3.69, $p < .001$).

Table 4

Means and standard errors for children's emotional expressiveness as function of emotion-eliciting context (fear, positive affect, frustration/anger) and maternal involvement (constrained and involved)

Episode	Emotional expression	Constrained		Involved		Total	
		M	S.E.	M	S.E.	M	S.E.
fear	positive affect expression	3.29	0.63	4.52	0.65	3.91	0.58
	frustration/anger expression	0.20	0.10	0.39	0.16	0.30	0.09
	fear expression	6.67	0.70	6.36	0.63	6.50	0.57
	total	3.39	0.17	3.76	0.11	3.57	0.11
positive affect	positive affect expression	4.07	0.58	5.82	0.56	4.93	0.52
	frustration/anger expression	0.33	0.12	1.09	0.30	0.71	0.16
	fear expression	1.29	0.36	0.35	0.19	0.81	0.24
	total	1.89	0.18	2.42	0.17	2.16	0.15
frustration/anger	positive affect expression	0.86	0.26	3.75	0.46	2.31	0.26
	frustration/anger expression	9.03	0.47	3.22	0.42	6.13	0.31
	fear expression	0.00	0.00	0.00	0.00	0.00	0.00
	total	3.29	0.13	2.32	0.15	2.81	0.11

Interactions between emotion- eliciting context and maternal involvement on toddlers' emotional expressiveness

Significant interactions between emotional expression x episode (F (4, 212) = 80.36, p < .001); emotional expression x maternal condition (F (2, 106) = 34.24, p < .001) and emotional expression x episode x maternal condition (F (4, 212) = 27.76, p < .001) were found.

During positive affect episodes (see table 4) children expressed significantly more positive affect during mother involved periods, than during mother constrained ones (t (53) = 3.62, p < .001). They also showed significantly more frustration/anger facial expressions when their mothers' behaviour was involved, than when it was constrained (t (53) = 2.27, p < .001). Children expressed significantly more fearful facial expressions during mother constrained episodes, than during mother involved ones (t (53) = 3.11, p < .001).

During frustration/anger episodes (see table 4) children expressed significantly more positive affect during mother involved periods, than during mother constrained ones (t (53) = 5.34, p < .001). They also showed significantly more frustration/anger facial expressions during constrained periods, than during involved ones (t (53) = 9.16, p < .001).

No significant differences between constrained and involved periods were found during fear episodes.

Main effects of emotion-eliciting context and mothers' involvement on toddlers' emotional intensity

When it comes to emotional intensity experienced by children, a repeated measures MANOVA was undertaken. Two within-effects levels were used: episode and maternal condition. Child gender was used as between-effects factor. No main effects were found for episode, maternal condition or child gender.

Interactions between emotional eliciting context and maternal involvement on toddlers' emotional intensity

A significant interaction between episode x maternal condition was found for toddlers' emotional intensity (F (2, 106) = 12.41, p < .001).

Table 5

Means and standard errors for children's emotional intensity as function of emotion-eliciting context (fear, positive affect, frustration/anger) and maternal involvement (constrained and involved)

Episode	Constrained		Involved		Total	
	M	S.E.	M	S.E.	M	S.E.
fear	18.26	0.85	18.90	0.65	18.58	0.66
positive affect	19.68	0.74	22.38	0.66	21.03	0.61
frustration/anger	21.04	0.10	18.23	0.66	19.64	0.71

During fear episodes, no significant differences between maternal constrained and involved periods were found (see table 5). During positive affect episodes (see table 5) children exhibited more emotional intensity during mother involved periods, than during mother constrained ones (t (53) = 4.03, p < .001). During frustration/anger episodes (see table

5) children displayed more emotional intensity when mothers were constrained, than when they were involved (t (53) = 3.01, $p < .001$).

During mother involved periods (see table 5) children showed more emotional intensity during positive affect episodes, than during fear (t (53) = 3.72, $p < .001$) and frustration/anger ones, (t (53) = 4.97, $p < .001$). No significant differences were found between fear and frustration/anger episodes.

During mother constrained periods no significant differences $p < .01$ were found between episodes.

In total, independently of the mothers' behaviour (see table 5) children exhibited more emotional intensity during positive affect episodes, than during fear episodes (t (53) = 2.61, $p < .01$). No significant differences were found between positive affect and frustration/anger episodes or between fear and frustration/anger episodes.

DISCUSSION

This study contributed in several ways to a better understanding of the development of early emotion regulation, by analyzing toddlers' behavioural strategies, and emotional expressiveness during positive affect episodes and comparing them to negative affect ones (fear and frustration/anger), as well as assessing emotional intensity as function of different emotion-eliciting contexts and maternal involvement. Moreover, the study was developed at naturalistic-settings (children's homes), which provides a different outlook on children's emotion regulation skills and may contribute to a new discussion around laboratory *versus* home assessements, concerning emotion regulation.

Effects of emotion-eliciting context: positive and negative affect episodes

Toddlers' behavioural regulatory strategies varied as function of emotion-eliciting episodes. In particular, children exhibited more strategies during positive affect episodes and frustration/anger ones. No significant differences were found between these two episodes. On the other hand, children expressed significantly less strategies during fear episodes, than in the other two. These results show that part of our initial hypothesis was confirmed, namely, the use of more behavioral strategies during frustration episodes than during fear episodes, which was already reported by Diener and Mangelsdorf (1999a). In both positive affect and frustration/anger episodes, the stimuli were desirable objects to play, a piano with musical

sounds and legos, respectively. It may have been that the desire to play with the stimulus during the positive affect episodes and the motivation to obtain the object during the frustration/anger ones, made children try more strategies in order to accomplish their immediate goals and regulate themselves (Campos, Mumme, Kermoian, & Campos, 1994). On the other hand, we also expected no differences between the number of strategies used during positive affect episodes and negative affect ones. However, this was not supported, given that children exhibited significantly less strategies during fear episodes, than during frustration/anger and positive affect episodes. This might have happened, because the fear stimulus was to aversive to promote any approach behaviours. Moreover, showing less behaviours could also serve an adaptation purpose, given that the stimulus was considered frightening by children and even dangerous. Showing less behaviours might have been a way to keep themselves safe, since children considered the toy to be alive and unpredictable. Most important, these results suggest that the development of emotion regulation strategies may follow different pathways when it comes to positive *versus* negative affect contexts (particularly fear), and that positive affect and frustration/anger regulation may share common aspects (in quantity of strategies mobilized, not quality), since both situations develop around desired stimuli.

Toddlers' emotional expressiveness was also significantly influenced by the emotion-eliciting context experienced by children. Independently of the mothers' behavior, children exhibited more expressiveness (either negative or positive), during fear and frustration anger episodes, particularly fear, and less during positive affect episodes. These results do not confirm our initial hypothesis, but suggest that children may use expressiveness as an important way to elicit mothers' behaviours during difficult and negative emotional contexts, when their survival perception is threatened (fear) or when they do not have enough resources to solve a situation (frustration/anger). Most important, there seems to be a difference in the way children use behavioural strategies and emotional expressiveness as regulatory resources, according to the emotional context experienced (positive *versus* negative). Toddlers seem to show more emotional expressions during negative affect episodes (particularly fear), than during positive affect contexts. However, behavioural strategies are exhibited less frequently during fear episodes, than during positive affect or frustration/anger episodes. These results suggest that during emotional contexts where survival perception is threatened (fear), emotional expressiveness may be a less expensive and more adaptive resource than behavioural strategies, since it allows children to signal their mothers about their needs and

distress, without exhibiting overtly open behaviours that could expose them to the unpredictable fear stimuli, considered to be alive.

Effects of maternal involvement on toddlers' emotion regulation

As in previous studies, toddlers' behavioural strategies varied as function of maternal involvement (Diener, & Mangelsdorf, 1999a). This may have happened because of past experiences in which the mothers' active participation and intervention was beneficial and helped children to regulate their emotions and accomplish their goals (Calkins, 1994; Kopp, 1989). Nevertheless, mothers' involvement seemed to influence the increase or decrease of certain strategies in detriment of others, according to the emotional context experienced. As in previous studies, during fear episodes, maternal involvement increased significantly children's playing with stimulus and proximity to stimulus behaviours (Diener, & Mangelsdorf, 1999; Grolnick, Bridges, & Connel, 1996). On the other hand, in frustration/anger episodes, maternal involvement decreased significantly children's fussing to mother, passive disengagement of attention, distraction and tension release behaviours. During positive affect episodes, mothers' active participation also influenced children's behaviour, either by increasing (engaging to mother strategies) or by reducing their strategies (passive disengagement of attention, self-soothing, stranger). These findings suggest that different emotional contexts have different goals and therefore, different strategies should be used by children, namely, through the mothers' involvement. For example, based on the results mentioned above, decreasing fussing to mother behaviours during frustration episodes in function of maternal involvement may help children to re-directed their attention to the stimulus and accomplish their goal, which is to play. Having the same approach during fear episodes, could be counterproductive, since the stimulus represents a threat and fussing to mother may be a way of reassuring protection. These results are consistent with a functionalist perspective to the study of emotion regulation (Campos, Mumme, Kermoian, & Campos, 1994). The functionalist approach defends that emotion regulation is a dynamical system which main purpose is to accomplish one's goals, according to the demands of the context (e.g., mothers' constrained behavior) and the individual's objectives (play with the toys during positive affect and frustration/anger episodes or protect themselves from harm, during fear episodes). As predicted, during fear episodes children showed more behavioural strategies during mother involved periods, than during mother constrained ones, probably as a way to get comfort or to explore the toy safely. During positive affect episodes, no differences between mother constrained and involved periods were found, as expected. However, during

frustration/anger episodes, toddlers did not exhibit more strategies during mother constrained periods, than during involved ones (as a way to get the toy back and play), as expected. Nevertheless, if analyzed independently, most of the strategies that showed differences as function of maternal involvement, where exhibited most frequently during mother constrained periods, than during mother involved ones.

Children's emotional expressiveness did not vary as function of maternal involvement, but significant differences were found as a result of an interaction between context and maternal involvement. As in previous findings children showed significantly more positive affect expressions when the mothers became involved, either during negative (frustration/anger) or positive affect episodes (Thompson, 1994; Gross, & Thompson, 2007; Diener, & Mangelsdorf, 1999a). This finding is particularly interesting, since both episodes develop around children's desire and approach behaviours towards the stimulus, particularly during frustration episodes, where the object is desirable, but unattainable. On the opposite, the mothers' involvement seems to have no significant impact on children's positive expressions during fear episodes, probably because the stimulus causes too much withdrawal reactions and emotions on children. When it comes to negative expressions (fear and frustration/anger), the mothers' involvement seemed to have a differential impact, according to the emotional context experienced. During fear episodes, it seemed to buffer children's negative affect, since negative affect expressions showed no significant differences from the constrained to the involved period. During frustration/anger episodes, mothers' involvement decreased significantly the levels of stress and frustration expressed by children. During positive affect episodes, mother's engagement decreased significantly children's fearful expressions. However, it increased significantly children's frustration/anger expressions, probably, due to the new negotiation behaviours that the mother's involvement created and imposed on children when it comes to sharing the desired positive affect stimulus during play. In fact, Van Kleef, & De Dreu (2010) reported a relationship between negotiation behaviors and anger expression.

Toddlers' emotional intensity did not vary as function of maternal involvement. However, an interaction between context and maternal involvement resulted in significant differences in children's emotional intensity. During mother constrained periods, no differences were found between episodes. During mother involved periods, children reacted in a significantly more intense way during positive affect episodes, when compared to fear and frustration/anger contexts. No differences were found between fear and frustration/anger

episodes. During positive affect episodes, the mothers' engagement in children's play with the stimulus, may have increased significantly children's emotional intensity. In frustration/anger episodes it may have had the opposite effect, by returning the unattainable desired object to children, mothers' involvement may have decreased the level of distress/emotional intensity felt by children during the mother constrained period, when the stimulus was taken away. During fear episodes, the mothers' involvement had no significant influence on children's intensity, probably because of the stressful impact of the stimulus. However, even though it did not decrease children's emotional intensity towards the frightening object, it may have helped children to maintain the same levels of stress under control.

Overall, children did not exhibit significant differences in emotional intensity in function of maternal involvement, they were only registered when the emotion-eliciting contexts were taken into account. This indicates the importance of interactions between mothers' behaviour and emotion-eliciting context in the study of emotional intensity in toddlers.

On the contrary to all the other studies on toddlers' emotion regulation strategies during challenging contexts (Diener, & Mangelsdorf, 1999a; Parritz, 1996; Buss, & Goldsmith, 1998), this work was developed at the children's homes and not at the laboratory. Similarly to other research done at more controlled settings, all the stimuli used at the dyads' homes elicited the emotions they were designed to evoke, which means that emotion-eliciting context and maternal involvement manipulations can be induced both at controlled or naturalistic settings. Moreover, when it comes to differences between challenging episodes (fear and frustration/anger) on toddlers' behavioural strategies, similar results were found in this study and Diener and Mangelsdorf's (1999a), developed at the laboratory. In both studies, children exhibited more behavioural al strategies during frustration/anger episodes, than during fear contexts. These results suggest that toddlers' emotion regulatory skills may be independent of children's familiarity perception towards the setting or place, where behaviours occur.

Limitations and future research

This study presented some limitations. Similar to Diener and Mangelsdorf's work (1999a), the mother constrained and involved periods were not counterbalanced, since during pilot testing, maternal involvement seemed to change the children's emotional interpretation of the stimuli, particularly, during fear episodes. In future research it would be very important

to study the mothers' characteristics (depression, anxiety, marital quality, etc), which may lead to differences in the quality of the mothers' involvement. The father's involvement and coherence with the mothers' should also be taken into account. Moreover, it would also be very important to understand the quality of the relationship between the mother and the child (attachment relationship), as well as the child's characteristics (temperament), which may influence the quality of mothers' involvement as well as the ability of the child to receive help or search for it.

In conclusion, around their second year of life, children use multiple emotion regulation resources, according to the demands and goals elicited by different contexts. Positive and negative emotional contexts should be assessed in the study of children's emotion regulation, given that differences in quality and quantity of behavioural strategies and emotional expressions were found between positive and negative (fear, frustration/anger) episodes, during the course of this study. Mothers' involvement seems to be an extremely important social support and secure base for toddlers' to explore novel environments, including during positive affect contexts. Emotional intensity seems to be used by children as another functional resource to communicate their needs to their mothers and better regulate themselves in different contexts. The study of the development of toddlers' emotion regulation, should always include the assessement of different contexts and maternal involvement, given that in some cases (emotional intensity) significant differences could only be found as function of interactions between context and maternal involvement. Moreover, in the case of behavioural strategies and emotional expressiveness, interactions were also found, which reinforces the importance of analyzing both context and maternal behaviour in the study of toddlers' emotion regulation.

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CHAPTER 2

DEVELOPMENTAL PRECURSORS OF EMOTION REGULATION: RELATIONSHIPS BETWEEN ATTACHMENT (CHILDREN'S SECURE BASE AND MOTHERS' ATTACHMENT REPRESENTATIONS), TEMPERAMENT AND TODDLERS' BEHAVIOURAL STRATEGIES, EXPRESSIVENESS AND INTENSITY DURING DIFFERENT SITUATIONAL AND SOCIAL CONTEXTS

ABSTRACT

This study investigated the relationships between attachment (children's secure base and mothers' attachment representations) and toddlers' emotion regulation, namely their behavioural strategies, expressiveness and intensity during different situational and social contexts. Fifty-five children between 18 and 26 months of age and their mothers participated in this study. Children were exposed to three situational (fear, positive affect, frustration/anger) and two social (maternal constraint vs involvement) contexts. Toddlers' behavioural strategies differed as function of emotion-eliciting context, maternal involvement and attachment quality. Emotional expressiveness varied as function of an interaction involving situational, social contexts and children's attachment security. Mothers' attachment representations predicted their children's secure base behaviours and influenced their expressiveness and emotional intensity.

Keywords: emotion regulation, attachment, strategies, expressiveness, intensity

INTRODUCTION

Emotion regulation consists of the intrinsic and extrinsic processes, responsible for monitoring, evaluating and modifying emotional responses, in terms of their intensity, modulation, temporal features and recovery, in the service of adaptation and one's goals (Thompson, 1994; Gross, & Thompson, 2007; Thompson, & Meyer, 2007). The intrinsic processes include the functioning of neuroregulatory systems (endocrine activity; brain electrical activity; heart rate and vagal tone), temperament (attentiveness; reactivity to novelty and frustration; soothability; sociability) and cognitive aspects (expectations about others and environment; internal working models; awareness). The extrinsic processes include caregiving styles and the quality of the attachment relationship (Calkins, 1994).

Attachment as an extrinsic and social source of individual differences in emotion regulation

Emotion regulation and attachment theory are related. Emotion regulation is influenced by attachment through the child's expectations (internal working models) about the caregiver's behaviour and availability, either physical or emotional (Bowlby, 1969/1982). In fact, positive maternal guidance is related to the use of more adaptive emotion regulation strategies (distraction, help searching) by children, when compared with an intrusive maternal guidance (Calkins, & Johnson, 1998). The attachment figure is also one of the most important regulators of arousal/tension and emotion during infancy and childhood. The caregiver helps the child to decrease their level of distress by holding, cuddling and talking or to increase the baby's arousal/tension during a playful game, in order to make the activity more enjoyable and appealing to the child (Sroufre, 1996). The quality of the affective communication between child and parent defines the context in which the child starts to understand, accept and organize emotional experiences, as well, as his (her) future personality. According to Bretherton (1990), the quality and openness of this communication is very important for the construction of a secure/insecure relationship. The author describes the communication in secure dyads as an "open communication", characterized by fluent, coherent and unrestricted interaction, either in sending or receiving signals. Insensitive caregiving develops when the mother suppresses or heightens the child's signals because of her own emotional restriction. By suppressing or exacerbating the children's emotion, mothers send a message to their child that not all emotions are acceptable.

Individuals characterized by flexibility to integrate positive and negative emotions are, generally, securely attached. On the other hand, people who show restricted or exacerbated

expressions of emotion in a constant way are more likely to have insecure attachments (Cassidy, 1994). Using the Strange Situation procedure (Ainsworth, Blehar, Waters, & Wall, 1978) and the Adult Attachment Interview (George, Kaplan, & Main, 1984), three emotion regulation styles emerge, based on individual differences in children and parents' attachment experiences: (1) an open and flexible emotion expression style; (2) a restricted style, characterized by a systematic suppression of emotions; (3) a restricted style, where emotions are systematically heightened (Cassidy, 1994). Empirical research has shown that insecure-avoidant children are characterized by a tendency to minimize negative affect. Masking negative emotions seems to be used by insecure avoidant children during new situations, namely, competitive games (building a tower), in the presence of an unfamiliar adult. Three-years-old insecure avoidant children did not display sad expressions or eye contact in the end of the game, replacing sadness with smiling. Sad expressions were observed in the beginning and during the game, when no emotional availability by the adult was possible. On the other hand, securely attached children expressed their sadness about losing when the game ended and the adult was more emotionally available (Lutkenhaus, Grossmann, & Grossmann, 1985). During the Strange Situation, avoidant children expressed significantly less negative vocalizations during the separations than did secure infants, although the post-Strange Situation cortisol levels indicated that the experiment was more stressful for avoidant than for secure babies (Spangler, & Grossman, 1993). Moreover, during reunion periods in the Strange Situation, insecure-avoidant children used, preferably, self-oriented emotion regulation strategies, instead of mother-oriented strategies, when compared with secure children. This means that avoidant infants do not share their distress with their caregivers or rely in them for comfort (Braungart, & Stifer, 1991). Similar results have shown that insecure-avoidant children instead of displaying negative affect during stressful situations (when it is more adaptive), show positive affect and the compressed lips expression more often, revealing signs of emotional suppression (Malatesta, Culver, Tesman, & Shepard, 1989). In the case of positive emotions, joy is also minimized, since it can be used as a sign of openness and willingness for interaction, which is just not possible with an attachment figure that is known to reject attachment behaviours. In fact, research has shown that insecure-avoidant children are more likely to decrease simmilling to the mother in interactions, during the first year, than secure ones (Malatesta et al., 1989).

In secure dyads, children and their parents express a range of positive and negative emotions in a flexible way. In securely attached dyads, the experience of negative emotions,

such as anger and fear, is less threatening to the child, than to insecure ones, because a sensitive and ameliorative response by the parents is expected. In this sense, attachment security does not mean denial of negative affect. Instead, it is felt through the increasing ability to experience and tolerate temporarily threatening and frustrating events, until the child is able to overcome them through long periods of time, even in the absence of the caregiver (Bowlby, 1969/1982; 1973; 1980; Stroebe, Schut, & Stroebe, 2005; Fraley, & Bonanno, 2004).

From an attachment point of view, this flexibility is built over the years, from experiences with a sensitive caregiver, who responds accordingly to the child's needs and emotional signals, much of the time, and does not ignore any selected behaviours. The child responds to these caregiving experiences by signalling his (her) wishes directly and freely, sharing emotions with the parents and using the mother as a secure base from which to explore the environment and a safe haven when a threat or some sort of distress emerges (Waters, & Cummings, 2000). Children with a sensitive caregiver are expected to feel and show little negative affect, as they believe that their emotional signals will be noticed and responded to sensitively. However, in the case of distress, secure children who experience negative emotions (as in the Strange Situation), the emotion regulation strategy used, generally involves open, direct and active expression to the mother, as well as searching for help in dealing with negativity, instead of hiding it from the parent. In situations of fear, securely attached children move towards the parent, when threatening situations occur and continue to explore if the event is not so alarming and the parent is present. On the other hand, if the experience allows the feeling of positive emotions, mutual expressions of joy serve to maintain interest in the relationship (Ainsworth et al., 1978; Ainsworth, 1967; 1989; Cassidy, 1999).

Insecure children, either show minimizing or heightening emotion expressiveness (Cassidy, 1994; Cassidy, & Berlin, 1994). Insecure children who show a suppression of emotion expression, exhibit little interest in proximity or contact with the parent and active avoidance behaviours, during reunion periods. From an emotional point of view, these children seem to be neutral, not showing overt distress during separations or pleasure on reunions. In the Strange situation they are called insecure-avoidant (Edelstein, & Shaver, 2004; Fraley, Davis, & Shaver, 1998). On the other hand, children who show heightening emotion expressiveness display resistant and angry behaviours towards the parent. In the Strange Situation they are classified as insecure-ambivalent and exhibit extreme distress

responses during separation and are very difficult to sooth or calm down by their attachment figures on reunion (Mikulincier, & Shaver, 2007; Shaver, & Fraley, 2008).

From an attachment point of view, minimizing expression children have developed emotion regulation strategies characterized by minimizing affects, reduced attention of the caregiver as a source of pleasure and safety, probably, because the activation of their attachment system has, consistently, resulted in rejection experiences (Bowlby, 1973). The minimization of emotions serves the purpose of minimizing the importance of the attachment relationship. In the case of negative emotions, minimizing distress, fear, sadness or anger, may help the child to prevent the caregiver's rejection and maintain sufficient proximity and guarantee protection (Bowlby, 1980). The parent's chronic rejection of the child's attachment needs is responsible for the development of an intense felling of anger by the avoidant child. Avoidance behaviors, shifts of attention and suppression of negative emotions reduces the child's level of arousal and diminishes the probability of direct expressions of anger towards the parent, which could alienate the attachment figure, on whom the child depends for survival (Cassidy, & Kobak, 1988). Summarizing, masking negative affect may have an adaptive effect, by reducing rejection experiences and the fear of alienating the parent and being abandoned (Bowlby, 1973; 1980). However, minimizing negative effect may be maladaptive in other social or problem-solving contexts, where certain emotion displays are expected. On the other hand, children who have developed emotion regulation strategies of heightening negative emotions and dependence behaviours on the caregiver (as a way of increasing bids for attention), have experienced an insufficiently or inconsistently available parent (Main, Kaplan, & Cassidy, 1985; Main, 2000). Heightened negative emotionality and exaggerated fearfulness towards non threatening stimuli is an adaptive strategy used to increase the probability of gaining the attention of an unavailable caregiver if true danger appears. Relaxing in the presence of an inconsistent attachment figure may represent a dangerous risk of losing contact with her (him), (Kobak, & Madsen, 2008; Cassidy, & Berlin, 1994). However, this emotion regulation strategy may become maladaptive if it interferes with exploration or threatens the existence of the attachment relationship (Bowlby, 1973; 1980).

Influence of caregiver's attachment representations on children's emotion regulation

The relationship between the caregiver's personal attachment representations (internal working models), and their children's emotion regulation still remains little explored.

The study of parents' own original attachment representations becomes very important in understanding the development of emotion regulatory processes, since there has been an acknowledgement that internal working models of initial attachment relationships are transformed into more complex symbolic and cognitive representations that influence the children's cognitions and emotions about the caregiver, the self, others and the world in general, in present and future relationships, as well as their perception of effectiveness and control over events, across development into adulthood (Bowlby, 1973; 1980; Ainsworth, Blehar, Waters, & Wall, 1978; Sroufe, 1979; Sroufe & Waters, 1977; Sroufe, 2005; Waters, Vaughn, Posada, & Kondo-Ikemura, 1995; Cassidy, 1994; Bretherton, 1990; Waters, & Cummings, 2000).

If the child's experiences are systematically characterized by the attachment figure's sensitivity, responsivity and availability, she (he) will probably develop a positive working model of this figure (later generalized to the world and others), as well as a corresponding self-image, worthy of love and care. On the other hand, if the child's experiences are consistently characterized by insensitivity and rejection, she (he) will probably develop a negative working model of the attachment figure (and the world in general) and a poor self-image (Bowlby, 1973; 1980; Ainsworth *et al.*, 1978; Waters, Vaughn, Posada, & Kondo-Ikemura, 1995).

The assessement of parent's own attachment history is crucial in understanding children's emotional regulatory efforts, since attachment relationships' follow a trans-generational pattern, characterized by a strong association between the parents' attachment representations and their children's attachment relationship quality (Main, Hesse, & Kaplan, 2005; Grossmann, Grossmann, Fremmer-Bombik, Kindler, Scheuerer-English, & Zimmerman, 2002; Steele, Steele, & Fonagy, 1996; van IJzendoorn, 1995; Veríssimo, Monteiro, Vaughn, Santos, & Waters, 2005; Monteiro, 2007).

Similar to their offspring, parents of secure children tend to exhibit openness to a wide range of positive and negative emotions, as well as an open acceptance of past human limitations in relationships. In the Adult Attachment Interview (George, Kaplan, & Main, 1984) these parents are classified as secure/autonomous. During this interviews, if these parents talk about their own childhood as secure, they support this affirmation through coherent memories, where positive experiences are reported, but also disappointments are integrate and felt as natural human limitations. If an insecure childhood is reported,

secure/autonomous parents still accept the importance of attachment relationships, understand and forgive their caregivers flaws (Hesse, 2008; Weiss, 1991)

On the other hand, many of the parents of insecure avoidant children also exhibit a similar emotional pattern of minimizing emotions, particularly, negative ones. In the Adult Attachment Interview, they are classified as dismissing (Main, Kaplan, & Cassidy, 1985). Suppression of negative emotion is usually done by these parents through idealization, where any negative characteristics about their childhood are denied. In other cases, these limitations are admitted but the negative responses towards them are minimized (Main, Kaplan, & Cassidy, 1985; Main, 2000). There are several behaviours that parents exhibit in their interactions with children which contribute to children's suppression of negative emotions and to the feeling that these affects are inappropriate. These parental behaviours are: (1) rejection (Bowlby, 1980); (2) withdrawal when the child expresses distress, negative affect or makes bids for comfort and reassurance. (Cassidy, 1994; 2008); (3) restricted range of emotion expressiveness (Malatesta et al., 1989); (4) over-involvement of the mother in daily mother-infant interactions, which shifts the attention from the attachment system and any negative emotion to other aspects of the interaction (Isabella, & Belsky, 1991). In this sense, the parents of avoidant children behave in a certain way with their children, in order to maintain their own state of mind about attachment. At the same time, they regard their children's avoidant behaviour and restricted negative emotionality as a form of cooperation and a communication signal that the child will not seek for comfort (Main, 2000; Adam, Gunnar, & Tanaka, 2004).

Finally, the parents of insecure-ambivalent children also exhibit a state of mind characterized by excessive preoccupation and incoherent focus on relationships, emotional dependence, undermined autonomy and heightened emotions, particularly anger towards their own parents (Main, Kaplan, & Cassidy, 1985; Main, 2000). In the Adult Attachment Interview, these parents are classified as "preoccupied" and their attachment narratives are described as conflicted and fearful, focused on current and unresolved angry fights with their parents (Hesse, 2008). Preoccupied parents exhibit certain behaviours which contribute to the heightened negative emotionality of ambivalent children, dependence behaviours and difficulties in moving away for exploration. These behaviours are characterized by a relatively unresponsive attitude to their children signals and by a failure in regulating their children negative emotions (Main, 2000; Adam, Gunnar, & Tanaka, 2004). Parents may, unconsciously, use these behaviours as strategies to reassure themselves that they will always

be needed, never left alone and to keep their children near all the time. Stimulating children's negative emotionality serves as a communication signal for these parents that children are cooperating with their wish to maintain their attachment-preoccupied state of mind (DeOliveira, Moran, & Pederson, 2005). Many others times, these behaviours are not always unconscious strategies, but represent a lack of emotional competence in responding to their children in more sensitive ways, due to difficulties in their own attachment backgrounds (Crowell, Fraley, & Shaver, 2008).

Temperament as an intrinsic source of individual differences in emotion regulation

A series of temperament constructs have been directly related to emotion regulation, namely, persistence, soothability, inhibitory control, behavioural inhibition, adaptability and effortful control. Failures in regulation are related to other temperamental dimensions, such as impulsivity and negative affect (Gartstein, & Rothbart, 2003; Bates, 2000; Thomas, & Chess, 1977).

Temperament has three major bio-behavioural systems, which are related to emotion regulation: (1) the defense system (which is organized around fear and defensive anger); (2) the approach system (supported by extraversion and emotional surgency); (3) the executive attention system (which include attention networks like alerting, orienting and effortful control), (Derryberry, & Rothbart, 1997). The defense and approach systems are related to emotional reactivity. They promote adaptive behaviours by inducing emotional states. On the other hand, the executive attention system has a regulatory nature and effect on emotions, allowing for the suppression or increases in the activation of the defense and approach systems (Rothbart, & Sheese, 2007).

The *defense system's* main goal is to protect the individual's well being, by avoiding harm and organizing responses to immediate and long-term threats. Fear, anxiety or defensive anger are induced by the activation of this system. These emotions reflect neurological and physiological alterations which promote certain defense behaviours, like avoiding or withdrawing from active or potentially threatening situations ("flight" response) in one hand, or defensive aggression, in the other ("fight" response), (Rothbart, & Posner, 2006). Children's fearful behavioural inhibition towards unfamiliar stimuli develops late in the first year and shows longitudinal stability across childhood, into adolescence (Rothbart, Derryberry, & Hershey, 2000).

Although negative emotions contribute to negative affect and distress, in this system fear is considered to be an evolutionary mechanism that promotes adaptive behaviour (Rothbart, & Bates, 2006), because it is involved in the self-regulation of approach and aggressive behaviours (Rothbart et al., 2000) and is related to the early development of moral motivation (Rothbart, Ahadi, & Hershey, 1994).

In fact, fear assessed during infancy predicted childhood fear, sadness and shyness at seven years of age, but not anger. In fact, it was inversely related to impulsivity, aggression and approach (Rothbart et al., 2000). Fearful infants show greater empathy, guilt and shame in childhood (Rothbart, Ahadi, & Hershey, 1994). Therefore, optimal levels of fear and anxiety are necessary to develop adaptive patterns of response, so that very low levels can be dangerous (Rothbart, & Bates, 2006).

The *approach system's* main objective is to acquire resources needed for the individual's survival and development, by organizing behavioural responses like approaching novel objects, seeking out for potential rewards or sociability (Rothbart, Derryberry, & Posner, 1994; Derryberry, & Rothbart, 1997). These behaviours can be observed by three months of age, increasing throughout the first year of live (Rothbart, Derryberry, & Hershey, 2000).

In situations where risk is present along with reward, both systems are activated and compete to influence information processing, physiological arousal and behavioral tendencies. In humans there is a tendency for defense to dominate approach in these situations. However, there are temperamental individual differences in the degree to which people show a tendency towards defense (Cacioppo, & Bernston, 1994).

The *executive attention system* is responsible for self-regulating the defense and approach systems, which underlie an individual's emotional reactive responses. This regulation is done by suppressing or increasing the activation of the defense and approach systems, by controlling the internal or external "input" or "output" that comes in and out of these systems, respectively (Rothbart, & Sheese, 2007). This is done through a series of processes, like alerting; orienting attention (selecting information from sensory input); reappraisal (reinterpreting the meanings or values of a representation), or effortful control ("capacity to inhibit a dominant response in order to perform a subdominant response, to plan, and to detect errors"), (Shoda, Mischel, & Peake, 1990).

Selecting information from sensory input (orienting) is an important mechanism for emotion regulation. Distraction or disengagement of attention is one way to achieve this, by promoting decreases in negative affect (Stifer, & Braungart, 1995). During infancy, the control of orienting is done by caregivers. However, by four months of age, infants have achieved some control over disengaging their gaze from one object to another visual location (Johnson, Posner, & Rothbart, 1991). Children who show greater orienting capacities have been associated with greater soothability and lower negative affect by their parents (Johnson, Posner, & Rothbart, 1991). The use of distraction and orienting behaviors towards light and sound soothing displays are used by children since three months of age (Harman, Rothbart, & Posner, 1997) and are positively related to their capacity to delay gratification at preschool age (Sethi, Mischel, Aber, Shoda, & Rodriguez, 2000). Research has also shown that infant's orientation of attention towards their mothers and the use of more active regulatory strategies (approach, attack) during the presentation of fearful stimuli (mechanical toys and masks) increased with age and passive self-soothing strategies decreased (Rothbart, Ziaie, & O'Boyle, 1992).

Attachment and temperament transactions in emotion regulation

Attachment theory and temperament's psychobiological framework have several similar aspects, as well as divergent cornerstones. This overlap allows the possibility for conceptual and empirical transactions or interactions between the two of them. Both theories are grounded in neuroanatomical and physiological structures, which promote the individual's adaptation and survival. Both theories emphasize the concept of regulation and regulatory processes, which guide the expression of behaviour, cognition and emotion, particularly in the first years of life, but also influence personality development and social adjustment later in life . However, there are also differences. Attachment is, primarily, a social and psychological system, focused on the dynamic co-construction and maintenance of interpersonal relationships, existing first between the partners, but also within them, later on. On the other hand, temperament grounds its foundations on a psychobiological framework, concerned, primarily, with the reactivity and regulation of behaviour, cognition and emotion. These regulatory processes are thought to be supported by internal neuroanamotical and physiological structures, variable across children (Vaughn, Bost, & van Ijzendoorn, 2008).

Interactions between attachment and temperament in emotion regulation are usually studied, directly or indirectly, across behavioural, cognitive and affective domains. These interactions can be expressed in intrapersonal outcomes (problem behaviours; personality and

cognition; biobehavioural responses) or/and interpersonal ones (social competence; peer acceptance; cooperation with parental figures), (Vaughn, Bost, & Van Ijzendoorn, 2008). The results observed in the literature are mixed, with some reporting interactions between attachment and temperament (Burgess, Marshall, Rubin, Fox, 2003; Bohill, Hagekull, & Andersson, 2005) and others showing no significant effects (McCartney, Tresch Owen, Booth, Clarke-Stewart, & Vandell, 2004; van Bakel, & Riksen-Waraven, 2004; Szewczyk-Sokolowski, Bost, & Wainright, 2005; Jaffari-Bimmel, Juffer, van Ijzendoorn, Bakermans-Kranenburg, & Mooijaart, 2006). At the same time, research has also shown that, in spite of its social nature, attachment is not always the primary predictor of outcomes in the interpersonal domain. In the same sense, temperament not always predicts outcomes in domains with high heritability (physiological reactivity, personality, IQ). When interactions are significant, attachment usually moderates effects of temperament, rather than the reverse in several domains, namely cortisol reactivity (Gunnar, Brodersen, Nachmias, Buss, & Rigatuso, 1996) and anger proneness (Kochanska, Askan, & Carlson, 2005). Consequently, it is recommendable that both attachment and temperament, as well as measures from intrapersonal and interpersonal domains, be included in all future studies.

Objectives

The objective of this work was to study the relationships between attachment (children's secure base and mothers' attachment representations), temperament and toddlers' emotion regulation (behavioural strategies, emotional expressiveness and intensity), during different situational (fear, positive affect, frustration/anger) and social contexts (mother constraint and involvement). We hypothesized that: (1) Toddlers' behavioural strategies will vary as function of situational and social contexts and attachment quality. In particular, secure children are expected to show significantly more behavioural regulatory strategies, than insecure ones during challenging and positive affect episodes; (2) Toddlers' emotional expressiveness will differ as function of emotion-eliciting episodes (situational contexts), maternal involvement (social contexts) and attachment quality. In particular, insecurely attached children are expected to show minimizing or heightening emotion expressiveness, when compared to securely attached ones; (3) Toddlers' emotional intensity will vary as function of situational and social contexts and attachment quality; (4) a trans-generational phenomenon of attachment quality from mothers to children is also expected, as well a significant relationship between mothers' attachment representations and their children's behavioural strategies, emotional expressiveness and intensity; (5) Toddlers' behavioural

strategies, emotional expressiveness and intensity will vary as function of children's temperament quality.

METHODS

Participants

Fifty-five mother/child dyads (27 boys and 28 girls), all Caucasian, from bi-parental families participated in the study. Children were between 18 and 26 months of age (*M* = 21.35; *S.D.* = 1.91). Twenty seven were firstborn and 28 had siblings. They started attending day-care between six and 24 months (*M* = 7.53; *S.D.* = 4.81) and spent seven to eleven hours (*M* = 6.96; *S.D.* = 2.64) in day-care each weekday. Mothers' age ranged from 25-43 years (*M* = 33.64; *S.D.* = 4.10) and fathers' age from 26-55 years old (*M* = 35.71; *S.D.* = 5.73). Mothers' level of education ranged from five to 19 years (*M* = 14.87; *S.D.* = 3.38) and fathers' from four to 19 years (*M* = 13.71; *S.D.* = 3.60). Ninety four percent of mothers were employed outside the home. Participants represented a range of socioeconomic status backgrounds, as reflected by parental education and were recruited from public and private daycare centers.

Measures

Emotion regulation paradigm: fear, positive affect, frustration/anger

The emotion regulation paradigm (Diener, & Mangelsdorf, 1999a), measured the behavioural strategies, emotional expressiveness and intensity exhibited by children during three episodes: positive affect, fear and frustration/anger, elicited by presenting the children three different toys. Each episode lasted for six minutes and had two distinct moments of three minutes each: (1) *mother constrained period* (mothers were instructed to refrain from initiating interaction with their children. If their children made bids for attention, mothers were instructed to respond to them with brief statements about the stimuli presented in each episode: "It's the dinosaur/piano/bear"); (2) *mother involved period* (mothers were instructed to be at ease with the child and the toy. Free behaviour was allowed, whatever they felt it was appropriate, according to their sensitivity). During the mother constrained period, if children showed 30 seconds of sustained high-intensity distress, mothers were instructed to become involved. If this situation happened during the mother involved periods, the episode was

terminated. During fear contexts, four children exhibited 30 seconds of sustained high-intensity distress (three children during mother constrained periods and one during mother involved ones). During frustration/anger episodes, nine children expressed high-intensity distress (eight children during mother constrained periods and one during mother involved periods). No sustained high-intensity distress was exhibited during positive affect episodes. All the episodes were videotaped.

Emotional stimuli

All stimuli used in this work were previously tested in a pilot test, which showed a varying emotional intensity in most children. In Diener and Mangelsdorf's original study (1999a) a battery-operated bouncing stuffed octopus that moved and made sounds was used to elicit fear and a large stuffed animal Big Bird was used during the frustration/anger episodes. However, after pilot testing we observed that stuffed animals caused no reaction in the children of this study. On the contrary, legos inside a movable toy did cause a high level of interest, enthusiasm and exploration. Therefore, during the frustration/anger episode, we presented children with a movable box with wheels, shaped in the form of a yellow bear, which contained coloured lego pieces inside. After the experimenter felt that the child was involved with the toy (two minutes on average), the experimenter took the toy away firmly and placed it out of reach but within the child's sight. The first moment of this episode only started after the removal of the object, even though the mother's behaviour was already constrained during the child's initial exploration. During fear episodes, a dinosaur toy with similar characteristics (elements of novelty, unpredictability and intrusiveness) to the battery-operated bouncing stuffed octopus present in Diener and Mengelsdorf work (1999a) was used to elicit fear. Finally, during the positive affect episode, children were given a toy piano that played music and created musical rhythms, similar to the one used by Diener and Mangelsdorf (1999a). Similar procedures for fear and frustration/anger episodes (but with different stimuli) were used in other studies (Diener, & Mangelsdorf, 1999a; Buss, & Goldsmith, 1998; Grolnick, Bridges, & Connell, 1995; Stifer, & Braungart, 1995).

Children behavioural strategies

Nineteen behavioural strategies, divided into four domains were coded (Diener, & Mangesdorf, 1999b): (1) *mother-related strategies* (proximity/contact seeking to mother; directing mother; fuss to mother; help seeking; information seeking; social referencing/looks to mother; engagement of mother); (2) *disengagement of attention strategies* (passive

disengagement; distraction toward other object or person/active disengagement; leavetaking; avoidance); (3) *dealing with the stimulus strategies* (playing/exploring; resistance/control; labeling; problem solving; proximity to stimulus); (4) *redirection of action strategies* (tension release; self-soothing). During the course of our study, another set of behaviours was observed, besides the ones proposed by Diener and Mangelsdorf (1999b). This one was coded under the name of "stranger", because it was characterized by behaviours directed at the strangers (experimenters) in the room during the sessions and it was placed in the "redirection of action strategies" domain (see appendix A).

Children's behavioural strategies were coded dichotomously on an occurrence/ non occurrence way, in 15 seconds intervals (1-occurrence; 0-non occurrence). Each three minute period had twelve 15 second intervals. The results for each strategy were summed for a total score. The possible range for each behavior was 0 to 12, for each three minute period. If an episode was terminated because of child distress, scores were prorated on the basis of the number of intervals completed, by dividing the sums of the scores by the number of intervals completed and multiplying 12 (the total number of intervals possible) (Diener, & Mangelsdorf, 1999b).

Emotional expression

The predominant emotional expression showed by children during the three episodes was also coded. *Fear* was scored when the child expressed at least one of these facial features: eyebrows raised or drawn together; eyes wide; mouth open, corners straight back. *Positive affect* was scored when the child smiled or produced a positive vocalization (laugh). *Anger* was coded when the child showed at least one of the following: brows pulled back down or together; raised cheeks; straight or angular mouth or tight lips. A score of "neutral" was given when the child did not express any of these emotions and showed a neutral expression. These scores were not included in the analysis. Children's emotional expressions (1-positive; 2-anger/frustration; 3-fear; 4-neutral) were coded during the 15 seconds intervals.

The intensity of emotion was scored in a scale of one to three points (1- low intensity; 2- medium intensity; 3-high intensity). If the child expressed more than one emotion during the time intervals used for coding, the most intense emotion was coded as the predominant one. Intensity of child's emotion rated from low to high intensity. High intensity emotion could be expresseded by facial affect, body postures, gestures and movements or full intensity vocalizations (e.g., laughter for positive affect; crying or screaming for negative affect). Low

intensity affect seemed mild and would be more ambiguous than high intensity one (Diener, & Mangelsdorf, 1999b). If the child expressed more than one emotion during the time intervals used for coding, the most intense emotion was coded as the predominant one (Diener, & Mangelsdorf, 1999b).

Separate pairs of coders, blinded to the hypotheses, coded the three episodes. Inter-rater reliability was calculated using Cohen's Kappas (fear=.73; positive affect=.84; frustration/anger=.70). This coding system is similar to those used in other studies of children coping strategies (Diener, & Mangelsdorf, 1999b; Buss, & Goldsmith, 1998; Calkins, & Jonhson, 1998; Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996; Parritz, 1996).

Attachment behavior Q-set (AQS) (version 3.0)

The AQS (Waters, 1995) evaluates the quality of the child's secure base behaviour towards the mother or other figures in an ecologically valid context, namely, the children's home. The 90 items of this instrument are distributed by the observer on a scale of nine points. The child's most characteristic items are placed in higher categories (9 - 7) and the less characteristic items are placed in the lower categories (3 - 1). The items that are neither characteristic nor uncharacteristic and/or items that were not observed are placed in the center of distribution (categories 6 - 4). Children final attachment score is obtained through a Pearson correlation between the child's individual Q-sort and the security criterion value of the "ideal child" (Waters, 1995; Waters & Deane, 1985). This correlation represents the place occupied by children on a security continuum. Children who are able to use the mother or other figure as a secure base receive a higher value, while the least able to do it, receive lower values. In most normative samples, security scores average about .35 (Bost, 2006).

Adult attachment representation narratives

The "Adult attachment representation narratives" (Waters, & Rodrigues-Doolabh, 2004) is an instrument developed to gain access and analyze adult secure base scripts and attachment representations in possible daily and anxious scenarios related with the attachment relationship (Monteiro, 2007). The attachment relationship is described in terms of a balance between proximity towards the caregiver and exploration behaviours, shown by the child or the adult. This balance is described by a sequence of events organized in an emotional and mental script called the secure base script, developed in early infancy and internalized by the

individual across development, including adulthood (Posada, Goa et al., 1995; Monteiro, 2007). The secure base script is described by a series of events: (1) the individual's secure base (parent or partner) supports his/her exploration; (2) the secure base remains available and responsive in case of need; (3) a threatening conflict and obstacle appears, which leaves the individual feeling anxious and fearful; (4) the individual searches and looks for comfort in the secure base and/or the secure base searches for the individual; (5) the conflict and threat are resolved; (6) the proximity and the contact with the secure base comforts the individual in an effective way and helps him to deal with the resulting anxiety; (7) the individual returns to his initial activity or changes it in a tranquil way (Veríssimo, & Santos, 1999).

There are six narratives. In each one of them are presented four groups of suggestive words, developed to guide the production of the narratives (Waters, & Rodrigues-Doolabh, 2004). The first two, "Baby's morning" and "Doctor's office", are related with interactions adult / child, while "Joan and Peter's camping trip" and "Susan's accident" are related to interactions adult / adult (couple). "A walk in the park" and "One afternoon at the shopping center" are considered neutral, since they are not relevant to the secure base phenomenon and only exist for control purposes. The words presented in each story can trigger a number of different stories, developed around the secure base script (Waters, & Waters, 2006). The narratives are scored in a seven point scale, indicating the extent to which the narrative is organized around the secure base script and the richness and detail of the relationship between the characters in the story (Monteiro, 2007). A final score summarizes both the presence and the quality of the script for each of narrative. The scores below four indicate a general lack of a secure base script. The lowest values (1 - 2) are reserved for stories that do not show a secure base script, but also have bizarre contents (e.g., the child who was hurt reassures her mother, who is upset with the wound). The values of four or above seven indicate the presence of a secure base script. The highest values are assigned when the script is elaborate, reveals knowledge and sensitivity concerning the emotional state of others, reinterprets the meaning of the obstacle/conflict suggested by the group of words presented in a positive way and makes it a part of the relationship between the characters of the story (Monteiro, 2007; Waters, & Rodrigues-Doolabh, 2004; Waters, & Waters, 2006). The secure base script final score for each subject results from the mean of the scores of the four stories with a secure base content. According to Waters and Waters (2006), during the analysis and scoring of the narratives it should not be taken into consideration details about the language (e.g. verbal tenses or repetitions) and the veracity of the story (since all of them are fictional). More,

inferences about the mental states of the subjects should be avoided, as well as psychodynamic interpretations (Monteiro, 2007). Waters and Rodrigues-Doolabh (2001, in Monteiro, 2007) reported that the mothers' I.Q. is not significantly correlated with the secure base script scores, which means that this method does not measure the verbal skills of the subjects, in a significant way.

The Bate's Infant Characteristics Questionnaire (ICQ)

The ICQ (Bates, Freeland, & Lounsbury, 1979; portugusese version by Soares, Rangel-Henriques, & Dias, 2009) is a 32-item temperament questionnaire for children, based on a seven point scale. The ICQ covers the following dimensions, based on the mother's perceptions: difficult; unstoppable; negative adaptation to change; dependent. The Cronbach's alphas obtained in the four dimensions were 0.82; 0.79; 0.73; 0.58, respectively (Carneiro, Magalhães, Dias, Baptista, Silva, Marques, Rouxinol, Rangel-Henriques, & Soares, 2010).

Procedures

Mothers became aware of this work through an informed consent, left at their children's daycare. All the parents who respond affirmatively, were contacted by cell phone and the sessions were scheduled according to the mother and child's availability.

AQS home visits

The AQS home visits lasted between two to three hours and were scheduled with the mother in a time of day when both the child and the mother were available and any other members of the family or friends were present at home. About 58% of the observations were held during the weekend. The remaining observations were undertaken during the week (42%). Parents were told that the purpose of the visit was to learn about both the child and mother's daily routine and interactions, and they were asked to maintain their daily life activities unchanged. No behavioural restrictions were placed upon the dyads during observations. These were conducted by two observers who behaved as if they were social visits, participating in child's games when requested and talking informally with the mother. However, observers were trained not to disturb interactions in progress or interfere in domestic routines. After each observation, the observers distributed the AQS items in an independent way. The distribution of the 90 items was conducted in two stages. Initially,

items were randomly divided into three groups: The first group is called the "characteristic behaviours", which is consistent with behaviours observed in children during the visit that are characteristic of the child's repertoire and around which the child's behaviour is organized. The second group, "behaviours that do not apply group", refers to those behaviours that were not observed or that were considered neither characteristic, nor uncharacteristic. The third group, the "uncharacteristic behaviour group", comprehends the behaviours that are opposite to the behaviours observed during the visit and that do not fit the child. Subsequently, the observers subdivided each of the three groups of cards into three new groups, so that each one stays with ten cards in a nine-point scale. In the first group, "the characteristic behaviours group", observers divided the cards into three subgroups, with 10 items each: the "extremely characteristic" (9), the "highly characteristic" (8) and "sufficiently characteristic "(7) sub-groups. Then, in the second group, "behaviours that do not apply", the observers divided the cards into three subgroups of 10 items each: the "uncharacteristic" (6), the "not applicable" (5) and the "little uncharacteristic" (4) sub-groups. Finally, the same procedure was done to the last group of cards, "uncharacteristic behaviour group", which was divided into "sufficiently uncharacteristic" (3), "highly uncharacteristic" (2) and "extremely uncharacteristic" (1) sub-groups. The observers were trained under supervision, over a period of several weeks before the observations. The observers' agreement mean was .80. Individual Q-sorts, resulted from a mean between the descriptions of the two observers.

Emotion regulation paradigm

The emotion regulation episodes (fear, positive affect, frustration/anger) were videotaped in different days, usually during a period of two weeks, with a minimum of two days apart from each session, in order to avoid any emotional contamination from one episode to the other and to guarantee that each episode only aroused one emotion at the time. They all started at the same time (18:30), in order to control cortisol circadian rhythm or mood. The time chosen to start the experiments was late afternoon, because 94% of the mothers worked outside the home and finish their shift around 17:00. The episodes were videotaped at the family's house, always in the same room, the living room, because it present itself as the most spacious and neutral place of the house, without any other toys that could serve as a distraction from the stimuli. All the electric gears present (television set) were turned off during the sessions and only the child, the mother and two experimenters were present in the room. The stimuli were placed in the center of the room, to allow the children to explore

freely. The three episodes were videotaped in a balanced way in order to control any order effect over the results.

RESULTS

Preliminary analyses

First, we tested if there were significant child gender differences in child attachment (AQS scores), child temperament (ICQ scores), emotion regulation strategies, emotional expressiveness and emotional intensity. No significant differences or gender main effects were found. Next, a regression analysis was undertaken in order to test attachment's trans-generational phenomenon from mothers to children. Children's AQS scores were used as dependent variable and mothers' total attachment scores in the Narratives were used as independent/predictor variable. Mothers' attachment representations predicted children's secure base behaviours in a significant way (F (1, 52) = 38.38, $p < .001$), ($\beta = .65$, $p < .001$), $R^{2\ adjusted} = .42$.

Relationships between children's attachment (AQS) and emotion regulation strategies

A repeated measures MANOVA was undertaken and three within-effects levels were used: episode (fear, positive affect, frustration/anger); maternal condition (constrained vs involved) and 19 emotion regulation strategies. For use as independent factor, children's attachment security (AQS) was dichotomized. The participants were grouped according to their scores on the AQS, into participants with secure (score ≥ 0.35) *versus* insecure (score < 0.35) attachment (Bost, 2006). Results revealed significant main effects for episode (F (2, 106) = 26.38, $p < .001$); maternal condition (F (1, 53) = 25.56, $p < .001$) and strategies (F (18, 954) = 129.18, $p < .001$). Most importantly, a significant interaction episode x maternal condition x attachment was found (F (2, 106) = 3.70, $p < .05$).

Planned contrast estimates analyses revealed that children with secure attachment (see table 1), during fear episodes showed more emotion regulation strategies during mother involved periods, than during mother constrained ones (t (53) = 5.11, $p < .001$). During positive affect episodes, secure children also exhibited more strategies when their mothers behaviour was involved, than when it was constrained (t (53) = 2.41, $p < .05$). Finally, during frustration/anger episodes, secure children did not show significant differences between mother constrained and involved periods. During mother constrained periods, secure children (see table 1) engaged in significantly more strategies during frustration/anger and positive

affect episodes, than during fear episodes, (t (53) = 5.49, p < .001; t (53) = 8.32, p < .001, respectively). No significant differences were found between frustration/anger and positive affect episodes. During mother involved periods, secure children (see table 1) exhibited significantly more strategies during positive affect and frustration/anger episodes, than during fear, (t (53) = 6.65, p < .001; t (51) = 2.71, p = .01, respectively).

Table 1

Means and standard errors for children's emotion regulation strategies, as function of children's attachment security, maternal behaviour and episode

Children's Attachment	Episode	mothers' condition	M	S.E.
secure (n=40)	fear	constrained	1.82	0.10
		Involved	2.34	0.08
	positive affect	constrained	2.78	0.08
		Involved	3.00	0.08
	frustration/anger	constrained	2.64	0.13
		Involved	2.74	0.11
insecure (n=15)	fear	constrained	1.76	0.16
		Involved	2.23	0.13
	positive affect	constrained	2.58	0.13
		Involved	2.57	0.14
	frustration/anger	constrained	2.34	0.22
		Involved	2.96	0.18

On the other hand, insecure children, during fear episodes (see table 1) showed significantly more strategies during mother involved periods, than during mother constrained ones (t (53) = 2.68, p = .01). During frustration/anger episodes, insecure children also exhibited more strategies when the mothers' behaviour was involved, than when it was constrained (t (53) = 2.97, p < .01). No significant differences were found for positive affect episodes. During mother constrained periods, insecure children (see table 1) engaged in more strategies during positive affect and frustration/anger episodes, than during fear episodes (t (53) = 4.38, p < .001; t (53) = 2.40, p < .05, respectively). No significant differences were found between frustration/anger and positive affect episodes. During mother involved periods,

insecure children (see table 1) exhibited significantly more strategies during frustration/anger and positive affect episodes, than during fear ones, (t (53) = 3.23, $p < .01$; t (53) = 2.22, $p < .05$, respectively).

Finally, when it comes to differences between secure and insecure children, no significant differences were found between the two groups either in fear, positive affect or frustration/anger episodes, during mother constrained periods (see table 1). On the other hand, during mother involved periods (see table 1), secure children showed significantly more strategies, than insecure ones, during positive affect episodes (t (53) = 2.65, p = .01). No significant differences were found for fear or frustration/anger episodes.

Relationships between mothers' attachment representations (Narratives) and children's emotion regulation strategies

A repeated measures MANOVA was undertaken and three within-effects levels were used: episode (fear, positive affect, anger); maternal condition (constrained and involved) and 19 emotion regulation strategies. Mothers' attachment representations (Narratives) were used as between-effects or independent variables. For use as independent factors, mothers' attachment representations were dichotomized. Mothers were grouped according to their total results on the "Adult attachment representation narratives", into participants with secure (score $\geq$ 3.5) *versus* insecure (score < 3.5) attachment representations (Waters, & Rodrigues-Doolabh, 2004; Waters & Waters, 2006). Results revealed significant main effects for episode (F (2, 102) = 35.31, $p < .001$); maternal condition (F (1, 51) = 32.29, $p < .01$) and for strategies (F (18, 918) = 147.71, $p < .001$). No significant main effects or interactions were found between mothers' attachment representations and children's strategies.

Relationships between children's temperament (ICQ) and emotion regulation strategies

In order to investigate the relationships between children's temperament and their behavioural regulatory strategies, correlation analyses were conducted. During fear episodes, no significant correlations were found between children's ICQ scores and their emotion regulation strategies, in mothers' constrained periods. When the mothers' behaviour was involved, ICQ scores were inversely associated with "helpseeking" (r = -0.28, $p < .05$); "information seeking" (r = -0.31, $p < .05$); "labeling" (r = -0.32, $p < .05$) and "stranger" (r = -0.29, $p < .05$) strategies. During positive affect episodes, ICQ scores were inversely related with "passive disengagement of attention" (r= -0,28, $p < .05$) and positively associated with "tension-release" (r = 0.28, $p < .05$) strategies, when the mothers' behaviour was constrained.

During mother involved periods, ICQ scores were inversely associated with "social referencing" (r = -0.4, p < .001); "engaging mother" (r = -0.27, p = .05) and "passive disengagement of attention" (r = -0.34, p = .01) strategies. Finally, during frustration/anger episodes, in mother constrained periods, ICQ scores were positively related with"avoidance" behaviors (r = 0.3, p < .05) and inversely associated with behaviours towards the "strangers" (r = -0.31, p < .05), when the mother was constrained.

Relationships between children's attachment (AQS) and children's emotional expressiveness and intensity

In the case of emotional expressiveness, three within-effects levels were used: episode (fear, positive affect, anger); emotional expressions (fear, positive affect, frustration/anger) and maternal condition (constrained and involved). Children's attachment security (AQS) was used as between-subject effects or independent variable. For emotional intensity two within-effects levels were used: episode (fear, positive affect, frustration/anger) and maternal condition (constrained and involved). Children's attachment security (AQS) was used as between-subject effects or independent variable.

In the case of children's emotional expressiveness, results showed significant main effects for emotional expressions (F (2, 106) = 7.02, p = .01) and episode (F (2, 106) = 24.44, p < .001). Most importantly, a significant interaction episode x maternal condition x emotional expressions x children's attachment security was found (F (4, 212) = 3.30, p = .01).

When it comes to children's emotional intensity, results revealed a significant interaction episode x maternal condition (F (2, 106) = 11.30, p < .001), but no main effects or interactions between children's attachment and their emotional expressions were found.

Planned contrast estimates analyses revealed that secure children (see table 2), during fear episodes showed more positive affect expressions during mother involved periods, than during constrained ones (t (53) = 2.45, p < .05). No significant differences in frustration/anger or fear expressions were found between the two periods. In total, during fear episodes, secure children (see table 2) did not show significantly more expressiveness (positive and negative) during mother involved periods, than during the constrained ones.

Table 2

Means and standard errors for children's emotional expressions, as function of children's attachment security, maternal condition and episode

Children's Attachment	Episode	Children's Emotional expression	Mothers' condition			
			Constrained		Involved	
			M	S.E.	M	S.E.
secure (n=40)	fear	positive	3.07	0.74	4.66	0.77
		frustration/anger	0.13	0.12	0.48	0.19
		fear	7.04	0.82	6.19	0.74
		Total	3.41	0.20	3.78	0.13
	positive affect	positive	3.42	0.66	5.64	0.66
		frustration/anger	0.33	0.15	0.92	0.36
		fear	1.35	0.42	0.47	0.23
		Total	1.70	0.21	2.34	0.21
	frustration/anger	positive	1.18	0.30	3.43	0.55
		frustration/anger	8.66	0.56	3.49	0.48
		fear	0.00	0.00	0.00	0.00
		Total	3.28	0.15	2.31	0.18
insecure (n=15)	fear	positive	3.87	1.21	4.13	1.25
		frustration/anger	0.40	0.20	0.13	0.31
		fear	5.67	1.35	6.82	1.21
		Total	3.31	0.32	3.69	0.21
	positive affect	positive	5.79	1.08	6.29	1.08
		frustration/anger	0.33	0.25	1.53	0.58
		fear	1.13	0.68	0.00	0.00
		Total	2.42	0.35	2.61	0.33
	frustration/anger	positive	0.00	0.00	4.60	0.89
		frustration/anger	10.00	0.91	2.49	0.79
		fear	0.00	0.00	0.00	0.00
		Total	3.33	0.25	2.36	0.29

During positive affect episodes, secure children (see table 2) showed more positive affect expressions when the mothers' behaviour was involved, than when it was constrained (*t*

(53) = 4.01, $p < .01$). They expressed significantly more fear during mother constrained periods, than during mother involved ones (t (53) = 2.41, $p < .05$). No significant differences between the two periods were found for frustration/anger expressions. In total, during positive affect episodes, secure children (see table 2) exhibited significantly more expressiveness during mother involved periods, than during mother constrained ones (t (53) = 2.89, $p < .01$).

Finally, during frustration/anger episodes, secure children (see table 2) exhibited more positive affect expressions when the mothers' behaviour was involved, than when it was constrained, (t (53) = 3.59, $p = .01$). They showed significantly more frustration/anger expressions during mother constrained periods, than during mother involved ones (t (53) = 7.02, $p < .001$). In total, during frustration/anger episodes, secure children (see table 2) exhibited significantly more expressions during mother constrained periods, than during the mother involved periods (t (53) = 4.61, $p < .001$).

In total, during mother constrained periods, secure children (see table 2) showed significantly more emotional expressions during fear and frustration/anger episodes, than during positive affect episodes, (t (53) = 6.83, $p < .001$; t (53) = 5.85, $p < .001$, respectively). No significant differences were found between fear and frustration/anger episodes. In total, during mother involved periods, secure children (see table 2) exhibited significantly more expressions during fear episodes, than during positive affect or frustration/anger episodes (t (53) = 6.33, $p < .001$; t (53) = 6.43, $p < .001$, respectively).

On the other hand, insecure children (see table 2), did not show any significant differences in their emotional expressions between mother constrained and involved periods, either during fear or positive affect episodes.

During frustration/anger episodes (see table 2), insecure children expressed more positive affect expressions during mother involved periods, than during mother constrained ones, (t (53) = 4.48, $p < .001$). They also expressed more frustration/anger expressions when the mothers' behaviour was constrained, than when it was involved (t (53) = 6.25, $p < .001$). No significant differences between the two periods were found for fear expressions. In total, insecure children showed more expressions, either positive or negative, during mother constrained periods, than during mother involved ones (t (53) = 2.83, $p = .01$).

In total, during mother constrained periods, insecure children (see table 2) showed more emotional expressions during fear and frustration/anger episodes, than during positive affect episodes (t (53) = 2.18, $p < .05$; t (53) = 2.07, $p < .05$, respectively). No significant

differences were found between fear and frustration/anger episodes. In total, during mother involved periods, insecure children (see table 2), exhibited significantly more expressions during fear episodes, than during positive affect or frustration/anger episodes (t (53) = 2.94, p < .01; t (53) = 3.57, p = .001, respectively).

Relationships between mothers' attachment representations (Narratives) and children's emotional expression and intensity

In the case of emotional expressiveness, we used three within-effects levels: episode (fear, positive affect, anger); maternal condition (constrained and involved) and emotional expressions (fear, positive affect, frustration/anger). Mothers' attachment representations (narratives) were used as between-subject effects or independent variable. For emotional intensity we used two within-effects levels: episode (fear, positive affect, anger) and maternal condition (constrained and involved). Mothers' attachment representations (narratives) were used as between-subject effects or independent variable.

When it comes to emotional expressiveness, results showed significant main effects for episode (F (2, 102) = 35.09, p < .001) and emotional expressions (F (2, 102) = 6.75, p = .001). Most importantly, an interaction episode x maternal condition x emotional expressions x mothers' attachment was found (F (4, 204) = 2.43, p < .05).

When it comes to children's emotional intensity during the three episodes, results revealed significant main effects for episode (F (2, 102) = 7.04, p = .001). Most importantly, a significant interaction episode x mothers' attachment was found (F (2, 102) = 2.97, p = .05).

Planned contrast estimates analyses revealed that children of secure mothers (see table 3) did not show any significant differences in their emotional expressions, between mother constrained and involved periods, during fear episodes. During positive affect episodes, secure mothers' children (see table 3) showed more positive affect expressions when the mothers' behaviour was involved, than when it was constrained (t (53) = 2.49, p = .01). They expressed more fear during mother constrained periods, than during mother involved ones (t (53) = 2.76, p = .01). No significant differences between the two periods were found for frustration/anger expressions.

During positive affect episodes, secure mother's children did not exhibit significant differences in their total expressiveness, between mother involved and constrained periods.

Table 3

Means and standard errors for children's emotional expressions, as function of mothers' attachment representations, maternal condition and episode

Mothers' attachment script	Episode	Children's emotional expression	Mothers' condition			
			Constrained		Involved	
			M	S.E.	M	S.E.
secure (n=20)	fear	positive	3.45	1.06	4.83	1.09
		frustration/anger	0.00	0.00	0.57	0.28
		fear	6.90	1.17	5.88	1.06
		Total	3.45	0.28	3.76	0.18
	positive affect	positive	2.88	0.94	4.80	0.91
		frustration/anger	0.35	0.22	1.40	0.51
		fear	1.90	0.58	0.50	0.33
		Total	1.71	0.31	2.23	0.28
	frustration/anger	positive	1.94	0.41	3.31	0.77
		frustration/anger	7.52	0.70	3.14	0.66
		fear	0.00	0.00	0.00	0.00
		Total	3.16	0.19	2.15	0.24
insecure (n=33)	fear	positive	3.39	0.83	4.15	0.85
		frustration/anger	0.34	0.13	0.30	0.22
		fear	6.20	0.91	6.77	0.82
		Total	3.31	0.22	3.74	0.14
	positive affect	positive	5.03	0.73	6.48	0.71
		frustration/anger	0.33	0.17	0.96	0.40
		fear	0.88	0.45	0.27	0.26
		Total	2.08	0.24	2.57	0.22
	frustration/anger	positive	0.25	0.32	4.24	0.60
		frustration/anger	10.12	0.55	3.16	0.52
		fear	0.00	0.00	0.00	0.00
		Total	3.46	0.15	2.47	0.19

Finally, during frustration/anger episodes, children of secure mothers (see table 3) exhibited more positive affect expressions when the mothers' behaviour was involved, than when it was constrained (t (53) = 3.59, p = .01). They showed more frustration/anger expressions during mother constrained periods, than during the mother involved ones (t (53) = 4.27, $p < .001$). No significant differences between the two periods were found for fear or positive affect expressions. In total, during frustration/anger episodes, children of secure mothers exhibited more expressions, either positive or negative, during mother constrained periods, than during mother involved periods (t (53) = 3.33, p = .001).

In total, during mother constrained periods, children of secure mothers (see table 3) showed more emotional expressions (either positive or negative), during fear and frustration/anger episodes, than during positive affect episodes (t (51) = 4.87, $p < .001$; t (51) = 3.82, $p < .001$, respectively). No significant differences were found between fear and frustration/anger episodes. In total, during mother involved periods, children of secure mothers (see table 3) exhibited significantly more expressions during fear episodes, than during positive affect or frustration/anger episodes (t (51) = 4.85, $p < .001$; t (51) = 5.07, $p <$ .001, respectively).

On the other hand, children of insecure mothers (see table 3), did not show any significant differences in their emotional expressions between mother constrained and involved periods, during fear episodes.

During positive affect episodes (see table 3), they expressed more positive affect expressions during mother involved periods, than during mother constrained ones, (t (51) = 2.42, $p < .05$). No significant differences between the two periods were found for fear or frustration/anger expressions. In total, during positive affect episodes, insecure mothers' children showed more expressions (either positive or negative), during mother involved periods, than during mother constrained ones (t (51) = 2.06, $p < .05$).

Finally, during frustration/anger episodes, insecure mothers' children (see table 3) showed more positive affect expressions during mother involved periods, than during constrained ones (t (51) = 5.80, $p < .001$). They also expressed more frustration/anger when the mothers' behaviour was constrained, than when it was involved (t (51) = 8.71, $p < .001$). No significant differences were found for fear expressions. In total, during frustration/anger episodes, insecure mothers' children showed more expressions (either positive or negative),

during mother constrained periods, than during mother involved ones, (t (51) = 4.21, p < .001).

In total, during mother constrained periods, insecure mothers' children (see table 3) showed more emotional expressions, either positive or negative, during fear and frustration/anger episodes, than during positive affect episodes (t (51) = 4.43, p < .001; t (51) = 4.68, p < .001, respectively). No significant differences were found between fear and frustration/anger episodes. In total, during mother involved periods, insecure mothers' children (see table 3) exhibited more expressions during fear episodes, than during positive affect or frustration/anger episodes (t (51) = 4.77, p < .001; t (51) = 5.16, p < .001, respectively).

When it comes to differences between children of secure and insecure mothers, we found that during fear episodes the two groups did not show significant differences in fear expressions, neither in mother constrained periods, nor in mother involved ones. During positive affect episodes, children of secure and insecure mothers also did not show significant differences in their positive affect expressions, neither in mother constrained periods, nor in mother involved ones. However, during frustration/anger episodes, insecure mothers' children (see table 3) expressed more frustration/anger, than secure mothers', during mother constrained periods (t (51) = 2.92, p < .01). No significant differences were found during mother involved periods.

Planned contrast estimates analyses revealed that children of secure mothers (see table 4) did not show any significant differences in their emotional intensity between mother constrained and involved periods, during fear or frustration/anger episodes. However, during positive affect episodes, secure mothers' children (see table 4) showed more emotional intensity when the mothers' behaviour was involved, than when it was constrained (t (51) = 2.63, p = .01).

In mother constrained periods (see table 4), children of secure mothers exhibited more emotional intensity during positive affect episodes, than during fear ones (t (51) = 2.80, p < .01). No significant differences were found between positive affect and frustration/anger episodes or between fear and frustration/anger ones. During mother involved periods, secure mothers' children showed more emotional intensity during positive affect episodes, than during fear and frustration/anger (t (51) = 3.96, p < .001; t (51) = 3.96, p < .001, respectively). No significant differences were found between fear and frustration/anger episodes. In total,

independently of mothers' condition (see table 4), secure mothers' children exhibited more emotional intensity during positive affect episodes, than during fear or frustration/anger episodes (t (51) = 3.74, p < .001; t (51) = 2.69, p = .01, respectively). No significant differences were found between fear and frustration/anger episodes.

Table 4

Means and standard errors for children's emotional intensity, as function of mothers' attachment representations, maternal condition and episode

Mothers' attachment script	Episode	Mothers' condition					
		Constrained		Involved		Total	
		M	S.E.	M	S.E.	M	S.E.
secure (n=20)	fear	16.15	1.29	18.17	1.08	17.16	1.06
	positive affect	21.08	1.19	24.04	1.06	22.56	0.97
	frustration/anger	19.97	1.62	18.68	1.03	19.33	1.11
insecure (n=33)	fear	18.81	1.01	19.32	0.84	19.06	0.83
	positive affect	19.94	0.93	21.52	0.82	20.23	0.76
	frustration/anger	21.62	1.26	17.76	0.80	19.69	0.86

On the other hand, children of insecure mothers (see table 4) did not show any significant differences in their emotional intensity between mother constrained and involved periods, during fear episodes. However, during positive affect episodes, insecure mothers' children (see table 4) showed more emotional intensity when the mothers' behaviour was involved, than when it was constrained (t (51) = 2.95, p < .01). During frustration/anger episodes, children of insecure mothers showed more emotional intensity during mother constrained periods, than during mother involved ones (t (51) = 3.20, p < .01).

During mother constrained periods, children of insecure mothers (see table 4) did not show any significant differences between episodes, when it comes to their emotional intensity. However, during mother involved periods insecure mothers' children showed more emotional intensity during positive affect episodes, than during frustration/anger ones (t (51) = 3.57, p = .001). No significant differences were found between positive affect and fear episodes or between fear and frustration/anger ones.

In total, independently of mothers' condition (see table 4), insecure mothers' children did not show significant differences between episodes.

When it comes to differences between children of secure and insecure mothers, no significant differences the two groups' emotional intensity was found during fear, positive affect or frustration/anger episodes, neither in mother constrained periods, nor in mother involved ones.

Relationships between temperament (ICQ) and children's expressiveness and intensity

In order to investigate the relationships between children's temperament and their emotional expressiveness/intensity, correlation analyses were conducted. No significant correlations were found between ICQ scores and children's emotional expressions, during fear and frustration/anger episodes. However, during positive affect episodes, children's positive affect expressions were positively associated with temperament, when the mothers' behaviour was constrained ($r = 0.39$, $p < .01$). No significant correlations were found between children's ICQ scores and their emotional intensity in any of the three episodes.

DISCUSSION

The present study examined possible relationships between attachment, temperament and toddlers' emotion regulation behavioural strategies, emotional expressiveness and intensity during different emotion-elicitin (fear, positive affect and frustration/anger) and social (mother constraint and involvement) contexts. Toddlers' behavioural strategies differed as a function of situational (episodes), social (maternal involvement) but, most importantly, as a function of an interaction involving children's attachment quality, which confirmed part of our initial hypotheses. When it comes to maternal involvement, during fear episodes, when children's survival perception was threatened, both secure and insecure children increased their strategies when their mothers were involved. This finding is consistent with Bowlby's (1969/1982) perspective. According to the author proximity behaviours and physical contact with the attachment figure are exhibited, particularly, during stressful or dangerous situations, when the caregiver is used as a "safe haven", where protection and comfort can be found (Bowlby, 1969/1982; Ainsworth, 1967; Ainsworth et al., 1978). During positive affect contexts, when children's survival perception is not threatened and the possibility for increasing emotional proximity to the mother through play is possible, only secure children, not insecure ones, showed significantly more strategies when the mothers behaviour was

involved. During frustration/anger contexts, when children's gratification is delayed and dependent on the mothers' involvement, secure children showed no significant differences between the constrained and involved periods, probably because of a positive expectation of being helped by the mother, even when her behaviour was constrained. This might have happened due to the existence of a positive working model of the attachment figure in secure children, based on past experiences during which the mothers' active participation and intervention was beneficial and helped children to regulate their emotions and accomplish their goals (Bowlby, 1973; 1980; Ainsworth et al., 1978; Waters, Vaughn, Posada, & Kondo-Ikemura, 1995). On the opposite, insecure children have not developed an internal working model based on the mothers' sensitive help and, therefore, must increase their strategies to call the caregivers' attention to their needs when they became involved (Bowlby, 1973; 1980; Ainsworth et al., 1978; Waters, Vaughn, Posada, & Kondo-Ikemura, 1995).

When it comes to situational contexts, both secure and insecure children engaged in significantly more strategies during frustration/anger and positive affect episodes, than during fearful ones, both when their mothers' behaviour was constrained or involved. This is result is similar to Diener and Mangelsdorf's work (1999a), in which children used more behavioural strategies during frustration episodes than during fear episodes. In both positive affect and frustration/anger episodes, the stimuli were desirable objects to play, a piano with musical sounds and legos, respectively. It might have been that the desire to play with the stimulus during the positive affect episodes and the motivation to obtain the object during the frustration/anger ones, made children try more strategies in order to accomplish their immediate goals and regulate themselves. On the other hand, during fear episodes, children exhibited significantly less strategies, probably, because the stimulus was too threatening to promote any approach behaviours. Finally, securely attached children exhibited more strategies during positive affect contexts, than insecurely attached ones, only when the mothers' behaviour was involved. No significant differences were found for fear or frustration/anger episodes, which suggests that secure children only exhibit more strategies than insecure ones, during specific contexts and not all, as it was expected. During negative emotional contexts (fear and frustration/anger), secure and insecure children seemed to use the mothers' involvement in the same way, as a "safe haven", where protection for danger (fear episodes) or comfort from distress (frustration/anger episodes) can be found. However, differences emerge in positive affect contexts, where either danger or distress are not present, but rather the possibility to increase emotional proximity between the members of the dyads,

through play. Secure children seem to seek it more than insecure ones, showing significantly more strategies when the mothers' are involved, than insecure children. This finding is also consistent with Bowlby's work (1969/1982), which postulates that attachment relationship is a regulatory behavioural system characterized not only by a "haven of safety", where children can seek comfort in the attachment figure in case of distress or danger, but also by the formation of a loving bond, characterized by the capacity to seek and sustain emotional proximity by both partners, in moments where danger is not present, like positive affect emotional contexts.

Children's emotional expressions differed as function of an interaction involving situational context, maternal involvement and children's attachment security. In particular, secure children showed more emotional expressions (positive and negative) when their mothers' behaviour was involved, during positive affect contexts. During these episodes, the toys were always available for children to play with or to explore. It might have been that secure children used emotional expressiveness during mother involved periods, as a way to signal their mothers about their intention to play or approach the toys together and not alone. In fact, secure attachment is characterized by an active participation of both partners during tasks and a desire for emotional proximity (Bowlby, 1969/1982; 1973; 1980). However, during frustration/anger episodes secure children exhibited more expressions (positive and negative) when the mother was constrained and not involved, probably, because interactive play could only be achieved by first signaling the mothers to get involved and retrieve the toy. This signaling might have been done through emotional expressiveness. In this sense, emotional expressiveness might be a way secure children use to signal their mothers, achieve their goals and better regulate themselves. In fact, Cassidy (1994), Bretherton (1990) and Stern (1985), mention the use of open, direct and active expression in secure children, as a way to send and receive signals unrestrictedly, instead of hiding it from the parent. In particular, secure children also showed significantly more positive affect expressions when their mothers' behaviour was involved, independently of the emotional context experienced, either positive (positive affect) or negative (fear, frustration/anger episodes). This finding is consistent with Thompson (1994) and Gross, & Thompson (2007) perspective, which defends that emotion regulation involves not just the inhibition of negative affect, but also the maintenance and enhancement of positive affect. On the other hand, insecure children showed no significant differences in their emotional expressions, between mother constrained and involved periods, during fear or positive affect episodes, except during frustration/anger ones.

Our results are consistent with Lutkenhaus, Grossman and Grossman (1985); Spangler and Grossman (1993) and Malatesta, Culver, Tesman and Sheppard (1989), where insecure children showed a minimizing emotion expression style. During fear and positive affect contexts, the mothers' involvement seemed indifferent in changing insecure children's emotional expressions. In frustration/anger contexts, during the mothers' involvement periods, insecure children showed significantly less expressions of frustration/anger and more expressions of positive affect. It might have been that in this context, insecure children perceived mothers' involvement not as a possibility for emotional proximity, but as an instrumental way to achieve their goal and, consequently, reduce their frustration levels. These findings are consistent with Cassidy's (1994) "minimizing emotion expression style", present in insecure children. According to Bowlby (1980), the minimization of emotions and masking effect has an adaptive and regulatory effect, by reducing rejection experiences and the fear of being alienating the parent and being abandoned.

In spite of their differences, both secure and insecure children showed more emotional expressiveness (positive and negative) during fear and frustration/anger contexts when their mothers were constrained (probably, due to the negative emotionality of the contexts), and more emotional expressions during fear contexts, when their mothers were involved (probably, because of the threatening nature of the stimulus, that prolonged its emotional effects even during the mothers' involvement). These results indicate that children, independently of their attachment security, use emotional expressiveness as a way to signal mothers about their affective states and increase their emotion regulation.

As expected, mothers' attachment representations not only predicted their children's secure base behaviours (Main, Hesse, & Kaplan, 2005; Grossmann, Grossmann, Fremmer-Bombik, Kindler, Scheuerer-English, & Zimmerman, 2002; Steele, Steele, & Fonagy, 1996; van IJzendoorn, 1995; Veríssimo, Monteiro, Vaughn, Santos, & Waters, 2005), but also influenced their expressiveness and emotional intensity in a significant way, through two interactions. These results suggest that the caregiver's attachment history influences their children's emotional development in several ways, not only through their children's proximity/exploration behaviors, as it is already known, but also through their expressiveness and emotional intensity. During frustration/anger episodes, when the mothers' behaviour was constrained, children with insecure mothers expressed significantly more frustration/anger, than children with secure mothers. This may be a reflection of their mothers' personal emotional response pattern to frustrating events, since insecure parents' state of mind can be

characterized by heightened emotions, particularly anger (Main, Kaplan, & Cassidy, 1985; Main, 2000; Cassidy, 1994). In fact, insecure parents exhibit certain behaviours which contribute to children's heightened negative emotionality and difficulties in exploration. These behaviours are often characterized by a relatively unresponsive attitude to their children signals and by a failure in regulating their children negative emotions, which may explain these results (Main, Kaplan, & Cassidy, 1985; Main, 2000).

Mothers' attachment history also influenced their children's emotional intensity in a significant way. Independently of mothers' condition, children with secure mothers showed significantly more emotional intensity during positive affect episodes, when compared to fear or frustration/anger ones. On the other hand, children with insecure mothers showed no differences between episodes. These results suggest that children with secure mothers may feel comfortable and safe enough to express their emotions more intensely, particularly during positive affect contexts, since their caregivers have a positive attachment working model, characterized by an openness to a wide range of positive and negative emotions, which helps them to correspond their children's bids for attention and play (Cassidy, 1994; Main, Kaplan, & Cassidy, 1985; Main, 2000). On the other hand, children with insecure mothers do not seem to use their emotional intensity differently across contexts, in order to signal their mothers. This might have happened, given that insecure caregivers tend to have difficulties in dealing with and regulating their children's emotionality, which causes them to either reject, restrict or neglect their children's distress, initiatives to play or bids for comfort (Bowlby, 1980; Main, Kaplan, & Cassidy, 1985; Main, 2000; Malatesta et al., 1989).

Children's emotion regulation, namely, their behavioural strategies were influenced not only by their attachment security, but also by their temperament quality, during the three episodes. These results are congruent with Rothbart and Sheese (2007) and Rothbart and Bates's (2006) works, which report that failures in regulation are related to temperamental dimensions, such as impulsivity, behavioural inhibition and negative affect. Significant negative correlations between children's temperament and several mother related strategies were found, particularly during fear (e.g., help seeking, information seeking) and positive affect (e.g., looks to mother; engaging mother) episodes, in mother involved periods. These results suggest that difficult temperament may present itself as a vulnerability in emotion regulation, since it does not predispose children to develop strategies towards reunion with the mother, during stressful (fear), or playful (positive affect) situations, particularly, when involvement with the mother is possible. On the other hand, when the mothers' behaviour is

constrained, temperament is associated positively with children's tension release and avoidance behaviours, during positive affect and frustration/anger episodes, respectively. These results suggest that difficult temperament may be associated with less tolerance to frustration when gratification is delayed and to the development of behavioural strategies that are not related with the mothers. Instead, difficult temperament seems to be associated with strategies that may push mothers away (avoidance and tension release), which may decrease their probabilities of being comforted and regulated.

In conclusion, by the end of the second year of life children use a large number of behaviours and emotional expressions to regulate themselves, according to the demands and objectives of the contexts experienced. These regulatory efforts differ as a function of children's attachment security to their mothers, their temperament quality, but also according to their mothers' own personal attachment history. Children's emotional expressiveness and intensity are significantly influenced by their caregivers' attachment representations, which not only suggests that children may use expressiveness and intensity as a way to signal their mothers about their emotional needs and better regulate themselves, but that they do it according to their mothers' internal state of mind, in order to increase their chances of being understood, or at least, to decrease the possibilities of being rejected.

In future research it is important to explore possible interactions between attachment and temperament, on children's behavioural strategies, emotional expressiveness and intensity, as well as the nature of those interactions. Moreover, since emotion regulation seems to be influenced by either external (attachment) or internal (temperament) processes to the child, in future studies it would be very interesting to explore other mechanisms, such as biological systems, like adrenocortical activity and its relationships with attachment and temperament qualities.

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CHAPTER 3

EMOTION REGULATION AND ADRENOCORTICAL ACTIVITY IN SITUATIONS OF FEAR, POSITIVE AFFECT AND FRUSTRATION/ANGER IN MOTHER-CHILD DYADS: RELATIONSHIPS WITH ATTACHMENT (CHILDREN'S SECURE BASE AND MOTHERS' ATTACHMENT REPRESENTATIONS) AND CHILDREN'S TEMPERAMENT

ABSTRACT

This study investigated biobehavioural relationships between emotion regulation and adrenocortical activity in response to different emotional contexts in mother-child dyads, in function of attachment security (children's secure base and mothers' attachment representations) and children's temperament. Fifty-one children between 18 and 26 months of age and their mothers participated in this study. Children were exposed to three episodes in naturalistic settings (fear, positive affect, frustration/anger). Mothers' behaviour was constrained during the first part and involved in the second part of the episodes. Children's behavioral regulatory strategies were videotaped during the episodes and children and mother's salivary cortisol were assessed before and afterwards. Children's cortisol response showed a significant decrease after the engagement in positive affect activities with the attachment figure. No significant differences were found for fear or frustration/anger episodes. Mothers exhibited significant cortisol decreases after watching their children being exposed to the 3 episodes. Children and mothers' adrenocortical responses were significantly influenced by children's attachment security. Secure children showed significant increases in their cortisol levels after fear episodes and significant decreases, after positive affect ones. No significant changes were found for frustration/anger episodes. Insecure children did not show significant differences in cortisol levels in any of the episodes, which suggests that insecure attachment may be related to HPA axis suppression in response to challenging and positive contexts. Mothers of secure children did not show any significant differences in their adrenocortical responses after the episodes. Insecure children's mothers showed significant cortisol decreases after the 3 episodes. Mothers' personal attachment representations not only predicted their children's attachment quality, but also influenced their own cortisol responses, as well as their children's (in a marginal significant way). Results indicated relationships between children's behavioural strategies and adrenocortical responses, both in children and in mothers and the importance of maternal involvement for children's behavior.

Keywords: emotion regulation, cortisol, attachment, temperament, multiple contexts

INTRODUCTION

According to this biopsychological perspective (Gross, & Thompson, 2007; Calkins, 1994; Loman, & Gunnar, 2010; Thompson, & Meyer, 2007), the comprehension of emotions requires the study of the physiological processes associated with emotional experience, as well as the understanding of the reciprocal and dynamic relationships between the biological and behavioural expressions of emotion. The hypothalamic-pituitary-adrenal (HPA) axis is one of the relevant physiological systems studied by researchers, nowadays. This occurs, mainly, due to two reasons: (1) adrenocortical activity is highly sensitive to emotional experience, particularly the regulation of stress responses. At the same time, emotions seem to mediate the intensity of the HPA axis' response to stressful and challenging situations (Sapolsky, 1998; 2007); (2) easy and non invasive measurement of cortisol (hormone released by the HPA system during stress) through small samples of saliva, both in adults and in children (Hanrahan, McCarthy, Kleiber, & Tsalikian, 2006; Kirschbaum, & Hellhammer, 1994).

The HPA axis stress response

The hypothalamic-pituitary-adrenocortical system is a neuroendocrine system, which means that its functioning is regulated by the central nervous system (CNS), namely, the hypothalamus, a brain region, which coordinates sensorial and cognitive inputs. In humans, cortisol is produced by the HPA system. Initially, stress causes the release of epinephrine from the adrenal medulla and norepinephrine (NE) from the sympathetic nervous system. Moments later, the control of cortisol production starts in the brain. The hypothalamus releases corticotropin-releasing hormone (CRH) into the bloodstream, which stimulates adrenocorticotropic hormone (ACTH) and beta-endorphin release from the anterior pituitary gland. ACTH then stimulates the secretion of cortisol from the adrenal cortex into the bloodstream. During stress, prolactin is also often released from the anterior pituitary and vasopressin is released from the posterior pituitary (Nelson, 2005), (Fig.1). Once in circulation, most of the cortisol is immediately binded to cortisol binding globulin (CBG). However, it is the unbound fraction of cortisol in circulation that is biologically active. The secretion of cortisol influences surrounding tissues and the functioning of receptors in the hippocampus and other brain areas (Bear, Connors, & Paradiso, 2001). The HPA stress responses are necessary for survival, allowing an individual to exist in physically and emotionally unprotected environments. A healthy stress response promotes adaptation and is

characterized by increases in cortisol, under situations of threat and its return to basal concentrations, when the threat has passed. Increases in cortisol lead to a rapid mobilization of energy to critical parts of the body from storage sites and inhibition of certain biological systems (disgestion, reproduction, immunity, growth), which functioning is very expensive and less necessary during emergency situations (Sapolsky, 1998).

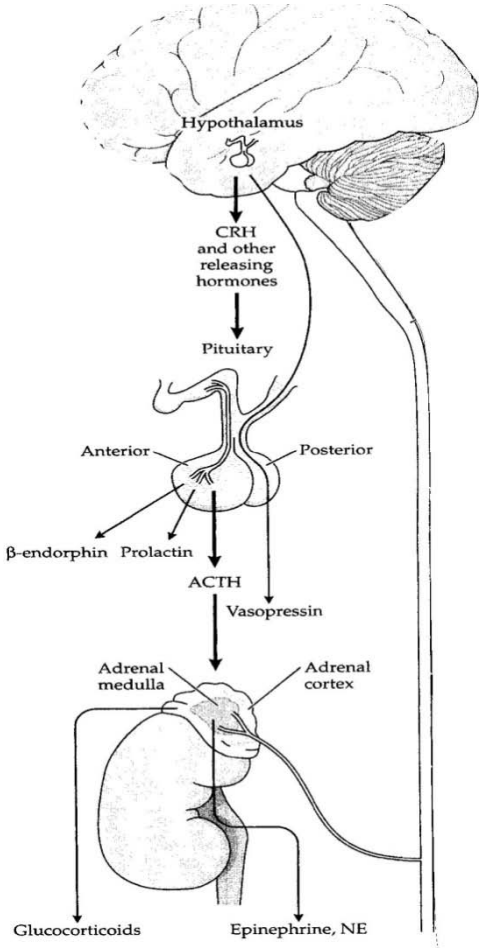

Fig.1 The HPA axis stress response (Nelson, 2005)

Emotion regulation and major phases of the HPA axis response

Emotion regulation and the HPA axis activity are related in a reciprocal way. In response to a stressor, the HPA axis follows certain major “phases” or “periods”, which correspond to time estimations and depend on various factors, such as the magnitude and rate

of the HPA response, as well as the perception and emotional interpretation of the stressful event, both in adults and in children. These phases are: (1) initial reaction; (2) preelevation; (3) fast-developing influences; (4) more slowly developing influences (Stansbury, & Gunnar, 1994).

In the “initial reaction” phase, psychological processes, such as the perception and interpretation of a stressful event, occur in some extent, before the stressor can activate the HPA stress response. If the event is perceived and interpreted as threatening, stress circuits in the hypothalamus and limbic system are activated. This phase corresponds only to the first moments after the individual is aware of the stressor.

The “preelevation” phase begins to occur 10 minutes following stress activation, when a set of physiological changes, such as increases in CRH, vasopressin an ACTH start to influence the central nervous system (CNS). Before these 10 minutes, the cortisol levels will still be at, or close to, basal concentrations. These physiological changes occur in order to sustain increased physical and psychological activity in the individual, such as a more complete emotional appraisal of the event or the access to emotion regulation processes and resources. These emotion regulation processes may either increase or decrease the activity in the limbic circuits, by influencing the continued appraisal of the stimulus either as more or less threatening.

The physiological and psychological processes that occur in these two initial phases, may not be enough to produce a significant cortisol stress response in subjects and to establish hormone-behaviour relationships.

During the “fast-developing influences” phase, which occurs 10-15 minutes after stress activation, cortisol has reached levels above basal concentrations and starts to have significant effects on CNS activity, which promote emotion-regulation. The first effects include increased energy and concentration; attention to changes in the environment; avoidance of threatening elements in the situation and increase of more adaptive behaviours. On the other hand, the experience of more adaptive behaviours diminishes distress and starts a physiological process of negative feedback, which influences the continued CRH-vasopressin an ACTH production that occurs at this time.

Finally, the “more slowly developing influences” phase occurs 20-30 minutes after stress activation and at least 15 minutes after cortisol has risen above basal concentrations. They include the slow negative feedback mentioned earlier and gene mediated effects and

usually take place after an acute stressor is over and the subjects have left the laboratory, in a research context. Slow effects may be important in understanding how emotion regulation strategies and experiences may change the individual's responses to future stressful events, because many of the gene-mediated effects influence memory and the integration of new information.

Emotion regulation and the HPA response: emotions related to activation and mediating strategies

In order to understand the reciprocal and psychobiological relationships between the HPA axis and emotion regulation, most of the work is done using mild stressors and brief situations, due to ethical reasons, both in children and in adults (Fox, Cahill, & Zougkou, 2010; van Bakel, & Riksen-Walraven, 2004). Moreover, most of the research done in emotion regulation and HPA axis addresses two questions: (1) which emotions activate the HPA stress response; (2) which emotion regulation strategies mediate this response (Lewis, & Ramsey, 2002; Schieche, & Spangler, 2005; Spangler, & Grossman, 1993).

Concerning the first question: *emotions related to the activation of the HPA stress response*, even though negative emotions have long been believed to be the main factors associated to the activation of the HPA response, research has shown that a rapid adaptation and habituation of the cortisol response, after repeated exposure to a psychological stressor, is highly characteristic in humans (Martí, & Armario, 1998; Wusta, Federenko, van Rossumb, Koper, & Hellhammer, 2005). For example, Gunnar, Connors and Isensee (1989) found that the newborn HPA stress response to two physical exams, separated by 24 hours, suffered a rapid habituation, showing decreases in the second trial, even though behavioural distress remained high. The same occurs in other species (Gunnar, Gonzales, Goodlin, & Levine, 1981), like rhesus monkey infants, separated from their mothers during a prolonged period of time. In these animals, cortisol levels returned to basal concentrations within 24 hours, while behavioural distress continued for several days. However, in response to more intense and threatening stressors, cortisol responses continue to increase, even after a first trial, when compared to less intense stressors. In fact, salivary cortisol of healthy human newborns, in response to repeated hell sticks (more intense stimulus) was higher, even after a second trial 24 hours later, than the response to repeated physical exams (less intense), (Gunnar, Herstsgaard, Larso, & Rigatuso, 1992). On the other hand, novelty, uncertainty, discrepancy and/or incongruity have also been considered the primary psychological elements associated with the HPA response. However, novel experiences occurring in positive contexts do not

elevate cortisol. In fact, pleasurable situations may even lower cortisol levels below basal concentrations. Babies between six and 13-months-old, lowered their cortisol levels below basal concentrations during first-time swimming classes with the mother (Hertsgaard, Gunnar, Larson, Brodersen, & Lehman, 1992). The main issue about uncertainty may not be the unfamiliarity of the event, but the uncertainty about one's ability and effectiveness in controlling the stressor or one's behavioural, physiological and emotional reactions to it. It seems that the violation of one's expectations and predictions creates a sense of uncontrollability over the events and leads to increases in cortisol, as way to improve one's adaptation through a rapid mobilization of energy (Peters, Godaert, Ballieux, van Vliet, Willemsen, Sweep, & Heijnen, 1998; Prince, & Anisman, 1990). Prediction seems to be extremely important to one's survival and adaptation, since it gives an animal time to prepare behavioral reactions, improve future choices, as well as to detect and manipulate the causal relationships of its interactions with the environment. In fact, dopaminergic neurons have been identified in the primate that seem to signal changes or errors in predictions of future rewarding events (Schulz, Dayan, & Montague, 1997).

The second main question addressed in research relates to which *emotion regulation strategies may mediate the HPA stress response*, that is, which behaviours initiated by the subject are capable of reducing negative emotions and sustain positive emotions and their associated physiological processes. According to Gunnar (1992) increases in cortisol levels are frequently correlated with children's active and appropriate coping efforts in response to potentially distressing situations. Some of the regulatory behaviours studied are: (1) control and predictability; (2) attention regulation; (3) self-soothing behaviours; (4) internalizing behaviour problems; (5) externalizing behaviours.

Control over stimulation and predictability, particularly, the perception or expectation of control, rather than the actual control it-self, is one of the most important factors influencing the HPA stress response (Pruessner, Gaab, Hellhammer, Lintz, Schommer, & Kirschbaum, 1997; Isowa, Ohira, & Murashima, 2003). Perceived control reduces elevations in cortisol in subjects during situations of very intensively negative stimulation, including loud noises (Bollini, Walker, Hamann, & Kestler, 2004; Hanson, Larson, & Snowden, 1976), exhausting physical exercise (Voigt, Ziegler, Grünert-Fuchs, Bickel, & Fehm-Wolfsdorf, 1990) and electric shocks (Abbott, Schoen, & Badia, 1984; Weiss, 1971), compared to situations where the subjects are exposed to the same stimulation, but do not believe they can control it. Controllability not only reduces elevations in cortisol during aversive contexts, but

also lowers its levels below basal concentrations in the presence of positive and pleasurable stimulation, including in children (Gunnar, 1980; Gunnar, Marvinney, Isensee, & Fisch, 1989). Older children suffering from phenylketonuria, who expressed more certainty about their ability to maintain self-control during treatments where repeated blood samples were taken, exhibited lower levels of cortisol and crying, than younger children, more uncertain about their emotional self-control (Gunnar, Marvinney, Isensee, & Fisch, 1989). In rats, the perception of control also buffers the HPA stress response. During the exposure to intermittent electric shocks, rats that were able to use a lever to decrease the rate of shocks, showed lower cortisol secretion than rats that received a shock whenever the first rat did, but could not control its frequency (Weiss, 1968).

Attention regulation is another regulatory strategy that seem to influence HPA activity. Research has shown that attention to relaxing and pleasant stimulation during non threatening contexts, lowers cortisol below basal levels, like watching nature ou funny films (Handlon, Wadeson, Fishman, Sachar, Hamburg, & Mason, 1962; Hubert, Möller, de Jong-Meyer, 1993); riding in the car, either awake or asleep (Larson, Gunnar, & Hertsgaard, 1991) or swim classes with the parent (Hertsgaard et al., 1992), in children.

Soothing behaviours, like self-grooming and rhythmic stroking, reduced the HPA stress response to intensively negative stimuli in rodents (Brett, & Levine, 1979). Maternal care (pup licking, grooming, arched-back nursing) influences hypothalamic-pituitary-adrenal (HPA) function in the rat through epigenetic programming of glucocorticoid receptor expression (Weaver, Cervoni, Champagne, D'Alessio, Sharma, Seckl, Dymov, Szyf, & Meaney, 2004). Animals who received a great deal of licking and grooming produced fewer stress hormones when dealing with a challenging or stressful situation than the rats who received less care (Liu, Diorio, Tannenbaum, Caldji, Francis, Freedman, Sharma, Pearson, Plotsky, & Meaney, 1997). The handling effect on HPA function persists throughout life. Moreover, the transmission of such individual differences in maternal behavior seem to pass from one generation of females to the next (Francis, Diorio, Liu, & Meaney, 1999).

Internalizing behaviour problems, like behavioural inhibition, social withdrawal, anxiety and fearfulness have been linked to HPA activity (McBurnett, Lahey, Frick, Risch, Loeber, Hart, Christ, & Hanson, 1991; Granger, Stansbury, & Henker, 1994). Kagan, Reznick and Snidman (1987), reported that extremely inhibited children showed higher home and laboratory salivary cortisol concentrations, than bold children. Afternoon basal cortisol concentrations were positively correlated with measures of internalizing behavior problems,

social problems and emotionality in a sample of young boys (Tyrka, Kelly, Graber, DeRose, Lee, Warren, & Brooks-Gunn, 2010). However, the relationships between behavioural inhibition and HPA activity seem to be mediated by social support and a willingness to take risks. Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss (1996) noted that fearful children only showed elevations in cortisol during the presentation of novel and arousing stimuli if they were insecurely attached to the parent present during the test. If the attachment relationship was secure, fearful children did not show any increase in cortisol.

Externalizing behaviours, like aggression or using outlets for frustration, are associated with buffering the HPA stress response in social contexts. Children showing the use of anger, aggression, hostility in a clinically significant way; externalizing behaviour patterns (Granger, Stansbury, & Henker, 1994) or conduct disorders (McBurnett, Lahey, Rathouz, & Loeber, 2000) in their social relationships (unless coupled with anxiety disorders), show significantly lower cortisol concentrations than any other children in response to novel social settings. However, for children who do not display externalizing behaviours in the clinical range and are developing in a normal way, peer conflict and aggression seems to activate the HPA response (McBurnett et al., 1991). Animal research has also shown that rats can lower or buffer their cortisol response to foot shock by using a reflexive kind of fighting that is elicited under stressful conditions (Connor, Vernikos-Danellis, & Levine, 1971). On the other hand, using outlets for frustration also diminishes the effects of stress. Rats that can chew on a piece of wood or attack another rat show relatively low glucocorticoid levels, after being shocked (Sapolsky, 1992).

Emotion regulation and HPA response in situations of fear, frustration/anger and positive affect

Research on individual differences in HPA reactivity in response to different emotional episodes is scarce, both in adults and in children. Moreover, only some few studies have directly compared HPA axis responses with different stress episodes in adults (Furlan, DeMartinis, & Schweizer, 2001) and in children (Lopez-Duran, Hajal, Olson, Felt, & Vazquez, 2009a). Neuroendocrine response has been studied as a characteristic of personality styles prone to frustration/anger (Sher, 2005) and fearful/inhibited temperament (Buss, Schumacher, Dolski, Kalin, Goldsmith, & Davidson, 2003). However, studies concerning cortisol reactivity in response to fear, frustration/anger and positive affect eliciting episodes are still limited.

Fear and neuroendocrine reactivity are related, particularly, when novelty and uncertainty are associated. Fearful responses involving novel and uncertain events result in cortisol increases (Gunnar, 1989), namely, during maternal separation episodes in nine-month-old (Gunnar, Larson, Herstgaard, Harris, & Broderson, 1992) and 18 month-old infants (Nachmias et al., 1996). The relationship between fear and cortisol seems to be enhanced by children's characteristics, namely temperament. In fact, children with a fearful/inhibited temperament show higher morning basal cortisol levels, than uninhibited ones (Schmidt, Fox, Schulkin, & Gold, 1999; Kagan, 1987). Three-year-old children with a fearful temperament also express a more frequent activation of the HPA axis in response to novel events that cause fear, like a stranger approach situation (Zimmerman, & Stansbury, 2004).

Several studies have examined the relationship between *frustration/anger* and HPA stress response in children. Some of them have found significant associations between high levels of peer ratings of aggression; conduct disorder (McBurnett, Lahey, Rathouz, & Loeber, 2000); hostility towards teachers (Oosterlaan, Geurts, Knol, & Sergeant, 2005); context inappropriate anger (Locke, Davidson, Kalin, & Goldsmith, 2009) and low morning cortisol levels in young boys (Van Goozen, Fairchild, Snoek, & Harold, 2007). However, some studies report that, in certain contexts, high levels of cortisol are associated with high levels of aggression, both in children (McBurnett et al., 1991), adolescents (McBurnett, Raine, Stouthamer, Loeber, Kumar, & Kuman, 2005) and in young adults (Gerra, Zaimovic, Avanzini, & Chittolini, 1997). Conflicting results may be associated to differences in aggressive tendencies, such as reactive and proactive aggression displayed by humans (Lopez-Duran, Hajal, Olson, Felt, & Vazquez, 2009b; van Bokhoven, van Goozen, van Engeland, Schaal, Arseneault, & Séguin, 2005) and non-human primates (Kalin, 1999a, b). There seems to be an overactive HPA-axis stress response associated with reactive aggression (defense and hypersensitivity to perceived threats), but no significant associations between proactive aggression (instrumental, goal oriented and planned) and cortisol (van Bokhoven et al., 2005). Reactive aggressive children showed higher cortisol reactivity than proactive and non-aggressive children, after being exposed to fear and frustration eliciting tasks. Reactive aggression also predicted total and peak post-stress cortisol in a significant way, regardless of the stress task, while proactive aggression was not a predictor of any cortisol index (Lopez-Duran, Hajal, Olson, Felt, & Vazquez, 2009b).

When it comes to differences in HPA activity in response to fear and frustration events, no significant differences were found in peak cortisol levels between the two stress

episodes in a sample of 73 seven year-old children. Children exposed to the fear condition reached peak cortisol levels at 25 minutes post-stress and those exposed to the frustration condition reached it at 45 minutes post-stress, which suggests the existence of a significant stress modality effect (Lopez-Duran, Hajal, Olson, Felt, & Vazquez, 2009a).

Finally, there are few studies concerning the neuroendocrine correlates of *positive affect*. Exposure to novel events in the mothers' presence that generally elicit positive affect, seems to decrease cortisol in infants (Gunnar, & Donzella, 2002). Infants who expressed more positive affect during two highly novel mother-infant swim classes and a more active engagement in the swim sessions, exhibited larger decreases in their cortisol levels (Herstsgaard et al., 1992). In adults, ecological momentary assessments (EMA) of happiness obtained four times during two working days, were inversely associated with early morning cortisol levels after waking, controlling for age, body mass index, and negative affect, in a sample of 72 healthy men. There was no significant relationship between positive affect and cortisol later in the day (Steptoe, Gibson, Hamer, & Wardle, 2007).

Emotion regulation and HPA stress response: relationships with attachment and temperament

Animal and human research suggests that the quality of early care and the formation of social ties, namely, the mother-infant attachment relationship, can be modelated by reciprocal and dynamic interactions between social experiences and different hormones, including cortisol. In humans, the release of cortisol by the HPA axis is also sensitive to variations in children's quality of care, especially for children whose temperament is characterized by a greater negative emotionality, particularly behavioural inhibition. These children are more likely to exhibit elevated levels of cortisol during challenging conditions, whenever the quality of care and maternal involvement are reduced (Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996; Zimmerman, & Stansbury, 2004). Dettling, Parker, Lane, Sebanc and Gunnar (2000), reported a significant correlation between levels of care and stimulation provided by the childcare provider and children's cortisol levels in home-based, center-based and "no out-of-home" (children not enrolled in full day) childcare. In this study there was a trend for lower concentrations of cortisol in the morning in home-based childcare to be associated with lower quality of attention and stimulation from the child provider. The authors also suggest that for children, activity of the HPA axis is sensitive to variations in the characteristics of their care settings, since lower mid-morning values of cortisol for the center-based childcare group were found, when compared to the other groups. This is present

probably due to the predictability and a more regimented pattern of daily activities in center-based settings.

When it comes to the quality of attachment relationships, children with a secure attachment do not exhibit increases in cortisol levels when the attachment figure is present, unlike the insecure ones, more likely to show increases in the presence of the attachment figure (Gunnar, Brodersen, Nachmias, Buss, & Rigatuso, 1996; Spangler, & Schieche, 1998). Insecurely disorganized infants showed significant cortisol increases, when compared to securely attached ones 15 minutes after a separation/reunion procedure from the mother (Strange situation), as well as significant differences between secure and insecure groups, 30 minutes after (Spangler, & Grossman, 1993).

Attachment security also seems to work as a buffer against stress. Children with higher behavioural inhibition reported higher post-session cortisol concentrations if they also had insecure relationships. On the other hand, inhibited but securely attached children did not show significant cortisol increases, nor did insecure children, low in inhibition. For insecure children, cortisol reactivity was higher for those with higher behavioural inhibition (Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996).

Maternal involvement and attachment quality are also related to children's cortisol responses, during challenging tasks of progressive difficulty that can only be resolved with the request for the mother's involvement. Low task orientation and exploration were correlated with high cortisol levels and low quality of maternal involvement. Insecure children's elevated cortisol was correlated with low task orientation, low help-seeking behaviour and high proximity seeking. Secure children showed no significant correlations between cortisol reactivity and behaviours during the task (Schieche, & Spangler, 2005).

Recent research in rodents and nonhuman primates has shown that early maternal separation contribute to persistent changes in neural circuitry involved in response to stress and emotions, leading to behavioural and neuroendocrine changes (Ladd, Huot, Thrivikraman, Nemeroff, Meaney, & Plotsky, 2000; Sanchez, Ladd, & Plotsky, 2001). In rodents, maternal separation has been associated with an increased response to stress (Higley, Hasert, Suomi, & Linnoila, 1991). Marmoset monkeys exposed to repeated maternal separation, exhibited a decrease of plasma cortisol during the early hours of the day (Dettling, Feldon, & Pryce, 2002). In humans, children victims of severe social deprivation, showed significantly lower early cortisol concentrations, when compared to children exposed to

healthy family environments (Carlson, & Earls, 1997). Many of these children who suffered abuse show elevated stress responses during adulthood (Heim, Newport, Heit, Graham, Wilcox, Bonsall, Miller, & Nemeroff, 2000), but low concentrations at awakening time (Heim, Newport, Bonsall, Miller, & Nemeroff, 2001). In cases of abuse, neglect or living in orphanages, children tend to exhibit a decrease in their cortisol levels and daily variability (Carlson, Dragomir, Earls, Farrell, Macovei, Nystrom, & Sparling, 1995; Hart, Gunnar, & Cicchetti, 1995).

The impact and effects of early experiences on the HPA stress response seem to extend themselves into adulthood, both in animals and in humans. Infant rats that experienced more prolonged maternal separations, exhibited greater anxiety, aggressiveness and decreased maternal care in adulthood, than the offspring exposed to brief separations or no separations at all (Boccia, & Pedersen (2001). In humans, subjects who suffered early loss experiences, particularly those who experienced a bigger number of losses before the age of 14, like parent's divorce or the death of someone dear, exhibited higher levels of cortisol during the day (Nicolson, 2004), reduced cortisol responses upon awakening time (Meinlschmidt, & Heim, 2005) and higher cortisol concentrations during the exposure to stressful situations (Luecken, 2000), when compared with individuals without the same life history. Some studies suggest that personal past histories may influence not only the individual's future stress responses, but also their offspring's. Sensitive mothers seem to be physiologically more in tune with their children's cortisol responses, showing significant correlations between their adrenocortical activity and their children's, unlike the less sensitive ones, during the performance of a challenging task for children (Sethre-Hofstad, Stansbury, & Rice, 2002). In fact, mothers' personal attachment history and representations influence and predict their children's attachment security in a significant and trans-generational way (Main, Hesse, & Kaplan, 2005; Grossmann, Grossmann, Fremmer-Bombik, Kindler, Scheuerer-English, & Zimmerman, 2002; Steele, Steele, & Fonagy, 1996; van IJzendoorn, 1995; Veríssimo, Monteiro, Vaughn, Santos, & Waters, 2005; Monteiro, 2007). However, studies relating mothers' attachment representations with their adrenocortical activity and their children's have not been done.

Objectives

The objective of this work is to study children's emotion regulation behavioural strategies and adrenocortical reactivity during episodes of fear, positive affect and frustration/anger in the context of mother-child dyads and its relationships with attachment

(children's secure base and mothers' attachment representations) and children's temperament. To our knowledge no studies have been done concerning mothers' adrenocortical responses after being exposed to their children in different emotional episodes or the relationships between their personal attachment representations and their cortisol responses. The assessement of cortisol responses in response to positive affect episodes has also been poorly studied. Moreover, this work was developed at naturalistic-settings (children's homes) and not at the laboratory, which may provide important insight to the understanding of children's emotion regulation and adrenocortical functioning during daily-life events, outside more controlled settings. It is our objective to unravel these issues.

We hypothesized that: (1) Children and mothers' HPA responses will vary as function of emotion-eliciting contexts (fear, positive affect, frustration/anger). During positive affect episodes, decreases in children and mothers' cortisol levels are expected. During negative affect episodes, increases in HPA stress response are expected during fear episodes, in both members of the dyad. However, during frustration/anger episodes, no significant differences in cortisol levels are expected, given that the episode was designed to elicit proactive anger and not reactive one (Lopez-Duran, Hajal, Olson, Felt, & Vazquez, 2009; van Bokhoven et al., 2005); (2) Children and mothers' HPA responses to different emotion-eliciting contexts will vary as function of children's attachment relationship quality. In particular, secure children and their mothers are expected to show lower cortisol levels after the exposure to negative affect/stressful (fear, frustration/anger) episodes, than insecure dyads; (3) Children and mothers' HPA stress responses will vary as function of mothers' personal attachment representations, given that mothers' personal attachment history and representations influence and predict their children's attachment security in a significant and trans-generational way (Main, Hesse, & Kaplan, 2005; Grossmann et al., 2002; van IJzendoorn, 1995; Veríssimo et al., 2005). In particular, secure mothers and their children are expected to exhibit lower cortisol levels after the exposure to negative affect/stressful (fear, frustration/anger) episodes, than insecure mothers and their offspring; (4) Children and mothers' cortisol levels will vary as function of children's temperament quality. In particular, children with more difficult temperament and their mothers are expected to exhibit higher cortisol concentrations after the exposure to negative affect episodes, than less difficult children and their mothers; (5) Children and mothers' cortisol responses will vary as function of children's emotion regulation strategies behavioural strategies, given that particular behaviours seem to mediate the HPA axis stress response (Schieche, & Spangler, 2005).

METHODS

Participants

Fifty-one mother/child dyads (26 boys and 25 girls), all Caucasian, from bi-parental families participated in the study. Children were between 18 and 26 months of age (*M* = 21.33; *S.D.* = 1.96). Twenty six (51%) of the children were firstborn. They started attending day-care between six and 24 months (*M*=7.53; *S.D.*=4.81) and spent between seven and 11 hours (*M* = 6.89; *S.D.* = 2.71) in day-care each weekday. Mothers' age ranged from 25-43 years (*M* = 33.64; *S.D.* = 4.10) and fathers' age from 26-55 years old (*M* = 35.88; *S.D.* = 5.86). Mothers' level of education ranged from nine to 19 years (*M* = 15.18; *S.D.* = 3.04) and fathers' from four to 19 years (*M* = 13.92; *S.D.* = 3.62). Ninety six percent of mothers were employed outside the home and all the fathers worked outside the home. Participants represented a range of socioeconomic status backgrounds, as reflected by parental education and were recruited from public and private daycare centers.

Measures

Emotion regulation paradigm: fear, positive affect, frustration/anger

The emotion regulation paradigm (Diener, & Mangelsdorf, 1999a), measured the behavioural strategies, emotional expressiveness and intensity exhibited by children during three episodes: positive affect, fear and frustration/anger, elicited by presenting the children three different toys. Each episode lasted for six minutes and had two distinct moments of three minutes each: (1) *mother constrained period* (mothers were instructed to refrain from initiating interaction with their children. If their children made bids for attention, mothers were instructed to respond to them with brief statements about the stimuli presented in each episode: "It's the dinosaur/piano/bear"); (2) *mother involved period* (mothers were instructed to be at ease with the child and the toy. Free behaviour was allowed, whatever they felt it was appropriate, according to their sensitivity). During the mother constrained period, if children showed 30 seconds of sustained high-intensity distress, mothers were instructed to become involved. If this situation happened during the mother involved periods, the episode was terminated. During fear contexts, four children exhibited 30 seconds of sustained high-intensity distress (three children during mother constrained periods and one during mother involved ones). During frustration/anger episodes, nine children expressed high-intensity distress (eight children during mother constrained periods and one during mother involved

periods). No sustained high-intensity distress was exhibited during positive affect episodes. All the episodes were videotaped.

Emotional stimuli

All stimuli used in this work were previously tested in a pilot test, which showed a varying emotional intensity in most children. In Diener and Mangelsdorf's original study (1999a) a battery-operated bouncing stuffed octopus that moved and made sounds was used to elicit fear and a large stuffed animal Big Bird was used during the frustration/anger episodes. However, after pilot testing we observed that stuffed animals caused no reaction in the children of this study. On the contrary, legos inside a movable toy did cause a high level of interest, enthusiasm and exploration. Therefore, during the frustration/anger episode, we presented children with a movable box with wheels, shaped in the form of a yellow bear, which contained coloured lego pieces inside. After the experimenter felt that the child was involved with the toy (two minutes on average), the experimenter took the toy away firmly and placed it out of reach but within the child's sight. The first moment of this episode only started after the removal of the object, even though the mother's behaviour was already constrained during the child's initial exploration. During fear episodes, a dinosaur toy with similar characteristics (elements of novelty, unpredictability and intrusiveness) to the battery-operated bouncing stuffed octopus present in Diener and Mangelsdorf work (1999a) was used to elicit fear. Finally, during the positive affect episode, children were given a toy piano that played music and created musical rhythms, similar to the one used by Diener and Mangelsdorf (1999a). Similar procedures for fear and frustration/anger episodes (but with different stimuli) were used in other studies (Diener, & Mangelsdorf, 1999a; Buss, & Goldsmith, 1998; Grolnick, Bridges, & Connell, 1995; Stifer, & Braungart, 1995).

Children behavioural strategies

Toddlers' behavioural strategies were divided into four domains (Diener, & Mangesdorf, 1999b): (1) *mother-related strategies* (proximity/contact seeking to mother; directing mother; fuss to mother; help seeking; information seeking; social referencing/looks to mother; engagement of mother); (2) *disengagement of attention strategies* (passive disengagement; distraction toward other object or person/active disengagement; leavetaking; avoidance); (3) *dealing with the stimulus strategies* (playing/exploring; resistance/control; labeling; problem solving; proximity to stimulus); (4) *redirection of action strategies* (tension release; self-soothing). During the course of our study, another set of behaviours was

observed, besides the ones proposed by Diener and Mangelsdorf (1999b). This one was coded under the name of "stranger", because it was characterized by behaviours directed at the strangers (experimenters) in the room during the sessions and it was placed in the "redirection of action strategies" domain (see appendix A).

Children's behavioural strategies were coded dichotomously on an occurrence/ non occurrence way, in 15 seconds intervals (1-occurrence; 0-non occurrence). Each three minute period had twelve 15 seconds intervals. The results for each strategy were summed for a total score. The possible range for each behaviour was from zero to 12, for each three minute period. If an episode was terminated because of child distress, scores were pro-rated on the basis of the number of intervals completed, by dividing the sums of the scores by the number of intervals completed and multiplying 12 (the total number of intervals possible), as proposed by Diener and Mangelsdorf (1999b).

Emotional expression

The predominant emotional expression showed by children during the three episodes was also coded. *Fear* was scored when the child expressed at least one of these facial features: eyebrows raised or drawn together; eyes wide; mouth open, corners straight back. *Positive affect* was scored when the child smiled or produced a positive vocalization (laugh). *Anger* was coded when the child showed at least one of the following: brows pulled back down or together; raised cheeks; straight or angular mouth or tight lips. A score of "neutral" was given when the child did not express any of these emotions and showed a neutral expression. These scores were not included in the analysis. Children's emotional expressions (1-positive; 2-anger/frustration; 3-fear; 4-neutral) were coded during the 15 seconds intervals.

Separate pairs of coders, blinded to the hypotheses, coded the three episodes. Inter-rater reliability was calculated using Cohen's Kappas (fear=.73; positive affect=.84; frustration/anger=.70). This coding system is similar to those used in other studies of children coping strategies (Diener, & Mangelsdorf, 1999b; Buss, & Goldsmith, 1998; Calkins, & Jonhson, 1998; Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996; Parritz, 1996).

Attachment behavior Q-set (AQS) (version 3.0)

The Attachment Behaviour Q-set (AQS), (Waters, 1995) evaluates the quality of the child's secure base behaviour towards the mother or other figures in an ecologically valid context, namely, the children's home. Secure-base behaviour is defined as a balanced and

harmonious organization between proximity towards the attachment figure and exploration behaviours in the environnment (Posada, Goa, Wu, Posada, Tascon, Schoelmerich, Sagi, Kondo-Ikemura, Haaland, & Synnevaag, 1995; Monteiro, 2007). The existence of the secure base phenomenon is not assumed by this technique, but its presence or absence is inferred from the profile (Posada, Goa et al., 1995). The AQS is a classification tool for systematic observation, based on the Q-Sort methodology, which provides a quasi-normal distribution of the data (Waters, Noyes, Vaughn, & Ricks, 1985). Like most of the Q-Sort, the AQS is completed by assigning items into categories, using a fixed distribution. The 90 items of this instrument are distributed by the observer on a scale of nine points, ranging from "extremely characteristic" to the "extremely uncharacteristic". The child's most characteristic items are placed in higher categories (9 - 7) and the less characteristic items are placed in the lower categories (3 - 1). The items that are neither characteristic nor uncharacteristic and/or items that were not observed are placed in the center of distribution (categories 6 - 4). Waters (1995) provided a criterion for security of attachment, which results from a compound of sorts done by experts (Waters & Deane, 1985). Children final attachment score is obtained through a Pearson correlation between the child's individual Q-sort and the security criterion value of the "ideal child". Thus, descriptions of individual children can be compared with the security criterion value of the "ideal child". This procedure allows us to obtain a value that reflects the degree of congruence between the individual and the criterion of the "ideal child". This correlation represents the place occupied by children on a security continuum. Children who are able to use the mother or other figure as a secure base receive a higher value, while the least able to do it, receive lower values. This value ranges between - 1.0 and 1.0. In most normative samples, security scores average about .35 (Bost, 2006).

Adult attachment representation narratives

The "Adult attachment representation narratives" (Waters, & Rodrigues-Doolabh, 2004) is an instrument developed to gain access and analyze adult secure base scripts and attachment representations in possible daily and anxious scenarios related with the attachment relationship (Monteiro, 2007). The attachment relationship is described in terms of a balance between proximity towards the caregiver and exploration behaviours, shown by the child or the adult. This balance is described by a sequence of events organized in an emotional and mental script called the secure base script, developed in early infancy and internalized by the individual across development, including adulthood (Posada, Goa et al., 1995; Monteiro,

2007). The secure base script is described by a series of events: (1) the individual's secure base (parent or partner) supports his/her exploration; (2) the secure base remains available and responsive in case of need; (3) a threatening conflict and obstacle appears, which leaves the individual feeling anxious and fearful; (4) the individual searches and looks for comfort in the secure base and/or the secure base searches for the individual; (5) the conflict and threat are resolved; (6) the proximity and the contact with the secure base comforts the individual in an effective way and helps him to deal with the resulting anxiety; (7) the individual returns to his initial activity or changes it in a tranquil way (Veríssimo, & Santos, 1999).

There are six narratives. In each one of them are presented four groups of suggestive words, developed to guide the production of the narratives (Waters, & Rodrigues-Doolabh, 2004). The first two, "Baby's morning" and "Doctor's office", are related with interactions adult / child, while "Joan and Peter's camping trip" and "Susan's accident" are related to interactions adult / adult (couple). "A walk in the park" and "One afternoon at the shopping center" are considered neutral, since they are not relevant to the secure base phenomenon and only exist for control purposes. The words presented in each story can trigger a number of different stories, developed around the secure base script (Waters, & Waters, 2006). The narratives are scored in a 7 point scale, indicating the extent to which the narrative is organized around the secure base script and the richness and detail of the relationship between the characters in the story (Monteiro, 2007). A final score summarizes both the presence and the quality of the script for each of narrative. The scores below 4 indicate a general lack of a secure base script. The lowest values (1 - 2) are reserved for stories that do not show a secure base script, but also have bizarre contents (e.g., the child who was hurt reassures her mother, who is upset with the wound). The values of 4 or above 7 indicate the presence of a secure base script. The highest values are assigned when the script is elaborate, reveals knowledge and sensitivity concerning the emotional state of others, reinterprets the meaning of the obstacle/conflict suggested by the group of words presented in a positive way and makes it a part of the relationship between the characters of the story (Monteiro, 2007; Waters, & Rodrigues-Doolabh, 2004; Waters, & Waters, 2006). The secure base script final score for each subject results from the mean of the scores of the four stories with a secure base content. According to Waters and Waters (2006), during the analysis and scoring of the narratives it should not be taken into consideration details about the language (e.g. verbal tenses or repetitions) and the veracity of the story (since all of them are fictional). More, inferences about the mental states of the subjects should be avoided, as well as psychodynamic

interpretations (Monteiro, 2007). Waters and Rodrigues-Doolabh (2001, in Monteiro, 2007) reported that the mothers' I.Q. is not significantly correlated with the secure base script scores, which means that this method does not measure the verbal skills of the subjects, in a significant way.

The Bate's Infant Characteristics Questionnaire (ICQ)

The ICQ (Bates, Freeland, & Lounsbury, 1979; Portuguese version by Soares, Rangel-Henriques, & Dias, 2009) is a 32-item temperament questionnaire for children, based on a seven point scale. The ICQ covers the following dimensions, based on the mother's perceptions: difficult; unstoppable; negative adaptation to change; dependent. The Cronbach's alphas obtained in the four dimensions were 0.82; 0.79; 0.73; 0.58, respectively (Carneiro, Magalhães, Dias, Baptista, Silva, Marques, Rouxinol, Rangel-Henriques, & Soares, 2010).

Children and mothers' salivary cortisol levels

Several studies have shown that salivary cortisol is a valid and reliable measure of cortisol concentrations in circulation, sampling only unbound fraction and being unaffected by flow rate, including in children (Kirschbaum, & Hellhammer, 1994; Schwartz, Granger, Susman, Gunnar, & Laird, 1998). The cortisol response was assessed from saliva, using Sarstedt's salivette kits in mothers and Salimetrics' sorbettes in children. No sugar crystals were used to stimulate more saliva. In the case of children, mothers were asked to introduce two sorbettes and move it around the children's mouth and under the tongue for 45 seconds to one minute, for each saliva collection. Mothers used gloves during children's saliva collection, in order to avoid contaminations. Sorbettes were then placed into labeled 2mL cryovials with the sponge side up (facing the cap), and frozen shortly after collection. In the mothers' case, we used salivette cotton rolls for about one minute during each collection, until they were soaked with saliva. All saliva samples were frozen at -80ºC within two hours after the collection. The samples were centrifuged (3000 rpm) at 10ºC, during 20 minutes. The assessment of cortisol was done by using luminoimmunoassay (LIA) kits. The mean intra and inter-assay coefficients of variation were 5,5% and 6,8% respectively.

Procedures

Mothers became aware of this work through an informed consent, left at their children's daycare. All the parents who respond affirmatively, were contacted by cell phone and the sessions were scheduled according to the mother and child's availability.

AQS home visits

The AQS home visits lasted between two to three hours and were scheduled with the mother in a time of day, when both were available and any other members of the family or friends were present at home. Parents were told that the purpose of the visit was to learn about both the child and mother's daily routine and interactions and they were asked to maintain their daily life activities unchanged. No behavioural restrictions were placed upon the dyads during observations. These were conducted by two observers who behaved as if they were social visits, participating in child's games when requested and talking informally with the mother. However, observers were trained not to disturb interactions in progress or interfere in domestic routines. When it became appropriate and following a conversation with the mother, questions about items that cannot be observed (e.g., item 10 refers to the child's behaviour during bedtime) or that were not observed during the visit (e.g., item 45 refers to the fact that the child likes to sing and dance to music) were asked about. After each observation, the observers distributed the AQS items in an independent way. The distribution of the 90 items was conducted in two stages. Initially, items were randomly divided into three groups: The first group is called the "characteristic behaviours", which is consistent with behaviours observed in children during the visit that are characteristic of the child's repertoire and around which the child's behaviour is organized. The second group, "behaviours that do not apply group", refers to those behaviours that were not observed or that were considered neither characteristic, nor uncharacteristic. The third group, the "uncharacteristic behaviour group", comprehends the behaviours that are opposite to the behaviours observed during the visit and that do not fit the child. Subsequently, the observers subdivided each of the three groups of cards into three new groups, so that each one stays with ten cards in a nine-point scale. In the first group, "the characteristic behaviours group", observers divided the cards into three subgroups, with 10 items each: the "extremely characteristic" (9), the "highly characteristic" (8) and "sufficiently characteristic "(7) sub-groups. Then, in the second group, "behaviours that do not apply", the observers divided the cards into three subgroups of 10 items each: the "uncharacteristic" (6), the "not applicable" (5) and the "little uncharacteristic" (4) sub-groups. Finally, the same procedure was done to the last group of cards, "uncharacteristic behaviour

group", which was divided into "sufficiently uncharacteristic" (3), "highly uncharacteristic" (2) and "extremely uncharacteristic" (1) sub-groups. The observers were trained under supervision, over a period of several weeks before the observations. The observers' agreement mean was .80. Individual Q-sorts, resulted from a mean between the descriptions of the two observers.

Emotion regulation paradigm

The emotion regulation episodes (fear, positive affect, frustration/anger) were videotaped in different days, usually during a period of two weeks, with a minimum of two days apart from each session, in order to avoid any emotional contamination from one episode to the other and to guarantee that each episode only aroused one emotion at the time. They all started at the same time (18:30), in order to control cortisol circadian rhythm or mood. The time chosen to start the experiments was late afternoon, because 96% of the mothers worked outside the home and finish their shift around 17:00. The episodes were videotaped at the family's house, always in the same room, the living room, because it present itself as the most spacious and neutral place of the house, without any other toys that could serve as a distraction from the stimuli. All the electric gears present (television set) were turned off during the sessions and only the child, the mother and two experimenters were present in the room. The stimuli were placed in the center of the room, to allow the children to explore freely. The three episodes were videotaped in a balanced way in order to control any order effect over the results.

Salivary cortisol collection

During each episode, children and mothers' salivary cortisol samples were collect two times, immediately before the episode (pre-session sample 1) and 30 minutes after the end of the session (post-session sample 2). Neutral and control samples were also collected by mothers a day before the beginning of the three episodes and at end of the three episodes, respectively, at 18:30 (sample 1) and 30 minutes after (sample 2).

RESULTS

Preliminary analyses

First, neutral and control samples were analyzed, in order to examine any possible effects of cortisol circadian rhythm (time of day) on children and mothers' adrenocortical

responses to the three emotional episodes. Moreover, we also wanted to test if the saliva collection procedure in children could, possibly, increase both children and mothers' cortisol levels in a significant way. In order to compare adrenocortical responses in neutral and control situations, difference scores, that is, cortisol delta levels (30 minute post-sample – pre-session sample) were computed for each child and mother. Several t-tests were conducted. In children, no significant differences were found for either neutral (t (11) = 0.27, $p > .05$) or control samples (t (13) = 0.01, $p > .05$). Moreover, no significant differences were found between neutral cortisol delta levels and control ones (t (11) = 0.23, $p > .05$). In mothers, significant differences were found between neutral samples ($M1$ = 1.12; $M2$ = 0.90; t (11) = 3.42, $p < .01$), but no differences were shown for control ones (t (13) = 0.34, $p > .05$). When we looked for differences between mothers' neutral and control cortisol delta levels, no significant differences were found between the two (t (11) = 1.01, $p > .05$). Thus, the time of day did not influence children's cortisol responses to the emotion regulation paradigm and children did not show a significant cortisol reactivity to the saliva collection procedure. However, mothers were probably very anxious to collect their first (neutral) saliva sample in children, showing a significant decrease in their cortisol levels, 30 minutes after the procedure. Nevertheless, the time of day did not influence their cortisol response to the three episodes, given that no significant differences were found between control samples.

No significant sex differences were found for children's attachment (AQS scores), (t (46) = 0.86, $p > .05$); children's temperament (ICQ scores), (t (46) = 0.22, $p > .05$) or emotion regulation strategies (F (1, 46) = 0.13, $p > .05$).

Finally, a regression analysis was undertaken in order to test attachment's trans-generational phenomenon from mothers to children. Children's AQS scores were used as dependent variable and mothers' total attachment scores in the Narratives were used as independent/predictor variable. Mothers' attachment representations predicted children's secure base behaviours in a significant way (F (1, 45) = 20.84, $p < .001$), ($\beta = -.57$, $p < .001$), $R^{2\ adjusted} = .31$.

Children and mothers' cortisol levels, during episodes of fear, positive affect and frustration/anger

Two repeated measures MANOVAs were undertaken to examine any significant differences between cortisol levels in the three episodes, as function of emotional episode and sampling moment, both for children and mothers. When the results were significant, relevant

differences were tested with planned contrast estimates analyses. We used two within-effects levels: episode (fear, positive affect and frustration/anger) and sampling moment (pre-session 1; post-session 2). Child gender served as between-effect or independent variable in the case of children's MANOVA. In children, the analysis revealed no significant main effects for emotional episode or sampling moment. However a significant interaction episode x sampling moment was found (F (2, 92) = 3.12, p = .05), showing that children's HPA axis response had a significantly different reactivity, according to the emotional episode experienced. No child gender effects were found.

Table 1

Means and standard errors for children's cortisol levels (ng/ml) as function of emotional episode (fear, positive affect, frustration/anger) and sampling moment (pre-session 1; post-session 2)

Episode	Pre-session		Post-session	
	M	S.E.	M	S.E.
fear	1.37	0.17	1.59	0.19
positive affect	1.44	0.15	1.15	0.09
frustration/anger	1.39	0.12	1.31	0.14

Planned contrast estimates analyses showed no significant differences between children's pre-session samples (see table 1). When it comes to differences between pre and post-session samples, during positive affect episodes (see table 1), children exhibited significant cortisol decreases (t (46) = 2.23, p < .05). No significant differences were found for fear or frustration/anger episodes.

When it comes to differences between episodes, significant differences were found between children's cortisol reactivity in response to fear and positive affect episodes (t (46) = 2.36, p < .05). Children's cortisol increased in response to fear episodes and decreased in response to positive affect episodes (see table 1). No significant differences between children's cortisol reactivity to fearful and frustration/anger episodes or between positive affect and frustration/anger episodes were found.

In the mothers' case, results showed a significant main effect for sampling moment, (F (1, 45) = 17.71, p < .001). No significant interactions between episode and sampling moment

was found, indicating that mothers' HPA axis reactivity did not differ significantly between episodes.

Table 2

Means and standard errors for mothers' cortisol levels (ng/ml) as function of emotional episode (fear, positive affect, frustration/anger) and sampling moment (pre-session 1; post-session 2)

Episode	Pre-session		Post-session	
	M	S.E.	M	S.E.
fear	1.12	0.1	0.95	0.08
positive affect	1.16	0.17	0.92	0.11
frustration/anger	1	0.08	0.85	0.05

Planned contrast estimates analyses showed no significant differences between mothers' pre-session samples (see table 2). After watching their children being exposed to different emotional episodes, mothers showed significant decreases from pre-session samples to the post-session ones, in fear episodes (t (45) = 2.86, $p < .001$); positive affect (t (45) = 2.51, p =.01) and frustration/anger episodes (t (45) = 2.12, $p < .05$), (see table 2).

Effects of attachment security (AQS) on children and mothers' cortisol responses, in episodes of fear, positive affect and frustration/anger

Two repeated measures MANOVAs were conducted to examine any possible significant differences in children and mothers' salivary cortisol responses as function of children's attachment security. We used two within-effects levels: emotional episode (fear, positive affect, frustration/anger) and sampling moment (pre-session 1; post-session 2). For use as independent factor, children's attachment security was dichotomized. The participants were grouped according to their scores on the AQS, into participants with secure (score ≥ 0.35) *versus* insecure (score < 0.35) attachment (Bost, 2006).

In children's case, we found no significant main effects for attachment security. However, a significant interaction episode x sampling moment x children's attachment security was found (F (2, 92) = 3.08, p = .05). In mothers, a significant main effect for sampling moment was found (F (1, 44) = 23.36, $p < .001$). Most importantly, a significant

main effect for children's attachment security (F (1, 44) = 6.06, $p < .05$) and a significant interaction sampling moment x children's attachment security (F (1, 44) = 4.81, $p < .05$) were also found.

Table 3

Means and standard errors for children's cortisol levels (ng/ml), as function of attachment security (secure *vs* insecure), emotional episode (fear, positive affect, frustration/anger) and sampling moment (pre-session 1; post-session 2)

	Secure attachment (n=31)				Insecure attachment (n=17)			
Episode	Pre-session (1)		Post-session (2)		Pre-session (1)		Post-session (2)	
	M	S.E.	M	S.E.	M	S.E.	M	S.E.
fear	1.23	0.13	1.80	0.22	1.25	0.18	1.09	0.30
positive affect	1.61	0.20	1.18	0.12	1.27	0.27	1.17	0.16
frustration/anger	1.38	0.18	1.37	0.30	1.64	0.24	1.73	0.40

Planned contrast estimates analyses revealed no significant differences between secure children's pre-session samples, except between fear and positive affect episodes, (t (46) = 2.02, $p < .05$), (see table 3). During fear episodes (see table 3), secure children showed significant increases in cortisol levels (t (46) = 2.90, $p < .01$). During positive affect episodes (see table 3), they exhibited a decrease (t (46) = 2.67, $p = .01$). No significant differences were found in frustration/anger episodes. Secure children's cortisol reactivity changed significantly between episodes. Significant differences were found between secure children's cortisol reactivity to fear and positive affect episodes, (t (46) = 4.17, $p < .001$). Secure children's cortisol increased in response to fear episodes and decreased in response to positive affect ones (see table 3). Significant differences were also found between children's cortisol reactivity to fear and frustration/anger episodes (t (46) = 2.05, $p = .05$). Secure children's cortisol increased in response to fear episodes and was non significant in response to frustration/anger ones (see table 3).

On the other hand, insecure children (see table 3) did not show any significant between pre-session samples or significant differences between pre and post-session samples in any of three episodes.

When it comes to differences between secure and insecure children, no significant differences between the two groups were found in pre or post-session samples, for any of the three episodes. However, significant differences were found between secure and insecure children's cortisol reactivity to fear episodes (t (46) = 2.22, $p < .05$). Secure children's cortisol variation increased in response to fear episodes and was non significant in insecurely attached ones (see table 3). No significant differences were found for positive affect or frustration/anger episodes.

Table 4

Means and standard errors for mothers' cortisol levels (ng/ml), as function of children's attachment security (secure *vs* insecure), emotional episode (fear, positive affect, frustration/anger) and sampling moment (pre-session 1; post-session 2)

	Secure attachment (n=30)				Insecure attachment (n=16)			
Episode	Pre-session (1)		Post-session (2)		Pre-session(1)		Post-session (2)	
	M	S.E.	M	S.E.	M	S.E.	M	S.E.
fear	0.97	0.12	0.89	0.10	1.31	0.17	1.03	0.14
positive affect	0.95	0.21	0.75	0.13	1.60	0.29	1.23	0.17
frustration/anger	0.81	0.09	0.74	0.06	1.37	0.12	1.07	0.08
total	0.91	0.12	0.79	0.08	1.43	0.16	1.11	0.11

Mothers of secure children (see table 4) showed no significant differences between pre-session samples or between pre and post-session samples, in any of the three episodes. Insecure children's mothers (see table 4), also did not show significant differences between episodes in their pre-session samples. However, during fear episodes, insecure children's mothers showed significant decreases in their cortisol levels (t (44) = 2.89, $p < .01$). Significant decreases in insecure mothers' cortisol levels were also found in response to positive affect (t (44) = 2.22, $p < .05$) and frustration anger (t (44) = 2.49, $p < .05$) episodes (see table 4).

When it comes to differences between mothers of secure and insecure children (see table 4) in pre-session samples, insecure children's mothers showed significantly higher cortisol levels, than mothers of secure children, in frustration/anger episodes, (t (44) = 3.56, $p < .001$). No significant differences were found for fear or positive affect episodes. Moreover,

on average and across the three episodes, insecure children's mothers showed significantly higher cortisol concentrations in pre-session samples, than mothers of secure children (t (44) = 2.55, p = .01), (see table 4). In post-session samples, insecure children's mothers showed significantly higher cortisol concentrations, than mothers of secure children (t (44) = 2.21, p < .05) in positive affect episodes, (see table 4). Insecure children's mothers, also exhibited significantly higher cortisol concentrations, than mothers of secure children (t (44) = 3.27, p < .01) in frustration/anger episodes (see table 4). No significant differences were found for fear episodes. Moreover, totally and across the three episodes, insecure children's mothers showed significantly higher cortisol concentrations in post-session samples, than mothers of secure children (t (44) = 2.21, p < .05), (see table 4).

Finally, when it comes to differences in cortisol reactivity between mothers of secure and insecure children, no differences were found between the two groups in any of the three episodes if analyzed independently. However, totally and across the three episodes, insecure children's mothers showed a significantly higher decrease in cortisol variation in response to the emotion regulation paradigm, than mothers of secure children, (t (44) = 2.19, p < .05), (see table 4).

Effects of mothers' attachment representations (Narratives) on children and mothers' cortisol responses, in episodes of fear, positive affect and frustration/anger

Two repeated measures MANOVAs were conducted to examine any possible significant differences in salivary cortisol responses as function of mothers' attachment representations, both in children and in mothers. We used two within-effects levels: emotional episode (fear, positive affect, frustration/anger) and sampling moment (pre-session 1; post-session 2). For use as independent factor, mothers' attachment representations were dichotomized. Mothers were grouped according to their total results on the "Adult attachment representation narratives", into participants with secure (score≥ 3.5) *vs* insecure (score < 3.5) attachment representations (Waters, & Rodrigues-Doolabh, 2004; Waters, & Waters, 2006).

In the case of children's cortisol responses, a significant interaction episode x sampling moment was found (F (2, 88) = 4.47, p = .01), as well as a marginal significant interaction episode x sampling moment x mothers' attachment representations (F (2, 88) = 2.86, p = .06).

When it comes to mothers' cortisol responses, a significant main effect for sampling moment was found (F (1, 42) = 11.47, p = .001) and, most importantly, a significant

interaction sampling moment x mothers' attachment representations (F (1, 42) = 7.66, $p < .01$) was also found.

Table 5

Means and standard errors for children's cortisol levels (ng/ml), as function of mothers' attachment representations (secure *vs* insecure), emotional episode (fear, positive affect and frustration/anger) and sampling moment (pre-session 1; post-session 2)

Episode	Secure attachment (n=17)				Insecure attachment (n=29)			
	Pre-session (1)		Post-session (2)		Pre-session (1)		Post-session (2)	
	M	S.E.	M	S.E.	M	S.E.	M	S.E.
fear	0.95	0.3	1.66	0.33	1.61	0.23	1.57	0.26
positive affect	1.39	0.27	0.94	0.16	1.46	0.21	1.29	0.12
frustration/anger	1.42	0.21	1.37	0.23	1.34	0.16	1.22	0.18

Planned contrast estimates analyses revealed no significant differences between the pre-session samples of children with secure mothers (see table 5). However, they exhibited a significant increase in their cortisol levels from pre to post-session samples during fear episodes (t (44) = 2.30, $p < .05$) and a significant decrease during positive affect ones (t (44) = 2.07, $p < .05$). No significant differences were found for frustration/anger episodes. Children with secure mothers showed significant differences between episodes in cortisol reactivity, namely between fear and positive affect episodes and between fear and frustration/anger ones. Children with secure mothers showed an increase in cortisol in response to fear episodes and a decrease in response to positive affect ones (t (44) = 3.21, $p < .01$), (see table 5). On the other hand, they showed a significant increase in response to fear episodes and a non significant variation in response to frustration/anger episodes (t (44) = 2.01, $p = .05$), (see table 5).

Children with insecure mothers (see table 5) did not show significant differences between pre-session samples or between pre and post-session samples in any of the three episodes. No significant differences between episodes were found.

When it comes to differences between children with secure and insecure mothers (see table 5), no significant differences were found between the two groups, either in pre or post-

session samples. Moreover, no significant differences were found in cortisol reactivity, between children with secure and insecure mothers, in any of the three episodes.

Table 6

Means and standard errors for mothers' cortisol levels (ng/ml), as function of mothers' attachment representations (secure *vs* insecure), emotional episode (fear, positive affect and frustration/anger) and sampling moment (pre-session 1; post-session 2)

Episode	Secure attachment (n=16)				Insecure attachment (n=28)			
	Pre-session (1)		Post-session (2)		Pre-session (1)		Post-session (2)	
	M	S.E.	M	S.E.	M	S.E.	M	S.E.
fear	0.92	0.18	0.93	0.14	1.20	0.13	0.92	0.11
positive affect	0.92	0.30	0.76	0.18	1.29	0.23	1.01	0.14
frustration/anger	0.77	0.14	0.85	0.09	1.13	0.10	0.86	0.07
total	0.87	0.17	0.84	0.12	1.21	0.13	0.93	0.09

Secure mothers (see table 6) showed no significant differences between pre-session cortisol samples or between pre and post session samples, in any of the three episodes. Insecure mothers (see table 6), also did not show any significant differences between their pre-session samples. However, they exhibited a significant decrease in their cortisol concentrations from pre to post session samples, during fear (t (42) = 3.75, $p < .001$), positive affect (t (42) = 2.24, $p < .05$) and frustration/anger (t (42) = 3.03, $p < .01$) episodes (see table 6). In total and across the three episodes, insecure mothers also showed a decrease in their cortisol levels (t (42) = 5.10, $p < .001$). No significant differences were found between episodes in insecure mothers.

When it comes to differences between secure and insecure mothers, no significant differences were found between the two groups in cortisol pre or post-session samples. Finally, when it comes to mothers' cortisol reactivity to the three episodes (see table 6), significant differences were found. During fear and frustration/anger episodes, insecure mothers showed a decrease in cortisol variation in both situations (t (42) = 2.31, $p < .05$; t (42) = 2.31, $p < .05$, respectively), while secure mothers exhibited non significant changes. No significant differences were found between the two groups in positive affect episodes. In total and across the three episodes, insecure mothers showed a decrease in cortisol variation in

response to the emotion regulation paradigm (t (42) = 2.77, p < .01) and secure mothers showed non significant changes.

Relationships between children's temperament (ICQ) and children and mothers' cortisol responses

In order to assess relationships between children's temperament quality and their adrenocortical activity, as well as their mothers' during the three episodes, correlation analyses were conducted. No significant Pearson correlations were found between children and mothers' cortisol delta levels and children's ICQ temperament scores in any of the three episodes.

Biobehavioural relationships: toddlers' emotion regulation strategies and adrenocortical activity in children and mothers

In order to investigate biobehavioural relationships, correlation analyses were conducted between toddlers' behavioural strategies and children and mothers' cortisol delta levels, as function of children's attachment (secure *vs* insecure), mothers' condition (constrained and involved) and emotional context (fear, positive affect and frustration/anger). Children's emotion regulation strategies were organized in four types: mother related; disengagement of attention; dealing with the stimulus; and re-directed action strategies (Diener, & Mangelsdorf, 1999b), (see Measures). Each type was composed by several behavioural strategies. Mean results were computed among the strategies of each type. Significant correlations between cortisol delta levels and children's strategy type and individual strategies are presented below.

Secure children showed significant correlations between their cortisol delta levels, in all three episodes, particularly, when the mothers' behavior was involved. During fear episodes, secure children's cortisol was associated with "fussing to mother" strategies (r = 0.48, p = .01). On the other hand, cortisol was inversely related to dealing with the stimulus strategies (r= -0.43, p < .05) namely, "proximity to stimulus" (r = -0.49, p = .01) and positively associated with re-directed action strategies (r = 0.43, p < .05) namely, "self-soothing" (r = 0.41, p < .05), during mother involved periods. During positive affect episodes, when the mothers' behaviour was involved, secure children's cortisol was inversely associated with "fussing to mother" (r = -0.60, p = .001) and "leavetaking" (r = -0.62, p < .001) strategies. Finally, during frustration/anger episodes, secure children's cortisol was positively related to re-directed action strategies (r = 0.47, p = .01) namely, "self-soothing"

behaviours, both when the mothers' behaviour was constrained (r = 0.40, p < .05) and involved (r = 0.48, p < .01).

On the other hand, insecure children showed no significant correlations between their cortisol reactivity and behavioural strategies, during fear episodes. During positive affect episodes, insecure children's cortisol was inversely associated with "looking to mother" (r = -0.55, p < .05) and "playing/exploring" (r = -0.56, p < .05) behaviours, when the mother was constrained. When the mother was involved, insecure children's cortisol was inversely associated with "engaging of mother" (r = -0.55, p < .05) and behaviours towards the "stranger" (r = -0.57, p < .05). Finally, during frustration/anger episodes, insecure children's cortisol was associated with "fussing to mother" (r = 0.77, p < .001); "distraction" (r = 0.72, p < .01) and "leavetaking" (r = 0.55, p < .05) behaviours and inversely related to "playing/exploring" (r = -0.54, p < .05) and "proximity to stimulus" (r = -0.60, p = .01) strategies, when the mothers' behaviour was involved.

Mothers of secure children showed significant correlations between their cortisol delta levels and children's behavioural strategies in all three episodes, both when their behaviour was constrained or involved. During fear episodes, mothers of secure children showed a significant association between their cortisol levels and their children's "leavetaking" strategies, when the mothers' behaviour was constrained (r = 0.38, p < .05). On the other hand, when the mothers' behaviour was involved, their cortisol was associated with their children's "distraction" behaviours (r = 0.38, p < .05). During positive affect episodes, mothers of secure children showed significant correlations between their cortisol and their children's mother-related behaviours (r = 0.43, p < .05) namely, "fussing to mother" (r = 0.38, p < .05) and "engagement of mother" (r = 0.44, p < .05), when the mothers' behaviour was constrained. When mothers of secure children were involved, their cortisol response was associated with their children's re-directed action strategies (r = 0.40, p < .05), namely behaviours towards the "strangers" (r = 0.42, p < .05). Finally, during frustration/anger episodes, mothers of secure children showed significant correlations between their cortisol response and their children's "avoidance" behaviours (r = 0.48, p < .01) and negative associations with their children's mother-related strategies (r = -0.45, p = .01) namely, "directing mother" (r = -0.39, p < .05) and "engagement of mother" (r = -0.43, p < .05), when mothers were constrained. Moreover, significant correlations were found between their mothers' cortisol and their children's "tension-release" strategies, both when mothers were constrained (r = 0.67, p < .001) and involved (r = 0.38, p < .05).

On the other hand, mothers of insecure children, during fear episodes, showed a negative correlation between their cortisol response and their children's "passive disengagement of attention" strategy (r = -0.56, p < .05), when the mothers' behaviour was constrained. During positive affect episodes, mothers' cortisol was inversely associated with their insecure children's "problem solving" behaviours, during mother involved periods (r = -0.63, p < .01). Finally, during frustration/anger episodes, mothers of insecure children showed negative associations between their cortisol response and their children's "leavetaking" behaviours, both during mother constrained (r = -0.74, p < .01) and involved (r = -0.53, p < .05) periods.

DISCUSSION

The present study examined children's emotion regulation behavioural strategies and adrenocortical responses in situations of fear, positive affect and frustration/anger in the context of mother-child dyads and possible relationships with attachment (children's secure base and mothers' attachment representations) and children's temperament. This study is important to the understanding of the reciprocal and psychobiological relationships between emotion regulation and adrenocortical activity, in the context of child development, stress and health care research. We tried to assess these issues, by addressing (1) which emotions are related to the HPA axis activation in response to everyday life events in children and in mothers; (2) relationships between attachment, temperament and adrenocortical activity both in children and in mothers; (3) which behavioural strategies may mediate the cortisol response to different emotional contexts, in naturalistic settings.

Emotions related to the activation of the HPA axis stress response

Like in previous studies, overall, children and mothers' adrenocortical activity showed significant differences after the exposure to different emotion-eliciting contexts (fear, positive affect and frustration/anger). Children's cortisol response showed a significant decrease after the engagement in positive affect activities with the attachment figure. This result is similar to other studies, which reported that novel experiences occurring in positive affect contexts do not elevate cortisol. In fact, pleasurable activities may even lower cortisol levels, especially if done in the mothers' presence (Hertsgaard et al., 1992; Gunnar, & Donzella, 2002). No significant differences were found in children' cortisol levels in response to either fear, or frustration/anger episodes. Other studies have also failed to report cortisol elevations to midly

threatening or distressing events, by the end of the first year until 18 months (last age tested), (Gunnar, & Nelson, 1994; Gunnar, & Donzella, 2002; Gunnar et al., 1996). This might have happened due to the developmental maturation of the HPA system, which results in a glucocorticoid hyporesponsive period in response to stressors, present over the first year of life, both in children (Larson et al., 1998; Gunnar, Broderson, Krueger, & Rigatuso, 1996; Gunnar, & Donzella, 2002) and in rodents (Rosenfield, Suchecki, & Levine, 1992). However, children's cortisol showed a tendency to increase after fear episodes and a slightly tendency to decrease, after frustration/anger episodes. Cortisol increases in response to fearful events, involving novel and uncertain events have also been reported (Gunnar, 1989; Gunnar et al., 1992; Zimmerman, & Stansbury, 1994). On the other hand, externalizing behaviours, like aggression or showing the use of anger are associated with buffering the HPA stress response in social contexts (Stansbury, & Gunnar, 1994), both in children (Granger, Stansbury, & Henker, 1994) and in rodents (Connor, Vernikos-Danellis, & Levine, 1971; Sapolsky, 1992), since it gives individuals some sort of control over the environment. Moreover, children's non significant cortisol responses to frustration/anger episodes, could be associated with the proactive aggression tendencies (instrumental and goal oriented: to get the toy back), shown by children during this episode. These results are similar to other works (van Bokhoven et al., 2005; Lopez-Duran et al., 2009b), that found no significant associations between proactive aggression and cortisol, but reported an overactive HPA-axis stress response associated with reactive aggression (defense to threats). Children's cortisol reactivity also showed significant differences between the emotional contexts experienced. Differences were found between fear and positive affect episodes. In fear episodes, children's cortisol levels showed a tendency to increase, when compared to positive affect episodes, where cortisol concentrations decreased significantly. No significant differences were found between children's cortisol reactivity to fearful and frustration/anger episodes or between positive affect and frustration/anger episodes. These results suggest the existence of a differential stress modality effect for frustration/anger contexts in comparison to fear episodes, reported by Lopez-Duran et al. (2009a). These authors found out that children exposed to frustrating conditions only reached cortisol peak levels 45 minutes post-stress, when compared to fear conditions, where they reached peak 25 minutes post-stress. Since post-session samples were collected 30 minutes after the ending of the episodes in our study, it might have been that children's cortisol peak levels to frustrating events were still not possible to register. The authors also did not find differences between cortisol responses to fear and anger situations.

In the mothers' case, after watching their children being exposed to three different emotional contexts (positive and negative), significant decreases in their cortisol levels were registered. It might have been that the mothers' expectations about what would happen during the episodes, increased their levels of stress and cortisol concentrations prior to the session. During the course and after the episodes have occurred, mothers might have developed a perception of control over the events, which led to a decrease in their distress and adrenocortical response. Control over stimulation and predictability, particularly, the perception or expectation of control has been associated to decreases in cortisol in subjects during situations of negative stimulation (Hanson, Larson, & Snowden, 1976; Weiss, 1971), or pleasurable stimulation (Gunnar, 1980; Gunnar, Marvinney, Isensee, & Fisch, 1988), when compared to subjects exposed to the same situations that do not believe they can control it. In this sense, mothers' HPA axis seemed to respond not so much to the emotional nature of the context to which children were exposed to, but, most likely, to the perception of control over possible threatening events that might represent a menace to their children's safety. These results are in conformity with the assumption that the main issue about uncertainty, may not be the unfamiliarity of the event, but the uncertainty about one's ability and effectiveness in controlling the stressor or one's behavioural, physiological and emotional reactions to it (Peters et al., 1990). Control perception over stimulation may increase through the engagement of behavioural regulatory strategies, capable of reducing negative emotions, sustaining positive ones, as well as their associated physiological processes, such as social support, namely the attachment relationship.

Relationships between adrenocortical activity and attachment quality

Our results showed that, overall, children and mothers' adrenocortical responses to different emotional contexts, either positive or negative (fear and frustration/anger), seemed to be significantly influenced by the quality of their attachment relationship. These findings are similar to other research work, which also reported that social support is an important regulatory mechanism in modulating the HPA response to life stressors, in adults and in children (Loman, & Gunnar, 2010; Gunnar et al., 1992) and that cortisol release is sensitive to variations in the quality of children's care and attachment relationship (Detling, Parker, Lane, Sebanc, & Gunnar, 2000; Nachmias et al., 1996). In this study, secure children showed significant increases in their cortisol levels after fear episodes and significant decreases, after positive affect ones. No significant changes were found for frustration/anger episodes. Moreover, significant differences in secure children's cortisol responses were found between

fear and positive affect episodes and between fear and frustration/anger ones. On the other hand, insecure children's HPA axis did not show any significant differences in its reactivity, after the exposure to the three different emotional contexts, either positive or negative. These findings are not similar to other works (Splangler, & Grossman, 1993; Gunnar et al., 1996; Spangler and Schieche, 1998), which showed that securely attached children do not exhibit increases in their cortisol levels, unlike insecure ones, more likely to show increases. These authors reported that attachment security works as a buffer against stress. On the contrary, our results suggest that insecure attachment may be related to HPA axis suppression to challenging (fear and frustration/anger) and positive emotional contexts in insecure children, due to past and continuous rejection experiences with the attachment figure, which may have cause habituation of the adrenocortical stress response. In fact, even though negative emotions have been associated with the activation of the HPA response, research has shown that a rapid adaptation and habituation of the cortisol response, after repeated exposure to a psychological stressor is highly characteristic in humans, namely children (Gunnar, Connors, & Isensee, 1989; Gunnar et al., 1992; Gunnar, 1992) and in other animals, such as rhesus monkey infants (Gunnar, Gonzales, Goodlin, & Levine, 1981). In fact, insecure children tend to show a suppressive or minimizing emotional and behavioural expression style, when compared to securely attached children, characterized by what seems a neutral behaviour, not showing overt distress during negative contexts or pleasure on reunions (Lutkenhaus, Grossman, & Grossman, 1985; Spangler, & Grossman, 1993; Malatesta, Culver, Tesman, & Shepard, 1989). According to Bowlby (1980), the minimization of emotions and masking effect have an adaptive and regulatory effect, by reducing rejection experiences and the fear of being alienating the parent and being abandoned. On the other hand, securely attached children tend to show an "open and flexible emotion expression style", characterized by a coherent demonstration of expressions of joy during pleasurable situations and the experience of negative emotions, during stressful events (Cassidy, 1994), which may explain the significant cortisol increases during fear episodes and decreases, during positive affect ones. This open communication style occurs in secure children because, unlike insecure children, a sensitive and ameliorative response is expected by the attachment figure (Cassidy, 2008). Experiencing events fully, either behaviour or physiologically, may help children to signal their mothers about their emotional and physiological states in a more effective way and increase their regulation and sense of well being.

Mothers' adrenocortical response, after watching their children being exposed to different emotional contexts, also seemed to be influenced by the quality of the mother-child attachment relationship. Mothers of secure children did not show any significant differences in their adrenocortical responses after the episodes, probably, because of a higher perception of control over the events, built on past secure attachment experiences, characterized by children's cooperation and mothers' effectiveness (Cassidy, 1999; Bowlby, 1980; Bretherton, 1990). On the contrary, insecure children's mothers did show significant decreases of their cortisol levels after positive and negative episodes (fear and frustration/anger), and, on average, significantly higher cortisol concentrations in pre-session samples, than mothers of secure children. It seems that insecure children's mothers were more distressed with the possibility of exposing themselves and their children to different emotional contexts than mothers of secure children, probably because of a diminished perception of control over the events, based on frustrating past experiences with their children (Cassidy, 1994; Bowlby, 1980; Bretherton, 1990).

Attachment relationships seem to influence children and mothers' adrenocortical stress responses to challenging and positive emotional contexts in a trans-generational way, through mothers' personal attachment representations, built in the past with their own attachment figures. In this study, results showed that mothers' attachment representations not only predicted their children's attachment quality, but also influenced their own cortisol responses, as well as their children's (in a marginal significant way). Attachment relationships' trans-generational pattern is characterized by a strong association between the parents' attachment representations and their children's attachment relationship quality (Main, Hesse, & Kaplan, 2005; Grossmann, Grossmann, Fremmer-Bombik, Kindler, Scheuerer-English, & Zimmerman, 2002; Steele, Steele, & Fonagy, 1996; van IJzendoorn, 1995; Veríssimo, Monteiro, Vaughn, Santos, & Waters, 2005; Monteiro, 2007). Based on their past positive experiences with their own attachment figures, secure mothers show a higher sensitivity to their children's signs in case of distress and motivation for physical or emotional closeness, during play (Main, Hesse, & Kaplan, 2005). In fact, the results showed that secure mothers' cortisol responses did not show any significant changes after the exposure to any of three episodes, probably due to a strong perception of control and effectiveness over the events, based on their personal past secure attachment experiences. On the other hand, children of secure mothers did, showing significant cortisol increases after fear episodes and cortisol decreases after a positive affect one, probably, because a sensitive and ameliorative response

to their signals and physiological state was expected by the attachment figure, either during negative or positive contexts (Cassidy, 1994; 1999; 2008). Insecure mothers exhibited significant decreases in their cortisol concentrations, after being exposed to their children in contexts of fear, positive affect and frustration/anger. It seems that insecurely attached mothers might have been distressed about the events prior to the sessions, due to personal past attachment experiences, which might have diminished their perception of effectiveness and security in controlling events. On the other hand, children with insecure mothers did not show any significant cortisol changes after the exposure to any of the three episodes, probably due to a suppression of the HPA stress response, caused by past continuous rejection experiences with the attachment figure. In fact, insecure mothers show more difficulties in understanding correctly their children's communication signs, either by distorting or blocking them, which causes them to behave in a rejecting and/or unpredictable way towards their children (Hesse, 1999; van IJzendoorn, 1995; Main, Hesse, & Kaplan, 2005).

Finally, results also suggested social support (mothers' involvement), but mostly, attachment security may mediate the relationship between children and mothers' adrenocortical responses and the behavioural regulatory strategies used by children during challenging and positive affect situations. Our findings showed that in secure children, the relationship between their cortisol responses and their behavioural strategies is mostly present when the attachment figure's behaviour is involved and during fear episodes. On the other hand, insecurely attached children showed no relationships between their coping behaviours and adrenocortical responses during fear episodes, either when the mothers' behaviour was constrained or involved. These results clearly show that maternal support, either through a secure attachment, or involved behaviour, has a significant influence on children's adrenocortical responses, particularly, during fearful episodes, when their survival perception is threatened. The mother seems to provide a secure base for children to approach and explore novel stimuli, since a sensitive and effective response, capable of having a soothing effect on children's adrenocortical stress responses, is expected when needed. On the other hand, continuous exploration of novel and fearful objects in the presence of an insensitive caregiver, may lead to the suppression of the HPA axis, which diminishes children's communication and physiological signs to their mothers about their internal states and needs, as well as their coping abilities.

Mothers' adrenocortical reactivity was also significantly influenced by their children's regulatory behavioural efforts, particularly in secure dyads, since more significant correlations

were found in mothers of secure dyads, than in insecure ones'. Independently of their children's attachment quality, mothers' cortisol reactivity was significantly more influenced by their children's behaviour, when they were constrained and their perception of control over the events was diminished, than when they were involved.

On the contrary to all the other studies on toddlers' emotion regulation strategies during challenging contexts (Diener, & Mangelsdorf, 1999a; Parritz, 1996; Buss, & Goldsmith, 1998) and on relationships between adrenocortical activity and attachment quality (Gunnar et al., 1996; Spangler, & Schieche, 1998; Spangler, & Grossman, 1993) this work was developed at the children's homes and not at the laboratory. Differences between naturalistic *versus* controlled settings may play an important role in the differences found between the results of this study and the ones reported in others. Insecure children in this study did not exhibit cortisol elevations in any of the three episodes, including the negative affect ones. On the contrary, past research reported that insecure attachment was associated with an increase in children's HPA axis activity and higher cortisol levels, compared to secure children. The results of this study suggest that past results on insecure children's increased adrenocortical stress responses, may be a associated with being on a strange controlled environment (laboratory), rather than with attachment quality alone.

In conclusion, the findings of this study contribute to the understanding of the complex, reciprocal and dynamical relationships between the biological and behavioural expressions of emotion. The regulation of emotions, either positive or negative, stress responses and physiological processes associated with emotional experience in everyday life events, is an extremely important task, since it helps us to achieve our immediate or long-term goals and promote our adaptation and sense of well being. Children develop regulatory efforts since early age, showing significant associations between their behaviours and adrenocortical stress responses to challenging or positive affect episodes. In this developmental and life-long quest for regulation, social support, namely, mothers' involvement, but particularly, the quality of the attachment relationship, have a crucial and significant role in biobehavioural organization since early infancy. This study suggests that secure attachment provides more flexibility in exploring, experiencing and coping with stressors, while insecure attachment seems to be associated with a suppression of the HPA axis stress response, probably due to continuous past rejection experiences with the attachment figure. From a coping point of view, experiencing significant cortisol reactivity during fearful or positive affect episodes, in the context of a sensitive caregiver may be a sign of emotion regulation and well being, since

it not only shows the existence of a strong sense of security to approach and explore events more intensely, as it provides extra communication and physiological signs to the mother, about children's internal and biological states. On the other hand, insecure children's HPA axis suppression, does not allow them to signal their mothers about their internal needs, which is a consequence of an insecure attachment, where a sensitive maternal response is not expected.

In future studies it would be very interesting to study possible gene-mediating effects associated with emotion regulation, since these ones may help us to understand how emotion regulation strategies and experiences may change the individual's responses to future stressful events, given that many of these effects influence memory and the integration of new information.

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DISCUSSION

This work contributes in numerous ways to a better understanding of early emotion regulation and typical socio-emotional development. This was achieve through a developmental psychobiological approach of how toddlers regulate their behavioural strategies, emotional expressiveness, intensity and adrenocortical responses, according to the situational (fear, positive affect, frustration/anger) and social (mothers' constrained and involved behaviour) contexts experienced. The results of this study suggest that significant adaptive developments in emotion regulation processes emerge early in life and occur in the context of significant first relationships. Moreover, it demonstrates that different emotions are regulated in different ways, according to the situational contexts and the objectives that each one elicits in the child. These empirical directions are very important. They highlight the fact that humans are not only capable of developing multiple emotional states, each one characterized by a distinct cognitive, behavioural, and physiological profile and a differential name, but, mainly, that they use them in service of particular immediate or long term goals, that serve individual trajectories and help us to understand different developmental pathways (Cole, Martin, & Dennis, 2004; Campos, Campos, Mumme, Kermoian, & Campos, 1994; Kagan, 1994).

Children's short or long term goals are closely linked to the characteristics of the environment in which they grow up. Children's attachment history may either expand or limit their socio-emotional potential. On the other hand, the development of particular emotion regulation patterns may serve the function of maintaining the relationship with the attachment figure, in order to ensure the caregiver's proximity and guarantee protection (Bowlby, 1969/1982; 1973; 1980; Cassidy, 1994). In the case of insecurely attached children this can be achieved either by minimizing negative emotions to avoid future rejection experiences, or by maximizing them, in order to gain the attention of an inconsistently available caregiver (Cassidy, 1994; Lutkenhaus, Grossman, & Grossman, 1985; Spangler, & Grossman, 1993; Malatesta, Culver, Tesman, & Shepard, 1989). Results are congruent with this perspective by showing that insecure children exhibited a minimizing emotion expression style during fear and positive affect episodes, showing no significant differences between mother constrained and involved periods. Children's behavioural strategies also differed in function of attachment security, particularly during positive affect episodes. Securely attached children exhibited significantly more strategies during positive affect contexts, than insecurely attached ones, only when the mothers' behaviour was involved. This finding is also consistent with Bowlby's work (1969/1982), which postulates that the attachment relationship is a regulatory

behavioural system characterized not only by a “haven of safety”, where children can seek comfort in the attachment figure in case of distress or danger, but also by the formation of a loving bond, characterized by the capacity to seek and sustain emotional proximity by both partners, in moments where danger is not present, like positive affect emotional contexts.

Not only social aspects of children’s development, like attachment or mother’s involvement, influence the development of emotion regulation. Internal processes to the child, such as temperament and neurobiological systems (HPA system), also contribute and are influenced significantly by the way toddlers behave and physiologically respond to challenging and pleasurable events in daily life (Schieche, & Spangler, 2005). This study confirmed it, by showing that children’s temperament quality and toddlers’ behavioural strategies were significantly associated, during positive affect and frustration/anger episodes. Children’s adrenocortical responses and temperament were also significantly related during the 3 episodes. Consequently, it is recommendable that both attachment and temperament be included in all future studies and the interactions between them are studied (Vaughn, Bost, & Van Ijzendoorn, 2008). Like in previous studies, children’s HPA system was also activated after the exposure to emotional events, particularly positive affect episodes (Gunnar, & Donzella, 2002; Herstsgaard et al., 1992). Children’s cortisol response showed a significant decrease after the engagement in positive affect activities with the attachment figure.

The development of emotion regulation occurs within a psychobiological system, through multiple significant relationships between external/social and internal/biological processes to the child. These processes have their impact not only in children, but also in their attachment figures, whose personal attachment history, in turn, influences significantly children’s socio-emotional development, e.g., children’s cognitions and emotions about the caregiver, the self, others and the world in general, in present and future relationships, as well as their perception of effectiveness and control over events, across development, into adulthood (Bowlby, 1973; 1980; Ainsworth, Blehar, Waters, & Wall, 1978; Sroufe, 1979; Sroufe & Waters, 1977; Sroufe, 2005; Waters, Vaughn, Posada, & Kondo-Ikemura, 1995; Cassidy, 1994; Bretherton, 1990; Waters, Vaughn, Posada, & Kondo-Ikemura, 1995; Waters, & Cummings, 2000).

Results showed that mothers’ attachment representations predicted their children’s attachment security (Main, Hesse, & Kaplan, 2005; Grossmann, Grossmann, Fremmer-Bombik, Kindler, Scheuerer-English, & Zimmerman, 2002; Steele, Steele, & Fonagy, 1996; van IJzendoorn, 1995; Veríssimo, Monteiro, Vaughn, Santos, & Waters, 2005; Monteiro,

2007), and influenced toddlers' emotion regulation, through significant relationships between mothers' attachment representations and their children's expressiveness and intensity but also indirectly, through their children's attachment security. Significant relationships were found between children's attachment security and their behavioural strategies, emotional expressiveness and adrenocortical responses (Gunnar, Brodersen, Nachmias, Buss, & Rigatuso, 1996; Spangler, & Schieche, 1998; Spangler, & Grossman, 1993; Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996), during fear, positive affect and frustration/anger contexts. In turn, children's behavioural strategies and attachment quality influenced significantly their mothers' cortisol stress responses during the three episodes. Mothers' attachment representations also influenced maternal adrenocortical stress responses (while watching their children being exposed to challenging and pleasurable novel events), as well as their children's in a marginal significant way. These results suggest that early social relationships, namely, attachment follow a trans-generational pattern from parents to children, exercising its influence not only at a behavioural level, as it is already known, but probably at a physiological level as well, at least indirectly.

In summary, from a developmental point of view this study highlights the importance of understanding emotion regulation as a psychobiological system, developed in the context of early relationships, namely, attachment, through a set of multiple, complex and reciprocal relationships between children and caregivers. These relationships serve functionalist purposes, e.g., the achievement of immediate goals elicited by different emotional contexts, but also long term objectives that are developed inside the relationship itself and serve the interest of both members of the dyad. Behavioural strategies, emotional expressiveness, intensity and adrenocortical responses are all different ways through which children try to communicate and regulate themselves according to the situational and social characteristics of the context, temperamental dispositions and the security of the relationship between mother and child. The study of emotion regulation and its development must be analyzed through the lens of a trans-generational framework at both behavioral and physiological levels, since significant relationships between mothers' personal attachment history and adrenocortical functioning and children's attachment security, cortisol responses and behavioural dispositions were found. In the future, the study of emotion regulation should include the assessement of multiple biological systems in different contexts and continue to analyze the trans-generational effects transmitted through attachment, in order to understand the psycho-socio-biological impact of emotions on the individual's organism, relationships and life.

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APPENDIX A

Emotion regulation strategies (Diener, & Mangelsdorf, 1999b):

(1) mother related strategies:

Proximity/contact, seeking to mother (“child takes several steps towards the mother or increases proximity; child sits or stands close to the mother (e.g., sits at mom's feet, must stay there awhile, not just approach and then immediately withdraw); child is in contact with the mother (e.g., sitting on mom' s lap, standing by mother with hand on her leg); child clings to mother, hugs her, desires very close proximity (more than simply leaning on mom's leg etc.”).

*Directing mothe*r (“child tries to get the mother to do something by pulling on her, verbally directing her, etc.; e.g., closes the magazine she is reading, pulls on her hand, tells her to do something. Any command to the mother, such as "you do it" or "come here" or "take it down”. Also includes physically directing her by pulling on her hand, trying to make her do something by pushing her toward or away, etc”).

Fuss to mother (“child fusses while looking at the mother; this should clearly be a directed cry, not just fussing in general; may look or point to the stimulus at same time. The goal appears to be to change or get the mother to change/remove the stimulus or get the mother to do something or stop doing something with a fuss; gets whiny”).

Helpseeking (“child asks the mother for assistance when dealing with the stimulus; does not include asking the mother for help with other objects, e.g., child points to the stimulus, looks at the mother and vocalizes “hands, mom, (names the stimulus)” in a clear attempt to get her to do something for the child”).

Information seeking (“child asks the mother for information about the stimulus, e.g., "What is it?"; "How do you open it?”).

Social referencing or looks to mother (child looks at mother during the episode).

Engagement of mother (“child attempts to engage the mother in interaction; child makes bids for attention by vocalizing to the mother (not just talking to oneself). Child may attempt to get the mother to play with him or her. This also includes playing with mom. No score if the child is just responding to the mother, but doesn't seem to want to engage with her”).

(2) Disengagement of attention strategies:

Passive disengagement of attention (“child looks around the room without really focusing on a particular object; child wanders around the room; humming, singing, babbling

what is not content codable; fingering toys or carrying them around. This category does not include looking at door; physical comfort seeking with toys (e.g., carrying blanket, stuffed animal, etc.")

Distraction or active disengagement of attention ("child plays with other objects in the room (not the stimulus); e.g., looks at magazines, plays with cushions. Also includes visual examination of an object, if it is very clear that the interest on the part of the child is sustained and intense, e.g., looks at metal plate on wall with interest; attempts to get the parent to play, ongoing reciprocal activity or play-like conversation with the parent. This category does not include comfort seeking attempts; mere fingering of items, simple looking or mouthing; any activities directed at the stimulus; attempts to leave the room").

Leavetaking ("child goes to the door and tries to open it; child goes to the door and bangs on it, clearly in the service of wanting to leave the room; child says "go bye bye" or some other phrase that indicates that the child wants to leave; child waves; child pulls mom toward the door (also given as directing mom").

Avoidance ("child attempts to withdraw, avoid, or resist interaction with the stimulus. The child does not touch the stimulus. Child moves away from the stimulus, but does not seek contact or proximity with mother. Thus, moving away seems focused on avoiding the stimulus. If the child is already in contact with the mother, and still turns the body away from the stimulus, one should code both avoidance and proximity seeking. Also includes saying "No" to the stimulus or saying "No" to mom's insistence that the child must play with or touch the stimulus; shaking head to mom's insistence that the child must play with the stimulus. This category does not include leavetaking").

(3) Dealing with the stimulus strategies:

Playing/exploring ("child attends to the stimulus and manually inspects it with concentration to understand how it works; plays with stimulus. This category does not include simply holding or touching the stimulus without really being engaged with it (e.g. wandering around the room holding the stimulus but looking at other objects in the room), or batting the stimulus away because the child does not want to play with it").

Resistance/control ("child controls the situation by attempting to move the stimulus, push it away, or attempts to stop the toy (child has to touch the toy). Child touches the stimulus in the service of disengaging with it or avoiding it, e.g., pushes stimulus away (not in

service of play), e.g., child hides the stimulus with cushions so he (she) won't have to look at the stimulus").

Labeling ("child names the stimulus; talks about object").

Problem solving ("child engages in some type of problem solving activity related to the stimulus (e.g., tries to reach the object; turn the off or on). This is something that the child is doing on his or her own, not seeking the help of mom").

Proximity to stimulus ("child takes a few steps towards the stimulus; child comes very close to the stimulus; child is in contact with stimulus; picks it up, touches it").

(4) Redirection of action strategies

Tension release ("child engages in high energy behavior with no instrumental focus (e.g., rocking, bouncing, waving arms; running, jumping, stomping, shouting, throwing toys, banging on the tables, or other high energy behaviours").

Self-soothing ("behaviors commonly considered to be anxiety symptoms (mouthing hands, fingers or clothing); rocking, rubbing part of body (e.g., wringing hands, rubbing head, pulling ear); twisting hair. It also includes soothing with a blanket or comfort object, like a pacifier or stuffed animal. If the child is already holding a blanket or stuffed animal or has a pacifier, then the child should get this code. This category of behavior does not include self-grooming (e.g., pulling hair out of eyes, adjusting shirt or pants").

Stranger (child looks in an intense way, points at or seeks proximity or close contact with the experimenters in the room).