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**"Early attachment behavior in mother-infant dyad:  
a study on Maternal Physical Engagement"**

*Advisor:*

Professor Paola Venuti

*PhD Candidate:*

Caterina Bembich

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# INTRODUCTION

## Foreword

The mother-infant bond is a fundamental relationship that motivates mothers and infants to undertake behaviors that ensure the infant's survival, and it is on the base of all mammalian affiliations (Bowlby, 1969). The maternal attachment behaviors have been evolutionarily shaped and constitute the basis for all conspecific social bonds (Keverne, 1992; Nelson & Panksepp, 1998; Broad et al., 2006). Moreover, attachment behavior is determined both by genetic predispositions and environmental influences (Adolphs, 2003).

The studies of attachment behavior lie at the crossroad of various disciplines, from sociobiology (particularly ethology) and anthropology to evolutionary and social psychology.

It is only in the past 20 years that some of the underlying neurobiological foundations of attachment theory have been discovered. With the development of new imaging techniques to visualize brain activity (fMRI, PET), the integration of results from available human data, animal models, neurophysiology and other related neuroscience disciplines has produced striking new findings about when and how specific brain regions, pathways, and circuits participate in the development of attachment behavior.

Important results from animal models come from the study of m-opioid mice (see Appendix). Among the behavioral systems influenced by the m-opioid receptor is the infant social attachment system (Nelson and Panksepp, 1998). During periods of interaction with a caregiver, opioids are released, thereby contributing to reinforcement of the attachment bond. A relative reduction in opioid release, which occurs during periods of separation, increases an infant's motivation to seek and maintain proximity to its caregiver (Herman and Panksepp, 1978; Kalin et al, 1995; Knowles et al, 1989). Genetic variation that affects m-opioid receptor function has been demonstrated to influence social behavior in various animal models (Barr et al, 2008; Moles et al, 2004). Mice lacking the OPRM1 receptor gene show prominent deficits in maternal separation-induced ultrasonic vocalizations, preference for maternal cues, and ultrasonic call potentiation after brief maternal exposure (Moles et al, 2004). In rhesus macaques, a nonsynonymous SNP in the OPRM1 gene (rhOPRM1 C77G), that increases reward sensitivity (Barr et al, 2007), predicts increased vocalization during periods of maternal separation and social preference for the caregiver upon reunion (Barr et al, 2008). These data suggest that spontaneous genetic variation at the OPRM1

gene might influence the development of social attachment and other related phenotypes in humans.

Regarding the study of attachment in humans, the attachment theory of Bowlby (1969) has been the main theoretical background for many studies that have dealt with the early mother child interaction.

The attachment system in the child is characterized by behaviors that are directed to a specific individual, the caregiver, and by behaviors that signal emotional distress during periods of separation from that individual. Children attach to caregivers instinctively to increase the probability of survival in stressful situations (Bowlby, 1969). Although the biological mother is the usual principal attachment figure, infants will form attachments to any consistent caregiver who is sensitive and responsive in social interactions. The attachment relationship increases the probability of survival for children (Bowlby, 1969).

Attachment behavior depends on an interaction. It is a reciprocal system of behaviors between an infant and a caregiver—generally the mother. The term reciprocal is apt because not only does attachment affect the child's behavior (for example, moving closer to the mother when stressed), but it also affects the responses of the mother, who emits caregiving responses in the presence of signals from the infant. Mothers and infants are equipped with instinctive attachment behaviors that ensure maternal care and the welfare, protection and survival of infants. This behavioral system underlies the affiliative system that develops in adulthood and subsequently parental behavior (Panksepp, 1994).

Among the attachment behaviors, body contact and proximity of the mother to the infant are essential for the child's growth. Variation in the expression of maternal physical engagement gives us the opportunity to observe and understand the implications and the influences of early physical contact for the wellbeing of the infant. All children seek physical contact with their mother, and feel comfort in being close to her. It is important for the psychological growth of children to be rocked, held, stroked, and cuddled by the caregiver (Ribble, 1944), and a lack of close physical contact with the mother is regarded as a form of deprivation with possible serious consequences (Schaffer, 1964). This view has been reinforced by the findings of Harlow (1958; 1959), which have demonstrated the importance of contact comfort in the establishment of young monkey attachment.

Physical contact influences child development during the prenatal period and after birth. Tactile stimulation affects fetal growth and it is the first way through which the mother begins to

communicate with the infant (via sound vibrations and amniotic fluid movements). It regulates the infant's arousal, enhances proximity between mother and infant, helps the mother to organize and soothe the infant, and it has a communicative function (Tronick, 1989; 1995). Moreover, the amount of physical contact influences the development of secure attachments for infants (Anisfeld, 1990), and it is superior to other modalities in helping an infant to cope with distress or discomfort (Grossman et al., 1985; Hunziker & Barr, 1986).

Even if physical contact is a universal attachment behavior, there is evidence that its expression is culturally mediated (e.g., Hewlett et al., 2000; Keller et al., 2009). Every culture has its own needs, conceptions of parenting norms, and modes of implementing parenting practices. Maternal behavior reflects these cultural ideas about mother-infant interaction and the specific goals and aims of parenting a child (Bornstein et al., 1992; Richman et al., 1992). Variations in cultural background are reflected in differences in conceptions of parenting norms and in modes of implementing parenting practices (Harkness, S., 1996; Goodnow, 1995; Bornstein et al., 1998; Joshi & Maclean, 1997) and they can be seen in the ways in which mothers establish physical contact with infants. For example, the amount of physical contact provided by the mother to the infant varies in relation to different social contexts, and it is higher in societies with interdependent lifestyles (e.g., Hewlett et al., 2000; Keller et al., 2009; LeVine et al., 1994), because it helps the child to consolidate his sense of connectedness to the group (MacDonald, 1992) and to prepare him to adapt to a social system (cf., Keller, Lohaus, Völker, Cappenberg, & Chasiotis, 1999). By contrast, the reduced emphasis on physical contact by Western middle-class mothers has been associated with the importance of fostering autonomy, independence and self-realization in children, all characteristics that require psychological separateness and stable ego boundaries (Hofer, 2012).

In this view, cross-cultural information can help to better explicate variations in child-rearing practices and their antecedents, to better explain child development, and help to understand the processes that are expressed in a universal way, and which are culturally influenced. Parents prepare the child to live in a particular social context, educating him for the physical, economic and psychosocial situations that are characteristic of the culture in which they have to survive (Benedict, 1938; Bornstein, 1991). Culture-specific patterns of child-rearing are expected to be adaptive for each specific society's setting and needs (Bronfenbrenner, 1989; Lerner, 1989; Valsiner, 1987).

## Overview of the Thesis

The purpose of this study, is to compare the extent and types of physical proximity and contact between mothers and infants across different countries during the early child stage of life, and to discuss how those activities are modulated by contrasting cultural styles. We have compared the way in which mothers are physical engaged with their children in different societies, to investigate similarities and differences in the physical and proximal maternal behaviors, selecting 5 different countries belonging to the Western (Italy and USA), Eastern (Korea and Japan) and Developing countries (Kenya). Moreover, the research analyzed how those early maternal activities are related to the child's subsequent development, examining how experiences during early life could affect his future growth. The results are discussed in light of the culture-universal as well as culture-specific aspects of parenting.

The research questions addressed in this study are as follows:

- (1) Do mothers with different socio-cultural background differ in the expression of physical behavior and in the establishment of proximity toward their children?
- (2) Do mothers with different socio-cultural backgrounds differ in how they respond proximally/physically to infant nondistress vocalizations?
- (3) Does early maternal physical engagement affect the child's growth, considering different aspects of child development (cognitive competence, the adaptive behaviors and socioemotional development)?

For the purpose of this study maternal behavior was observed during mother–infant (age=5 months) natural interaction in the 5 countries. Different infant development measures were obtained at 20 months of age for the Italian sample. Video records were coded twice by independent coders, using a coding system that provided continuous records of maternal and infant behavior (infant nondistress vocalizations) during one hour of naturalistic interaction. The coding system used to assess maternal behavior, “Maternal Proximity and Physical Engagement”, was developed for this study. Infant nondistress vocalizations were coded using a system (MOMINF) previously developed in connection with a longitudinal, cross-cultural investigation of normative child development and parenting (Bornstein, 2009). In order to answer to the specific scientific questions mentioned above, three studies have been developed:

## **1. Comparison between Italy and the United States.**

This study examines and compares the ways in which mothers physically engage their very young infants in two different cultures in Italy and the USA, and ask whether they differ in the proximal and physical response to infant vocalizations. These specific countries were selected because known differences in the socialization goals of the two cultures were predicted to be reflected in differences in the expression of parental behaviors (Bornstein, Venuti, et al., 2005; New, R. S., & Richman, 1996).

In Italian culture, mothers believe that their primary parenting task is to guarantee protection and warmth to the infant through the integration of the baby into the family, don't encourage their babies to be independent early in life (Joshi & Maclean, 1997; New, 1994) and tend to focus the infant's attention more on social exchanges and less on didactic interactions (Senese, Poderico, Venuti, 2003). Compared to Italian culture, the goal of American parenting is less focused on establishing closeness to the child and more on enhancing independence and autonomy, and this tendency is reflected in the amount of time spent in physical contact with the infant (Harkness, 2007; Tronick, 1996).

Considering these cultural differences, we hypothesized that Italian mothers would stay in closer proximity and establish closer physical contact with their babies than American mothers, and would be more physically contingent to their infants' vocal signals than would American mothers. We also hypothesized that Italian mothers would be more likely than American mothers to demonstrate a pattern of physical response to nondistress vocalization conducive to communication exchange and turn-taking.

## **2. Five country comparison: Italy, USA, Korea, Japan and Kenya.**

This study extends the comparison on the way in which mothers are physical engaged with their children in different societies, and investigates similarities and differences in the physical and proximal maternal behaviors in countries belonging to the Western (Italy and USA), Eastern (Korea and Japan) and Developing countries (Kenya). The aim is to make a wider analysis of the maternal physical engagement across different countries, in order to investigate culturally common as well as culturally specific aspects of maternal behaviors. The cultures we studied contrast with each other in cultural background, in the specific types of competencies that parents wish to promote in children, in developmental timetables that parents wish their children to meet, and in beliefs that parents have about their role in achieving those ends. Considering the cultural characteristic

of the different countries selected, we expected to find differences across Western, Eastern and Developed countries, and also within the two Western countries considered (Italy vs USA) and Within the two Eastern countries (Korea vs Japan). In fact even if general common cultural aspects are usually refers to the set of countries named Western and other different common aspects are refers to the set of countries named Eastern countries, within this group of countries there are present important variations and differences related to the specific context of provenience.

### **3. Longitudinal study: Influence of early Maternal physical engagement on child development**

The overall goal of the study was to determine the impact of maternal physical engagement on the development of infant play, adaptive behavior, and child emotion availability, in the Italian sample. We speculated that the early maternal physical engagement that the mother establishes with her infant could influence infant development outcomes in different ways, depending on the differences in the degree of proximity and physical contact of the mother toward the infant. The aim is to evaluate the importance of early maternal close body contact with the infant as a factor that contributes to the establishment of a warm bond inside the dyad that affects subsequent child growth.

Finally, in the Appendix, I report a study on animal models in which I discuss the role of biological and genetic variation in determining variations in animal affiliative behavior. I have analyzed the mother and pup behaviors in the  $\mu$ -opioid mice, which are genetically modified to lack the opioid receptor, and therefore show deficits in attachment behavior. The endogenous opioid binding to receptors, is hypothesized to mediate natural rewards and has been proposed to be the basis of infant attachment behavior. The study has analyzed a particular form of attachment behavior presented in mammals, that is, the Transport Response (TR). The TR is a form of attachment behavior that helps the mother to carry the pup, in which the pup adopts a specific posture to be better transported by flexing the limbs and closing the eyes. I hypothesized that the  $\mu$ -opioid receptor may influence the expression of this particular form of attachment behavior. The study corroborates the importance of investigating the genetic basis of attachment behavior in order to better understand the affiliative relationship in higher mammals, principally because the underlying mechanisms of maternal attachment have been evolutionarily co-opted to serve as the basis for all conspecific social bonds.



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## CHAPTER I

### Cross cultural research on parenting

Parental behaviors show variation in their expression from one population to another, are sensitive to population-specific contexts, and are not comprehensible without detailed knowledge of the socially and culturally organized contexts that give them meaning (Tomlinson & Swartz, 2003; Moghaddam, 1987; Bornstein, Tamis-LeMonda, Pecheux, & Rahn, 1991). The cross cultural literature provides evidence for wide cultural variations in childhood environments and highlights differences among world cultures in their concepts of childrearing and of what constitutes normal child development (Bornstein, 1991; Bornstein, 1998; Bornstein, 2007; Collins, 2000). The results of these studies reveal that the theories on child development need to be modified to encompass cultural variation in order to avoid false generalization about the human species. Moreover, in light of these results, it is clear that parenting is made up of differentiated and complex behaviors. Ethnographic researchers have described international differences in the norms and practices that form childhood environments and in the baseline developmental pathways of children from birth to adolescence (Levine, 2007). Whereas genetic researchers have supported the role of heredity in child development, giving parental influence little importance (e.g. Rowe, 1994), the evidence of cross cultural research confirms that the expression of heritable traits depends strongly on experience, including specific parental behaviors. There is an interrelated effect between parenting, non familial influences, and the broader context in which families live (Bronfenbrenner, 1979; Bronfenbrenner & Ceci, 1994; Brooks Glunn et al., 1993; Darling & Steinberg, 1997; Wachs, 1999).

Cross-cultural perspectives on parenting have many aims: to inventory and compare similarities and differences among child development in different countries, to evaluate the bases of adaptive processes in child development, and to evaluate the universality and cultural specificity of psychosocial theories (Collins, 2000).

Adults prepare children for the physical, economic and psychosocial situations that are characteristic of the culture in which they are to survive and thrive (Bornstein, 1991; LeVine, 1988). The caregiver, generally the mother, plays an important role in child development through various forms of interaction. The caregiver shapes the child's activities as well the expression of their early development of mental and social competencies (Bornstein, M., & Tamis-

LeMond,1989). Maternal activities are a differentiated, culturally sensitive form of parenting, and they are typically characterized by patterns of individualized and differentiated behavior. The child, parent, and the culture in which they both live mutually influence each other. In fact, infants in all cultures appear to exert some control over maternal behavior. When infants begin to explore the environment over the second half of the first year, and improve their verbal competence and cognitive comprehension, mothers everywhere increasingly begin to prepare their children for the world outside the dyad.

Comparative studies of the mother–infant relationship address questions about the origins and early development of individual and cultural identity and cross-cultural variation, because the home environment reflects the larger culture in terms of the values, beliefs and customs it promulgates (Bornstein, 1980; 1991). Previous research has evaluated similarities and differences in mother–infant relationships across cultures through parallel, cross-cultural developmental observations of mothers interacting with their infants in the home (e.g. Bornstein & Tamis-LeMonda, 1990; Bornstein et al., 1990; 1991). These studies have compared different cultural settings (e.g., Argentina France, Israel, Japan, and the USA). The sociodemographic samples were selected to be roughly equivalent in terms of modernity, urbanity, education and living standards. The participating families selected were middle-class and urban families; the mothers were normally the primary care-givers in the family setting, which was typically nuclear. The methodology followed by these studies was ecological, in the sense that the results were obtained by observing mothers and children during everyday family activities. Their aims were to observe mothers and children under the most natural and least obtrusive conditions possible.

Important substantial differences among cultures emerged from these studies in terms of history, beliefs and values associated with child rearing. Even with generally similar ultimate goals (\*please give an example??), these cultures differ in the competencies that parents promote in their children, in the paths parents believe children should take to achieve success, and in the developmental timetables parents wish their children to follow. Similarities and differences were found mother and child behaviors such as maternal activity, responsiveness, coherence, interaction and language, and mother–toddler play. The results identified both culturally consistent and divergent patterns of parenting (Bornstein, 1994; 1995).

It is possible to identify universals of child rearing in different cultures. Common patterns among the behavior of mothers from urban, middle-class, nuclear families may reflect similarities in the caregiving practices in industrialized and developed societies. These caregivers wish to promote

similar general competencies in their offspring, and some appear to do so in similar ways. Structures and processes may be manifest and function similarly in different populations, between individuals, and across cultures. Shared biology or similar environmental or cultural pressures may produce universal structures and processes in individuals. When these universals do not emerge, individual or culture-specific phenomena are typically implicated.

Mothers show culture-specific patterns of parenting that are adaptive to each specific society's setting and needs (Bronfenbrenner, 1998). It is possible that cultural parental values and beliefs mediate differences in child rearing practices. For this reason, it is important to understand the impact that various parental activities might have on development (see Bornstein & Lamb, 1992, ch. 3).

The influence of culture may be evident in the earliest activities and interactions of parents with their infants. Child rearing practices influence the course and eventual outcome of individual development and are driven by the distinctiveness of cultural styles. Experience with substantive maternal activities that promote or confirm "attuned" interactions can have a significant impact on child growth and development, almost independent of the frequency with which those activities are carried out (Abelson, 1985). Children may follow different ontogenetic paths if their interactive environments, particularly those that they are exposed to repeatedly, differ even slightly. The patterns established early in life eventuate in mature personalities that are adequately adjusted to the demands of society. In this way, adults help to shape the cultural lives of their children.

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## **CAPTHER II**

### **Maternal proximity and physical engagement in Infancy: A cross-cultural comparison between Italy and the United States**

This study examines and compares the ways in which mothers physically engage their very young infants in two different cultures, Italy and the USA, and ask whether they differ in the proximal and physical response to infant vocalizations. Results revealed both cross-cultural similarities and differences in physically engage and responsiveness. In general, Italian mothers stay in closer proximity to their babies during the course of a typical hour of interaction than do American mothers. In both countries mothers responded to infant non distress vocalization by coming within reach of the baby and by touching. Italian mothers respond more often by positioning themselves within reach of the baby, by contrast American mothers responded contingently to their infants in more different ways, showing more variation in the behavioral contingently response. The findings are discussed from the perspective of the cultural influences on parenting, that affect the way in which parental practice are expressed.

#### **Background:**

The mother infant bond is a fundamental relationship that motivates mothers and infants to undertake behaviors that ensure the infant's survival and his development (Bowlby, 1982). The mechanisms comprising the mother-infant attachment relationship are the result of mammalian evolution and form the basis for all conspecific social bonds (Keverne, 1992; Nelson & Panksepp, 1998; Broad et al., 2006). Moreover, attachment behavior is determined both by genetic predispositions and environmental influences (Adolphs, 2003).

The attachment system in the child is characterized by behaviors that are directed to a specific individual, the caregiver, and by behaviors that signal emotional distress during periods of separation from that individual. This behavioral system underlies the affiliative system that develops in adulthood and of parental behavior (Panksepp, 1994). The attachment relationship increases the probability of survival for children (Bowlby, 1958). Indeed the attachment behavior depends on an interaction. It is a reciprocal system of behaviors between an infant and a caregiver—generally the mother. The term reciprocal is apt because not only does attachment

affect the child's behavior (for example, moving closer to the mother when stressed), but also affects the responses of the mother, who emits care-giving responses in the presence of signals from the infant. Mother and infants are equipped with instinctive attachment behaviors that ensure both maternal care and the welfare, protection and survival of infants.

Previous research has defined the degree to which a mother maintains physical contact with her infant as a form of maternal attachment behavior (Leifer, 1972). Physical contact and tactile behaviors play an important role in early human development. All children seek physical contact with their mother, and feel comfort in being close to her. It is important for the psychological growth of children to be rocked, held, stroked, and cuddled by the caregiver (Ribble, 1944), and a lack of close physical contact with mother is regarded as a form of deprivation with possible serious consequences (Schaffer, 1964).

Harlow (1958, 1959) confirmed the fundamental importance of physical contact in the establishment of attachment in research analyzing the behavior of young monkeys. He found that young monkeys who were removed from their natural mother preferred a terrycloth-covered mother surrogate whether or not it provided them with food to a wire surrogate that always provided nourishment. These results demonstrated that close physical contact between mother and infant (contact comfort) is fundamental in early primate development.

Tronick (1989) has emphasized the important role of physical contact and its function in the regulation of the infant's arousal, focusing on the specific role of touch. His research suggests that physical contact has many functions: it enhances proximity between mother and infant, it helps the mother to organize and soothe the infant, and it has a communicative function (Tronick, 1995).

Physical contact has been shown to influence child development even during the prenatal period. Barnard and Brazelton (1990) found that tactile stimulation has an influence on fetal growth and is the first way through which the mother begins to communicate with the infant (via sound vibrations and amniotic fluid movements). Even after birth, physical contact continues to be the primary channel of communication between mother and child, because it is the first infant sensory system to develop, beginning 7.5 weeks after conception (Goleman 1988). Moreover, amount of physical contact influences the development of secure attachments for infants (Anisfeld, 1990), and it is superior to other modalities in helping an infant to cope with distress or discomfort (Grossman et al., 1985; Hunziker & Barr, 1986).

The caregiver can establish physical contact with the infant in different ways, and the various sub-types of contact behaviors may affect infant development in unique ways, especially during the first months of life (Field, 2011). Previous studies have identified different forms of physical contact using both global constructs, e.g., negative touch versus affectionate touch (Hertenstein, 2002), and more detailed categories of touch, e.g., proprioceptive touch, vestibular touch, passive touch, instrumental touch, and firm touch (Stepakoff, 2000; Muir; 2002). These sub-types have been used to describe different maternal styles during interaction with the child.

Maternal contact is an aspect of maternal behavior that has been emphasized and integrated by attachment theory in the general concept of maternal responsiveness. (Bowlby 1982; Weiss, 2000). Maternal responsiveness is defined as prompt, contingent, and appropriate reactions to children (Ainsworth, Bell, & Stayton, 1974; Bornstein, 1989; Bornstein et al., 1992) and is an important element of everyday exchanges between parent and child. When the infant expresses his feelings and needs, the parent must understand the signals and respond in an appropriate way. This response, in turn, will influence the baby's experiences and the future expression of his needs. Responsiveness is a universal characteristic of parenting shaped by evolution (e.g., Girolametto et al., 2002; Paavola, Kunnari, Moilanen, & Lehtihalmes, 2005) that influences emotional, social and cognitive outcomes in the child (Ainsworth et al., 1974; Bornstein, 1989; Bornstein, Tamis-LeMonda, & Haynes, 1999; Paavola et al., 2005).

To be responsive, maternal behavior has to be prompt and contingent on the infant's signal. To be perceived as a response by the infant, maternal behavior must occur within a specific latency window. If the parental response occurs outside of this time window, the child cannot connect the mother's response to his own behavior. When the infant receives a contingent response to his signal, he experiences himself as a causal agent whose behavior has an effect on the environment. When the infant experiences a predictable pattern of responsive social exchanges, s/he learns to be an active participant in interaction (Tarabulsky, Tessier, & Kappas, 1996).

Physical contact is a universal attachment behavior: in every culture mothers touch their infants and maintain physical proximity. But within this universal behavior modality, some aspects are culturally mediated. Every culture has its own needs, conceptions of parenting norms, and modes of implementing parenting practices. Maternal behavior reflects these cultural ideas about mother-infant interaction and the specific goals and aims to be realized when parenting a child (Bornstein et al., 1992; Richman et al., 1992).

The differences in the ways in which societies both conceptualize parenting and care for their offspring (Harkness, S., 1996; Goodnow, 1995; Bornstein et al., 1998; Joshi & Maclean, 1997) can be seen in the ways in which mothers establish physical contact with infants. For example, farming mothers in non-Western societies spend more time in close contact with their babies than do Western middle-class mothers (e.g., Hewlett et al., 2000; Keller et al., 2009). Farm families have an interdependent lifestyle (LeVine et al., 1994), and the higher amount of mother-infant physical contact functions to foster social interdependence and adaptation to a social hierarchy (Keller, 2007; Keller et al., 2006). Physical contact helps the child to feel he is a member of the group, consolidates his sense of connectedness, and provides the experience of emotional warmth (MacDonald, 1992). Taken together, these experiences help to prepare the infant to adapt to a social system (cf., Keller, Lohaus, Völker, Cappenberg, & Chasiotis, 1999). By contrast, the reduced emphasis on physical contact by Western middle-class mothers has been related to the importance given to fostering autonomy, independence and self-realization in children, all characteristics that require psychological separateness and stable ego boundaries (Hofer, 2012).

In Italian culture, mothers believe that their primary parenting task is to guarantee protection and warmth to the infant through the integration of the baby into the family. Mothers don't expect infants to reach developmental milestones quickly, and they don't encourage their babies to be independent early in life (Joshi & Maclean, 1997; New, 1994). Italian mothers tend to focus the infant's attention more on social exchanges and less on didactic interactions (Senese, Poderico, Venuti, 2003). As a result of this belief about parenting, Italian mothers put great emphasis on the physical well-being of the infant (New, 1989).

By contrast, American mothers tend to educate their children in a more individualistic way. They consider individual achievement, self-actualization and autonomy in children to be very important (Markus & Kitayama, 1991) and encourage these qualities in their children (Harkness, Super, & Keefer, 1992; Harwood, Leyendecker, Carlson, Asencio, & Miller, 2002; Richman, Miller, & Solomon, 1988). Investment in childrearing is high because US mothers think that child behavior is determined by parenting successes (Bellah, R. N., Madsen, R., Sullivan, W. M.; Bornstein et al., 1998). Compared to Italian culture, the goal of American parenting is less focused on establishing closeness to the child and more on enhancing independence and autonomy, and this tendency is reflected on the amount of time spent in physical contact with their infant (Harkness, 2007; Tronick, 1996).

With these considerations in mind, the purpose of this study was to compare the extent and types of physical proximity and contact between mothers and infants in two different countries: Italy and the United States. These specific countries were selected because known differences in the socialization goals of the two cultures were predicted to be reflected in differences in the expression of parental behaviors (Bornstein, Venuti, et al., 2005; New, R. S., & Richman, 1996).

The aim was to answer two specific questions: (1) Do mothers in Italy and the United States differ in the way that they physically engage their infants? (2) Do Italian and American mothers differ in how they respond proximally/physically to infant non distress vocalizations?

Regarding the first question, because Italian mothers tend to be more protective toward their children and tend to emphasize social exchanges whereas American mothers tend to socialize their children to be independent and autonomous, we hypothesized that Italian mothers would stay in closer proximity and establish closer physical contact with their babies than American mothers. Regarding the second question, considering that Italian mothers are more sensitive toward their children (Bornstein, 2008), show a preference for social activities (Axia and Weisner; 2002) and concentrate their energies on affective relationships with their child (Bimbi, 1990), we hypothesized that Italian mothers would be more physically contingent to their infants' vocal signals than would American mothers. We also hypothesized that Italian mothers would be more likely than American mothers to demonstrate a pattern of physical response to nondistress vocalization conducive to communication exchange and turn-taking.

## **Method:**

### **Participants**

Twenty-five Italian and 25 American mother-infant dyads were included in this study. The Italian sample consisted of 25 dyads from Padua, whereas the sample for the United States was selected from a larger sample ( $N=176$ ) of adult mothers from the Washington DC metropolitan area. The US sample was randomly drawn within maternal education strata. For example, in order to match the distribution of education in the Italian sample, 3 mothers with a 7<sup>th</sup>-9<sup>th</sup> grade education and ten mothers with a high school education were randomly selected from the larger pool of American mothers. Sociodemographic information for the participants appears in Table 1.

All infants were firstborn, born at term, and did not differ in birth weight (IT 3373.6

(434.85) g; USA 3463.86 (409.22) g;  $t(48)=-0.930$ , ns). Infants were observed at home at approximately 159.48 days of age ( $SD = 6.13$ ); Italian infants were slightly but significantly younger than the US infants when they were observed,  $t(48)=-6.007$ ,  $p<.01$ . The percentage of female was respectively for the Italian sample 36%, for the American sample 44%,  $t(48)=.545$ , ns.

Mothers were primiparous and were recruited using methods of recruitment that are common in developmental science (mass mailings, hospital birth notifications, patient lists of medical groups, newspaper birth announcements, and advertisements in newspapers). The two groups were matched to the degree possible on demographic characteristics (see Table 1).

Italian and American mothers were equivalent in terms of maternal age, level of maternal education, and SES. On average, at the time of data collection, Italian mothers were 29.26 years old ( $SD= 3.40$ ) and American mothers were 27.93 years old ( $SD=6.97$ ),  $t(48)= .94$ , ns. In both samples the mean level of maternal education was high school graduate,  $t(48)= -.20$ , ns., and Family SES was predominantly middle class,  $t(48)= .16$ , ns. (the Hollingshead, 1975, Four-Factor Index of Social Status; see Bornstein, Hahn, Suwalsky, & Haynes, 2003).

At the time of data collection, 20% of Italian mothers and 56% of American mothers worked outside of the home ( $t(48)=-2.68$ ,  $p< 0.1$ ). Among those that were employed, Italian mothers worked fewer hours per week than did American mothers (IT 3.15 (0.18), USA 15.27 (0.51);  $t(48)= -3.39$ ,  $p < .01$ ).

## **Procedures**

Mother/infant dyads were observed at home for 1 h by a female filmer, and a videorecord of naturally occurring mother–infant interaction was made.

Visits were scheduled for a time when mother and infant were at home alone together. Mothers were encouraged to behave in their usual manner and to disregard the observer's presence insofar as possible. The filmer did not talk to the mother or engage the baby during the filming; she attempted to be as unobtrusive as possible.

At the end of the home visit, mother and filmer independently rated maternal and infant behavior during the visit by marking a series of 8-point (range = 0–7) graphic rating scales, randomly ordered with respect to valence but recoded in ascending order. Both groups of mothers rated their own behavior as typical, Italian 5.53 (1.45), and USA 4.9 (1.73),  $t(48)=1.027$ , ns. Mothers in both groups also reported that the babies behaved in typical fashion, Italian 5.7 (1.72), USA 5.4

(1.79),  $t(48) = 0.50$ , ns. The filmer rated both groups of mothers as being relaxed during the observation, Italian 4.50 (2.34), USA 5.28 (1.33),  $t(48) = -1.10$ , ns.

*The research study was conducted in accordance with relevant ethical standards defined by the American Psychological Association and was subject to oversight by the National Institute of Child Health and Human Development Institutional Review*

## **Behavioral Coding**

All videorecords were coded twice by independent coders, using coding systems that provided continuous records of maternal and infant behavior during the hour of naturalistic interaction.

The coding system used to assess maternal behavior, Maternal Proximity and Physical Engagement, was developed for this study. It assesses a mother's proximity to and physical contact with her infant. The code has 5 levels, ordered from least to most proximal, and a "Cannot code" option. More proximal levels pre-empt less proximal levels. A new level is coded when the behavioral criteria for that level are met, and this effectively functions as the offset of the previous behavior level. The levels of the code were defined as follows:

1. **Out of reach.** *Mother is out of her own arm's reach of the infant.*
2. **Within reach.** *Mother is within her own arm's reach of the baby (i.e., mother can comfortably extend her arm and make contact with the baby even if having to lean or bend but without taking any steps through space) and is not engaged in touching, looming, or holding.*
3. **Touch.** *Mother touches the infant with her hand(s). Do not code touching the infant's body with an inanimate object held in the mother's hands UNLESS the object is made of paper or cloth and is associated with caregiving (e.g., an article of infant's clothing, a diaper, a washcloth, a tissue.) Very brief breaks in touching (e.g., less than one second) are not coded as the cessation of touching.*
4. **Loom.** *While within reach of and looking at but not holding the baby, mother purposefully moves her face closer to the infant's face, seemingly with the intention of engaging the baby or observing the baby closely. Continue to score Loom until mother moves her head back from the close position. Simply bending over the baby to provide caregiving is not coded as Loom.*
5. **Hold.** *Mother supports the infant's weight with her arms, legs, or trunk. Mother may be lying down, squatting, sitting, standing, or moving through space.*



The code yields measures of the frequency of onsets of each behavioral level and the duration of time spent at each level. Maternal behavior is coded without considering infant responses to the behavior (Obswin, 2008). Data were coded using the observational data collector ObsWin 2008 (Neil Martin, Chris Oliver and Scott Hall, 1999; Obswin data collector, free download on <http://www.antam.co.uk/obswin.htm>). The default datafile type used by ObsWin is the Timed Sequential datafile, a types of the Sequential Data Interchange Standard (\*.SDS datafiles) developed by Bakeman and Quera (1995).

Infant Nondistress vocalization was coded using a system (MOMINF) previously developed in connection with a longitudinal, cross-cultural investigation of normative child development and parenting (Bornstein, 2009). This system is an on-line coding procedure, and the output is identical to the output of Obswin. Infant non distress vocalization was defined as a vocalization that was positive or neutrally toned. Infant vocal behavior was coded in a separate pass through the videotaped home observations and yielded continuous behavioral records, coded in real time. Although different coding systems were used, the two data sets were comparable.

We converted Infant non distress vocalization data generated from Mominf to SDIS format, following a procedure developed by the Child and Family Research Section, and we created an SDS file containing all data for analyses.

For both sets of continuously coded behaviors, Cohen's (1960, 1968) *Kappa* was used to assess coder reliability. Coders were first trained to be reliable. During the coding of the data, 20% of records were independently coded by two coders. Reliability coefficients were computed with  $\kappa$  separately for the 2 cultural groups, and reliability for both codes were acceptable (Infant non distress vocalization: IT  $\kappa = .72$ ; USA  $\kappa = .70$ ; Maternal proximity and physical engagement: IT  $\kappa = .89$ ; USA  $\kappa = .97$ ).

## **Data Analysis**

### **Cultural differences in Maternal Proximity and Physical Engagement**

For each measure of maternal behavior measures of frequency and duration were obtained. Frequency is the number of times the target behavior was initiated by the mother within the observation session. Duration is the amount of time that the mother engaged in the behavior. Because some observations were shorter than one hour, measures of frequency and duration per time unit were calculated.

Prior to data analysis, distributions of pro-rated frequency and duration of mothers' behaviors were examined for normalcy and outliers. Transformations were applied to the following variables: the pro-rated frequency of Within Reach, Loom and Hold, and the pro-rated durations of Out of Reach, Touch, and Loom were cube-root transformed. Mother age, infant age, and maternal education were screened as covariates but were not used because none was significantly correlated with maternal proximity ( $p > .05$ ).

The 5 levels of the code were then collapsed into 2 aggregate measures, No Contact and Close Contact. No Contact combined the levels in which the mother did not touch the baby (Out of reach and Within reach); Close Contact combined the levels of the code system in which the mother established close physical contact with the infant (Touch, Loom, and Hold). Untransformed values for the 5 levels of Maternal Proximity and the 2 aggregate measures are presented in Table 2. Tests of group comparisons (t test) were performed on pro-rated frequency and duration of the varying levels of maternal physical engagement and on the two aggregate measures to investigate cultural differences between Italian and American mothers (Table 2).

### **Contingency of maternal physical response to infant vocalization**

To answer the second question regarding maternal changes in proximity and physical contact in response to infant nondistress vocalizations, sequential analysis was used. For the sequential analysis we used the Generalized Sequential Querier for Windows (GSEQ), a program that queries, manipulates, and carries out simple and sequential statistical analyses of data that is in Sequential Data Interchange Standard (SDIS) format. In order to use Mominf data in these analyses, we followed a procedure for moving Mominf data into SDIS format for use by GSEQ.

Prior to data analysis the frequency of infant non distress vocalization in the two countries was examined. In order to compute an odds ratio (OR), more than 5 occurrences of the target behavior should be observed; otherwise the value of the OR is considered as missing. All subjects had more than 5 instances of non distress vocalization and were included in the analysis. There was a total of 9382 instances of infant non distress vocalization across the two countries (4961 for Italy and of 4421 for USA), (Table 3).

To investigate maternal behavioral response to infant non distress vocalization in the two countries, five sequential dependent variables were calculated. Following Bornstein, Tamis-LeMonda, et al. (1992) a 5-s time window was used to assess the likelihood that mother: (a) Began to Hold the infant within 5 sec of the onset of infant non distress vocalization; (b) Started to Loom

within 5 sec of the onset of infant non distress vocalization; (c) Touched the infant within 5 sec of the onset of infant non distress vocalization (d) Came Within Reach of the infant within 5 sec of the onset of infant non distress vocalization, and (e) Moved Out of Reach of the infant within 5 sec of the onset of infant non distress vocalization (procedure described in Bakeman and Quera (1995)).

Using the formula described in Bakeman, Deckner, and Quera (2005), time units were tallied in 2x2 tables for each behavioral sequence, and the odds ratio was computed for each maternal behavior. Values between 0 and 1 indicate that the target behavior is less likely to begin within the specific time window than at other times, whereas values greater than 1 indicate that it is more likely to begin in the 5 second window than at other times. T-tests were performed to investigate cultural differences in mothers' contingency responses to infant non distress vocalization. The data used in the analyses can be found in Table 4.

## **Results**

### **Cultural differences in Maternal Proximity and Physical Engagement**

Results indicate some differences in the duration of proximity between Italian and American mothers and their infants (Figure 1 and 2; Table 2).

Italian mothers touched their infants for a significantly longer period of time than did American mothers ( $t(48)= 2.108$ ;  $p=0.04$ ). Italian mothers also maintained close en-face engagement (Loomed) significantly longer than did American mothers ( $t(48)= 2.056$ ;  $p=0.04$ ).

No significant differences were found in the pro-rated duration of Out of reach or Hold between the two groups, although Hold was close to significance with the mean for Italian mothers being higher than the mean for American mothers ( $t(48)= 1.88$ ;  $p=0.06$ ). American mothers remained Within Reach of their babies without touching significantly longer than did Italian mothers ( $t(48)= -2.55$ ;  $p=0.014$ ). Italian mothers spent 59% of the time in close physical contact with the infant, while American mothers spent 45% (Figure 2). Conversely, Italian mothers spent 40% of the time and American mothers spent 54% of the time out of contact with the baby. Both differences between the two countries were significant. No significant differences were found in the pro-rated frequency of occurrence of any of the maternal behaviors

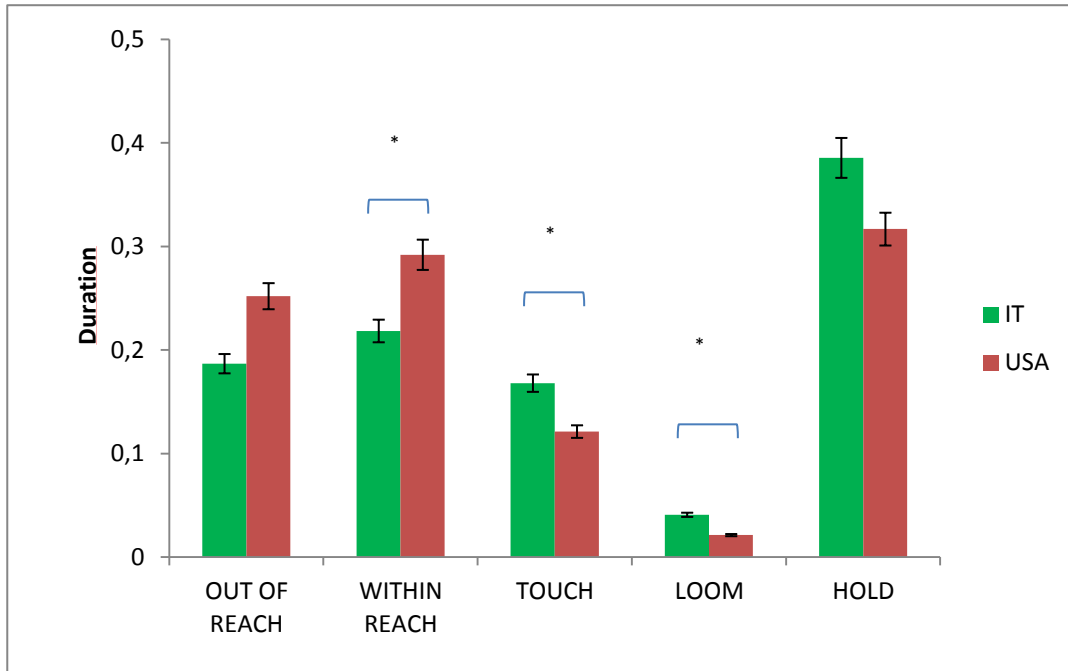


Figure 1. Pro-rated duration of Maternal Proximity and Physical Engagement in Italian and American mothers \*Statistically significant differences ( $p < .05$ ).

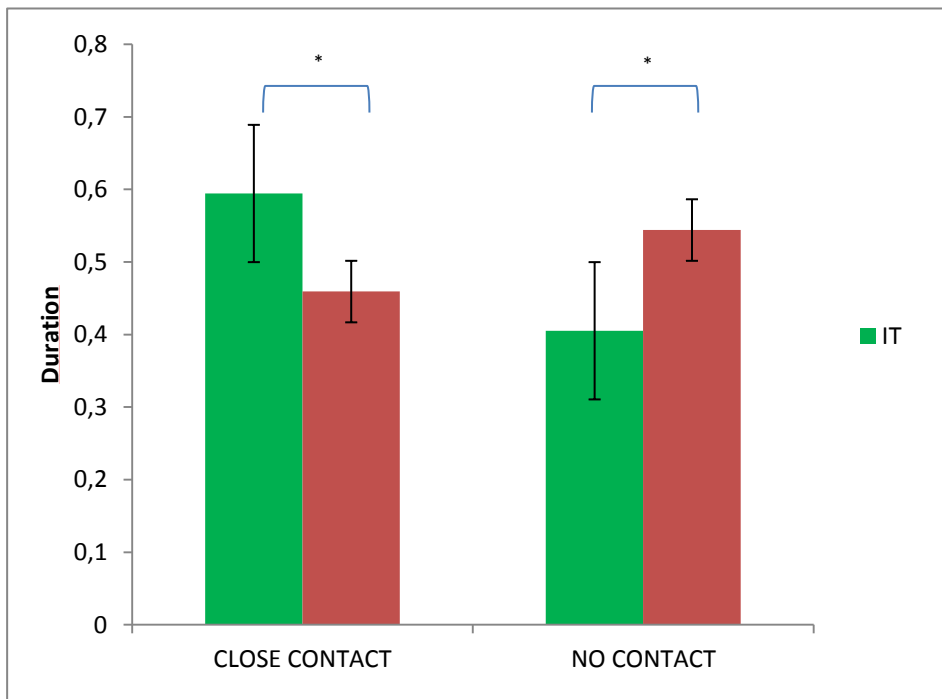


Figure 2. Pro-rated duration of Close contact and No contact with the infant for mothers in Italy and the United States. \*Statistically significant differences ( $p < .01$ ).

### **Contingency of maternal proximal/physical response to infant nondistress vocalization.**

Table 3 shows the joint frequencies of child vocalization followed by maternal response in the two countries. The most common maternal response to infant nondistress vocalization in both countries was to come to Within Reach of the infant; followed by Touching the infant. Holding, Looming, and moving Out of Reach occurred infrequently for both groups. Compared to American mothers, Italian mothers responded more often to infant nondistress by coming within reach of the baby (Italy: Joint Frequencies=396,  $M=15.84$  (6.87); USA: Joint Frequencies= 246,  $M=9.84$  (6.08)),  $t(48)= 2.02$ ,  $p<.05$ , and by touching the baby (Italy: Joint Frequencies=338,  $M=13.52$  (6.91); USA: Joint Frequencies=206,  $M=8.24$  (4.69)),  $t(48)= 2.35$ ,  $p<.01$ . They also responded significantly more often overall (total Joint Frequencies (Within reach, touch, loom and hold): Italy= 902, USA= 586,  $t(48)=2.37$ ,  $p<.02$ ).

To determine whether the sequences of behaviors of infant and mother were significantly contingent we performed Chi-square tests (Table 4). Results indicated that, in both countries, mothers were significantly likely to respond within 5 seconds to infant nondistress vocalization by coming within reach of the baby (IT:  $XSQ=36.74$ ,  $p<.01$ ; USA:  $XSQ=44.21$ ,  $p<.01$ ) and by touching (IT:  $XSQ=18.19$ ,  $p<.01$ ; USA:  $XSQ=27.68$ ,  $p<.01$ ). In addition, US mothers were significantly likely to contingently loom (USA:  $XSQ=48.54$ ,  $p<.01$ ) and hold the baby (USA:  $XSQ=15.28$ ,  $p<.01$ ) when the baby vocalized.

Results indicated that only for Within Reach there was a significant difference between the two countries. The contingency between infant nondistress vocalization and mother coming within reach was stronger in Italy than in USA (IT: mean= .77 (.16); USA: mean= .60 (.32)).

### **Discussion**

The main aims of this study were to compare the ways in which mothers physically engage their very young infants in two different cultures, Italy and the USA, and to ask whether they differ in the ways in which they respond proximally and physically to infant vocalizations.

We investigated: (1) Frequencies and durations of varying types of maternal physical engagement of young infants in the two countries; and (2) The degree to which different types of maternal physical engagement of the baby occurred contingently when the baby vocalized nondistress.

Group differenced emerged in the duration of maternal behaviors. Italian mothers tend to maintain closer contact with their babies than do American mothers, by touching their babies or looming and remain far from the infant for shorter times than American mothers. In general, these

results indicate that Italian mothers generally stay in closer proximity to their babies during the course of a typical hour during the day than do American mothers.

We suggest that the differences in maternal proximity found in this study are in line with the differences in parenting beliefs and practices in Italy and the United States reviewed earlier (Senese, Poderico, Venuti, 2003; Bornstein et al., 1998; Bornstein, M. H., Tal, J., & Tamis-LeMonda, 1991). More generally, our results corroborate the findings of previous research that has identified two different parenting styles in the way in which mothers establish body contact with the infant: the proximal and the distal style (Keller, 2007; Keller et al 2009; Keller, Lohaus et al., 2004). The proximal parental style is characterized more by greater proximity and body contact. It favors closeness between mother and infant and the establishment of a warm relationship (Hetherington & Frankie, 1967). It is further related to the early development of compliance (Keller, Yovsi et al., 2004), and it is more frequent in more traditional societies (Keller, Lohaus et al., 2004) that give more importance to aspects related to social relationships (Kağitçibaşı, 1996; Keller, Kärtner, Borke, Yovsi, & Kleis, 2005). The distal parenting style is characterized by less body contact between mother and infant and more communication originating in face-to-face contact and through the distal senses. It tends to favor independence and autonomy in the child through separateness, and it tends to occur more often in countries in which competition, individual achievement, and self-enhancement are considered more important in socialization (Keller, 2007; Keller, Borke, Yovsi, Lohaus, & Jensen, 2005). Our data suggests that Italian mothers tend to adopt a more proximal parental style and American mothers a distal parental style. We speculate that these differences in maternal proximity to and physical contact with their infants might lead to different kinds of interaction in the dyad between the two countries: one favoring the establishment of a social relationship, related to the cultural tendency of Italian mothers to give great emphasis to social aspects in childrearing (Bimbi, 1991) and the other favoring the child independence, related to the more autonomous education provided by American mothers (Bornstein et al., 1998).

Regarding the second question investigated in this research, considering the frequency with which mothers respond quickly to infant non distress vocalization by altering their proximity, results show that, overall, Italian mothers respond more often by positioning themselves within reach of the baby, a position that may facilitate close interaction with the baby. These findings are in line with previous research indicating that Italian mothers give importance to the communication aspect of the relationship with the child, and focus more of their attention on the

child's language (Senese, Poderico, Venuti, 2003; Tardif et al., 1997). For Italian mothers, the language domain is an important area of the child's healthy development, and progress in this area is generally considered a barometer of normal growth (Tardif et al., 1997; Bornstein, 2005)

Similarities and differences emerged in how Italian and American mothers altered their physical proximity to the baby contingent upon the baby's signaling. In both countries mothers responded to infant nondistress vocalization by coming within reach of the baby and by touching, although only the first measure differed significantly between the two groups. Both sets of behaviors could favor the establishment of communication between mother and child. By coming within reach of the infant, the mother assumes a proximal position in space that could attract his or her attention. Being within reach to the baby could set the stage for face-to-face interactions and dyadic exchanges, could help the dyad to develop a reciprocal joint coordination with the partner, and could favor co-regulation, an important aspect of effective social communication (Fogel, 1987; 1993).

Maternal touch is another important part of the mother–infant communicative system (Ferber, 2008). It is related to maternal sensitivity and to the capacity of the mother to respond to the infant in a coordinated way. Responding to infant nondistress vocalization by touching can take different forms that have different meanings. For example, an affectively positive touch like caressing or lightly stroking promotes a synchronous dialogue between mother and child and may be one way in which mothers support of the development of infant self-regulation (Ferber, 2004). On the other hand, a stimulating touch could be useful when infants are more passive and require stimulation to be more active in communicating with mother (Ferber, 2008). In general, maternal touch may encourage the development of inter-subjectivity and joint attention, help to baby's capacity for affect regulation to develop, and may be the basis of the experience of dyadic communication exchange between the two partners.

In contrast to Italian mothers, American mothers responded contingently to their infants in more different ways, showing more variation in the behavioral contingently response. We speculated that these differences in contingency reflected the different maternal beliefs about how parents think to act out their parental role, in relation to their own cultural ideology (Bornstein, 1991; Goodnow, Miller, & Kessel, 1995; Harkness & Super, 1996). Italian mothers tend to think that the child development is largely a natural process and that adults don't influence a lot his growth (New, 1994). By contrast American mothers are likely to believe that they are responsible for child's developmental outcomes (New & Richman, 1996), and they tend to view

the child behavior as a significant source of parenting successes. Because of they think to be an active part of the process of growth and development of the child, they are probably more motivated to interact in a more stimulating way towards the infant, showing a more complexity in the type of response toward his signal.

Generally, the results of this study support the idea that parental behaviors and the basic process of parental responsiveness are part of an evolved, general parenting program that differs according to culture-specific beliefs. The way in which mothers behave and respond to their infants with variations in physical proximity is a specific function that may be moderated by culture.

Maternal physical proximity is a differentiated, culturally sensitive format of parenting, that, in most cases, serve the best interests of the infants across cultures. Caregivers follow different cultural scripts in parenting, that have an adaptive value within the specific sociocultural context within the culture-specific script is developed. These findings suggest that there may be cultural forces operating to influence the way in which universally-occurring attachment-related behaviors are expressed very early in an infant's life. In this way cross-cultural research helps to elucidate variations in child-rearing practices related to cultural background, and to understand which processes are expressed in a universal way and which are culturally influenced. This information could help to better understand variations in child-rearing practices and in its goals.

Finally future research could be developed to analyzed several points. One possible investigation could be focus on the relative implications of the maternal physical engagement and proximity on the development of the mother- infant bond and on the infant developmental outcomes, analyzing both the effects of the amount of physical engagement and of the earlier physical contingency experiences on infants' development. It has been demonstrated that maternal responsiveness are specifically associated with certain child outcomes at specific periods in development (Tamis-LeMonda, Bornstein, and Baumwell; 2001). Future research should aim to demonstrate the significance of physical contingency experiences for later developmental outcomes, considering the caretakers' sociocultural orientation. Moreover future research could assess how the different forms of maternal physical engagement and proximity evolve across infancy and how the multiple various patterns affect the infant's ultimate growth. Finally future investigations should assess the maternal physical engagement in conjunction with maternal and infants' emotional displays during maternal body contact, investigating how the dynamics of this form of communication is developed.



Table 1

## Sociodemographic characteristics of participants

	Italy (n=25)	USA (n=25)	Group comparison
<b>Infant</b>			
Age (days)	155.59 (4.78)	163.37 (4.72)	t(48)=-6.007, p<.01
Gender (Girls:Boys)	9:16	11:14	t(48)=-.545, ns
Birth weight (g)	3373.6 (434.85)	3463.86 (409.22)	t(48)=-.930, ns
<b>Mother</b>			
Age (years)	29.26 (3.40)	27.93 (6.97)	t(48)=.943, ns
Education <sup>1</sup> (Hollingshead) <sup>a</sup>	4.24 (1.36)	4.52 (1.44)	t(48)= -.20, ns
SES (Hollingshead)	42.5 (9.71)	41.96 (13.26)	t(48)= .168, ns
Mother working outside at 5 mo.	5	14	t(48)=-2.68, p<.01
Hours work outside at 5 mo.	3.15 (7.96)	15.27 (16.42)	t(48)=-3.39, p<.01

<sup>a</sup>7-point Hollingshead (1975) education scale (1 = less than 7th grade, 6 = college or university graduate, 7 = graduate professional training).

Table 2

Untransformed descriptive statistics of pro- Rated data of maternal behaviors by country (mean and standard deviation) and group comparison

	Frequency			Duration		
	Italy	USA	t	Italy	USA	t
Out of reach	13.20 (6.57)	11.96 (5.85)	.705	0.18 (0.13)	0.24 (0.14)	-1.56
Within reach	50.46 (13.12)	48.15 (19.60)	.814	0.21 (0.096)	0.28 (0.105)	-2.551*
Touch	45.92 (13.78)	41.44 (18.04)	.985	0.16 (0.099)	0.12 (0.078)	2.10*
Loom	14.41 (10.94)	10.28 (8.33)	1.62	0.038 (0.033)	0.02 (0.021)	2.05*
Hold	11.68 (3.81)	10.15 (5.42)	1.52	0.37 (0.12)	0.31 (0.13)	1.88
Contact	72.01 (22.19)	61.87 (26.40)	1.46	0.59 (0.12)	0.45 (0.14)	3.50**
No Contact	63.67 (14.71)	60.12 (23.69)	-1.02	0.40 (0.12)	0.54 (0.14)	-3.62**

\*p < .05; \*\*p < .01.

Table 3

Joint Frequencies and Proportion of 5-sec infant vocal non distress time window with maternal responses by country

	Joint Frequency		Proportion		t
	Italy	USA	Italy (n=4961)	USA (n=4421)	
Out of reach	83	49	.016	.011	1.90
Within reach	396	246	.079	.055	2.02*
Touch	338	206	.068	.046	2.35*
Loom	97	73	.019	.016	.527
Hold	71	61	.014	.013	.082
Tot of maternal response (Within reach, touch, loom, hold)	902	586	.18	.13	2.37**

\*p < .05, \*\*p < .01

Table 4

Log odds, Odds ratio, test of contingency for odds ratio ( chi-square\*) and group comparison

	Italy			USA			Group comparison t test
	Log odds	Odds ratio	Chi- squared	Log odds	Odds ratio	Chi- squared	
Out of reach	0.06	1.06	(0.24)	0.21	1.24	(1.81)	t(48)=1.31 ns
Within reach	0.37	1.45	(36.74)*	0.48	1.61	(44.21)*	t(48)=1.907, p<.05
Touch	0.28	1.32	(18.19)*	0.41	1.51	(27.69)*	t(48)=.836, ns
Loom	0.16	1.17	(1.74)	0.94	2.57	(48.54)*	t(48)=-.096, ns
Hold	0.01	1.01	(0.01)	0.56	1.76	(15.28)*	t(48)=.565, ns

\*p &lt; .01.

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## CHAPTER III

### **Similarity and differences in Physical contact and proximity in Infancy in five different countries: Italy, USA, Korea, Japan and Kenya.**

In this study we have analyzed how mothers coming from Western societies (Italy and USA), from Eastern societies (Korea and Japan), and from Developing country (Kenya), establish proximity and physical contact with the infant and respond proximally/physically to infant nondistress vocalizations. The results reveal that mothers from Eastern, Western and Developing countries, except American mothers, maintain a close proximity to their babies during the course of a typical hour during the day, preferring a more proximal parental style. The way through which the maternal proximity is expressed, presents however variation across different countries.

Mothers commonly responded to infant nondistress vocalization by coming within reach of the baby and by touching. Otherwise different patterns of response towards infant vocalization emerged across countries, highlighted more similar pattern of contingently responses in the 2 Eastern countries, in comparison with the 2 Western countries, while the Developing country differentiates itself much more from the other countries. The findings are discussed looking at the specific cultural background and cultural ideology about parenting present in each countries.

#### **Background**

The care of offspring is a biological imperative present in human nature that is modulated by culture. In fact, many aspects of parental behavior are universally present in every culture and have a biological foundation; in every culture mothers are instinctively motivated to care for infants, and they expend a great deal of time and resources to help their children grow. However, the way in which universal parenting behaviors are expressed is shaped and modulated by cultural influences. In every culture there is a particular socioeconomic environment that favors the development of specific behaviors that are considered more adaptive in that culture. This influence is also evident in parental practices, because parents tend to promote the development of those social aspects in the child considered to be more functional for their cultural background (Keller, 2007). Cultural values influence parental aims and expectations for children (LeVine, 1970) and determinate which kinds of social conventions, communication styles, and social behaviors

are expected in a specific environment. Cultural background can also influence maternal responsiveness toward the infant's signals (Bornstein, Tamis-LeMonda, Pecheux, & Rahn, 1991; Richman, 1992). Maternal responsiveness is expressed through a variety of forms of behavior, contingent on different infant signals. Even if mothers from different countries are all equally responsive to their babies' signals, they will demonstrate differences in contingency patterns and in which types of responses are dominant (Kärtner, 2008). Exploration of ecological context is important in order to understand cultural similarities and differences in parenting (Bornstein, 1980, 1991, 2009). Universal generalizations about parenting are probably wrong if they are based only on the study of one or a few specific cultural groups (Tomlinson & Swartz, 2003; Moghaddam, 1987; Russell, 1984; Triandis, 1980). Cross cultural developmental research in this sense can help to better clarify parental behavior and its processes and highlight the limits of generalization (Bornstein, 2002).

Among parental behaviors, proximity and physical contact between the caregiver and the child are considered fundamental aspects involved in early mother- child interaction (Harlow, 1958; Ribble, 1944). Physical contact with caregiving figures has a fundamental influence on child development. It is considered the first and the most basic form of social communication between the caregiver and the child (Goleman, 1988); it has the function of protecting the child and of regulating his internal state (Tronick, 1989); and it is important for the psychological growth of the infant (Ribble, 1944). Maintenance of close proximity to mother is regarded as a fundamental need for the child, that helps in the establishment of the mother- child bond (Bowlby; 1969). In infancy, the primary responsibility for maintain proximity and contact lies with the mother. However, even if physical contact and proximity are universal parental behaviors, some research has found cultural differences in the way in which these behaviors are expressed (e.g., Hewlett, Lamb, Leyendecker, & Schölmerich, 2000; Keller, 2007; Keller et al., 2009). Keller (2007) found differences in the amount of physical contact that mothers directed toward the child between mothers from non-Western and Western societies. Mothers from non-Western farming societies spent more time in close proximity and had more physical contact with their 3- to 4-month-old infants than did middle-class Western mothers (e.g., Hewlett et al., 2000; Keller et al., 2009). Two different parenting styles regarding the way in which mothers establish physical contact with their infants have been identified--proximal and distal (Keller, 2007). The two styles are related to cultural backgrounds that influence parental behavior differently. The proximal parenting style, characterized by greater proximity and physical contact between mother and child, is more

frequently observed in more traditional societies (Keller, Lohaus et al., 2004) that stress social relationships, obedience to authority, and hierarchy (Kağıtçıbaşı, 1996; Keller, Kärtner, Borke, Yovsi, & Kleis, 2005) and in the rural farming families (Keller, 2009), where the parents usually practice proximal parenting strategies characterized by high amounts of body contact and body stimulation (Abels et al., 2005; Keller, 2003; Keller and Kärtner, 2005). This style favors closeness between mother and baby and the establishment of a warm relationship (Hetherington & Frankie, 1967) and is related to the early development of compliance in children (Keller, Yovsi et al., 2004). The distal parenting style, characterized by less physical contact and more communication derived from face-to-face contact and the distal senses, is more frequent in Western middle-class societies where competition, individual achievement and self-enhancement are considered important in socialization (Keller, 2007; Keller, Borke, Yovsi, Lohaus, & Jensen, 2005). The distal style encourages independence and autonomy in the child through separateness from mother.

The two parenting strategies (proximal and distal) (Keller, 2007) are closely related to the expression of separateness and relatedness and of heteronomy and autonomy in different cultural models (Kağıtçıbaşı, 1996). In general three prototypical cultural models related to different contextual patterns can be identified: (1) the Independence model (in which separateness and autonomy are valued), (2) the Interdependence model (in which relatedness and heteronomy are valued) and the Psychological Interdependence model (in which relatedness and autonomy are valued). These models are related to different contexts: the model of independence characterizes Western urban middle-class families, the model of interdependence characterizes non-Western rural families and the autonomous related model characterizes the urban educated middle-class families from non-Western societies (Kağıtçıbaşı, 1996). Keller et al. (2009) found that the urban, educated middleclass families from Western societies, representing the independent cultural model, express more the distal style of parenting; the families with a urban educated lifestyle in a society that holds beliefs especially for family life traditionally oriented towards relatedness, representing the model of autonomous relatedness, express the two styles on a medium level; the rural farming families with little formal education, representing the interdependent cultural model, express a proximal style of parenting.

Countries belonging to Western, Eastern and Developing societies are characterized by different cultural and social backgrounds with distinctive norms and social practices that influence the way in which parental practices are expressed.

### *Italy*

In Italian culture social and interactive exchanges play an important role in society, and they are considered an important parenting goal (Bornstein, Cote, & Venuti, 2001). Italian mothers pay great attention on the social development of the child (Senese, Poderico, & Venuti, 2003) and they expect high levels of social maturity in their infant (Gandini & Edwards, 2000). They tend to involve the child in family activities and interactions, and they tend to be protective, establishing a warm relationship with the infant (Carugati, Emiliani, & Molinari, 1990; Donati, 1993; Edwards, Gandini, & Giovaninni, 1996; Emiliani & Molinari, 1995). These characteristics are also reflected in mother- child interaction. Italians usually spend a great deal of time in dyadic social exchanges with infants and are very focused on social- affective behaviors and on social interaction (Hsu & Lavelli, 2005; Bornstein, Cote, & Venuti, 2001).

### *United States*

The U.S. culture is highly individualistic and competitive. For American mothers it is important that the child develop self-reliance, self-actualization, and autonomy (Bellah, Madsen, Sullivan, Swindler, & Tipton, 1985; Bornstein, 1994). They urge their children to express themselves in the best way in order to realize their full potential (Bellah et al., 1985; Markus & Kitayama, 1991). U.S. mothers are less focused on social aspects of the mother-child relationship: they are less engaged in social play (Bornstein, Haynes, Pascual, Painter, & Galperin, 1999), they give less attention to communicational and verbal aspects of interaction (Richman, LeVine, et al., 1988), and they are less involved in dyadic social exchanges with their infants (Hsu & Lavelli, 2005).

### *Korea*

In Korean culture collectivism forms the basis of society. Great emphasis is given to group harmony and cooperation and to the establishment of interdependence among individuals. A strong social hierarchy orders individual relationships based on differences in age, role and gender (Min, 1995; Park & Cho, 1995). The basis of the culture is constructed on Confucian values, traditions and customs (Kim, 1995; Park & Cho, 1995), which accord great attention to others' needs and the importance of harmony within the group (Choi, Kim, & Choi, 1993). This same set of cultural values is reflected in childrearing practices and in expectations toward children in Korea. In general, parenting practices are based more on societal rules than on individual perspective

(Ahn, 2012). The culture is centered on the family system which has a patriarchal structure within which the ties between components are strong.

The Korean concept of maternal behavior emphasizes closeness to the baby and the dependence of the child on the mother. Mothers tend to consider the infant as passive and dependent. They rarely separate from the baby, focus their constant attention on him or her (Brandt; 1971), and they emphasize relatedness (Choi, 1992; Kim & Choi, 1994).

### *Japan*

The Japanese culture gives great importance to social relationship, social harmony and to group socialization. The relationship between mother and child is based on strong emotional ties reflecting a specific feeling of oneness (Fogel, Stevenson & Messinger, 1992). This aspects have been interpreted as distinctive characteristics of Japanese culture that set a typical pattern for Japanese social relationships (Rothbaum, Pott, Azuma, Miyake, & Weisz, 2000).

Japanese mothers tend to show relatively little authority toward their children. They tend to empathize with the infant's feelings, focusing on the infant's needs and trying to meet the infant at the infant's level (Bornstein, Azuma, Tamis-LeMonda, & Ogino, 1990, Stevenson, 1986). However, although Japanese mothers are not direct and forceful in their disciplinary strategies (Zahn-Waxler, Friedman, Cole, Mizuta, & Hiruma, 1996), they expect obedience and self-control in their children from a very early age (Hess, Kashiwagi, Azuma, Price, & Dickson, 1980, Conroy, 1980).

The Japanese mother gives great importance to the moral education of the child (Kojima;1986). In fact, it is important in Japanese culture to enhance personality characteristics that favor the creation of harmonious social relationships, e.g., gentleness, empathic responding, compliance with others.

### *Kenya*

In Developing countries such as Kenya, the culture tends to favor a sense of collectivism, rather than the satisfaction of individual goals (Frederiksen, 2000). The presence of adverse external factors such as widespread political violence, poverty, and higher mortality rates contribute to a sense of vulnerability that leads underprivileged individuals to find help and recourse in the group (Altrocchi & Altrocchi, 1995).

For this reason the care of a child often falls not only to the parents, but is shared by the extended family and the community (Munroe & Munroe, 1972; Weisner & Gallimore, 1977). The child is integrated into the wider family group and is encouraged to learn through observation and cooperation with others, and to develop interdependence skills rather than individualistic autonomy. Kenyan society embodies a distributed model for socialization of children (Serpell, 1993), in which childcare is a part of a chain of support rather than being organized around an exclusive parent-child relationship. Instead, other members of the group consistently participate in caring for the child (Espinosa, 2002). Rather than encouraging the development of individualism and autonomy in children, this type of social caretaking contributes to the development of a sociocentric sense of personhood and reinforces affective ties among members of the group (Harrison, 2000).

In this study we have compared the way in which mothers are physical engaged with their children in different societies, selecting countries from the West (Italy and USA), the East (Korea and Japan) and from Developing nations (Kenya). The countries selected can be considered as representative of the 3 different cultural models mentioned above (Kağıtçıbaşı, 1996). The first group of samples (Italy and USA), represents the cultural model of urban, educated middleclass families in Western societies, The second group of samples (Korea and Japan), is made up of urban, educated families with a traditional family life. Kenya, represents a Developing country of rural farming families with little formal education (Kağıtçıbaşı, 1996).

We addressed two different research questions: (1) Do mothers with different socio-cultural backgrounds differ in the expression of physical behavior and in the establishment of proximity toward the child? (2) Do mothers with different socio-cultural backgrounds differ in how they respond proximally/physically to infant nondistress vocalizations? Specifically, we predicted that:

(1) Mothers in Italy

Because Italian mothers tend to be protective toward their children and tend to emphasize social exchanges, we hypothesized that Italian mothers would stay frequently and for a long period of time in close proximity and in physical contact with their babies, demonstrating a proximal parental style. Regarding the second question, considering that Italian mothers are more sensitive toward their children (Bornstein, 2008), show a preference for social activities (Axia and Weisner; 2002) and concentrate their energies on

affective relationships with their child (Bimbi, 1990), we hypothesized that Italian mothers would be highly proximally/physically contingent to their infants' vocal signals.

(2) Mothers in the United States

Because American mothers tend to socialize their children to be independent and autonomous, we hypothesized that American mothers would stay less frequently and for a short duration of time in close proximity to the baby, expressing a distal parental style. Regarding the second question, considering that the U.S. mothers are little focused on social aspects of the mother-child relationship (Bornstein, Haynes, Pascual, Painter, & Galperin, 1999), and that they give less attention to communicational and verbal aspects of interaction (Richman, LeVine, et al., 1988), we hypothesized that American mothers would be not much proximally/physically contingent to their infants' vocal signals.

(3) Mothers in Korea

Because the Korean culture represents a socialization model of autonomous relatedness, and the society beliefs are oriented towards a traditionally family life, and relatedness (Kağıtçıbaşı,1996), we hypothesized that Korean mothers would express the two parental styles proximal and distal on a medium level, in term of frequency and duration.

Because the Korean mothers emphasize closeness to the baby and focus their constant attention to the needs of the infant (Kim & Choi, 1994) we hypothesized that Korean mothers would respond to infant to nondistress vocalizations promptly and highly proximally/physically contingent.

(4) Mothers in Japan

Because Japanese culture gives great importance to social relationship, social harmony and to group socialization, and enhance personality characteristics that favor the creation of harmonious social relationships, and at the same time they are expected to value autonomy due to their urban educated lifestyle (Kağıtçıbaşı,1996), we hypothesized that Japanese mothers would behave similar to Korean mothers, and express the two parental styles on a medium level, in term of frequency and duration.

Because Japanese mothers are less likely to respond selectively to infant vocalizations, and they tend to not co-occurently respond to infant vocalizations (Fogel, 1988), we hypothesized that Japanese mothers would respond to infant to nondistress vocalizations less promptly and contingent.



(7) Mothers in Kenya

Because Kenya culture tends to favor a sense of collectivism, rather than the satisfaction of individual goals (Frederiksen, 2000), and the social background is that of the rural farming families with little formal education, a form of society that enhance a cultural model of interdependence (relatedness and heteronomy) (Kağıtçıbaşı,1996), we hypothesized that Kenyan mothers prefer a proximal parental behavior to get in contact with the baby, in term of frequency and duration.

Because Kenyan mothers are physically responsive toward the child particularly to crying and rather than to nondistress vocalization (Richman, 1992; Dixon, 1981), we hypothesized that Kenyan mothers would respond to infant to nondistress vocalizations less promptly and contingent.

(5) Mothers in the two Western countries

Italy and USA belong to the Western urban middle-class society. Considering that Italian mothers believe that their primary parenting task is to guarantee protection and warmth to the infant through the integration of the baby into the family (Joshi & Maclean, 1997; New, 1994) whereas the goal of American parenting is less focused on establishing closeness to the child and more on enhancing independence and autonomy (Harkness, 2007; Tronick, 1996), we expected to find differences among the two Western countries in the frequency and duration of maternal physical engagement, and in the contingency behavior towards infant vocalization signals. We expected that American mothers seemed most like the distal parenting style rather than Italian mothers. We hypothesized that American mothers would be less frequently and for a shorter duration of time in close physical contact to the baby, and would be less proximally/physically contingent rather than Italian mothers.

(6) Mothers in the two Eastern countries

Korea and Japan belong to the urban educated middle-class families from non-Western societies. Considering that in both culture great emphasis is given to the group harmony, cooperation, and to the social relationship (Kim, 1995; Park & Cho, 1995; Fogel, Stevenson & Messinger, 1992), we expected that Korean and Japanese mothers would express a similar pattern of parental style, showing the two styles proximal and distal on a medium level in term of frequency and duration of maternal physical engagement.

Otherwise, considering that Korean mothers focus their constant attention to the needs of the infant (Kim & Choi, 1994), and Japanese mothers are less likely to respond selectively

to infant vocalizations (Fogel, 1988), we hypothesized that Korean mothers would respond to infant to nondistress vocalizations more promptly and highly proximally/physically contingent rather than Japanese mothers.

## **Method**

### **Participants**

In each country, 25 mother-child dyads were selected for inclusion in the study. The Italian sample consisted of 25 dyads from Padua; the U.S. sample was selected from the Washington DC metropolitan area; the Korean sample came from the greater metropolitan area of Seoul, South Korea; the Japanese sample was from Hokkaido, and the Kenyan sample resided in Kamba.

All children were firstborn, born at term and healthy at the time of the study. Italian, American and Korean children had similar birth weights (average birth weight: 3391.75 (SD=431.70),  $F(4,120) = .668$ , ns); whereas Japanese and Kenyan children had a lower weight (Japanese mean = 3011.76, (393.57), Kenyan mean = 2913.40, (591.38)). Four Kenyan infants were of low birthweight (range = 1800-2065 grams). Infants were observed at home at approximately 159.66 days of age (SD= 7.66); American and Korean infants were slightly but significantly older than others infants when they were observed ( $F(4,120) = 6.89$ ,  $p < .001$ ). The percentage of females was 36% for the Italian sample, 44% for the American sample, 52% for the Korean sample, 44% for the Japanese sample, and 56% for the Kenyan sample ( $F(4,120) = .487$ , ns). Sociodemographic information for all samples appears in Table 1.

Mothers were primiparous and were screened to have had uncomplicated pregnancies. All mothers were adults (> 18 years) except for 4 Kenyan mothers who were less than 18 years of age (range = 15.81-17.63 years) at the child's birth. At the time of data collection, Italian mothers were approximately 29.26 years old (SD= 3.40), American mothers 27.93 years old (6.97), Korean mothers 28.45 years old (2.61), Japanese mothers 27.97 years old (4.99) and Kenyan mothers 21.31 years old ((3.48),  $F(4, 120)= 12.722$ ,  $p < .001$ ). In Italy, the US and Japan the mean level of maternal education was high school graduate, whereas Korean mothers were more highly educated and Kenyan mothers less so ( $F(4, 120)= 16.976$ ,  $p < .001$ ). At the time of data collection, 14 American mothers, 5 Italian mothers, 13 Korean mothers, 8 Japanese and 4 Kenyan mothers worked outside of the home ( $F(4, 120)=3.425$ ,  $p < .01$ ). Among the employed, there was a significant group differences in the number of hours worked ( $F(4, 120)= 4.490$   $p < .01$ ). No mothers

or infants emerged as outliers, so all were retained in the final sample. Maternal age and education were used as covariates in the statistical analyses.

## **Procedures**

Mother/infant dyads were observed at home for 1 h by a female filmer, and a videorecord of naturally occurring mother–infant interaction was made. Visits were scheduled for a time when mother and infant were at home alone together. Mothers were encouraged to behave in their usual manner and to disregard the observer's presence insofar as possible. The filmer did not talk to the mother or engage the baby during the filming; she attempted to be as unobtrusive as possible.

The research study was conducted in accordance with relevant ethical standards defined by the American Psychological Association and was subject to oversight by the National Institute of Child Health and Human Development Institutional Review Board.

## **Behavior Coding**

All videorecords were coded twice by independent coders, using two different coding systems that provided continuous records of maternal and infant behavior during the hour of observation. The coding system used to assess Maternal Proximity and Physical Engagement was developed for this study. It assesses a mother's proximity to and physical contact with her infant. The code has 5 levels, ordered from least to most proximal, and a "Cannot code" option. More proximal levels pre-empt less proximal levels. A new level is coded when the behavioral criteria for that level are met, and this effectively functions as the offset of the previous behavior level. The levels of the code were defined as follows:

1. **Out of reach.** *Mother is out of her own arm's reach of the infant.*
2. **Within reach.** *Mother is within her own arm's reach of the infant (i.e., mother can comfortably extend her arm and make contact with the infant even if having to lean or bend but without taking any steps through space) and is not engaged in touching, looming, or holding.*
3. **Touch.** *Mother touches the infant with her hand(s). (Touching the infant's body with an inanimate object held in the mother's hands was not coded unless the object was made of paper or cloth and was associated with caregiving (e.g., an article of infant's clothing, a diaper, a washcloth, a tissue.) Very brief breaks in touching (e.g., less than one second) were not coded as the cessation of touching).*

4. **Loom.** *While within reach of and looking at but not holding the baby, mother purposefully moves her face closer to the infant's face, seemingly with the intention of engaging the infant or observing the infant closely. (Loom was scored until the mother moved her head back from the close position. Simply bending over the infant to provide caregiving was not coded as Loom).*

5. **Hold.** *Mother supports the infant's weight with her arms, legs, or trunk. Mother may be lying down, squatting, sitting, standing, or moving through space.*

The code yields measures of the frequency of onsets of each behavioral level and the duration of time spent at each level. Maternal behavior is coded without considering infant responses to the behavior. Data were coded using the observational data collector ObsWin 2008 (Neil Martin, Chris Oliver and Scott Hall, 1999; Obswin data collector, free download on <http://www.antam.co.uk/obswin.htm>). The default datafile type used by ObsWin is the Timed Sequential datafile, a type of the Sequential Data Interchange Standard (\*.SDS datafiles) developed by Bakeman and Quera (1995).

Infant nondistress vocalization was coded using a system (MOMINF) previously developed in connection with a longitudinal, cross-cultural investigation of normative child development and parenting (Bornstein, 2009). MOMINF is an on-line coding procedure, and the output is identical to the output of Obswin. Infant nondistress vocalization was defined as a vocalization that was positive or neutrally toned. Infant vocal behavior was coded in a separate pass through the videotaped home observations and yielded continuous behavioral records coded in real time. Although different coding systems were used for the two sets of coded behavior, the two data sets were comparable.

We converted the Infant nondistress vocalization data generated by MOMINF to SDIS format, following a procedure developed by the Child and Family Research Section, and we created an SDS file containing all data for analyses (Bakeman, R., Quera, V.; 1992).

For both sets of continuously coded behaviors, Cohen's (1960, 1968) *Kappa* was used to assess coder reliability. Coders were first trained to be reliable. During the coding of the data, 20% of records were independently coded by two coders. Reliability coefficients were computed with  $\kappa$  separately for each cultural group, and reliability for both codes was acceptable for all groups (nondistress Maternal physical engagement: IT  $\kappa$  = .89; USA  $\kappa$  = .97; KO = .85; JP  $\kappa$  = .97; KE  $\kappa$  = .95); Infant nondistress vocalization: IT  $\kappa$  = .72; USA  $\kappa$  = .70; KO  $\kappa$  = .75; JP  $\kappa$  = .83; KE  $\kappa$  = .70.)

## **Data Analysis**

### **(1) Cultural differences in Maternal Proximity and Physical Engagement**

For each level of the coding system measures of frequency and duration were obtained. Frequency is the number of times the target behavior was initiated by a participant within the observation session. Duration is the amount of time that a participant engaged in the behavior. Because the durations of some observations were less than 3600 sec (one hour), pro-rated measures of frequency and duration per time unit were calculated and used in the analyses. Prior to data analysis, distributions of pro-rated frequency and duration of maternal behaviors were examined for normalcy and outliers. Cube-root transformations were applied to all variables. Maternal age and education were used as covariates for all analyses because they correlated significantly ( $p > .05$ ) with the dependent variable.

The levels of the code were then collapsed into two aggregate measures, No Contact and Close Contact. No contact combines the levels of the code in which the mother does not touch the infant (Out of reach and Within reach); Close contact combines the levels of the code in which the mother establishes close physical contact with the infant (Touch, Loom, and Hold).

Tests of group comparisons (indexed by univariate analysis of variance) were performed on pro-rated frequency and duration of the varying levels of the code and on the two aggregate measures to investigate cultural differences between groups. Pairwise comparison using multiple t test (LSD) were also performed (Tables 2 and 3).

### **(2) Contingency of mother's physical response to the child**

To answer the second question and to examine the extent to which mothers responded contingently to infant nondistress vocalization across the 5 countries, sequential analysis was used.

For the sequential analysis we used GSEQ for Windows, Generalized Sequential Querier (Quera, V., Bakeman, R., & Gnisci, A., 2007), a program that queries, manipulates, and does simple and sequential statistical analyses of data that is in Sequential Data Interchange Standard (SDIS) format. In order to use MONINF data for sequential analysis, we followed a procedure for converting Mominf data into SDIS format for use by GSEQ (Bakeman, R., Quera, V. ; 1992).

Prior to data analysis the frequency per time unit of infant nondistress vocalization across countries was explored. In order to compute odds ratio, more than 5 occurrences of the behaviors should be observed, otherwise the value of the OR is considered as missing. All the subjects

presented more than 5 instances of nondistress vocalization and for this reason we included all the subjects in the data analysis. There were a total of 20580 instances of infant nondistress vocalization across countries (4961 for Italy, 4421 for US, 2388 for Korea, 3311 for Japan, 5499 for Kenya), (Table 4).

To investigate maternal behavioral response to infant nondistress vocalization in all 5 countries, five sequential dependent variables were calculated. Following Bornstein, Tamis-LeMonda, et al. (1992) a 5-s time window was used to capture the maternal proximity response that began in the 5 second window following the infant nondistress vocalization. These variables assessed the likelihood that mother: (a) Began to Hold the infant within 5 sec of the onset of infant nondistress vocalization; (b) Started to Loom within 5 sec of the onset of infant nondistress vocalization; (c) Touched the infant within 5 sec of the onset of infant nondistress vocalization (d) Came Within Reach of the infant within 5 sec of the onset of infant nondistress vocalization, and (e) Moved Out of Reach of the infant within 5 sec of the onset of infant nondistress vocalization (procedure described in Bakeman and Quera (1995)).

Using the formula described in Bakeman, Deckner, and Quera (2005), time units were tallied in 2x2 tables for each behavioral sequence, and the odds ratio were computed for each maternal behavior. Values between 0 and 1 indicated that the target behavior was less likely to begin within the specific time window than at other times, whereas values greater than 1 indicated a greater likelihood that the behavior would begin in the 5 second window than at other times. Tests of group comparisons (indexed by univariate analysis of variance) were performed to investigate cultural differences in mothers' contingency responses to infant nondistress vocalization. The data used in the analyses can be found in Table 5.

## **Results:**

### **(1) Cultural differences in Maternal Proximity and Physical Engagement**

Results indicate some differences in the pro-rated frequencies (Table 2 and Figure 1) and durations (Table 3 and Figures 2 and 3) across the 5 cultural groups.

#### **Out of reach**

Considering the pro-rated frequency of maternal behavior the main effect of cultural group was significant ( $F(4, 120) = 3.499; p < .01$ ). In general mothers in Western countries were more frequently out of arm's reach of infant than mothers of Eastern countries: US mothers are more

frequently out of reach of the infant than Korean mothers ( $p=.006$ ); Italian mothers are more frequently out of reach than Korean ( $p=.001$ ) and Japanese mothers ( $p=.04$ ).

Considering the duration of behavior the main effect of cultural group just missed being significant ( $F(4, 120) = 2.400$ ;  $p = .054$ ). US mothers spent the most time out of reach of the infant, followed by Kenyan mothers. Both US and Kenyan mothers were different than Korean mothers, who spent the least amount of time out of reach of the infant (USA vs KO:  $p = .004$ ; KE vs KO:  $p = .033$ ).

### **Within reach**

The main effects of cultural group for both pro-rated frequency ( $F(4, 120) = 4.058$ ;  $p = .01$ ) and duration of Within Reach ( $F(4, 120) = 7.801$ ;  $p = .001$ ) were significant.

Mothers in Western countries came within reach of their infants more frequently than did mothers in Eastern and Developing countries. Specifically, Italian mothers were within reach more frequently than Korean mothers ( $p=.038$ ), Japanese mothers ( $p=.017$ ), and Kenyan mothers ( $p=.001$ ). American mothers were within reach more frequently than Japanese mothers ( $p=.05$ ), and Kenyan mothers ( $p=.004$ ).

Kenyan mothers spent the least amount of time within reach of the baby of any group ( $p < .001$ ). US mothers stayed within reach of the baby the greatest length of time of all groups, differing significantly from Italian mothers ( $p = .049$ ) and Japanese mothers ( $p = .015$ ).

### **Touch**

The main effect of cultural group for frequency of touch was not significant ( $F(4, 120) = 1.494$ ;  $p = .85$ ).

There was a significant main effect of cultural group for pro-rated duration of touching ( $F(4, 120) = 3.950$ ;  $p = .01$ ). Differences emerged between the two Western countries (Italy vs USA) but not between the two Eastern countries (Korea vs Japan). American mothers and Kenyan mothers were similar and both spent less time touching than Italian mothers (US,  $p = .05$ ; Kenya,  $p = .026$ ), Korean mothers (US,  $p = .008$ ; Kenya,  $p = .007$ ) and Japanese mothers (US,  $p = .007$ ; Kenya,  $p = .003$ ).

### **Loom**

Main effects of cultural group for both frequency ( $F(4, 120) = 12.561$ ;  $p = .001$ ) and duration ( $F(4, 120) = 8.809$ ;  $p = .001$ ) of Loom emerged. Italian mothers initiated close en-face engagement the most frequently and Kenyan mothers the least. Italian mothers loomed more often than Japanese mothers ( $p = .007$ ) and Kenyan mothers ( $p = .000$ ). Kenyan mothers loomed

much less frequently than Italian mothers ( $p=.000$ ), American mothers ( $p=.000$ ), Korean mothers ( $p=.000$ ) and Japanese mothers ( $p=.000$ ).

Italian mothers maintained close face-to-face engagement with their babies significantly longer than did American mothers ( $p= .024$ ), Japanese mothers ( $p= .001$ ) and Kenyan mothers ( $p= .000$ ). For Kenyan mothers, the duration of face-to-face engagement was shorter than all other groups (Italy,  $p= .000$ ; USA,  $p= .000$ ; Korea , $p= .001$ ; Japan , $p= .01$ ).

**Hold**

The main effect of cultural group for the frequency of maternal holding was not significant ( $F(4, 120)= 1.782$ ;  $p= .137$ ). Significant main effect of cultural group for pro-rated duration emerged ( $F (4, 120) = 3.424$ ;  $p = .01$ ).

A main group effect for duration of holding indicated that American mothers held their babies for less time than other countries, differing significantly from Italian mothers ( $p =.038$ ), and Kenyan mothers ( $p=. 000$ ). Kenyan mothers held their babies longest, differing significantly from American mothers ( $p=. 000$ ), Korean mothers ( $p=. 05$ ) and Japanese mothers ( $p=. 05$ ).

**Close Contact/ No contact**

American mothers were the only group to spend less than half (46%) of the time in close contact with their babies. Mothers of the others countries were in close physical contact from 59% to 64% of the time. The differences in the percentage of time spent in close contact with the baby were significant for all pairwise comparison between American mothers and the other groups ( $p<.01$ ).

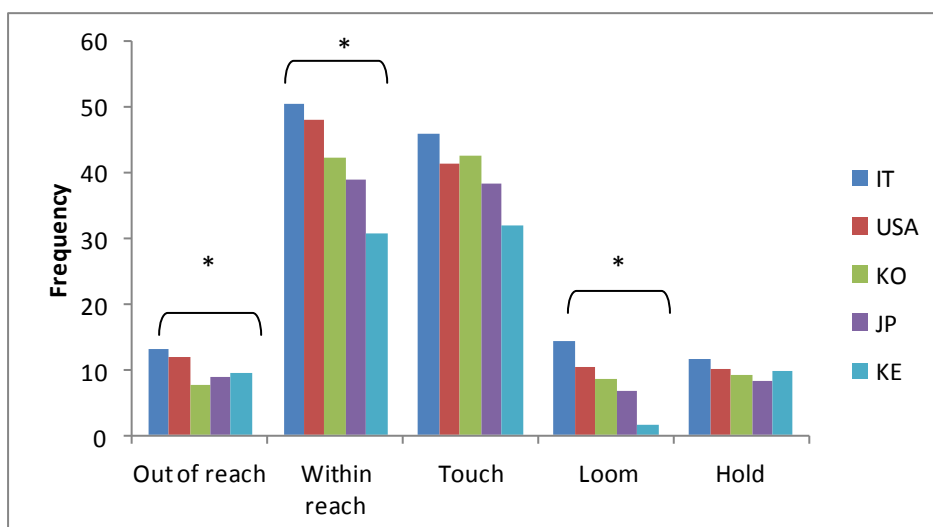


Figure 1. Pro-rated frequency of maternal behaviors in 5 countries



\*Statistically significant differences ( $p < .01$ ).

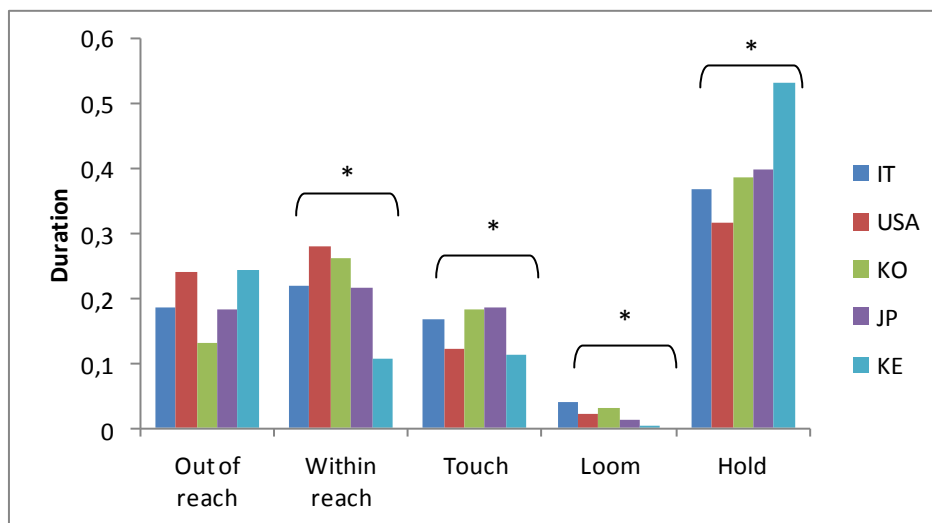


Figure 2. Pro-rated duration of maternal behaviors in 5 countries

\*Statistically significant differences ( $p < .01$ ).

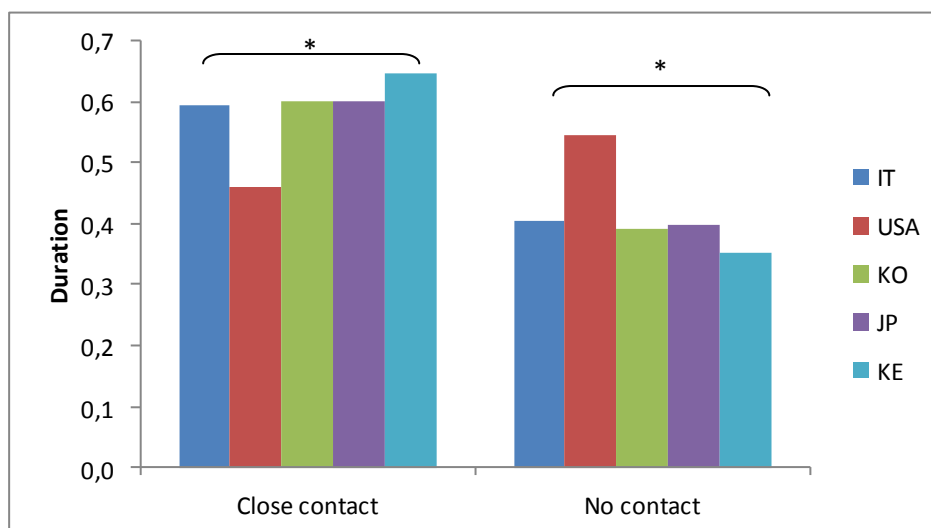


Figure 3. Pro-rated duration of maternal "close contact" and "no contact" in 5 countries

\*Statistically significant differences ( $p < .01$ ).

## (2) Contingency of physical response of the mother toward the child

Table 4 shows the joint frequencies of child nondistress vocalization followed by maternal proximal/physical response across countries. To compare the different countries, the proportion of joint frequencies in relation to the number of instances of infant nondistress vocalization was calculated (joint frequencies divided by the number of instances of infant nondistress vocalization in each country). We have calculated the overall number of infant nondistress vocalizations

followed by a maternal response including in the analysis only the maternal response that were directed towards infant (total joint frequencies (Within reach, touch, loom and hold). Tests of group effects (indexed by univariate analysis of variance) and then pairwise comparisons using multiple t tests (LSD) were performed (Table 4). The main effect of cultural group for the overall number of infant nondistress vocalizations with a maternal response was significant ( $F(4, 120) = 10.868, p < .000$ ). Italian and Korean mothers were the most (and equally) responsive ( $p = .83, ns$ ), and both were more responsive than Japanese and Kenyan mothers ( $p < .05$ ). In addition, Italian mothers were more responsive than American mothers ( $p = .02$ ). American mothers responded significantly more often to nondistress than Japanese mothers ( $p < .000$ ). The Japanese mothers responded least often (.03), and differed from all other groups ( $p < .05$ ) (Table 4).

The most frequent response of mothers following infant nondistress vocalization was to come within reach of the baby (Sum of proportional Joint Frequencies = .248) or to touch (Sum of proportional Joint Frequencies = .232) (Table 5).

To determine whether the sequences of mother and infant behaviors were contingent Chi-square tests were used (Table 5). With the exception of Kenyan mothers, who responded contingently only by looming, all of the other groups were contingently responsive in multiple ways. Italian, American, Korean and Japanese mothers all responded to nondistress infant signals by coming within reach of the baby (IT:  $XSQ = 36.74, p < .01$ ; USA:  $XSQ = 44.21, p < .01$ ; KO:  $XSQ = 11.07, p < .01$ ; JP:  $XSQ = 62.34, p < .01$ ). Moreover, Italian, American and Korean mothers (but not Japanese mothers) responded to infant nondistress vocalization by touching (IT:  $XSQ = 18.19, p < .01$ ; USA:  $XSQ = 27.68, p < .01$ ; KO:  $XSQ = 11.07, p < .01$ ).

Other patterns of response emerged as contingent across countries even as they occurred less frequently. American, Korean, Japanese and Kenyan mothers tended to initiate close en-face engagement with the baby in response to infant vocalization (USA:  $XSQ = 48.54, p < .01$ ; KO:  $XSQ = 4.12, p < .04$ ; JP:  $XSQ = 59.69, p < .01$ , KE:  $XSQ = 9.63, p < .01$ ) and, except for Kenya, to hold the baby (USA:  $XSQ = 15.28, p < .01$ ; KO:  $XSQ = 6.21, p < .04$ ; JP:  $XSQ = 141.15, p < .01$ ). Finally, Japanese mothers occasionally moved out of reach of the baby immediately following an infant nondistress signal (JP:  $XSQ = 7.05, p < .01$ ).

There were significant differences between countries for Within reach ( $F(1, 120) = 5.058, p < .01$ ), for Loom ( $F(1, 120) = 2.64, p < .05$ ), and for Hold ( $F(1, 120) = 6.06, p < .01$ ). The contingency between infant nondistress vocalization and mother coming within reach was stronger in Japan than in Italy  $t(48) = -2.05, p < .05$  and stronger in Italy than in the US  $t(48) = 1.79, p < .05$ . The

contingency between infant nondistress vocalization and mother Loom was stronger in Japan than in the US  $t(48) = -2.378$ ,  $p < .05$ . The contingency between infant nondistress vocalization and mother Hold was stronger in Japan than in Italy  $t(48) = -3.83$ ,  $p < .01$ .

## Discussion

The main aim of this study was to compare the way in which mothers are physically engaged with their children in Western, Eastern and Developing countries, considering 5 different cultural groups: Italy and USA as Western; Korea and Japan as Eastern; and Kenya as a Developing country. We investigated: (1) Frequencies and durations of varying types of maternal physical engagement of young infants in the five countries; and (2) the degree to which different types of maternal physical engagement with the baby occurred following infant vocal nondistress.

### *Mothers in Italy*

Italian mothers tend to get frequently out of reach of the baby or to get within reach of their babies without touching him, but only for a short period of time. They maintain more often a closer contact with their babies, by touching their babies, looming or holding and generally stay in closer proximity to their babies during the course of a typical hour during the day for the most of the time (60% of the time). Italian mothers are highly proximally/physically contingent to their infants' vocal signals, and respond most frequently altering their proximity to the baby in response to nondistress vocalizations.

We suggest that the proximal parental style preferred by Italian mothers, has the function to establish a close warm contact with the baby in order to reinforce the social–affective bond and reflects the empathize given in the Italian culture to the affective relationship between mother and child (Bimbi, 1991). Moreover our findings are in line with the results of previous researches, who have found that Italian mothers give more importance to the communication aspect of the relationship with the child, and focus more their attention to their children's language (Senese, Poderico, Venuti, 2003; Tardif et al., 1997). This domain represents for mothers an important sign of the child's healthy development and progress in this area is generally considered a barometer of normal growth, and probably for this reason they are more prompt to respond to this kind of infant signal.

### *Mothers in the United States*

American mothers are frequently out of their own arm's reach of infant or within reach of him without physical contact and they tend to adopt a distal parental style. American mothers stay for

the majority of time not in close contact with the baby (54% of time). We speculate that this parental style lead to the more autonomous education provided by American mothers that tend to favor the child independence (Bornstein et al., 1998). This way of thinking is reflected in the physical engagement of the mothers, who are less physical involved with their children, and tend to stay less close to the baby.

Regarding the second question, the results don't corroborate fully our hypothesis regarding a poor presence of proximally/physically contingent response in the American mothers to their infants' vocal signals. American mothers quite frequently altering their proximity to the baby in response to nondistress vocalizations, and are proximally/physically contingent to their infants' vocal signals at a medium level in comparison to other countries. American mothers responded contingently to their infants in different ways, showing variation in the behavioral contingently response. We speculated that these results reflected the American mothers view on parenting, considering thyself as responsible for child's developmental outcomes (New & Richman, 1996). Because of they think to be an active part of the process of growth and development of the child, they are probably motivated to interact in a stimulating way towards the infant, showing more complexity in the type of response toward his signal.

#### *Mothers in Korea*

Korean mothers contrary to our expectation, do not present both parental style, proximal and distal on a medium level, but tend to maintain a closer contact with their babies, by touching or holding him, and generally stay in closer proximity to their babies during the course of a typical hour during the day (60% of the time), and tend less frequently to get out of reach of the baby or to be within reach of the infant without touching him.

Korean mothers maintain a close en-face engagement highly frequently than other countries, probably because this kind of behavior is functional to the Korean parental behavior that emphasized the relatedness and the dependence between mother and infant (Kim & Choi, 1994). Korean mothers are promptly and highly proximally/physically contingent and frequently altered their proximity to the baby in response to nondistress vocalizations. These results are in accordance with the previous research that underlined as Korean mothers rarely separate from their children, because they emphasize more the closeness between mother and infant (Kim & Choi, 1994) and focus their constant attention to the needs of the infant (Kim & Choi, 1994).

### *Mothers in Japan*

Japanese mothers behave similar to Korean mothers, and contrary to our expectation, do not present both parental styles, proximal and distal on a medium level, and tend to maintain a closer contact with their babies, by touching their babies or holding. They generally stay in closer proximity to their babies during the course of a typical hour during the day (60% of the time), and tend less frequently to get out of reach of the baby or to be within reach of their babies without touching him. Japanese mothers are less frequently physical responsive toward infant non distress signal, and in a small percentage of cases, tend to ignore infant non distress signal, getting out of reach of the baby, after his vocal signal. This result is in line with previous research that found that Japanese mothers were less likely to respond selectively to infant vocalizations, and they tend to not co-occurently respond to infant vocalizations (Fogel, 1988). This result could explained considering some aspect involved in the interpersonal communicative style in Japan, in which is given more importance to the non verbal signal rather than verbal, often is preferred the indirectness in the conversation and the affective meaning is communicated nonverbally. Therefore it could be expect that Japanese mothers use the same style of interaction toward infant, and as results of this cultural inflation they pay less attention to verbal non distress infant signal.

### *Mothers in Kenya*

Mother in Kenya when get close to the baby, usually prefer to maintain the closest form of body contact with the infant, by holding him, and present the lowest distal parental style in comparison to the others countries. We speculated that mothers prefer the most proximal parental behavior to get in contact with the baby, because holding the infant has the function to prevents the baby from exposure to dangers and permit to the mothers to promptly react to infant's needs (Keller, 2007; Keller et al., 2006). If there aren't other members of the group available to take care of the baby, the most secure way for the mothers to guarantee the safety of the infant is holding him, and this behavior allows also the mothers to contemporary work on other household tasks.

Kenyan mothers are less responsive towards infant non distress signal, because they are physically responsive toward the child particularly to crying and rather than nondistress vocalization (Richman, 1992; Dixon, 1981); for Kenyan mothers, it is important to guarantee responsive care during infancy by comforting distress of the infant and it is less important engaging him in an conversational interaction. In fact it is a primary aim of child raining for Kenyan mothers to protect

their babies, and for this reason it is not fundamental engage the infants in an emotionally arousing conversational interaction in order to enhance the verbal communication.

#### *Mothers in the two Western countries*

We individuated less similarities in maternal behaviors of mothers coming from Western countries. Italian mothers stay higher physical and in a proximal contact with the infant than American mothers and are significantly more responsive toward infant vocalization signal. The pattern of contingent physical response is also different, because American mothers show more variation in the behavioral response, in comparison to Italian mothers. Inside a sample of countries traditionally defined as Western, considered representatives of the cultural model of Independence (separateness and autonomy) in the socialization goal, we individuate differences and variation in the expression of maternal behavior, underlined as the cultural models in the Western societies present more variation in the way in which they are expressed.

#### *Mothers in the two Eastern countries*

We individuated many similarities in the parental behaviors of mothers from Eastern countries, who present a constant similar pattern of maternal response, and contrary to our expectation, mothers in the two Eastern countries have the tendency to maintain a closer contact with their babies preferring a proximal parental style. Regarding the possible cultural influences on mother's contingent physical response to infant nondistress vocal signals, the two countries differ in the frequency of maternal response to infant vocalizations, because Korean mothers are more promptly and highly proximally/physically contingent than Japanese mothers, but present more similar pattern of contingently behavioral responses towards infant vocalization, in comparison with the Western countries. Both countries respond to the infant by coming within reach to the baby, by touching or holding him. In general the 2 Eastern countries, represent a prototypical cultural models widely shared, that is reflected in a similar pattern of maternal physical engagement, even if some variation regarding the attention versus the communication aspects are individuated.

Generally, these results support the idea that parental behaviors and basic process of responsiveness is based in an evolved, general parenting program that could differ according to culture-specific beliefs. The way in which mothers behave and response in term of physical engagement to infant signal is a specific function that may be further moderated by culture. Mothers coming from Western, Eastern and Developing country show parental behaviors that are for some aspect common across countries, but for other aspects they modulate their parental

behaviors in an adaptive way considering the particular context of leaving and also considering the cultural background. Also inside a sample of countries traditionally defined as Western or Eastern we can individuate differences and variation in the expression of maternal behavior, even if mothers from Eastern countries seem to share more common aspects in the maternal behaviors, rather than mothers from West.

Cultural forces influence the way in which universally-occurring attachment-related behaviors are expressed very early in an infant's life. In this way cross-cultural research helps to elucidate variations in child-rearing practices related to the cultural background, to document variations in developmental outcomes, and to understand which processes are expressed in a universal way and which are culturally influenced. This information could help to better understand variations in child-rearing practices and in its goals.

Finally future research could be developed to analyzed several points. One possible investigation could be focus on the relative implications of the maternal physical engagement and proximity for the development of the mother- infant relationship and for infant developmental outcomes, analyzing both the effects of the amount of physical engagement and of the earlier physical contingency experiences on infants' development. It has been demonstrated that maternal responsiveness are specifically associated with certain child outcomes at specific periods in development (Tamis-LeMonda, Bornstein, and Baumwell; 2001). Future research should aim to demonstrate the significance of physical contingency experiences for later developmental outcomes, considering the caretakers' sociocultural orientation. Moreover future research could assess how the different forms of maternal physical engagement and proximity evolve across infancy and how the multiple various patterns affect the infant's ultimate growth. Finally future investigations should assess the maternal physical engagement in conjunction with other maternal behaviors and infants' emotional displays during maternal body contact, investigating how the dynamics of this form of communication is developed.

Table 1

## Sociodemographic characteristics of participants

	Italy (n=25)	USA (n=25)	Korea (n=25)	Japan (n=25)	Kenya (n=25)	Group comparison
<u>Infant</u>						
Age (days)	155.59 (4.78)	163.37 (4.72)	163.00 (4.56)	156.48 (9.83)	159.64 (9.63)	F(120)=6.89, p<.001
Gender  (Girls:Boys)	9:16	11:14	13:12	11:14	14:11	F(120)=.487, ns
Birth weight (g)	3373.6 (434.85)	3463.86 (409.22)	3369.79 (443.54)	3011.76 (393.57)	2913.40 (591.38)	F(120)=7.13, p<.001
<u>Mother</u>						
Age (years)	29.26 (3.40)	27.93 (6.97)	28.45 (2.61)	27.95 (4.99)	21.35 (3.48)	F(120)=12.72, p<.001 F(120)=16.97, p<.001
Education <sup>a</sup> (Hollingshead)	4.24 (1.36)	4.52 (1.44)	5.52 (0.82)	4.40 (0.86)	2.67 (1.70)	F(120)=16.97, p<.001
Mother working outside at 5 mo.	5	14	13	8	4	F(120)=3.425, p<.01
Hours work outside at 5 mo.	3.15 (7.96)	15.27 (16.42)	21.14 (24.12)	22.53 (4.68)	5.16 (13.25)	F(120)=4.490, p<.001

<sup>a</sup>7-point Hollingshead (1975) education scale (1 = less than 7th grade, 6 = college or university graduate, 7 = graduate professional training).



Table 2

Untransformed descriptive statistics of pro-rated frequency of maternal behaviors by country (mean and standard deviation) and ANOVA results

	Italy	USA	Korea	Japan	Kenya	F	Significant paired comparison
Out of reach	13.20 (6.57)	11.96 (5.85)	7.74 (4.98)	9.02 (4.67)	9.57 (5.02)	3.499*	IT > KO IT > JP USA > KO
Within reach	50.46 (13.12)	48.15 (19.60)	42.19 (20.67)	38.95 (15.47)	30.86 (17.39)	4.058*	IT > KO IT > JP IT > KE USA > JP USA > KE
Touch	45.92 (13.78)	41.44 (18.04)	42.57 (18.65)	38.40 (14.02)	31.89 (18.80)	1494	IT > KE
Loom	14.41 (10.94)	10.28 (8.33)	8.69 (9.02)	6.73 (6.43)	1.75 (3.70)	12.561**	IT > JP IT > KE USA > KE KO > KE JP > KE
Hold	11.68 (3.81)	10.15 (5.42)	9.22 (5.06)	8.45 (3.22)	9.85 (4.50)	1782	IT > JP

\* $p \leq .01$ . \*\*  $p \leq .001$

Table 3

Untransformed descriptive statistics of pro-rated durations of maternal behaviors and aggregated variables by country (mean and standard deviation) and ANOVA results

	Italy	USA	Korea	Japan	Kenya	F	Significant comparison	paired
Out of reach	0.18 (.13)	0.24 (.14)	0.13 (.10)	0.18 (.14)	0.24 (.17)	2.400	USA > KO <	KO KE
Within reach	0.218 (.09)	0.28 (.10)	0.26 (.12)	0.215 (.13)	0.10 (.09)	7.801**	IT > USA > USA > USA > KO > JP >	KE IT JP KE KE KE
Touch	0.16 (.09)	0.12 (.07)	0.18 (.09)	0.18 (.09)	0.11 (.06)	3.950*	IT > IT > USA < USA < KO > JP >	USA KE KO JP KE KE
Loom	0.04 (.03)	0.02 (.02)	0.03 (.06)	0.01 (.02)	0.001 (.004)	8.809**	IT > IT > IT > USA > KO > JP >	USA JP KE KE KE KE
Hold	0.37 (.12)	0.31 (.13)	0.38 (.15)	0.39 (.19)	0.53 (.17)	3.424*	USA < USA < JP <	IT KE KE
Contact	.59 (.12)	.45 (.14)	.60 (.13)	.59 (.15)	.64 (.18)	5.313**	USA < USA < USA < USA <	IT KO JP KE

No Contact	.40 (.12)	.54 (.14)	.39 (.13)	.39 (.16)	.35 (.18)	4.241*	USA> USA> USA> USA>	IT KO JP KE
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\* $p \leq .01$ . \*\*  $p \leq .001$

Table 4

Joint Frequencies and Proportion of 5-sec infant vocal nondistress time window with maternal responses by country

	Joint frequency					Proportion					F
	Italy	USA	Korea	Japan	Kenya	Italy (4461)	USA (4421)	Korea (2388)	Japan (3311)	Kenya (5499)	
Out of reach	83	49	17	7	41	.016	.011	.007	.002	.007	8.02**
Within reach	396	246	162	38	199	.079	.055	.067	.011	.036	9.20**
Touch	338	206	169	37	208	.068	.046	.070	.011	.037	7.70**
Loom	97	73	35	4	20	.019	.016	.014	.001	.003	5.31**
Hold	71	61	39	21	67	.014	.013	.016	.006	.012	1.36
Tot	902	586	405	100	494	.18	.13	.17	.03	.09	10.86**

\*\*  $p \leq .001$

Table 5

Odds ratio, test of contingency for odds ratio ( chi-square\*) and group comparison

	Italy	USA	Korea	Japan	Kenya	Tot Sample	Group comparison
	Odds	Odds	Odds	Odds	Odds	Proportion	F
						Joint FR	
Out of reach	1.06	1.24	.65	2.67*	.62	.043	2.37
Within reach	1.45*	1.61*	1.33*	3.45*	1.04	.248	5.058**
Touch	1.32*	1.51*	1.40*	2.04	1.05	.232	2.30
Loom	1.17	2.57*	1.45*	3.42*	2.48*	.053	2.65*
Hold	1.01	1.76*	1.54*	9.46*	1.11	.06	6.06**

\*p≤ .05; \*\*p≤ .01.

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## **CHAPTER IV**

### **Influence of early Maternal physical engagement on child development: a Longitudinal study**

The purpose of this research is to explore the effect of early maternal physical engagement on the development of three different infant outcomes at 20 months of life: the infant play, the adaptive behavior and the socioemotional development. Results revealed that the early close body contact has a positive influence on the emergence of symbolic play, on the development of infant daily living skills and on the ability of socialization. The early close maternal presence within reach to the infant have a positive effect on the subsequent child capacity to respond to the parent in an appropriate way, whereas an excessive maternal touching behavior does not stimulate the active participation of the child into the interaction with the caregiver at 20 months. The results support the importance of early maternal close body contact with the infant as a factor that affects the child development in several way.

#### **Background**

There is widespread agreement that a positive parent–child interactions are critical for optimizing developmental outcomes, including social–emotional and cognitive growth. The strengths or vulnerabilities of the emotional, behavioral and cognitive development are established during early development: the early experience of infant life and the environment of leaving, shaped the neural development, the gene expression and the permanent neural architecture of infant brain (Weaver, 2009). For this reason the primary caregivers of the infants, in general the mother who has uniquely close and long-term relationship with the child, have a fundamental role in child development.

Several studies, both in animals and humans, has been demonstrated that maternal responses could affect the infant’s long term health and development (Strathearn, Gray, O’Callaghan, & Wood, 2001; Weaver, 2009). The animal study have analyzed the biological impact of maternal behavior in the mammalian development, founding that it has an influence on the gene expression, on brain development and on the behavioral phenotypes of the pups (Ahern & Young, 2009).

Regarding the human studies, many researchers have analyzed different factors involved in the mother–child relationship that have a significant influence on the development of child cognitive, emotional and social life, like the mother’s health or the maternal psychological mood (Carter, et al, 2001; Field, 1992), the mother’s cognitions when interacting with infant (Meins, et al, 2001), the verbal and nonverbal behaviors (Landry, 1997), the caregiving skills (Beckwith & Rodning, 1996; Field, 1985; Landry, 2006; McElwain & Booth-LaForce, 2006), the maternal sensitivity defined as warm and appropriate responses towards infant signals (Bigelow, Maclean, Proctor, Myatt, Gillis, & Power, 2010; Mantymaa, Puura, Luoma, Salmelin, Davis, & Tsiantis, 2003). Considering these results, it is evident that mothers exhibit a variety of behaviors, and these behaviors could influence multiple and different infant outcome in different way.

One of the maternal behavior that play an important role in the early human development is the maternal physical engagement. Physical contact is considered one of the primary form of attachment behaviors (Bowlby; 1969). In fact establishing a close physical contact with the infant during the early stage of life, plays a crucial role in child healthy growth. To be rocked, fondled, held, stroked and cuddled is essential for young children because it guarantees the building of a specific tie with the caregiver that assures the survival of the infant (Ribble, 1944). Many researchers have underlined the important value of physical contact in the human development. For example Harlow (1958) demonstrated that intimate body contact between mother and infant is fundamental in primary care in primate development. Reite (1990) underlined the importance of touch in the psychological and physiological growth, arguing that the amount and quality of the touch received during infancy affect the well-being in the adulthood. Hofer’s (1995) corroborate the physiological regulation function of the maternal proximity and contact during the post-birth period in helping the child of regulate his internal state. Feldman (2002; 2003) found that early maternal contact affect positively infants’ emotion regulation, stress-reactivity, and social and cognitive development in preterm infant.

Moreover it was found that physical contact plays several function in the early stage of life of the infant: it enhances the establishment of attachment between mother and child (Bowlby, 1958; Harlow, 1958; 1959); it helps the infant to regulate his internal state (Tronick, 1995); it influences the development of secure attachments in infants (Anisfeld, 1990). Additionally it is the first channel of communication between the mother and child; in fact the skin is the first sense organs to be developed (Field, 2001), and it is the first way through which the child received stimulation (Dieter, Field, Hernandez-Reif, Emory, & Redzepi, 2003; Lagercrantz & Changeux, 2009). Body

contact have a positive influence and a beneficial effect even on some physiological and biochemical values, like blood pressure, heart rate, cortisol levels and oxytocin levels (Heinrichs, Baumgartner, Kirschbaum, & Ehlert, 2003; Henricson, Berglund, Maatta, Ekman, & Segesten, 2008). It has a positive effect in the development of pre term infant (Korja, 2008; Kostandy, 2008), by diminishing infant's distress (Christensson et al, 1995) and by improving the quality of mother-infant interaction (Axia & Bonichini, 2005; Crockenberg & Lerkees, 2006; Jahromi et al., 2004).

Different infant development outcomes could be considered as index of child healthy growth, considering different aspects involved in child development, as the cognitive development, the capacity of cope with the demands of their environment and the socioemotional development.

### *Play*

Play is the predominant activity of daily life of a child, it absolves many functions during the course of child development: it serves to strengthen the mental abilities, to learn social models, to represent internal mental states and emotional experiences. It has an adaptive function in the sense that through it the child has the possibility to acquire tools, to learn about the environment and to learn how to behave in it (Piaget, 1962).

The development of play is strictly related to the structuring and consolidation of cognitive abilities of the child (Bornstein et al., 1995; 1999). For this reason the observation and the study of child's play allows to analyzed infant cognitive development: in fact starting from the studies of Piaget (1962), has been proved the existence of an evolutionary progression in the development of play, from the exploratory activities to the achievement of symbolic play, which reflects the different underlying cognitive abilities and follows the same development trajectory of other forms of mental abilities (McCune-Nicolich, 1981).

The development of play start from the simple manipulation of objects, observed in early childhood, followed by the functional game, in which the object is used on the basis of its specific function, and then by the combinatorial activity in which the child puts together the objects (stacking, beating or placing one inside the other). Afterwards at 13-14 months the child refers to the first forms of symbolic play, but it is only at 18-20 months that play appears clear symbolic. The child is now able to "pretend", carrying out actions with imaginary objects, or attributing to real objects imaginary characteristics (Piaget, 1962).

The skills that the child display in the play are the expression of two distinct underlying mental capacities (exploratory and representational capacity) that have different origins and consequences (Tamis-LeMonda, Bornstein, 1993). While the exploratory capacity is closely associated with the attentional processes, the representative capacity is related to symbolic and linguistic skills (in particular for understanding language) and it is expressed in the level of sophistication in the use of toys (Bornstein, 1999). From the observation of the child's game is therefore possible to deduce and draw lines of development of some basic mental processes (attention span and ability of symbolization), (Leslie, 1987).

The emergence of the symbolic play has been considered one of the most direct index of the representational capacities of the child, and in his development the interpersonal and social contexts play a crucial role (Werner and Kaplan; 1963). Play follows a developmentally regular processes, but this trajectory is variable among children, and it is mediated by the interaction with the caregiver (Bornstein et al., 1996; Bornstein & Tamis-LeMonda, 1995). In the emergency of symbolic functioning, the early experience of sharing an emotional bond between mother and child, leads to the development of the capacity to communicate and symbolize (O'Connell e Bretherton, 1984). From Werner and Kaplan theoretical perspective, there is a linked between symbolic development and dyadic functioning, and the establishment of an early harmonious mother-child relationship give a contribute in the development of symbolic thought (Bretherton, 1979, 1985; Ainsworth et al, 1978; Bowlby ,1982; Vygotsky, 1978), suggesting that the differences in the quality of the early mother-child relationship has a directly influence in the emergence of early symbolic processes.

### *Adaptive behavior*

The adaptive behavior has been conceptualized in psychology as the capacity of modify the behavior to cope more effectively with the demands of the environment (Lazarus, 1999 Scarr, 1996) by selecting those cues in the environment that are more salient and then by choosing strategies to deal successfully with those demands. First White (1959) has given a definition of adaptive competence as the capacity of an organism to interact efficiently with its environment. Than Ainsworth and Bell (1974) have used this definition to analyzed the competence in infancy, considering competent an infant who could control the effect that the environment has on him by changing his own activity.

Adaptive behaviors include a wide-range of different capacities involving motor, cognitive, language, socialization, self-help skills, domestic activities, and interpersonal relationships (Leland,1983; Keith,1987) and it is related to the successful growth and to the functional development of the individual. It is the result of the interaction between biological needs and the acquisition of knowledge gained through learning and through situation-specific experiences.

It has been demonstrated that the adaptive behavior is strongly related to the establishment of good early attachment between mother and child (Matas, 1978). In fact it was found that the quality of attachment predicted later aspects of more autonomous functioning, as underlined by the attachment theory (Bowlby, 1969; Ainsworth, 1979), and that there is a continuity in the quality of individual adaptation during infant growth. In fact in previous research it was found a correlation between the quality of attachment in early infancy and the development of different adaptive competence at 24 and 40 months, like the capacity of problem-solving, the persistence, the cooperation, and more in general in showing a more effective behavior (Matas, 1978).

These results demonstrated as the child adaptive behavior could be shaped and influence in the early infancy, underlining the importance of early experience for subsequent child development and the role of social interaction as a crucial precursor of infant competence.

### *Child emotion availability*

The emotional availability is considered an important index of healthy infant socioemotional development. It is defined as the interest of the child toward the parent and the ability to respond to him in an affectively positive way in order to establish an interaction. This characteristic is anticipated and prepared by the 'emotional dialogue' that characterized the interactions between prelinguistic infants and caregivers. Emotional availability refers to the individual's emotional responsiveness and attention to another's needs and goals (Emde; 1980). It is initially regulated during the early mother-child interaction, being linked to the 'emotional availability' of the caregiver (Emde & Easterbrooks, 1985) and then it become a regulatory own internal system of the child.

The child's emotional availability is composed by two different abilities: the child responsiveness and the child involving of parent (Biringen, 1991). The Child responsiveness is the capacity of the child to respond to the parent in an appropriate way, in relation to the context and to the infant age, with a genuine and appropriate affect. Child involvement of the parent is the capacity of the

child to invite the parent into play, and it is considered analog to other attachment signalling behavior, as looking or smiling, that have the function of create an interaction.

The development of emotional is influenced and driven by different factors, including the evolutionary stage of developmental agenda, the children and parents psychological characteristics and the context of development (Bornstein, 2010).

Moreover the construct of emotional availability is related to the attachment theory (Bowlby, 1982; Bretherton, 1985; Cassidy, 1999). In fact the early experience with a caregiver emotionally accessible and responsive, helps the infants to regulate his own emotions adaptively. In previous research it was found that a secure attachment in early infancy is related to a better functioning of emotional expression in the subsequent child development, showing how early mother child interaction is associated to the emotional child availability in childhood (Easterbrooks, 2000). Several study have exanimate the construct (convergent) validity of the EAS against different measures of attachment (see Easterbrooks & Biringen, 2000, 2005), underling as the indicators of emotional availability in middle childhood was predicted by security of attachment in infancy or founding associations between attachment security and emotional availability (Ziv, 2000). A more complete description of the EAS can be found in Biringen and Robinson (1991), Easterbrooks and Biringen (2000), Biringen (2000), and a special issue of the Infant Mental Health Journal (Ammaniti, 2006).

Starting from this considerations, the purpose of this research is to explore the effect of early maternal physical engagement on the development of three different infant outcomes at 20 months of life. Even if the previous research have analyzed the positive effect of the early maternal contact on child wellbeing, less is known about longer term effect of the early physical engagement in children with typical development. For this reason the purpose here is to analyzed the different impact of a specific early maternal behavior on different aspects involved in child future development and growth, considering the infant play as index of cognitive development, the child adaptive behavior as the capacity of cope with the demands of the environment and the child emotional availability as an index of the socioemotional development.

In the specific we tested the following hypotheses:

(1a) We hypothesized that maternal physical engagement at 5months of age will have a predictive value in the development of infant symbolic play.

(1b) We expected that high physical contact will be a predictor of subsequent symbolic play.



- (2a) We hypothesized that different expressions of maternal physical engagement will have different predictive value on child adaptive behavior.
- (2b) We expected that the behaviors related to more physical contact will be predictors of the development of child adaptive behavior especially in relation to the development of social capacity and to the acquisition of daily living skills.
- (3a) We hypothesized that maternal physical engagement will influence the child emotion availability.
- (3b) We expected that behaviors more related to the establishment of a close contact will predict the development of child emotion availability.

## **Method:**

### **Participants**

25 mother-child dyads from Italy, were selected for inclusion in this study. All infants were firstborn, born at term, with normal birth weight (3373.6 (434.85) g). Infants were observed at home at approximately 159.49 (4.78) days of age during the first visit and at approximately 600.6 (.14). The percentage of female was respectively for the Italian sample 36% (16:9).

Mothers were primiparous and were recruited using methods of recruitment that are common in developmental science (mass mailings, hospital birth notifications, patient lists of medical groups, newspaper birth announcements, and advertisements in newspapers). (see Table 1). At the time of data collection, Italian mothers were 29.26 years old (SD= 3.40); the mean level of maternal education was high school graduate, and Family SES was predominantly middle class (the Hollingshead, 1975, Four-Factor Index of Social Status; see Bornstein, Hahn, Suwalsky, & Haynes, 2003). At the time of data collection, 20% of mothers worked outside of the home and among those that were employed, mothers worked for an average 3.15 (0.18) hours per week. Sociodemographic information of the sample appears in Table 1.

### **Procedures**

Each mother-child dyad was assessed when the child was 5 months and then at 20 months of age.

Maternal behavior was observed at home by a female filmer, during maternal-infant natural interaction at child 5 months of age. Visits were scheduled for a time when mother and infant

were at home alone together. Mothers were encouraged to behave in their usual manner and to disregard the observer's presence insofar as possible. The filmer did not talk to the mother or engage the baby during the filming; she attempted to be as unobtrusive as possible.

At the end of the home visit, mother and filmer independently rated maternal and infant behavior during the visit by marking a series of 8-point (range = 0–7) graphic rating scales, randomly ordered with respect to valence but recoded in ascending order. Mothers rated their own behavior as typical, 5.53 (1.45), and reported that the babies behaved in typical fashion, 5.7 (1.72). The filmer rated mothers as being relaxed during the observation, 4.50 (2.34).

An observation of 10 min of free play at child's 20 months of age were then obtained. The data was collected at 20 months, because at this age the child shows an improvement in the verbal, symbolic, and fine and gross motor skills (Bornstein and Haynes, 1998). Moreover at this age the child is sensitive and responsive toward others feelings and emotions and demonstrate the capacity to understand the psychological states of others (Edwards and Liu, 2002).

The videos at child's 20 months of age, record 10 min of play between mother and child. The visit began with a set up and familiarization period, lasting approximately 20 to 30 min (Stevenson, Leavitt, Roach, Chapman, & Miller, 1986). After a solitary play session, the child and mother played collaboratively for 10-min. The mother was asked to play with her child as she ordinarily would and to disregard the researcher's presence as much as possible. A set of standard, age-appropriate toys (doll, blanket, tea set, toy telephone, toy train, two small picture books, foam ball, and set of nesting barrels) was used; these toys were selected to represent feminine, masculine, and gender-neutral categories, and allowed for a variety of different play behaviors ranging from simple exploration to relatively complex symbolic play (Bornstein et al., 1996). Mothers and children could use any or all of the toys provided; the child's own toys were not present.

## **Measure**

### *Measure at 5 months*

#### (1) Behavioral Coding: Maternal physical engagement

All videorecords were coded twice by independent coders, using coding systems that provided continuous records of maternal and infant behavior during the hour of naturalistic interaction.

The coding system used to assess maternal behavior, Maternal Proximity and Physical Engagement, was developed for this study. It assesses a mother's proximity to and physical contact with her infant. The code has 5 levels, ordered from least to most proximal, and a "Cannot code" option. More proximal levels pre-empt less proximal levels. A new level is coded when the behavioral criteria for that level are met, and this effectively functions as the offset of the previous behavior level. The levels of the code were defined as follows:

1. **Out of reach.** *Mother is out of her own arm's reach of the infant.*

2. **Within reach.** *Mother is within her own arm's reach of the baby (i.e., mother can comfortably extend her arm and make contact with the baby even if having to lean or bend but without taking any steps through space) and is not engaged in touching, looming, or holding.*

3. **Touch.** *Mother touches the infant with her hand(s). Do not code touching the infant's body with an inanimate object held in the mother's hands UNLESS the object is made of paper or cloth and is associated with caregiving (e.g., an article of infant's clothing, a diaper, a washcloth, a tissue.) Very brief breaks in touching (e.g., less than one second) are not coded as the cessation of touching.*

4. **Loom.** *While within reach of and looking at but not holding the baby, mother purposefully moves her face closer to the infant's face, seemingly with the intention of engaging the baby or observing the baby closely. Continue to score Loom until mother moves her head back from the close position. Simply bending over the baby to provide caregiving is not coded as Loom.*

5. **Hold.** *Mother supports the infant's weight with her arms, legs, or trunk. Mother may be lying down, squatting, sitting, standing, or moving through space.*

The code yields measures of the frequency of onsets of each behavioral level and the duration of time spent at each level. Maternal behavior is coded without considering infant responses to the behavior (Obswin, 2008). Data were coded using the observational data collector ObsWin 2008 (Neil Martin, Chris Oliver and Scott Hall, 1999; Obswin data collector, free download on <http://www.antam.co.uk/obswin.htm>). The default datafile type used by ObsWin is the Timed Sequential datafile, a types of the Sequential Data Interchange Standard (\*.SDS datafiles) developed by Bakeman and Quera (1992).

For all continuously coded behaviors, Cohen's (1960, 1968) Kappa was used. After a coder had achieved initial reliability, at least 5 records that she or he coded was independently coded by a second coder; altogether, approximately 20% of the records were coded independently by two

coders. Reliability coefficients were assessed, and  $\kappa$  was statistically acceptable ( $K = .89$ ).

#### *Measure at 20 months*

Different infant development measure were obtained at 20 months of age. The measures included:

##### (a) Behavioral Coding: Child with mother play

Child collaborative play was coded using a system (MOMINF) previously developed in connection with a longitudinal, cross-cultural investigation of normative child development and parenting (Bornstein, 2009; 1992). This system is an on-line coding procedure, and the output is identical to the output of Obswin. Child collaborative play was coded from videotape in accordance with a mutually exclusive and exhaustive category system that included 8 levels and a default (no play) category; these play levels were derived from previous research on the progressive nature of play across the first and second years of life (see Bornstein et al., 1996; Bornstein & O'Reilly, 1993; Tamis-LeMonda & Bornstein, 1996; Vibbert & Bornstein, 1989). Play was coded continuously by noting the play level as well as start and end times (accurate to 1 sec). Minimum play time was set to 1 sec, and play at a given level was coded so long as there was no break longer than 10 sec and the player did not touch another toy. Scores for Levels 1-4 were summed to form measures of the frequency and duration of exploratory play, and scores for Levels 5-8 were summed to form measures of the frequency and duration of symbolic play. Reliability for child play was based on sec-by-sec agreement. There were 600 sec in each play session, and kappa ( $\kappa$ ) was based on whether the coders agreed with the play level coded for each sec;  $\kappa$  was .57 for exploratory play, and .63 for symbolic play. Only the child symbolic play was considered into the analysis.

##### (b) Child adaptive behavior: Vineland

To assess the adaptive behavior in young children, the Vineland Adaptive Behaviour Scales (VABS) was used (VABS; Sparrow et al., 1984). Mothers were asked to answer to The Vineland Adaptive Behaviour Scales. The VABS is a semi-structured interview, lasted approximately 45 min (297 item); it is a standardized scale that assesses the child actual adaptive behavior. Mothers are asked to assess their children's actual adaptive behavior, in four areas: communication, daily living skills, socialization, and motor skills.

Validity of the VABS is well supported (Sparrow et al., 1984). Sparrow and Cichetti (1978) reported a high validity of this scale, reporting high correlations between caregivers' estimates of levels of adaptive behavior and others independent assessments of those behaviors.

Item scores reflect whether or not the individual performs the activity described. A score of 2 indicates yes, usually, 1 sometimes or partially, and 0 no, never.

### (c) Child emotional availability: EAS

To evaluate the infant emotion availability (EA) toward the mother, the Emotional Availability Scales was used (EAS, 3rd ed.; Biringen et al., 1998). The EAS were specifically assess through observations and ratings the parent– child interaction and reflect age appropriate behaviors in parent– child interaction.

The EAS assess a specific behaviors of one partner but at the same time capture joint interactional style of the dyads. Dimensions of emotional availability include 4 scale to asses maternal behavior (parental sensitivity, parental structuring, parental non intrusiveness, and parental nonhostility), and two dimension to asses child emotion availability (child responsiveness to the parent and child involvement of the parent).

In this study we have consider only the child dimension, in order to have a measure of child emotion availability behavior toward the mother at 20 months as an index of attachment.

Child responsiveness to the parent is the ability of the child to respond to the parent with genuine appropriate affect (ranges from 1 (nonoptimal) to 7 (optimal)). Child involvement is the ability of the child to invite the parent into play (from 1 (nonoptimal) to 7 (optimal)).

EA was coded from the 10 minute video records of mother child interaction during play. The coders have obtained a satisfactory inter reliability with one of the authors of the EAS and with one another after a training (Biringen, 2005). The coders didn't know the hypotheses and purposes of the study.

Descriptive statistic of child measures are reported in table 2.

### **Data Analysis**

For each measure of the Maternal Behavioral Coding measures of frequency and duration were obtained. Frequency is the number of times the target behavior was initiated by the mother within the observation session. Duration is the amount of time that the mother engaged in the

behavior. Because some observations were shorter than one hour, measures of frequency and duration per time unit were calculated.

Prior to data analysis, distributions of pro-rated frequency and duration of mothers' behaviors were examined for normalcy and outliers. Transformations were applied to the following variables: the pro-rated frequency of Within Reach, Loom and Hold, and the pro-rated durations of Out of Reach, Touch, and Loom were cube-root transformed. Mother age, infant age, and maternal education were screened as covariates but were not used because none was significantly correlated with maternal proximity ( $p > .05$ ).

The 5 levels of the code were then collapsed into 2 aggregate measures, No Contact and Close Contact. No Contact combined the levels in which the mother did not touch the baby (Out of reach and Within reach); Close Contact combined the levels of the code system in which the mother established close physical contact with the infant (Touch, Loom, and Hold). Finally a global index of maternal behavior was created, calculating a global mean zeta score of frequency and duration. Untransformed values for the 5 levels of Maternal Proximity, 2 aggregate measures and zeta score are presented in Table 3.

The general linear model procedures were chosen to analyze the predictive value of the maternal physical engagement on the child with mother play and on child adaptive behavior at 20 months. The Regression trees analyses (Breiman, Friedman, Olshen, & Stone, 1984) were used to estimate how well maternal physical engagement could predict the child emotion availability at 20 months of age. Regression trees is a nonparametric technique that can select from a number of variables those and that are most important in determining the outcome variable to be explained. It is a prediction model that can identify prediction rules that are easy to interpret and evaluate and also estimates optimal cut-point values to partition the data set according to the chosen predictor variable.

## Results

### 1) Maternal physical Engagement predict child with mother play and child adaptive behavior

The variables we have included as predictors into the general linear model analysis, were the global mean zeta score of frequency and duration of maternal behaviors (all levels of the code system and 2 aggregate measures No Contact and Close Contact) and the maternal education: (1) Out of reach Zeta (2) Within reach Zeta, (3) Touch Zeta, (4) Loom Zeta, (5) Hold Zeta, (6) Contact Zeta, (7) No contact Zeta (8) Maternal education.

We have considered as target behavior in the analysis the child symbolic play and separately the Vineland score of the communication, daily living skills, socialization, and motor skills scale.

Data analyses for maternal behaviors are summarized in Table 4.

The table reports the relevant predictors in the model, with a significant effect on the target variable. The results show that considering child's play, the maternal contact is a significant predictor of infant symbolic play ( $p < .01$ ), that has a positive effect on the target variable. Considering the child adaptive behavior, the maternal touch is a significant predictor of child's daily living skills ( $p < .05$ ); close face to face engagement and hold are significant predictors for child's socialization. By contrast none of the maternal behavior considered is a significant predictor of child motor skills and communication.

## 2) Maternal physical Engagement predict child emotion availability

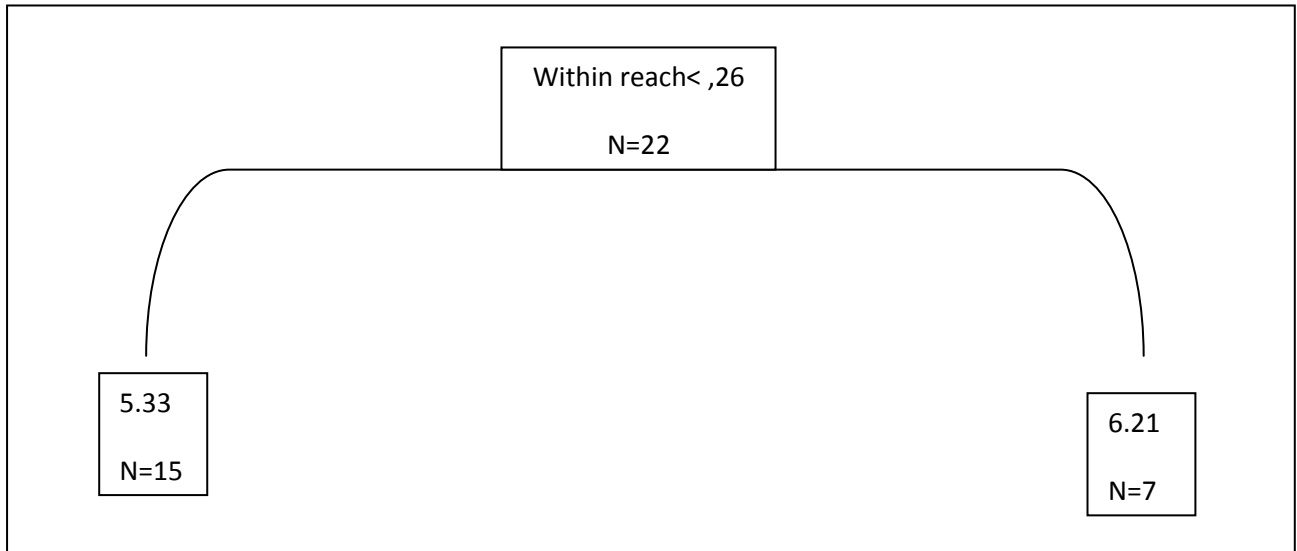
The regression trees analyses were implemented using the free downloadable R studio version 0.95.262. 22 subjects were available for the analysis. We used into the analysis as predictor variables the pro-Rated duration of maternal behaviors ((1) Out of reach (2) Within reach, (3) Touch, (4) Loom, (5) Hold, (6) Contact, (7) No contact) and the maternal education; the global mean zeta score of frequency and duration of maternal behaviors were not used in the analysis because the zeta scores did not result as relevant predictors in the model.

For the child responsiveness (Mean = 5.614,  $ds = 0.81$ ), the predictor variables selected as most important in determining the outcome variable was the duration of maternal behavior "within reach" (cut-point scaled score of .265). Duration of maternal within reach lower than .265 (within reach mean = .22) predict a significant lower score of responsiveness at 20 months ( $t = 3.1939$ ,  $df = 18.132$ ,  $p\text{-value} = 0.004$ ) (Figure 1).

For the child involving (mean=5.5,  $ds = 0.77$ ), the predictor variables selected as most important in determining the outcome variable was "Touch". Duration of touch higher than .175 (touch mean = .17) predict significant lower score of child involvement ( $t = 2.5902$ ,  $df = 12.735$ ,  $p\text{-value} = 0.02272$ ) (Figure 2).

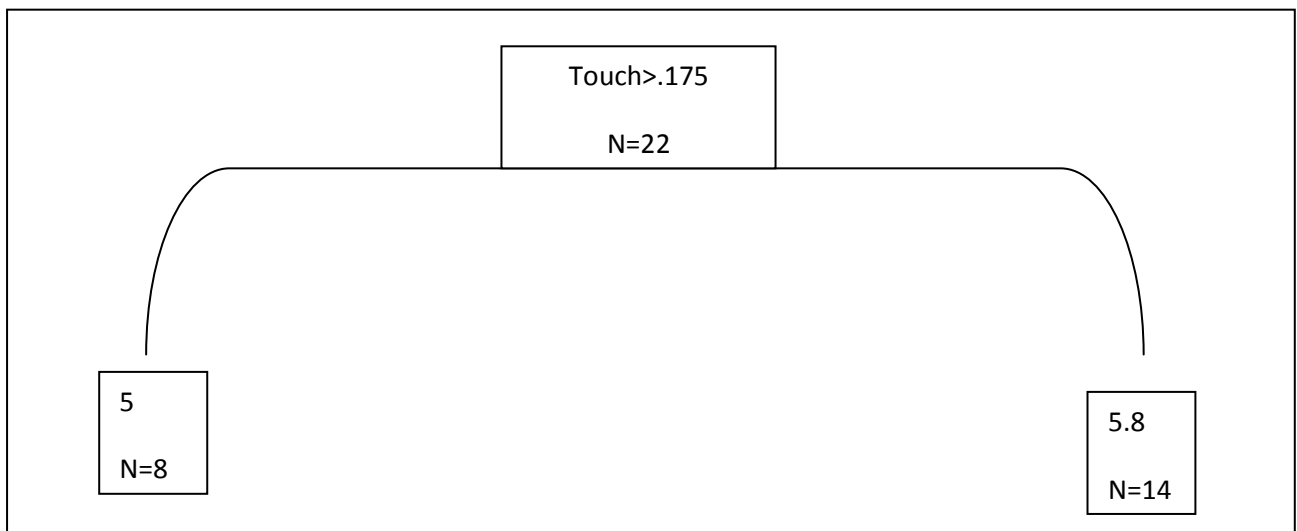
Figures 1

Regression trees analyses: significant Maternal physical Engagement predictor of child Responsiveness



Figures 2

Regression trees analyses: significant Maternal physical Engagement predictor of child Involving





## Discussion

The central purposes of this study were to determine the impact of maternal physical engagement on the development of infant play, on adaptive behavior and on child emotion availability. We speculated that the early maternal physical engagement that the mother establish with her infant could influence the infant development outcomes in different way, depending on the differences in the degree of proximity and physical contact of the mother toward the infant.

Regarding the first hypothesis of this study, we hypothesized that maternal physical contact at 5 months of age will have a predictive value in the development of infant symbolic play. The results suggest that the maternal physical contact is a significant predictor of the symbolic play at 20 months. This data suggest that a close body position of the mothers towards the infant during his early development could have an effect on the emergency of representational capacity expressed trough the play. We speculated that an early close body contact between mother and child could favor an establishment of a close emotional bond between mother and child that could enhance the establishment of an harmonious mother-child relationship. As reported in the literature, quality of the early relationship and the possibility to share an emotional bond between mother and child have a directly influence in the emergence of early symbolic processes and that his development is related to the interpersonal contexts (Werner and Kaplan; 1963). Our finding supports this view, indicating that a close early proximity is a maternal behavior that have an impact on the subsequent emergency of child's symbolic play.

Moreover the characteristics of mother-child interaction show a continuity during the different stage of infant life, showing a certain degree of coherence across the period from infancy to middle childhood (Easterbrooks, 2000; Thompson, 1998). We speculated that mothers who tend to stay in close proximity during the early stage of life of the child, will continue to show this tendency also during the subsequent period of child development, probably maintaining also a higher proximity toward the child even during infant play. It has been demonstrated that child play activity could be enhanced in situation in which child is supported by the presence of the mother (O'Connell; Bretherton, 1984; Fiese (1990). In fact the child could reach a more advanced level of development respect his actual level, through the presence of a more competent and experience partner that interacts and collaborates with him (Vygotsky ;1978).

Regarding the second hypothesis we expected that the maternal early physical contact would be a predictor of the development of child adaptive behavior. We found that maternal physical engagement predict two aspects of the adaptive behavior in the children at 20 months:

the daily living skills and the capacity of socialization. In the specific maternal touch is a predictor of the infant daily living skills, and close face to face engagement and hold are predictors of the ability of socialization.

Both aspects are related to the development of skills that are necessary for adequate functioning in a specific cultural and social environment. Daily living skills is considered the capacity of the child to develop skills to adapted his self to the daily life (e.g. cooperation and independence in feeding skills, communication regarding soiling; understanding that hot things are dangerous), whereas socialization is considered a process whereby an individual acquires and learns the norms, values, behavior, and social skills appropriate to his or her social context.

Our results are in line with previous research that found that early body contact between mother and child has a specific psychological function that enhance the development of child capacity more related to the social ability (Kağitçibaşı, 1996; Keller, 2000). In fact the close vicinity of the infant to the mother provide a body stimulation that favor the establishment of an emotional bond in the dyad. This bond expressed trough body contact, conveys emotions trough different sensory system like the somesthetic, kinaesthetic and cutaneous (Stack, 2001), and creates a sense of interactional warmth and affection between the mother and child. This closeness to the mother and the establishment of a warm relationship (Hetherington & Frankie, 1967) is a primitive channel for the transmission of the social norm and values (Keller, 2000; 2003; Keller, Yovsi et al., 2004; MacDonald, 1992) and have the function to enhance the development competence to face the social context and the everyday life (Kağitçibaşı, 1996; Keller, Kärtner, Borke, Yovsi, & Kleis, 2005).

Finally considering the third hypothesis of this study, we expected that the early maternal close body contact would positively predict the development of development of emotion availability of the child. Our result however revealed two unexpected results. The maternal presence in the proximal zone of the infant at 5 months of age have an effect on the subsequent child capacity to respond to the parent in an appropriate way, even if the physical contact is not present, and if the duration of this behavior is not enough long, the development of child responsiveness is affected.

We speculate that this kind of behavior guarantee a position of the mother that is close to the child and in this way the child could experience the presence of a caregiver who is accessible and available. To be within reach to the baby is a position that could easily facilitate if necessary, the face-to-face interaction and a dyadic exchange, helping the dyad to develop a reciprocal joint

coordination with the partner, and favoring a co-regulation, (Fogel, 1987; 1993). The experience of a caregiver who is accessible and available is an essential component of helping infants to regulate their own emotions adaptively (Bowlby, 1969).

Moreover to develop an optimal emotional availability it is not necessary a constant vigilance or presence of the mother (Easterbrooks, 2000). In fact, the mother have to allow for appropriate autonomy and individuation, in order to help the child development. To favor the socio-emotional development of the child emotion, the mother has to balance both the necessity of the child to feel close in contact with her and the necessity to feel a sense of autonomy (Easterbrooks, 2000). Probably to be within reach to the baby is a maternal behavior that more easily could guarantee the fulfillment of both aspects and for this reason it is an aspect that affect the child's capacity to be appropriately responsive toward the caregiver.

Regarding the capacity of the child to invite the parent into interaction, our result reveal that if the mother touch the infant at 5 months for period of time that is too long, the child is less active in invite the mother to participate into the play and is more passive in the interaction with the caregiver at 20 months.

As mentioned above to enhance the development of the child socio-emotional ability, the mother has to encourage the child progressively to become more autonomous and to became an active partner during the interaction. Probably mothers who touch excessively their infant become too intrusive and in this way don't encourage the infant to express his self in an active way.

Moreover it has been demonstrating that an excessive stimulation of the mother toward the child have a negative effect on his socio-emotional development. Infants who have mothers that are highly and consistently active during interactions, and thus presumably overstimulating them, tend to develop disorder in the attachment behavior, developing for example insecure-avoidant behavior. Previous research found that mothers of children showing insecure attachment behavior responded more frequently to general infant behavior (Lewis & Feiring, 1989) and facial emotion expression (Malatesta, Culver, Tesman, & Shepard, 1989); responding to them using behaviors that are more intense than was warranted by infants' cues (Smith and Pederson; 1988); and are more intrusive during interaction (Russel, 1991).

Probably the tendencies of mothers to over stimulated the child promote in him a state of stress, and the tendency to developed a defensive strategy for protecting themselves, since he has contemporary the necessity to stay in close contact with the mother, but at the same time he

knows that her behaviors are likely to overwhelm them (Isabella & Belsky, 1991), and this affect also the initiative of the child of involve in an active way the caregiver during interaction.

In summary, the maternal behaviors have a deep effect on child development outcomes not only during the early stage of infant life but also during the subsequent child's growth.

Our findings provide an evidence that the way in which mothers establish a physical engagement with the infant could be a predictor of different child developmental outcome, including development of cognitive, social and emotional ability. In general the results support the importance of early maternal close body contact with the infant as a factor that contribute to the establishment of a warm bond inside the dyad that affect the child development in several way. But also the result reveals that is not necessary true that an high level of body contact have a positive effect on child wellbeing, because if it is excessively intrusive the effect is to create a negative interaction with the infant and a subsequent negative consequence on his behavior.

However several important issues remain unresolved. First we didn't analyzed the affective aspects that were presented during the interaction. It could be interesting in the future research considering also the maternal socioemotional response that co-occur with the different kind of maternal behaviors considered in this study, in order to better understand which kind of maternal emotional response are associated with her position in the space and how this association have the power of affect the infant development. Moreover it could be interesting also evaluating the degree of tuning developed by the mother infant dyad at 20 months, in order to evaluate how the early close proximity of the mother could favor the development of an harmonious relationship, in order to have an index also of the dyadic quality of parent-child interaction.

Table 1

## Sociodemographic characteristics of participants

	Italy (n=25)
<b>Infant</b>	
Age	155.59
(days)	(4.78)
Gender	9:16
(Girls:Boys)	
Birth weight	3373.6
(g)	(434.85)
<b>Mother</b>	
Age	29.26
(years)	(3.40)
Education <sup>1</sup>	4.24
(Hollingshead) <sup>a</sup>	(1.36)
SES	42.5
(Hollingshead)	(9.71)
Mother working outside at 5 mo.	5
Hours work outside at 5 mo.	3.15
	(.18)

<sup>a</sup>7-point Hollingshead (1975) education scale (1 = less than 7th grade, 6 = college or university graduate, 7 = graduate professional training).

Table 2

Descriptive statistic of child measures (mean and standard deviation)

Play	Adaptive behavior				Emotion availability	
Symbolic play	Vine. Motor Skills	Vine. Communication	Vine. Daily Skills	Vine. L. Socialization	Child Responsiveness	Child Involving
.54 (.32)	36.58 (4.76)	42.17 (8.90)	27.46 (1.16)	41.08 (4.22)	5.614 (.81)	5.5 (.77)

Table 3

Untransformed descriptive statistics of pro- Rated data and Mean zeta score of frequency and duration of maternal behaviors (mean and standard deviation).

	Frequency	Duration	Mean zeta score
Out of reach	13.20 (6.57)	0.18 (0.13)	.2091 (.9522)
Within reach	50.46 (13.12)	0.21 (0.09)	.2231 (.5457)
Touch	45.92 (13.78)	0.16 (0.09)	.2453 (.8925)
Loom	14.41 (10.94)	0.038 (0.033)	.5905 (1.001)
Hold	11.68 (3.81)	0.37 (0.12)	.1446 (.5074)
Contact	72.01 (22.19)	.59 (0.12)	.31 (.65)
No Contact	63.67 (14.71)	.40 (0.12)	.21 (.56)

Table 4

General linear model analysis of Maternal physical Engagement as predictor of child play and child adaptive behavior.

	Predictor	Coeff.	Std. error	Sum of sq.	df	F	sign
Symbolic play	Intercept	-8.487	3.405	0.693	2	4.315	.027
	Contact	6.572	2.258	.680	1	8.470	.008
Vine. Motor Skills	Intercept	324.943	639.99	179.271	7	1.196	.359
	-						
Vine. Communication	Intercept	2,124.31	1,216.85	590.942	7	1.091	.414
	-						
Vine. Daily L. Skills	Intercept	567.815	638.630	404.858	7	2.713	.047
	TouchZ	90.434	43.966	90.196	1	4.231	.05
Vine. Socialization	Intercept	929.185	531.850	173.262	7	1.674	.186
	LoomZ	80.908	38.161	66.425	1	4.495	.05
	Hold Z	95.059	39.11	87.341	1	5.907	.027

Predictor with a significant effect on target variable ( $p < .01$ )

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## CHAPTER V

### Conclusion

Body contact and maternal proximity are forms of maternal attachment behavior that have several functions, such as convey emotions, expressing love, care, empathy, a feeling of security (Stack, 2001), and of transmitting interactional warmth (Keller, 2003; Keller, Yovsi et al., 2004; MacDonald, 1992). Clearly, physical contact is recognized by the majority of mothers as an essential ingredient of early communication with infants, even in cultures that are very different in their overall attitudes about body contact (Brazelton; 1990).

Establishing close physical contact with the infant during the early stage of life plays a crucial role in healthy development. The early experiences of infant life and the living environment are critical for optimizing developmental outcomes, including social–emotional and cognitive growth (Weaver, 2009). The mother has a uniquely close and long-term relationship with the child, and guarantees the primary care and well-being of the child through early physical contact (Harlow, 1958). To be rocked, held, stroked and cuddled guarantees the building of a specific bond with the caregiver that assures the survival of the infant (Ribble, 1944), helps the physiological regulation function of the child’s internal state (Hofer; 1995), positively affects the child’s emotion regulation and stress-reactivity, and influences social and cognitive development (Feldman, 2002; 2003).

The results of the current research underline that there is a general tendency of mothers with different cultural backgrounds to spent the majority of their time in close physical contact with their infants. Mothers from Eastern, Western and Developing countries, with the exception of American mothers, maintain close proximity to their babies during the course of a typical hour during the day, preferring a more proximal parental style. The way through which the maternal proximity is expressed, however varies across different countries. This result is in agreement with the attachment theory (Bowlby, 1969), which suggests that parental behaviors are based on an evolved proximal parenting style that can be express differently according to culture-specific beliefs.

American parental behaviors differ significantly from other countries’ behaviors in that there is no general tendency of the mothers to stay in close body contact with the infant, with displaying a more distal parental style. We have interpreted this tendency as being related to the emphasis of American culture on autonomous education that favors the child’s independence



(Bornstein et al., 1998), which supports the idea that variations in child-rearing practices are influenced by cultural background.

Mothers from Western, Eastern and Developing countries show similarities and differences in the way they alter their proximity to the infant in response to nondistress vocalizations, indicating that culture influences the mother's contingent physical response to infant vocal signals. In general, two main physical responses of mothers toward their infant's nondistress vocalizations emerged frequently across countries. Mothers commonly responded to infant nondistress vocalizations by coming within reach of the baby and by touching. Being within reach of the baby allows for more communication between mother and child. By coming within arm's reach of the child, the mother assumes a proximal position in the optimal space for communication with the baby that can easily attract his attention. Additionally, being within reach of the baby encourages face-to-face interaction and a dyadic exchange, which could help the child to develop reciprocal coordination with the caregiver, and support a co-regulation, which is an important aspect of social communication (Fogel, 1987; 1993).

Maternal touch is an important part of the mother–infant communicative system (Ferber, 2008). It is related to maternal sensitivity and to the capacity of the mother to respond in a coordinated way to the infant. Response to infant nondistress vocalization by touching, could have different consequences and could present in different forms (Ferber, 2004, 2008). Touching the baby improve the development of inter-subjectivity and joint attention, help the capacity of regulate affect to emerge, and may be the basis to the experience of dyadic communication exchange with the primary caregiver.

Different patterns of response towards infant vocalization emerged across countries, with more similar patterns of contingent responses in the two Eastern countries, compared to the two Western countries, while the Developing country was much more differentiated from the other countries. Within a sample of countries traditionally defined as Western or Eastern, we can individuate differences and variations in the expression of maternal behavior, even if mothers from Eastern countries seem to share more common aspects in maternal behaviors, than mothers from West. These differences could be explained by examining the specific cultural background and cultural ideology about parenting present in the Western, Eastern and Developing countries (Bornstein, 1991; Goodnow, Miller, & Kessel, 1995; Harkness, 1996).

Some aspects of universally occurring attachment parental behaviors are expressed in common ways across countries, but other aspects are modulated in an adaptive way considering

the living context and the cultural background. Mothers coming from Western, Eastern and Developing countries respond in terms of physical engagement to infant signals with behaviors that may be further moderated by culture.

Close body position of the mother to the infant during early development has an impact on different aspects involved in the child's future development and growth. An early close body contact between mother and child could favor an establishment of a close emotional bond that could enhance a harmonious mother-child relationship. The close vicinity of the infant to the mother through body contact elicits activation of different sensory system like the somesthetic, kinaesthetic and cutaneous (Stack, 2001), and creates a sense of interactional warmth and affection between the mother and child. The quality of the early relationship between mother and child and the possibility to share an emotional bond have a direct influence on the emergence of early symbolic processes (Werner and Kaplan; 1963), in the development of social ability (Kağitçibaşı, 1996), and in socio-emotional development (Easterbrooks, 2000). Our results corroborate these findings, confirming that early close body contact has a positive influence on the emergence of symbolic play (which is considered one of the early symbolic processes), on the development of infant daily living skills, and on the ability to socialize, all of which are considered needed competences to face different social contexts and everyday life (Kağitçibaşı, 1996; Keller, Kärtner, Borke, Yovsi, & Kleis, 2005).

To enhance the development of the child's socio-emotional ability, mothers have to balance the child's necessity to feel close during contact with the child's need to feel a sense of autonomy. The mother's constant vigilance or presence is not necessary for the socio-emotional development of the child (Easterbrooks, 2000), and the mother should not physically stimulate the child in an excessive way. The mother has to encourage the child to progressively become more autonomous and become an active partner during interaction, while staying close to the child and being accessible and available without becoming too intrusive and over stimulating.

In sum, the results of this study support the idea that maternal physical engagement and responsiveness form a general parenting program that has been evolutionarily co-opted as part of maternal attachment behaviors, that presents similarities and variations across different countries. Attachment behavior depends on complex interactions between genetic predispositions and the environment (Adolphs, 2003). Every culture has its own needs and has evolved its own developmental agenda (Bornstein et al, 1991; 1992) in relation to the cultural background, and the way in which maternal physical engagement and responsiveness is expressed is culturally

sensitive. Maternal physical proximity is a universally and culturally sensitive format of parenting that affects child development in several ways. Early maternal close body contact with the infant is a factor that contributes to the establishment of a strong bond within the mother-child dyad that influences child development in several ways, not only during the early stages of infant life, but also during the child's subsequent growth.

Finally, future research could be developed to analyze several points. How and why do mothers and children come to develop a bond with one another so early in life? Although hormonal or physiological processes are likely involved (Bornstein & Suess, 2000; Panksepp, 1998), our results clearly show that the cultural context of the mother and infant play a role, as well.

It would be desirable to examine the processes by which maternal physical engagement guides elements of the social agenda of day-to-day parent-child interactions. In this regard, it may be interesting to investigate parenting beliefs about physical interactions with the child, analyzing how they influence the parental behaviors, especially in different cultural contexts (Lansford, J. E., & Bornstein, 2011). Children may follow divergent ontogenetic paths if their interactive environments—that is, those to which they are exposed repeatedly—differ even slightly in infancy. On this argument, the eventual developmental consequences of early variation in maternal physical engagement could be studied more deeply.

Another avenue for future investigation would be to focus on a micro analytic analysis of maternal physical engagement, considering the different vestibular stimulation acting by the mothers during body contact and the emotional aspects outsourced, to better understand which kind of maternal stimulation and emotional response are associated with her position in the space and how this association has the power to affect the mother-infant bond.

One other possible investigation could be to focus on the relative implications of maternal physical engagement and proximity on the development of the mother-infant bond. It could be interesting to evaluate how early close proximity of the mother could favor the development of a harmonious relationship; in particular, it is important to analyze the dyadic quality of parent-child interactions developed by the mother-infant dyad to evaluate the degree of tuning reached by the dyad.

Finally, it could be interesting to evaluate how mothers of children with atypical development express physical engagement toward their child. This would be important for identifying possible variations and adjustments in the ways in which physical contact is expressed in relation to the child's psychopathology.

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## APPENDIX

### Transport Response: attachment behaviour in the mother-pups dyad

*Kuroda Research Unit for Affiliative Social Behavior*

*RIKEN BSI Summer Program 2010*

#### ABSTRACT

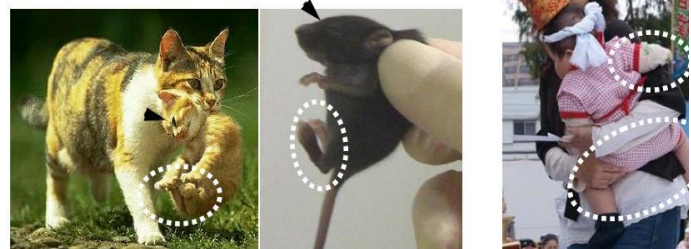
The goal of the study is to analyze the role of biological and genetic variation in determining variations in animal affiliative behavior. Investigating the genetic basic of the attachment behavior is critical to understanding affiliative relationship in higher mammals, principally because the underlying mechanism of maternal attachment have been evolutionarily co-opted to serve as the basis for all conspecific social bonds.

The aims is analyzed a particular form of attachment behavior presented in mammalian, that is the Transport Response (TR), in the  $\mu$ -opioid mice, which are mice genetically modified who lack the opioid receptor and therefore show deficits in attachment behavior. Transport Response (TR) is a set of psycho-motor responses of quadruped mammalian infants to the caretaker's carrying. TR can be regarded as a primitive form of attachment behaviour, in order to minimize the burden of the caretaker during retrieving. Human babies also tend to stop crying and cling to the caretaker when they are held and transported. Those human infants' responses to be carried appear to have the same adaptive value, and may also have kinetic similarities with non-human TR. On the basis of our preliminary results we can hypothesize that the  $\mu$ -opioid receptor may affect the TR, and influence this particular form of attachment behavior.

#### INTRODUCTION

The studies of attachment behavior lie at the crossroad of various disciplines, from sociobiology (particularly ethology) and anthropology to evolutionary and social psychology.

It is only in the past 20 years that some of the



*Figure 1. A kitten, a mouse pup and a baby are carried by their mothers. Arrow: Eye closure. White dashed circle: Flexion of limbs. The Images were provided by Dr Kumi O. Kuroda.*

underlying neurobiological foundations of attachment theory have been discovered. With the

development of new imaging techniques to visualize the brain activity (fMRI, PET), the integration of results from available human data, animal models, neurophysiology and other related neuroscience disciplines produced striking new findings about when and how specific brain regions, pathways, and circuits participate in the development of attachment behavior. The goal of the study of animal model is to analyze the role of biological and genetic variation in determining variations in animal affiliative behavior. Investigating the genetic basic of the attachment behavior is critical to understanding affiliative relationship in higher mammals, principally because the underlying mechanism of maternal attachment have been evolutionarily co-opted to serve as the basis for all conspecific social bonds.

Among the studies on animal models, important results come from the study of m-opioid mice. Indeed among the behavioral systems influenced by the m-opioid receptor is the infant social attachment system (Nelson and Panksepp, 1998). During periods of interaction with a caregiver, opioids are released, thereby contributing to reinforcement of the attachment bond. A relative reduction in opioid release, which occurs during periods of separation, increases an infant's motivation to seek and maintain proximity to its caregiver (Herman and Panksepp, 1978; Kalin et al, 1988, 1995; Knowles et al, 1989).

Genetic variation that affects m-opioid receptor function has been demonstrated to influence social behavior in various animal models (Barr et al, 2008; Moles et al, 2004). Mice lacking the OPRM1 receptor gene show some attachment problems, for example emit fewer ultrasonic vocalizations when removed from their mothers, or they do not show a preference toward their mothers' cues (Moles et al, 2004). These data suggest that spontaneous genetic variation at the OPRM1 gene might influence the development of social attachment and other related phenotypes in humans.

The specific aim of my study is to analyze a particular form of attachment behavior presented in mammalian, that is the Transport Response (TR), in the  $\mu$ -opioid mice. The TR is a form of attachment behavior that helps the mother to carry the pup. In the mammalian it's appeared when the pup is picked up by the mother in order to be transported. The pup adopts a specific posture to be better transported, he flexes his limbs and he closes his eyes. This posture, referred to as "transport response" (TR), involves general quiescence, the limp body trunk and the adduction of limbs against the body (Figure 1). The ecological value of this response was demonstrated by Brewster and Leon (1980) who lightly anaesthetized rat pups prior to transport, blocking limb adduction. This resulted in the mothers' dragging and/or tripping over the pups,



ultimately reducing carrying efficiency and potentially the probability of successful relocation. In this light, the TR response can be interpreted as a form of attachment behaviour since it help the mother to carry the pup, it guarantee the bonding among mother and pup and ultimately the survival of the pup.

I hypothesized that the  $\mu$ -opioid receptor may affect the TR, and influences this particular form of attachment behavior.

*Human infant and TR.* Infants cling to the mother's body when they are carried by the caretaker. Also it has been empirically known that a human baby, even right after the birth, tend to stop crying or calm down when the baby is held in the mother's arm, or is transported even in a stroller or in a car seat. These motor responses of human babies involve general quiescence, pliable body trunk so that fit to the curvature of the maternal body, and limb flexion for clinging. Therefore, human babies seem to show a comparable array of psychomotor control to that of quadruped mammals, even though the resultant postures are quite different in these species (i.e., the quadruped infants are carried like a compact limp sac, while the primate infants stick to the mother's body and unite as one). The tactile sensory inputs may also be different, but the vestibular inputs (mildly shaken in a certain frequency during transport) seem to be commonly required for elicitation of TR in quadruped animals and in human. And the function of these responses is the same: to help maternal carrying.

### AIMS

The goal of the study of animal model is to analyze the role of biological and genetic variation in determining variations in animal affiliative behavior.

In this study, I investigate TR of pups  $\mu$ -opioid receptor knockout (*Orpm*<sup>-/-</sup>) compared with *wild type pups* (*Orpm*<sup>+/+</sup>), using the Eshkol Wachman Movement Notation (EWMN, Teitelbaum et al., 2004; 2005) (Figure 2). The EWMN is a quantitative movement notation

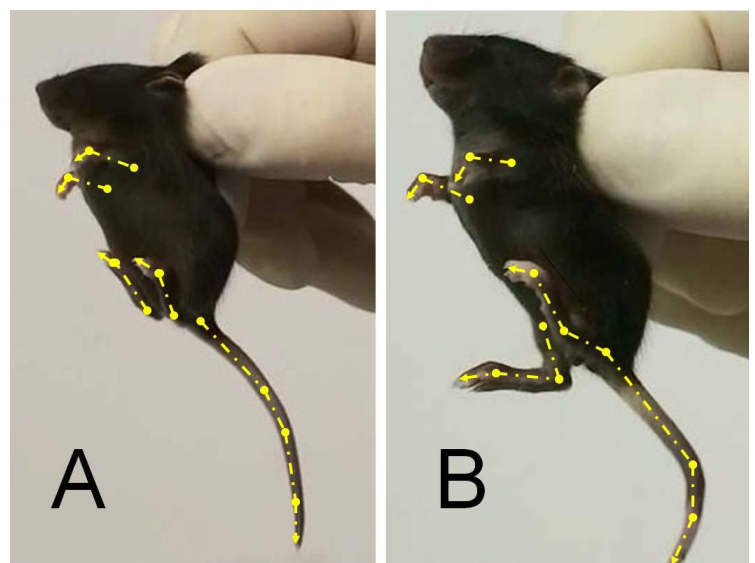


Figure 2: The figure shows a typical (A) and an atypical (B) pattern of TR in mouse. The yellow lines have been drawn using the EWMN and they can allow us to accurately describe the TR patterns.

system that assumes one general form that will stand conceptually for all bodies. In that form, each limb is reduced to its longitudinal axis, an imaginary straight line of unchanging length. These axes are analogous to the skeletal structure of the body. The movements of a single axis of constant length free to move about one (fixed) end all will be enclosed by a sphere; the free end will always describe a curved path on the surface of this sphere. Every limb segment in the body can be regarded as such an axis. In EWMN, a coordinate System of Reference (SoR) is used in which each limb segment is regarded as the radius of a sphere. The orientation of the SoR is such that its central axis is perpendicular to the ground; the plane of the equator (the horizontal plane) is parallel to the ground. One direction on the horizontal plane is selected as a starting position for all measurements. Other directions on the horizontal plane are defined in relation to it. Thus, eight directions are obtained when the measuring unit is 45°.

This approach would result in better differentiation and definition of each psychomotor component of mouse TR.

## Research

### Sample

30 *Orpm*<sup>+/+</sup> and 30 *Orpm*<sup>-/-</sup> pups of C57BL/6 mice in 2 time points of Post Natal Day (PND): (i) PND8; PND 12; (N=3 each per timepoint) will be analyzed for their TR. In these time points it has been showed that the *Orpm*<sup>-/-</sup> mice do show specific differences in attachment behaviours compared to their wild-type littermates.

### Procedure

A ratio of 1 mother\*6 pups will stay in each cage. In order to elicit TR in pups, I insert in the cage a round transparent plastic cap (7 cm height \* 12 cm diameter) from Postnatal day 3 (P3).

From P4 to P20, every day, three pups are placed in the transparent cup, and the maternal retrieval behaviour and the pups' TR is video-recorded at P8 P12 P16 (Figure 3).

We select this task to analyze in a more naturalistic way the interaction between mother and pup. In this task the pup has to help the mother in order to be carried, assuming the typical position of TR. After the data collection, we coded the videos using a second by second system's code.



Fig.3: Maternal retrieval behavior.

Variables:

The most important variables that we considered in the analysis of the video recorded mother-pups behavior are:

- (i) Retrieval time: The task is for the mother to retrieve the pup by grasping and lifting to take it completely outside of the cup. It is complete when the mother has successfully removed the pup from inside of the cup to the ground outside of the cup and the mother's four limbs are also touching the ground.
- (ii) Pup's mobility and posture. Analyzing the movement using a frame by frame analysis two categories have been defined: (a) TR: Transport Response (the posture operationalized in Brewster and Leon [1980] in particular, both forelimbs are abducted and both hindlimbs are flexed) (b) not TR: Partial Transport Response (the pup moves one or more limbs in an antigravitational direction, it means that at least one of the forelimbs is abducted or at least one of the hindlimbs is flexed); or Passively moved (the pups does not move any limbs in a antigravitational direction, it is carried passively); or Straggling (the pup move the body limbs in an irregular way).

### **Data Analysis**

General linear model with 2 factors (GROUP: *Orpm*<sup>+/+</sup> vs *Orpm*<sup>-/-</sup>; TIME: PND 8 vs PND 12) is been applied for all the variables. The analysis allow us to investigate whether or not those mutants have different TR than laboratory mice. Data analysis are run using R for general the analysis.

### **Results**

Mothers at post natal day 12 take significantly more time to pick up the  $\mu$ -opioid knockout pups ( $p < .05$ ) (Tab 2). The  $\mu$ -opioid knockout pups when are taken by the mother to be transported, show more significantly "struggling" rather than the wild type mice during the post natal day 12 ( $p < .05$ ) (Tab.3).

### **Discussion**

The preliminary results showed that the  $\mu$ -opioid knockout pups when are taken by the mother to be transported, show more "struggling" rather than the typical posture of TR expected at the post natal day 12. During this post natal period, the wild type mice present infrequently the struggling behavior (table 1), and assume a posture that facilitate the transportation (TR).

The mother takes significantly more time to retrieve the  $\mu$ -opioid knockout pups, because they instinctively don't assume a position of the body that help the mother to carry them. This behavior has negative consequences for the survival of the pup, because the probability for the pup to be located in a safe nest decrease. On the basis of these previous results we can hypothesize the  $\mu$ -opioid receptor may affect the TR, and therefore we could supposed that it influences this particular form of attachment behavior.

Our finding corroborate the biological and genetic basis of the affiliative behavior, and support the view that consider the alterations in the attachment behavior as a consequence of a variation in the neurobiological brain activity. Alterations of the attachment system have been considered as etiological factors for several psychiatric syndromes. Therefore the researches on mice lacking opioid receptors are a useful animal model to evaluate the consequences of deficits in the affiliative system during development and adulthood.

Table 1

Ontogenetic description of TR in Wild type mice (post natal day 4, 8, 12 and 16).

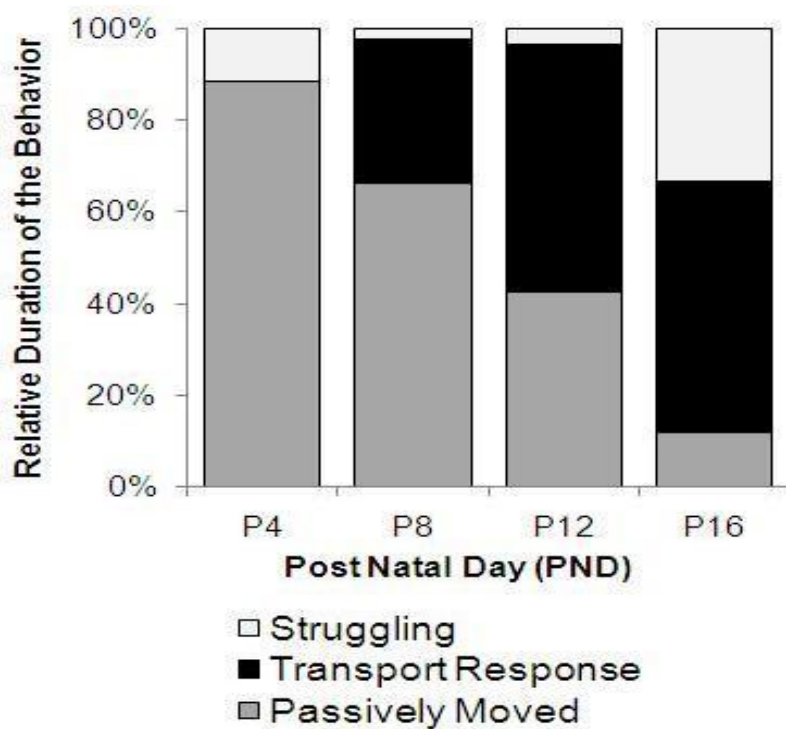
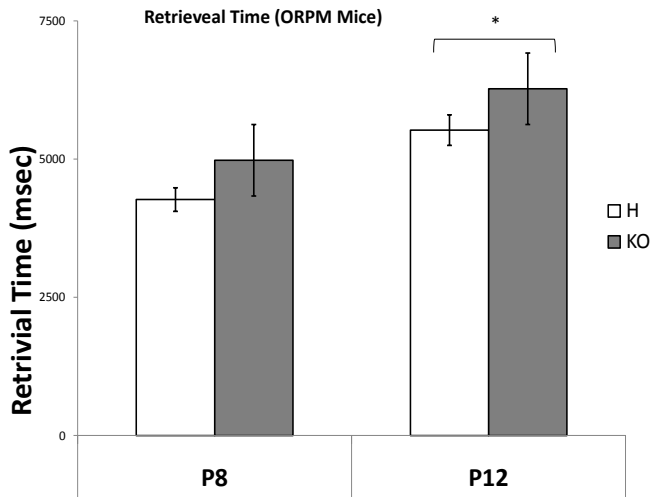


Table 2

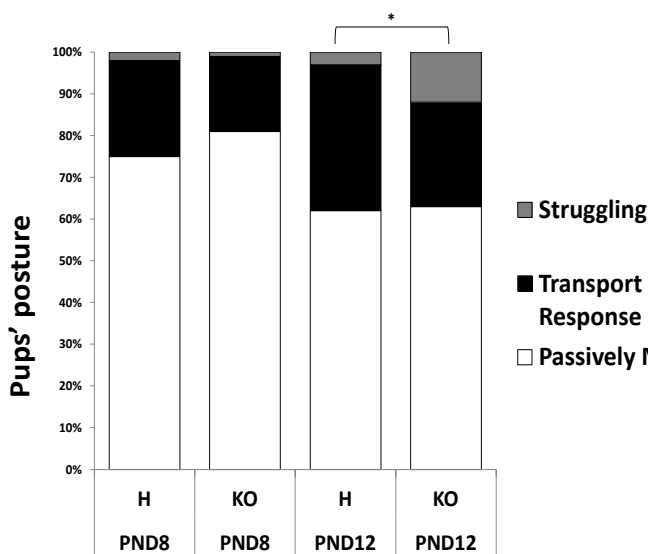
Retrieval time of Wild type pups (H= Hetero) and  $\mu$ -opioid receptor knockout pups (KO), at post natal day 8 and 12



		H	KO
Retrieval	P8	4267 (151)	4978 (202)
	P12	5523 (368)	6271 (334)

Table 3

Pups' posture during Retrieval in Wild type pups (H= Hetero) and  $\mu$ -opioid receptor knockout pups (KO), at post natal day 8 and 12.



		Transport Response	Passively Moved	Struggling
PND8	H	0,23	0,75	0,02
	KO	0,18	0,81	0,01
PND12	H	0,35	0,62	0,03
	KO	0,25	0,63	0,12

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