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Contemplating the Evolution of Attachment and Cognition in a Collaborative Learning Environment

A dissertation submitted in partial satisfaction of the requirements for the degree

Doctor of Philosophy

in

Anthropology

by

Angelica Marcello

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Professor Roy D’Andrade
Professor Steven Parish
Professor Olga Vásquez

2006
The dissertation of Angelica Marcello is
approved, and it is acceptable in quality and
form for publication on microfilm:

Chair

University of California, San Diego

2006
To my dad Girolamo, my mom Lesa, and my brothers Alessandro and Michele for always supporting me and encouraging my choices
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VITA

EDUCATION

- Ph.D., Anthropology, UCSD, June 2006. Concentration on child development and evolutionary theories.
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TEACHING EXPERIENCE

  - Explained child development and socio-cultural theories to undergraduates.
  - Prepared and directed undergraduate students to mentor school-age children in bilingual computer classes.
  - Assessed undergraduate performance and graded research papers.

  - Advised, coordinated, and assisted undergraduate students in the development of a research project involving hands-on experience with children.
  - Evaluated undergraduate research projects and graded research papers.

  - Designed, organized, and led grammar and conversation classes to beginner, intermediate, and advanced undergraduate students.
  - Developed and implemented evaluating material.

  - Taught biology and evolutionary concepts to freshmen undergraduates and led group discussions.
  - Evaluated undergraduate performance.

AWARDS

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Coordinator, “La Clase Mágica”, University of California, San Diego (UCSD), 2003-2004
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community members to become actively involved in the program.
• Led and coordinated English monolingual students to mentor Spanish-speaking
children in bilingual computer classes.
• Designed and implemented evaluation material.

Graduate Student Researcher, UCSD TACKLE program, 2001-2003
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Research Assistant, “San Raffaele” Hospital, Milan, Italy, 1996-1997
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Contemplating the Evolution of Attachment and Cognition in a Collaborative Learning Environment

by

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Doctor of Philosophy in Anthropology

University of California, San Diego, 2006

Professor James J. Moore, Chair

This study investigates the evolution of attachment and cognition by considering them to be products of the ontogenetic and evolutionary pressures acting on the developing individual. It is argued that the unique cognitive capabilities of humans evolved through the attachment system because of the strong selection for plasticity that has shaped our evolutionary history. The possibility that the attachment system represents the substrate for the development of our unique cognitive capabilities is investigated by
looking at the relative performance of secure versus insecure preschoolers in solving cognitively engaging tasks within a theoretically-informed collaborative learning environment. Security of attachment to the mother and cognitive performance were evaluated for a sample of 38 children (mean age, 49 months). Results indicated that attachment security was associated with overall performance (accuracy), critical thinking skills, and short-term memory. Moreover, mother-child attachment security was related to maternal sensitivity and children’s empathy. Finally, a negative association between security and variability in cognitive performance was detected. Security-related differences in cognitive performance, sensitivity, and empathy are interpreted in light of ultimate and proximate perspectives. It is argued that while attachment research traditionally favors ultimate-level explanations, it can no longer disregard the important role that proximate factors and biology play on the developing individual. Attachment is viewed as a continuum of adaptive patterns that are all maintained by evolution because of selection for plasticity. The possibility that attachment is continuously (versus categorically) distributed is investigated by looking at the variability in cognitive performance between secure and insecure children. Critiques are advanced to the use of the Strange Situation Procedure as attachment assessment tool both on its typological classification of attachment types, as well as on its methodology. Lastly, this work explores ontogenetic and phylogenetic arguments about the rise of theory of mind in our species. Opposing views on the ontogenetic appearance of theory of mind like capabilities and on the phylogenetic implications of their emergence are combined as a way to better comprehend the reasons behind the evolution of human’s unique cognition.
“The evolution of human attachment may be implicated in the evolution of culture”

(Chisholm & Wescombe, 1994).

INTRODUCTION

In this study I investigate the evolution of attachment and cognition by considering them to be products of the ontogenetic and evolutionary pressures acting on the developing individual. I argue that theory of mind\(^1\) evolved through the attachment system because of the strong selection for plasticity that has shaped our evolutionary history. This work is centered on a population of preschool-age children involved in a theoretically-informed collaborative learning environment.

It has been proposed that the attachment relationship that develops between mothers and their infants represents the ideal ontogenetic and phylogenetic context within which to search for the origin of our unique cognitive capabilities (Belsky, Steinberg, & Draper, 1991; Belsky, 1999; Brockway, 2003; Chisholm, 1999b; 2003; Povinelli, Prince, Preuss, 2005). Reciprocal interactions within mother-infant dyads, combined with a growing intellectual potential of our ancestors, have translated into capacities of perspective-taking and intersubjectivity which ultimately allowed for the rise of a human-like theory of mind (Brockway, 2003; Chisholm, 1999b; 2003).

\(^{1}\) Theory of mind: “The capacity to attribute mental states to oneself and to others and to interpret behavior in terms of mental states” (Baron-Cohen, 1995).
I believe these arguments tend to overestimate the role of the early caregiving environment in shaping the individual’s socio-cognitive outcomes. Attachment research has traditionally favored ultimate-level explanations while undervaluing the effects of proximal mechanisms on the development of the individual. But infants’ and caregivers’ genetic makeup, and especially their temperamental predispositions, share equal weight with the environment in shaping developmental outcomes. I argue that attachment research can no longer disregard the important role that biology plays on the developing individual and also should not overlook other factors that are extraneous to the attachment relationship, but that nevertheless strongly affect the child’s socio-cognitive development.

In this study, the possibility that the attachment system represents the ontogenetic and phylogenetic substrate for the development of our unique cognitive capabilities is investigated by looking at the relative performance of secure versus insecure children in solving cognitively engaging tasks. Secure children have been reported to outperform their insecure counterparts in various socio-cognitive skills (such as problem-solving, critical thinking, motivation, and goal-orientation) (Frankel & Bates, 1990; Matas, Arend, & Sroufe, 1978; Slade, 1987). From an evolutionary standpoint secure and insecure children’s distinct cognitive skills can be explained in terms of different reproductive strategies. On the one hand, it is argued that secure children, because they receive high quality care and live in stable and resourceful environments, would be able to delay reproduction and thus to allocate resources to improve the quality of their socio-cognitive development. On
the other hand, insecure children, because of an unfavorable combination of environmental conditions, would need to allocate resources to optimize reproductive success at the expense of developmental quality (Belsky et al., 1991; Belsky, 1999; Chisholm, 1999a; 1999b; 2003). Therefore, the fact that secure children perform better than insecure when cognitively engaged, can be explained in terms of long- versus short-term reproductive strategies. I believe that these arguments tend to undervalue proximal levels of explanation and the important role of genes in development.

However, from a proximate perspective, it is argued that maternal sensitivity fosters the development of empathic capabilities, and that both are involved in the development of theory of mind (Baron-Cohen, 2005; Moore & Symons, 2005). Mothers in secure relationships are described as more sensitive to their infants’ needs, and secure infants are reported to be more empathic than insecure infants (Baron-Cohen, 2005). It is argued that maternal sensitivity and infants’ empathy are involved in the development of theory of mind and that securely attached children are reported to have an earlier onset of theory of mind capabilities compared to their insecure counterparts (Moore & Symons, 2005). Part of my investigation, therefore, looks at the role of maternal sensitivity and children’s empathic capabilities in the development of higher cognitive skills of secure versus insecure children, aiming at confirming previous findings. Furthermore, the possibility that securely attached children are perceived by an observer as having more “desirable” characteristics than insecure children is
investigated. In fact, although Povinelli et al. (2005) argued that parents tend to invest more in offspring that are perceived of higher quality, they do not empirically test the hypothesis. Part of this research aims at testing this possibility on a qualitative basis.

Moreover, my study offers a comprehensive view of some of the various factors affecting the developing attachment relationship. Because of the virtually infinite number of factors involved in the individual’s development, I propose a view of attachment as a continuum of patterns that spans from individuals who are very adapted to ones who are extremely maladapted to the local environmental conditions. Under this view, even the seemingly most maladaptive phenotypes could be adaptations to particularly unfavorable circumstances. This study offers an exploration of the cognitive performance of disorganized children in order to investigate the possible adaptive implications of this (and other) insecure attachment patterns. I argue that disorganized attachment, usually regarded as a maladaptation for its undesirable socio-cognitive outcomes, should instead be considered an adaptation. These considerations are extended to all known (and probably other yet unknown) attachment types.

In light of these considerations, I raise some concerns to the use of the Strange Situation Procedure (SSP) (Ainsworth & Wittig, 1969) as an attachment assessment tool. My study advances critiques both on its typological classification of attachment types (versus considering attachment as a continuum), as well as on its methodology. The use of the Attachment Q-Sort (AQS, version 3.0, Waters,
1987) procedure is proposed as a tool with high potential in terms of investigating behavioral constructs that go beyond the mere measure of secure-base behavior. The AQS at the level of individual behavioral items, proposed for the first time by van Bakel and Riksen-Walraven (2004), is used in order to identify the presence of disorganized children in the sample. In addition, the same methodology is tested to investigate levels of maternal sensitivity and infants’ empathy within mother-child dyads. The possibility that attachment is continuously (versus categorically) distributed is investigated by looking at the variability in cognitive performance between secure and insecure children, and within the insecure types.

The second part of this work explores ontogenetic and phylogenetic arguments about the rise of theory of mind in our species. New findings have shown that apes understand intentions, visual perception, and psychological states in others (Behne, Carpenter, Call, & Tomasello, 2005; Call, Hare, Carpenter, & Tomasello, 2004; Hare, Call, Agnetta, & Tomasello, 2000; Tomasello, Carpenter, Call, Behne, & Moll, 2005). As a consequence, previous hypotheses on the ontogenetic development of theory of mind have been challenged, and it is now believed that capacities that will later develop into theory of mind in the preschool years emerge at around 14 months, when infants start developing an empathizing system (Baron-Cohen, 2005), understanding intentions and perceptions, and engaging in an intersubjective fashion (Tomasello et al., 2005). Accordingly, it has been recently proposed that the “first real step” in human cognition occurs at 14 months, and not four years as previously believed (Baron-Cohen, 2005; Meins,
Fernyhough, Wainwright, Gupta, Fradley & Tuckey, 2002; Tomasello et al., 2005). The possibility that these new findings could just reflect researchers’ ability to lower the detection threshold and thus being able to earlier perceive developmental changes, rather than representing a developmental shift (Moore, 2006 personal communication), has not been proposed. Future studies should investigate this possibility.

From a phylogenetic perspective, I will reconcile two of the main current views for the development of theory of mind. Although presented as antagonists in the literature, I believe that Tomasello’s (Tomasello, Call, & Hare, 2003; Tomasello & Call, 2004) and Povinelli’s (Povinelli, Prince, Preuss, 2005; Povinelli & Giambrone, 2001; Povinelli & Bering, 2002; Povinelli & Vonk, 2003; Povinelli & Vonk, 2004) numerous accounts describing the rise of humans’ higher cognitive capacities contain much common ground, a combination of which would be more informative than the debate they currently engage in. Both views seem to agree that humans added to their cognitive repertoire new capacities: some building on a previous phylogenetic history, others unique to the human lineage, and that theory of mind should be considered to be comprehensive of various processes of social cognition (versus being something that a species either has or does not have). Thus, the fact that humans may activate the same behaviors through distinct cognitive systems needs to be considered when comparing performances of human and non-human primates in given cognitive tasks, because alike behaviors can be activated by different underlying cognitive skills. I argue that by combining the two views
we can account for the presence of various degrees of theory of mind in many human and non-human species. I believe not only that selection for plasticity in our species has determined the development of different attachment types, but also that it has favored the rise of higher cognitive capabilities and, ultimately, human cultural evolution.

The setting for this study is centered in a collaborative learning environment that has been developed based on socio-cultural theories of learning and development. According to socio-cultural theory, cognitive development is strictly linked to the social experiences that the individual undergoes within the surrounding cultural environment and learning arises from intersubjective and collaborative interactions that are fundamental for the development of human’s cultural evolution (Cole & Wertsch, 1996). This setting represents the ideal place where to investigate the development of human attachment and theory of mind as they relate to culture, since capacities for collaborative learning allowed for cultural development in our species, from both ontogenetic and phylogenetic perspectives. Moreover, a focus on preschool-age children is relevant since it is the age when children start showing metacognitive capabilities. Also, only few studies have examined the relations between attachment and cognitive development in preschoolers, and findings on their performance are applicable to later cognitive development and adaptation.
CHAPTER 1 - ATTACHMENT THEORY UNDER AN EVOLUTIONARY PERSPECTIVE

“Attachment theory has proven to be perhaps the most important developmental construct ever investigated” (Sroufe, Egeland, Carlson, & Collins, 2005).

“What infants expect is what has happened before” (Weinfield, Sroufe, Egeland, & Carlson, 1999).

“The child foreshadows the adult that is to be” (Thompson, 1999).

Introduction

In the first chapter I lay down the basic principles of attachment theory as proposed by Bowlby and Ainsworth in the sixties. I then frame attachment within notions of modern evolutionary theories, and discuss the evolutionary implications of the different attachment patterns that have been described using the Strange Situation Procedure (SSP) as measurement tool. Next, I present current theories of attachment in an evolutionary perspective, along with some critiques that have been advanced to them. By applying evolutionary theories to attachment, some authors have argued that young individuals take decisions about optimal reproductive strategies based on their previous experiences with the caregivers. In this context,
parental style transmits to developing individuals an appreciation of the conditions in which they will probably be living (and thus reproducing) (Belsky, 1999; Chisholm, 1999b). Within this argument, it is maintained that attachment outcomes are likely to be the phenotypic representations of the environment on which selection operates in order to maximize fitness (Chisholm, 1999b).

Although partly agreeing with this view, I also believe that attachment theorists tend to overestimate the role of the attachment relationship in shaping the individual’s development, often overlooking important factors that are extraneous to the attachment relationship, but that are equally important in modeling the child’s socio-cognitive growth. It is reasonable to believe that early attachment quality does not predict all outcomes, nor that attachment is the only variable involved in socio-personality development. The parent-child relationship is the result of an interaction between various social dimensions, one of which is attachment, but other behavioral systems - which are not necessarily related to attachment - are also involved. I will argue that one important shortcoming of such evolutionary theories is that they significantly undervalue proximal levels of explanation. In addition, it is a general tendency of sociobiologists to overestimate the importance of the environment while underestimating (or even disregarding) the role of genes in determining developmental outcomes. As a consequence, I believe that one of the major limitations of current evolutionary perspectives on attachment is that proximal factors and genetic arguments are (at times purposely) discounted from the arguments, thus providing for incomplete theories. Factors
such as temperamental dispositions of parents and infants, as well as explanations at a proximal level, are as important as the early environment in determining developmental outcomes (Keller & Miller, in press).

In the second part of the chapter I analyze the many factors – both internal and external to the attachment relationship – that are responsible of producing individual differences in attachment patterns, arguing how it is limiting to force attachment patterns into discrete categories. Given the virtually infinite combinations between environmental conditions, parental and child behavior and temperament, and differential receptiveness of children to rearing conditions, I view the attachment system as a continuum that spans from individuals who are extremely adapted to the local environment, to individuals who are extremely maladapted to specific environmental conditions. Within this framework, disorganized attachment (see later for details), because of an extremely unfavorable combination of events, could either be the most maladapted within the population and conditions under study, could represent a defense mechanism to very adverse conditions (thus being adaptive). There is the possibility that, because of the extremely large and intricate genetic makeup underlying human behaviors, some (maladaptive) alleles could be maintained in the genetic pool because it is difficult for selection to operate on them (Keller & Miller, in press). I view attachment as a relative concept and I argue that patterns that are seemingly maladapted in certain environments could be adaptive in other environments and maintained by evolution as a consequence of selection for plasticity in our species. Under this perspective,
the disorganized attachment pattern is seen as an adaptation to extremely unfavorable conditions. In conclusion of the chapter I raise some concerns to the use of the SSP as an attachment assessment tool. Critiques are raised both to its topological classification of attachment types (versus considering attachment as a continuum), as well as to its methodology.

Next chapter will analyze how phenotypical expressions of attachment are implicated in the rise of theory of mind, and ultimately cultural evolution in our species.

**Basic principles of attachment theory**

The basic principles of the theory were formulated by Bowlby (Bowlby, 1969; Bowlby, 1973; Bowlby, 1982) who for the first time defined the word “attachment” as “that intense, long-lasting emotional bond that develops between two persons” (Bowlby, 1969), and, in relation to infancy, as that strong emotional tie that develops over time between an infant and his primary caregiver. Ainsworth (Ainsworth, 1964; Ainsworth, Blehar, Waters, & Wall, 1978) contributed by investigating the “strength and quality” of infant-mother attachment patterns and recognizing the importance of maternal sensitivity in the development of the

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2 Throughout, I tend to use masculine pronouns to refer to children as a convention and for reasons of style.

3 I tend to use “mother” (or feminine pronouns) to refer to caregivers for reasons of style and as a convention, mainly because mothers are more often involved in the rearing of children than fathers are.
attachment relationship (Bretherton, 1995). In addition, Ainsworth (1973) added the view of attachment as a process rather than a static bond. Accordingly, attachment is viewed as an ongoing, dynamic interaction between infant and mother, who repeatedly go through cycles of separations and reunions.

One of Ainsworth’s most important contributions to attachment theory was the development of the Strange Situation Procedure (SSP), which is a tool for measuring the quality of infant-mother attachment. Although many other measurement instruments have been developed since Ainsworth, the SSP remains the most widely used procedure for the measurement of attachment. The SSP will later be described in detail and some concerns with the method will also be raised.

**Bowlby’s intellectual background**

At the time Bowlby was developing attachment theory the two accepted theories explaining the strong tie existing between a child and his mother were based on secondary-drive speculations (Dollard & Miller, 1950). According to drive theory, the need for nourishment represents the infant’s “primary drive” since being fed satisfies his basic needs. Only after the primary needs are satisfied, the theory goes, the infant becomes interested in interacting with one or few caregivers, who are the focus of a “secondary drive”. Psychoanalytic and social learning theories, the only accepted theories explaining attachment before Bowlby, saw the infant as a dependent, clingy and demanding individual whose closeness to the mother was associated with the pleasure of being fed, and who thus developed a
close relationship with the mother only because she represented the source of feeding (Freud, 1910/1957; Sears, Maccoby, & Levin, 1957). In the late fifties these views were put into question by empirical evidence coming from animal studies. The classic work of Harlow and Zimmermann (1959) showed how infant rhesus monkeys (*Macaca mulatta*) raised in isolation from their mothers preferred to interact with a cloth-surrogate “mother” that could be used as a contact comfort (but that had no role in feeding) over a wire “mother” figure containing a feeding bottle in the middle of the chest. By testing the infant monkeys in fear-provoking situations, Harlow was able to show how they ran towards the terrycloth surrogates when frightened, even though they continued to feed on the wire “mothers”. Thus, the animals seemed more “attached” to the terrycloth surrogates, even if the wire figure was the only source of food. Harlow’s results proved the fundamental role of “contact comfort” (Harlow & Zimmermann, 1959) in the formation of social relationships, and the secondary importance of feeding. Combining Harlow’s findings with his own knowledge of maternal deprivation (that was available to Bowlby from a study he conducted on orphans and children that were separated from their families during WW2), Bowlby (Bowlby, 1969; Bowlby, 1958) concluded that human infants have a biologically-based need for social interaction that focuses on a specific adult (Lamb, Thompson, Gardner, & Charnov, 1985). Bowlby’s findings ultimately contradicted the secondary drive theory that was until then considered the basis of the relationship between infant and caretaker⁴.

⁴ Although Harlow’s work was widely accepted by the research community, some attachment
Bowlby’s intellectual development was also greatly influenced by Freud. While disagreeing with most of psychoanalytic theory, Bowlby preserved Freud’s perspectives on relationships and early experiences (Waters, Kondo-Ikemura, Posada, & Richters, 1991). According to Freud (Freud, 1910/1957) the relationship between mother and infant is of fundamental value for personality development and provides a prototype for later love relationships. As put by Sroufe (1986), “Central to Bowlby, as with Freud, is the idea that even with development and notable change, early experience is not lost”. To preserve Freud’s insights but at the same time revise his explanations for the mechanisms of attachment, Bowlby replaced the view of the infant as dependent and needy with the notion of the infant as a competent, explorative, and interested individual. Also, he replaced the drive-motivational theory with one based on control systems and ethological theories (Lay, Waters, Posada, & Ridgeway, 1995). Bowlby’s development of attachment theorists raise concerns about the validity of his studies. Michael Lewis (M. Lewis, November 2004) for example, maintains that Harlow’s work is unconvincing for three main reasons. First, by replicating the original studies using a heated instead of a cold wire as a support for the feeding bottle, Lewis showed that infant rhesus monkeys preferred to interact with that rather than with the cloth-surrogate mother. He argues that the infants in the original studies by Harlow were not attracted to the wire mother surrogate essentially because the wire was cold. Second, Lewis argues, there were only four monkeys in Harlow’s studies, which does not provide for statistical value for his findings. It is ironic, Lewis maintains, how Harlow was aware of these deficiencies and didn’t reference his own work in subsequent studies. A third critique raised by Lewis is that Harlow’s subjects were not only raised without the mother, but they were raised in complete social isolation, which would make them particularly attracted to any animal figure when the possibility arose. If the monkeys had been raised in the presence of peers, Lewis maintains, the effect of extreme attachment to a wire-cloth “mother” surrogate would not have been found. Lewis’ critiques are intriguing since they put into question a work that has been extremely influential for many fields of study. However, the fact that his work has not been officially published, raises some reservations on the validity of his critiques. Regardless of whether such criticism is well founded, Harlow’s work had on Bowlby’s thinking was of invaluable importance since it allowed him to move beyond secondary-drive theories and to develop what is now considered the main theory of infant social-emotional development (Chisholm, 1999b).
theory, as well as Ainsworth’s contributions to it, will be reviewed in the next sections to illustrate the original development of the theory and how it has been re-evaluated in light of more recent findings within evolutionary biology.

Attachment as a behavioral control system and the concept of a secure-base behavior

Bowlby proposed that a behavior control system originates during the first year of life from the interaction between the human infant’s biases in learning abilities, his social experiences, and an expectable and ordinary caregiving environment (Waters et al., 1991). This mechanism, Bowlby maintains, guarantees that the attachment system will be organized according to species-specific patterns that were under selective pressures in the original environment where humans evolved. By viewing attachment as a process, Ainsworth (1973) described the cycles of interactions between infant and mother that are at the origin of its formation. At birth, the mother is attuned with the infant and is in charge of maintaining a balance in his arousal. As a consequence, the child feels secure in the presence of the mother and this gives him the confidence to embark in exploration away from her. However, if he moves too far, for too long, or is faced with a frightening event, the child will search for the mother’s contact to re-establish his “felt security” (Sroufe & Waters, 1977). Only after the child will have re-gained such confidence, he may be able to move away and explore the environment even further. But, if the mother does not reassure him properly (for instance by ignoring
or rejecting him), or if she has previously interfered with his exploratory attempts, the child feels insecure, fearful, and/or uncertain (Chisholm, 1999b). By viewing attachment as a cycle of approaches and withdrawals organized by a behavioral control system, and given the infant’s motivation in exploring the environment, attachment security not only implies proximity seeking on the part of the infant, but also entails his ability to use the attachment figure as a “secure base from which to explore the environment” (Ainsworth, 1973), a concept that is a keystone of attachment theory. The attachment system thus refers to the balance between exploration and proximity-seeking, and this balance is related to the degree to which the caregiver is available and supportive (Ainsworth et al., 1978; Bowlby, 1969; Waters & Valenzuela, 1999), as well as to the child’s developmental social and cognitive stages (Bretherton & Munholland, 1999).

The secure-base concept, characterized by active and goal-directed behaviors, is an important sign of the emergence of attachment (Bowlby, 1969; Sroufe, 1996). It comes around the first year of life, when the infant becomes able to directly communicate with the caregiver in an intentional and specific fashion; he actively looks for contact, changing his behaviors in order to achieve such a goal. Bowlby referred to the “secure-base phenomenon” to describe such behaviors when they are organized, consistent, and directed to only one or a few caregivers (Waters & Valenzuela, 1999). In this context, behaviors like grasping, clinging, crying, signaling and smiling, all have the same function of promoting the caregiver’s proximity to the infant, are adaptively functional in maintaining
proximity, and are thus important in promoting the development of attachment (Lamb et al., 1985; Posada, Jacobs, Carbonell, Alzate, Bustamante, & Arenas, 1999). Although infants emit such precursor attachment behaviors promiscuously in an early stage of life, these behaviors already indicate attachment as they actively promote adult’s proximity and care towards them, which will in turn facilitate the infant’s ability to recognize the primary caretaker figures and finally develop an attachment bond (Bowlby, 1969). In support to this, we now know that infant’s ability in discriminating people develops much earlier than Bowlby thought, that is around 4-6 weeks of life for human infants and not 8-12 weeks as previously believed (Lamb et al., 1985), thus the stage for the formation of attachment might be placed earlier than Bowlby supposed.

Next, I will discuss how these cycles of interactions between mother and infant are responsible for the development of individual differences in the formation of the attachment bond.

Secure and insecure children and continuity in individual adaptation

The use of the caregiver as a base for exploration, the ability to find comfort in interaction with her, and distinct levels of caregiver’s availability, create differential expectations that underpin individual differences in attachment (Weinfeld et al., 1999). An infant who has a history of available, responsive, and supportive caregivers will be able to use them as a secure base for exploring the environment and as safe figures for comfort and reassurance when confronted with
any frightening stimuli (Ainsworth, 1967; Schaffer & Emerson, 1964). This infant, referred to as “secure” can count on a relationship that supports his “active exploration and mastery of the inanimate and social environment” (Matas et al., 1978). Conversely, an insecure child has a history of unresponsive, rejecting, or interfering parents. He may have difficulty separating from the attachment figure in order to explore the environment, even when danger is minimal. Also, he may be unable to derive comfort from proximity to the attachment figure when distressed, or may actively avoid contact and/or interaction when reunited following active exploration (Sroufe & Waters, 1977). An insecure child fears that the caregiver will be unavailable for support and thus cannot count on the confidence on himself that a secure child has. As a consequence, he will be more likely to have a low sense of worthiness and effectiveness (Weinfield et al., 1999).

It is argued that these early experiences lay the foundations for later adaptation5 (Matas et al., 1978) and that the attachment behavioral control system, regulating the secure-base phenomenon, may have a determinant role in socio-personality (Thompson, 1999) and cognitive (Waters et al., 1991) development throughout the life span. In fact, through a history of sensitive or insensitive care, a child will construct his own representation of the caregiver’s availability and responsiveness. This, in turn, will influence his own developing sense of self and

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5 This view is not shared by all. For instance, (Lewis, Feiring, & Rosenthal, 2000) argue, “individual differences in attachment are not consistent over time […] there is no continuity in attachment classification from infancy, adolescence, and adulthood”. Other views on the issue of developmental continuity in attachment representations will be advanced in chapter 2.
perception of others. As a consequence, many aspects of the emerging personality, such as “sociability, emotional predispositions, curiosity, self-esteem, independence, cooperation, and trust” (Thompson, 1999), will be important outcomes of the attachment relationship. In fact, individual adaptation can be seen as a continuous process in which, based on the own perception of self and others, a person develops his own interpersonal environment (Sroufe, 1986). The images of the self that the child creates according to the mental representation he has of others are referred to as *Internal Working Models of Self and Others* by Bowlby (1969). It is argued that these internal working models (IWMs hereafter) will regulate the child’s personality even beyond infancy (Bretherton & Munholland, 1999), and thus represent a foundation of developmental continuity (Thompson, 1999).

Within this line of thought, mental representations of the attachment figure(s), the self, and the environment, are cognitive components of the attachment behavioral system. This concept will be applied in the second chapter to analyze the role of maternal “cognitive” sensitivity in the development of higher cognitive capabilities and ultimately theory of mind in our species. In fact, it is argued that children’s selected ability to understand their parents’ intentions could have favored the development of theory of mind in our ancestors (Chisholm, 1999b).

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6 It should be noted that attachment theorists often tend to overestimate the influence that attachment-related early experiences have over development versus the importance of other factors. Although early attachment experiences do actually have an important role in social and cognitive development, we should not assume that all outcomes are related exclusively to attachment, nor that attachment experiences only can lead to predetermined outcomes (Sroufe, Egeland, Carlson, & Collins, 2005). A more comprehensive view on attachment will be advanced later in the chapter, as well as in chapter 2.
I will now turn into a description of the Strange Situation Procedure and how it was originally conceived. Later in the chapter, after having introduced modern evolutionary arguments, I will return to the SSP emphasizing its weaknesses and flaws in light of new evolutionary speculations.

**The Strange Situation Procedure (SSP)**

The SSP was developed by Ainsworth and Wittig (1969) in order to assess individual differences in the quality of infant-parent attachment and how these are related to prior patterns of interactions within the dyad. The procedure is based on the observation of 1-2 years old infants and it examines how they organize their behavior in terms of attachment and exploration around attachment figures, when they are mildly distressed. It is a laboratory procedure that involves infants in a series of brief interactions with a stranger in the presence of the parent, separations of the infants from the parents while left with the stranger, and subsequent reunions with the parents. Since the basic function of the attachment behavioral system in Bowlby’s and Ainsworth’s model was to promote infant survival by keeping the infant in proximity to the caregiver(s) in new or scary situations, the SSP was designed to create a gradual increase of stress in the infant in order to assess the resulting changes in behavior with respect to the caregiver when the fear behavioral system (in Bowlby’s 1969 terms) is activated. At the end of the procedure, when the child is allowed to be reunited with the parent, the initial stress is released and the attachment behavioral system (in Bowlby’s 1969 terms) is activated instead.
According to their exploratory patterns, their orientation toward the stranger, and their behavior during reunion with the parent, children are classified as “avoidant/rejective”, “secure”, or “resistant/anxious” by the SSP (Chisholm, 1996; 1999b; Lamb et al., 1985).

The secure (or B) pattern, the most common of the three, describes infants who consistently display “secure base behaviors”; they freely explore the environment staying around the caregiver and keeping her at the center of exploration and as a safe figure to return to for reassurance. They miss the mother following separation, they welcome her when reunited, and soon after they return to play and explore. Mothers in secure relationships are available, attentive and responsive to their infants’ needs (Lamb et al., 1985). The avoidant (or A) pattern includes infants who explore while ignoring or avoiding their parents’ presence, and who are little distressed when separated (Lamb et al., 1985). Upon reunion, they also seem to ignore the parents. Mothers in avoidant relationships are described as being relatively insensitive (Cassidy & Kobak, 1988), and as showing inhibition of interpersonal aspects of communication with their children (Moss & St-Laurent, 2001). Finally, the resistant pattern (or C) includes infants who have difficulty in separating from their mothers and are highly distressed by their departure. After reunion, they move from combining proximity-seeking to rejecting behaviors. Mothers in ambivalent relationships are described as unresponsive, rejecting, and inconsistent (Lamb et al., 1985).
These attachment patterns are consistent across studies. It is reported that in low-risk samples around 65% of the infants are classified as secure, 21% avoidant, and 10-14% resistant (Goldberg, 2000). Higher insecurity proportions, as well as different proportions of the three attachment patterns, are reported in some cross-cultural studies and in high-risk samples (Belsky & Cassidy, 1994; Grossmann, Grossmann, Huber, & Wartner, 1981; Lamb, Hwang, Frodi, & Frodi, 1982; Lamb et al., 1985). The three patterns of attachment are usually stable, in stable environments, for at least the first decade of life, but they can change in unstable and/or unpredictable environments (Belsky & Cassidy, 1994; van Ijzendoorn, Juffer, & Duyvesteyn, 1995; van Ijzendoorn, Schuengel, & Bakermans-Kranenburg, 1999).

**Attachment in an evolutionary perspective**

“Attachment theory is an evolutionary theory” […] “Significant advances in attachment theory and research will rest on the successful and complete integration of attachment theory into a modern evolutionary perspective” (Simpson, 1999).

In the past couple of decades attachment research has moved from being a mere analysis of the ontogenetic pathways through which the attachment patterns are created and of the proximal factors controlling the attachment system, to being a theory that analyzes the evolutionary basis of the development of the various
types of attachment bonds. It has basically moved from questions on how attachment works to questions about the why it works the way it does (Belsky, 2005a).

Bowlby based much of his theories on the notion that human attachment behavior has biological roots that can be comprehended only within the context of Darwinian evolutionary principles and of the original environment where humans evolved (Waters et al., 1991). Although he explained attachment in evolutionary terms, the poor knowledge of evolutionary principles at the time he was formulating attachment theory did not allow him to develop a full understanding of the ultimate implications for the various attachment styles. Believing that natural selection operates on the species’ differential survival, Bowlby (1969) theorized that attachment behavior has evolved as a way to protect infants from predators, and thus provide survival advantage for the species by keeping the vulnerable infant in close proximity to the mother. Attachment behaviors (part of the attachment behavioral system), he proposed, were selected in the “Environment of Evolutionary Adaptedness” as a source of protection from danger (part of the fear behavioral system), and, ultimately, survival of the young. In support of this, Bowlby maintained that the attachment behavioral system is sensitive to many variables that would have been associated with risks to the infant’s own survival in the EEA; in addition to separation from adults, these also include exposure to unfamiliar settings and adults, hunger, and illness, among others. Therefore,

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7 Environment of Evolutionary Adaptedness (EEA): The original environment where humans evolved and to which behaviors are supposedly adapted.
infants’ ability to look for protection from conspecific adults and their skillfulness in eliciting and maintaining such protection would have been of survival advantage. Moreover, since the attachment process also depends on the adults’ availability and capability to respond to such signals, reciprocal interactions would also become important. Given that infants’ attachment focuses on individuals who consistently react to their needs for proximity, natural selection would have provided adults with special capacities for caretaking responses. According to these arguments, infants and adults are seen as adapted to respond to each other’s signals as a means to promote species’ survival (Lamb et al., 1985).

Under this (outdated) ethological perspective, the B pattern of the Strange Situation procedure is considered adaptive. By seeking proximity and contact with the caregiver, the infant maintains interaction with the attachment figure thus behaving in a way that would have favored his survival in the EEA. By contrast, the A and C patterns are seen as maladaptive (Sroufe, 1988) since the behavior involved would not have enhanced infants’ survival during evolution (Lamb et al., 1985). These assumptions have been challenged in light of modern evolutionary theories. This will be the topic of the following sections.

**Some background on modern evolutionary thinking**

Evolutionary thinking started to change after Tinbergen’s (1963) “four why in biology” to explain behaviors at various levels, Hamilton’s development of the inclusive fitness concept (Hamilton, 1964a; Hamilton, 1964b), Triver’s parental...
investment (Trivers, 1972) and parent/offspring conflict (Trivers, 1974) theories, and the more recently developed life history theory (Clutton-Brock & Scott, 1991), that includes considerations on all of the above. By applying these theories to attachment some authors are now convinced that variability in attachment classification has adaptive implications (Belsky, 1999; Chisholm, 1996; 1999b), and none of the attachment types should be considered as maladaptive (Weinfield et al., 1999).

Life history theory, that can be defined as the “study of organism-environment interactions throughout development in an evolutionary context” (Chisholm, 2003 original emphasis), assumes that life cycles (and their development) are evolved reproductive strategies under continuous selection pressures (Charnov, 1993; Stearns, 1992). Since life histories are believed to vary not only between, but also within species (Gross, 1996), life history variations in the same species should also have evolved in the service of reproductive fitness (Belsky, 1999). By applying life history theory to attachment we can integrate evolutionary and developmental perspectives. According to modern evolutionary theories, selection occurs at the genes/individual (not species) level, therefore, in the course of evolution, the physiological, anatomical, and behavioral components that give survival advantages to the individual are transmitted through the gene pool. As such, evolution is driven by differential, not absolute reproduction of one’s genes (Simpson, 1999). These considerations will now be applied to attachment.
Attachment in a modern evolutionary perspective

Based on these considerations, Belsky (Belsky et al., 1991; Belsky, 1999) and Chisholm (1996; 1999a; 1999b) have proposed a view of attachment from the perspective of modern evolutionary thinking, that assigns to the early caregiving environment major responsibility in determining developmental outcomes. In their account, an individual’s development is strongly determined by specific information on environmental quality that is acquired in childhood and that is an indication of the conditions within which the individual will be reproducing. Although Chisholm correctly assumes that individual differences in attachment are strongly intertwined with parental investment and mating strategies (Kirkpatrick, 1999), his exclusive evolutionary explanations led his theory to be an interesting, although incomplete account for the presence of individual differences in attachment security (Amin & Thompson, 2001; Buss & Greiling, 1999; Hawkes & Rushton, 1994; Kirkpatrick, 1999; Maccoby, 1991; Rushton, 2001).

I will now present Chisholm’s (which partly takes from Belsky’s et al., 1991 speculations) argument because I believe he presents an interesting and comprehensive account on the ultimate, evolutionary implications for the rise of different attachment, parental, and mating styles. Later, I will advance some critiques that have been advanced to his model, while highlighting some important insights that his theory presents in terms of evolution of theory of mind in our species (which is the topic of chapter 2).
Chisholm’s (1996) arguments start from the realization that, in addition to survival, fitness\(^8\) comprises two other main components; growth/development, and reproduction. Moreover, reproduction itself consists of the actual production of offspring (mating effort) and the rearing of them (parenting effort); increasing the number and quality of offspring, respectively. Given that time and resources are always limited (Levins, 1968), modern evolutionary theorists consider adaptations to be under a cost-benefit analysis. As a consequence, there need to be trade-offs between the different components of fitness because resources cannot be allocated simultaneously to all of them. Organisms need to find the optimum balance between these various components, which, in relation to reproduction, reflects into equilibrium between mating and parenting efforts (either increase the quantity by allocating more resources into producing offspring, or increase the quality by investing more in rearing fewer of them).

Because of the assumed instability and unpredictability of the original environments\(^9\) (hereafter, EEAs), the fact that resources are limited, and the need of trade-offs among the components of fitness, it is not always in the parents’ interest to respond consistently sensitively to the infants’ cues or to provide the care that the offspring would want or need (Trivers, 1974). During conflict over weaning, for

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\(^8\) Fitness: “The genetic contribution of an individual to the next generation’s gene pool relative to the average for the population, usually measured by the number of offspring or close kin that survive to reproductive age” (Webster's college dictionary 1992).

\(^9\) Although Bowlby often referred to the EEA as if it was a single and consistent environment, we need to assume that humans evolved in a multitude of physically, socially, and ecologically different environments (Chisholm, 1996; Simpson, 1999).
instance, natural selection fosters mothers’ rejection, thus making infants adapted to cope also with rejecting caregivers. According to Trivers, there is a conflict over care and resources because parents and infants have different reproductive goals that create a tension of interests. Parent/offspring conflict theory (Trivers, 1974) assumes that the reproductive value of offspring depends on many factors, such as mother’s and infant’s age, health status, the certainty of paternity, the relative value of other offspring, etc. Also, the interests of infants and adults change over time; for example the possibilities for further reproduction in the adult, and the chances of survival of the young vary with time. Moreover, since selection favors traits that maximize the reproductive success of the parents, and because resources are limited, parents are selected not to maximize the development of individual offspring, but to divide the efforts among all individuals sharing their genes. In fact, parents only share 50%, and not 100%, of their genes with each of their offspring (Trivers, 1972). Starting from these considerations, Chisholm has reasoned that such conflict should foster parents’ unwillingness to care for their infants since, even if parents would have the means for a respectable quality of parental care, they need to reduce it in order to invest in other living or future offspring. Conversely, if parents are willing to invest in the quality of parental care but aversive environmental conditions are impending, they may become unable to do so (Chisholm, 1996; 1999b). Unwillingness and inability to properly care for infants are, according to Chisholm, responsible for the formation of the two types of insecure attachment, A and C. He speculates that parental unwillingness to
invest in offspring would have selected for avoidant/rejective attachments, whereas parents’ inability to invest would have fostered ambivalent/anxious attachment relationships.

Therefore, under a modern evolutionary perspective, A and C patterns can both be viewed as adaptive. In fact, two are the main questions that need to be addressed when analyzing a particular phenotype and behavior; questions about the *how* it is achieved (its cause), and questions about the *why* it has been favored by selection (its adaptive function) (Tinbergen, 1963). When analyzed from these viewpoints, even if from a causal level of analysis insecure attachment is non-desirable and maladaptive\(^\text{10}\), it could be as adaptive as the secure type when analyzed from a phylogenetic perspective, which considers the specific environment where it evolved (Hinde, 2005). According to this view, avoidant and ambivalent attachment types are no longer considered maladaptations but, under purely evolutionary terms, they are both adaptive (Weinfield et al., 1999); they should be considered as evolved strategies that enhance the individual’s reproductive success in a particular environment, or at least this is what happened in the EEAs (Belsky, 1999).

Moreover, Chisholm (1996; 1999b) and Belsky (1999) argue that because immature individuals cannot reproduce, the major trade-off they have to face is the one between survival and growth and development. To examine how juveniles’ experience of parental behavior is translated into adjustments of their growth and

\(^{10}\) The possibility that insecure attachment is maladaptive will be analyzed later in the chapter.
development, and, ultimately, how this enhances their reproductive fitness, both proximate and ultimate explanations need to be addressed. Parents of secure children tend to engage in long-term and stable pair bonds and to highly invest in their offspring by improving the quality of their development (Belsky, 1999). Ultimately, a sensitive, consistent and responsive parenting in the EEAs was a sign that the mother was willing to continue investing, that infants had good reproductive value, and survival, growth and development were not threatened (Chisholm, 1996). Under this perspective, secure children should be able to improve the quality of their development by exploiting long-term learning (thus having the possibility of enhancing their socio-cognitive development), and their optimal developmental strategy should be to allocate all resources to maximize the quality of development (Belsky, 1999; Simpson, 1999). Different considerations are advanced for insecure infants and juveniles who experience insensitive, inconsistent, or rejecting parenting, which was fostered by highly risky and uncertain environments in the EEAs. Their parents would engage in short-term and unstable pair bonds and provide a low quality of parental investment, favoring quantity versus quality of offspring (Belsky, 1999). Ultimately, parental information would have been emotionally acquired by infants as an indication that they had low reproductive value, and this would have been reflected as threats to insecure juveniles’ growth and development (Belsky, 1999; Chisholm, 1999a). The optimal developmental strategy of insecure juveniles, facing unfavorable and unpredictable environments, should focus on early mating (and procreation) and
thus on allocating resources to maximize reproduction at the expense of developmental quality (therefore they will have fewer opportunities to enhance their socio-cognitive development).

The optimal developmental strategy of avoidant children would be, according to Chisholm (Chisholm, 1999b), to maximize current survival and avoid a rejective parent. The optimal developmental strategy for ambivalent children would be to try to maintain investment from a “poor” parent (Chisholm, 1999b). Belsky (1999) and Chisholm (1999b) argue that, in order to enhance their fitness, ambivalent children should maximize the rate of maturation, engage in opportunistic interpersonal relationships, have an earlier onset of puberty and reproduction, and provide limited parental investment.

Because the relationship with the parent is the most intimate and powerful relationship experience of young infants, Belsky et al. (1991) argued that natural selection has shaped offspring to use parental style as a cue to the environmental conditions that were likely to be encountered later in life. In fact, even if lacking higher cognitive capacities, infants have the ability to appreciate if their caregivers are giving them the attention, care, and resources that they need (Simpson, 1999). Furthermore, infants do not passively attain important information about their futures, but are selected to actively seek out that knowledge by interpreting the quality of parental care they are receiving (Chisholm, 1999b). According to these arguments, information on the social and ecological environment would have been transmitted to developing individuals through parental investment, and individual
differences in attachment would represent facultative adaptations to parental behaviors that evolved to enhance fitness in different rearing environments (Belsky et al., 1991). Attachment can thus be considered an adaptation for assessing certain kinds of risk and uncertainty and ultimately learning about one’s optimal developmental pathway (Chisholm, 1996). Ultimately, the knowledge acquired by infants through the attachment system would have been used to shape future mating and caregiving behaviors in service of reproductive fitness goals and would have promoted children’s psychological processes. Under this perspective, individual differences in attachment are seen as developing reproductive strategies in a given environment (Belsky et al., 1991; Belsky, 1999; Chisholm, 1996; 1999a).

Although fascinating, this model contains some flaws and limitations that need to be addressed. Some critiques that have been advanced to the theory, as well as my personal perspective, will be presented next.

**Critiques to Chisholm’s theory**

Three main critiques have been advanced to Chisholm’s (and partly Belsky’s) theories. The first critique is that they did not account for the different reproductive strategies of males and females. We know that, while male fitness is limited by the availability of females, females’ limiting factor is represented by the number of offspring they can produce. As a consequence, hypotheses on the adaptability of reproductive strategies should be separately examined for the two sexes (Amin & Thompson, 2001; Buss & Greiling, 1999; Hawkes & Rushton,
It is more likely that, given that reproductive behaviors have different fitness consequences in males and females, evolution has selected for the two sexes to have different reproductive and parenting strategies, and both short- and long-term approaches should be adaptively present in humans’ mating repertoires (Amin & Thompson, 2001; Buss & Greiling, 1999; Hawkes & Rushton, 1994; Kirkpatrick, 1999; Maccoby, 1991).

On this account, short-term mating should not be considered as a maladaptation since its fitness outcomes are relative to present selection pressures (Buss, 1999).

A second critique is that Chisholm’s theory is needlessly evolutionistic and mentalistic (Amin & Thompson, 2001; Maccoby, 1991). In fact, although proximate and ultimate considerations are complementary, behavioral ecology and sociobiology traditionally tend to emphasize problems of ultimate causation at the expense of proximate considerations. But, in order to answer a variety of important questions about the evolution of behavior, it is also of fundamental importance to get information about proximate behavioral mechanisms because proximal explanations are sometimes sufficient to account for certain behaviors (Clarke, Mason, & Moberg, 1988; Cubicciotti, Mendoza, Mason, & Sassenrath, 1986; Mason, Long, Mendoza, 1993; Mason & Mendoza, 1998; Mendoza & Mason, 1989; Mendoza & Mason, 1997). It is argued that the choice between short- and long-term strategies can be explained without mentalistic considerations, for instance by considering the determinant role of the home environment for those girls who come from stressful childhood histories, experiencing lower supervision.
and/or higher sexual promiscuity on the part of their mothers. These girls could be prone to an earlier puberty for reasons that are not evolutionistic. In fact, unstable environments and insecure attachment may lead children to become detached from their parents at an earlier age and puberty could occur earlier because of this distance (Amin & Thompson, 2001).

A third critique to Chisholm’s speculations is that he (consciously) avoids genetic determinism and assigns to the environment the major (if not only) role for the individual’s developmental outcomes (Rushton, 2001). However, it is now commonly accepted by behavioral geneticists that “both environmental and genetic factors are 100% necessary for the species-typical expression of every trait” (Keller & Miller, in press). As pointed out by Rushton (2001), “Twin and adoption studies have repeatedly demonstrated that people inherit their personalities and temperaments, their attitudes and values, and a whole complex of behaviors including mate-preferences and parenting styles […], genes plainly do contribute significantly to people’s temperaments, abilities, and patterns of interest. They even help create the individual differences in empathy, nurturance, altruism, and aggression that Chisholm makes the basis for his theory of mind”.

Overall, Chisholm’s theory seems to want to “predict too much of what we already know to be false” (Amin & Thompson, 2001). Furthermore, it does not account for exceptions in cases in which children raised in unstable environments become secure, or in situations in which insecure children become responsible adults (Amin & Thompson, 2001), thus there is something important that is missing
in Chisholm’s speculations. On my account, his theory falls short for not considering the possibility of proximate mechanisms - especially temperamental\textsuperscript{11} dispositions of both mother and infant - to be responsible for individual differences in attachment. Distinct temperamental styles are based on physiological variations that bias the individual versus a certain temperamental response style from birth (Thomas & Chess, 1987), although its outcome may differ due to environmental influences (Kagan, Snidman, & Arcus, 1992) and to maturational development (Rothbart & Derryberry, 1981; Rothbart & Posner, 1985). In line with Buss (1992) and Rothbart, Derryberry, & Posner (1994) I believe that the developing attachment relationship must be viewed from both the infant’s and the caregiver’s perspectives, and the role of the mother as a source of security or comfort depends, not only on her sensitivity to the infant’s signals, but also on the infant’s requirements for such security (Sroufe & Waters, 1977). The match (or mismatch) between mother’s and infant’s temperaments is perhaps more important than each one’s temperament considered alone. Thus, biology and environment interact in a dynamic fashion to produce particular behavioral outcomes (Calkins & Fox, 1994), and this is often overlooked by developmental research. Moreover, not only the environment is directly involved in gene expression, but also the way in which the environment is experienced by the individual will influence the phenotypic manifestation of a

\textsuperscript{11} The term temperament refers to behavioral patterns that develop from biological characteristics (Bates, 1989; Braungart, Plomin, DeFries, & Fulker, 1992; Emde, Plomin, Robinson, & Corley, 1992; Goldsmith, Buss, Plomin, & Rothbart, 1987). These patterns include sensitivity and intensity of reaction (Goldsmith & Campos, 1992; Strelau, 1983; Thomas & Chess, 1977), emotional self-regulation, and sociability (Buss & Plomin, 1984).
given gene (Fonagy, 2003). This, in turn, is a function of temperamental predispositions. Finally, biology is the motivating force for temperamental outcomes and the extent of environmental influences will depend on both how extreme an infant’s disposition or temperament is as well as the strength of the environmental forces that act on such biological disposition (Calkins & Fox, 1994).

Despite these limitations in Chisholm’s evolutionary perspective of attachment I believe his insights on the development of theory of mind, analyzed within the attachment relationship, is very valuable. This is the topic of chapter 2.

A third type of insecure attachment: The disorganized pattern

Disorganized attachment (D), first described by Main & Solomon (1986), refers to a particular subset of children who are difficult to classify using the SSP (Howes & Ritchie, 1999; Main & Solomon, 1990; van Ijzendoorn, Vereijken, Bakermans-Kranenburg, & Riksen-Walraven, 2004). These children were labeled disorganized because their (inconsistent) behavioral responses to separation and reunion during the SSP did not fall in any of the (organized) behavioral descriptions characteristic of the other three attachment categories (Main & Solomon, 1990; Main, 1995; van Ijzendoorn et al., 1999) or showed mixtures of their features (Zeanah, Danis, Hirshberg, Benoit, Miller & Heller, 1999). They are also reported to be more inconsistent in their behavioral responses since they lack clear objectives and intentions (Solomon & George, 1999). Although many researchers (e.g., Howes & Ritchie, 1999; Main & Solomon, 1986) include the “D
pattern” as one of the insecure types (along with A and C), this view is not shared by all. Some authors (e.g., Carlson, Cicchetti, Barnett, & Braunwald, 1989) label disorganized infants as unclassified, while others (e.g., van Bakel & Riksen-Walraven, 2004) place them outside of the secure/insecure attachment classification dichotomy.

In the SSP, disorganized children have been described as lacking a coherent plan for eliciting comfort and security (Howes & Ritchie, 1999; Zeanah et al., 1999), being fearful of the attachment figure (Howes & Ritchie, 1999), being “non compliant, fussy, angry, easily upset, and difficult to comfort” (van Bakel & Riksen-Walraven, 2004), and exhibiting behaviors that seemed to “lack observable goal, intention, or explanation – for example, contradictory sequences or simultaneous behavioral displays; incomplete, interrupted movement; stereotypies; freezing/stilling; direct indications of fear/apprehension of parent; confusion, disorientation” (Solomon & George, 1999).

Because of difficult living situations, a caregiver could not be emotionally prepared to raise a child. It is argued that disorganized children’s irregular behavioral tendencies are outcomes of past experiences with attachment figures that gave the child a disrupted view of the mother (and, by extension, everyone else) as a person who cannot be trusted and who does not take the time and effort to care for his own growth (Howes & Ritchie, 1999). Difficult life circumstances, partner and family violence, maltreatment, and mother’s depression are among the main variables responsible for the development of disorganized mother-infant attachment
patterns (Carlson, Cicchetti, Barnett, & Braunwald, 1989; Lieberman & Pawl, 1990; Martins & Gaffan, 2000; Zeanah et al., 1999). It is reported that in normal, middle class families, about 15% of the infants assessed in the SSP are disorganized and in other social situations (i.e., lower class homes with more stresses on the parents, unstable child-rearing practices, frightening parental behavior) or clinical populations, the number can double, or even triple (van Ijzendoorn et al., 1999). In a study analyzing attachment in one-year-old maltreated and non-maltreated infants, Carlson et al. (1989) found 82% disorganized infants in the maltreatment group. In that study it was concluded that maltreatment is a major determinant of disorganized attachment patterns and that maltreated infants, compared with non-maltreated matched groups, are especially at risk for disorganized attachment. Moreover, not only disorganized attachment is associated with non-desirable behavioral characteristics in infancy, but it has also been related to behavior problems and developmental risks at preschool and school age (Moss, St-Laurent, & Parent, 1999) as well as adolescence (Carlson, 1998) and adulthood (Lyons-Ruth & Jacobvitz, 1999). Moreover, infants and young children identified as disorganized tend to display aggressive behavior disorders (Lyons-Ruth, 1996; Zeanah et al., 1999) and are considered at great risk for the development of psychopathologies (Boris, Fueyo, & Zeanah, 1997; Lyons-Ruth, 1996).

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12 It should be noted that direction of causality is difficult to determine in these types of studies, thus we need to consider that there still is the (although less likely) possibility that children who are difficult to raise due to given inborn characteristics might provide parents with extremely frustrating and inconsistent feedback, which, in turn, promotes maltreatment (Moore, 2006).
1996; Zeanah, Boris, & Larrieu, 1997). Evaluation of the mother-infant attachment relationship at an early age is thus of fundamental importance to detect a child’s difficult rearing environment in a way to start prompt intervention measures and thus prevent future behavioral problems. In fact, although few studies looking at the links between maltreatment and attachment have focused on infants younger than two (Zeanah et al., 1999), behaviors associated with disorganized attachment patterns in infancy are not temporary but are likely to persevere through at least the toddler years (Barnett, Ganiban, & Cicchetti, 1999), therefore making early detection and intervention highly desirable.

An analysis of the disorganized attachment pattern is relevant to my study since, although the assessment tool used in this research (AQS, see chapter 3 for details) does not identify different insecure attachment types, some of the subjects present behavioral characteristics that would label them disorganized if the SSP was used. Moreover, these subjects, along with other insecure ones, present a much greater variability in cognitive performance than secure children, allowing for speculations on the origins of such cognitive variability. These findings will be analyzed in detail in the method, data analysis, and discussion sections (chapters 3, 4 and 5, respectively).

Given the unfavorable characteristics associated with a disorganized attachment pattern, we might wonder whether it is adaptive or better considered a maladaptation. Belsky (1999) has wondered whether evolutionary considerations can be applied to determine the adaptive value of disorganized attachment, as it was
done for the other two insecure types. Unfortunately, differently from the A and C patterns for which there are some longitudinal studies that investigate mating and parenting behavior (thus allowing for speculations on their adaptive value), no such data are available for disorganized attachment (Belsky, 1999). Therefore, as the field stands now, it is difficult to analyze the adaptive value of disorganized attachment. Future studies should look at the reproductive success of individuals classified as disorganized in infancy, in order to give account for possible evolutionary explanations of its origin that might fit with Belsky’s and Chisholm’s theories.

Buss and Greiling (1999) make an important point by arguing that, when analyzing the adaptive function of an evolved mechanism, “it is critical to distinguish between a mechanism that is functioning as it was designed to function but is no longer adaptive (i.e., no longer leads to reproductive success) and a mechanism that is malfunctioning (i.e., not doing what it was designed to do)”. Under this perspective, I ask, could disorganized attachment represent an adaptation to the original environments that is now maladaptive because those environments are no longer present, or could it just be a (even recently developed) maladaptation that is maintained by selection for some reason? Or, from another viewpoint, could disorganized attachment be a reactive defense that suggests that something in the environment is wrong, and thus be an (adaptive) aversive reaction
to unfavorable conditions\(^{13}\)? To address these questions I will now analyze the general issue of whether all insecure types (A, C, and D) are adaptations or should be considered as maladaptive.

**Is insecure attachment a maladaptation?**

Given that insecure attachment patterns, generally speaking, seem to hinder an ideal cognitive, socio-emotional, and perceptual development (Chisholm, 1999b), we are presented with the possibility that insecurity represents a sort of maladaptation which might have recently developed for reasons that are not adaptations to an original evolutionary environment and individual differences in patterns of attachment may not be adaptive (Miller & Fishkin, 1997; Strum, April 2002). This possibility is reinforced by the likelihood that we are now experiencing just a subset of the attachment patterns that have originated during evolution (Belsky, 1999). The fact that the disorganized attachment pattern has been recently “discovered” because studies have started analyzing populations at risk, should suggest that the attachment patterns that we observe today could reflect just what is fostered by current environmental conditions, and not the full array of possibilities that arose during human evolution (Belsky, 1999). Furthermore, ancestral conditions that no longer exist could have originated patterns that are different from A, B, C, and D types and that are not maintained by evolutionary pressures because

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\(^{13}\) Examples of adaptive aversive reactions are phobias and depression. Keller and Miller (in press) argue, “[…] certain phobias and depressions may be reactive defenses analogous to fever, nausea and bodily pain, which protect against infections, toxins, and tissue damage, respectively” (original emphasis).
the environments where they originated are no longer present. Along these lines, the fact that the secure type is more present today should not make it as more “ideal”, but just more frequent in the present environments. There is no way for us to know whether the same frequencies in attachment patterns that we observe today were true in our evolutionary past (Belsky, 1999), although cross-cultural studies suggest they might have been quite different. Moreover, there is the possibility that behaviors that were designed in our original environments could result as maladaptive today if the environment in which they are found is significantly different from the one for which such behaviors were designed (Kirkpatrick, 1999). Thus, we might ask, why are the insecure patterns, in general, maintained at such high percentages (even around 50% in some populations)? Why has the disorganized attachment pattern been maintained by evolution if it compromises a healthy development? And, why is it present in a good 15% of the infants in normal middle class populations (and even in double quantity in clinical samples)?

Answers to these questions may come from genetic studies, such as the one by Keller and Miller (in press) on heritable mental disorders. Wondering why selection has been unable to eliminate the genes that predispose to mental disorders, Keller and Miller advance three hypotheses; “ancestral neutrality (susceptibility alleles were not harmful among ancestors), balancing selection (susceptibility alleles sometimes increased fitness), polygenic mutation-selection balance (mental disorders reflect the inevitable mutational load on the thousands of genes underlying human behavior)”. Supporting a polygenic mutation-selection
balance model, they raise the possibility of individuals affected by mental disorders to be distributed along a continuum that ranges from non-affected to extremely affected by a given disease. Their hypothesis is that, although mental disorders may be detrimental to fitness, they may underline such a multifaceted combination of alleles that it is difficult for natural selection to operate on. Moreover, they argue, “behavioral traits are especially susceptible to harmful mutations because they depend on the most complex organ in the human body, the brain […], [which] is affected by over half of the hundreds of mutations that all humans carry” (Keller & Miller, in press). Although insecure attachment is not a heritable, mental disorder, it is likely that it partly depends on alleles of the kind described by Keller and Miller. In fact, although Chisholm’s theories deliberately avoid genetic arguments, the individual’s genetic potential should instead be integral part of his speculations given that it is now known that genes have about the same power as the environment in determining developmental outcomes (Rushton, 2001).

Because of the virtually infinite environmental situations and human’s extremely rich and intricate genetic makeup, I see attachment as a continuum of patterns. I believe the reasons for maintaining insecure, especially D, types, are to be found in the selection for plasticity in our species. Phenotypic plasticity, that is “the capacity of a single genotype to produce a wide range of phenotypes that are contingent on environmental information” (Chisholm, 1999b), represents an adaptive advantage when fitness requires information that is more updated than the one provided by the organism’s genotype. Because they represent adaptations to
specific environments, phenotypes are maintained by evolution because they are adaptive in some (even if not frequent) circumstances. Through selection for plasticity, patterns are maintained in the available repertoire of a developing individual to be able to cope with a wide range of environmental conditions.

Applying the concept of plasticity to attachment, Hinde (1982) affirmed, “there is no best mothering (or attachment) style, for different styles are better in different circumstances, and natural selection would act to favor individuals with a range of potential styles from which they select appropriately”.

By considering the attachment system as a continuum of environmental adaptations rather than a construct divided into discrete categories, I believe we can provide a framework where to investigate the adaptive implications of insecure attachment types. My view of attachment as a continuum will be illustrated next.

A view of attachment as a continuum

The fact that insecure children are described with three (two for some authors) attachment classifications while only one pertains to secure children might indicate that, if environmental conditions are favorable and parents are willing and able to invest in their children, there is only one developmental outcome; a secure relationship. Conversely, it is interesting to realize that there might be many factors determining less-than ideal rearing conditions leading to insecure attachment. In addition to lack/impredictability of resources and parent/offspring conflict, these also include temperamental dispositions of both parents and infants, among others.
Combinations of these factors may yield different parenting styles (insensitive, intrusive, unresponsive, rejecting, or any combination of them) that would both proximately and ultimately result into a variety of children’s developmental pathways as well as attachment patterns.

Although Chisholm has argued, “from the child’s perspective there may be just two kinds of risk and uncertainty – one concerning caretakers’ motives to maintain investment and the other concerning caretakers’ means or opportunities to maintain investment” (Chisholm, 1999c, original emphasis), I believe there to be more than just two types of risk for the child as well as more than just two parenting styles. In addition, I do not believe there to be major different ultimate explanations for the evolution of avoidant and ambivalent attachments. Both insecure patterns evolve under less-than-optimal conditions. Knowing that parents are behaving insensitively, whether it is for parent/offspring conflict or lack of resources, should transmit a similar kind of message to the offspring. Moreover, inability and unwillingness to invest are not mutually exclusive, nor are they the only determinants of caregivers’ insensitivity to the infants’ needs. As a consequence, the extent of the combination of the two should lead to a continuum, not only in attachment classification, but also in terms of adaptations of one’s own developmental pathways. Finally, I believe it is unlikely that there is only one set of favorable conditions that fosters secure attachment, or that the outcome of a “good caregiving environment” is necessarily a secure relationship. Other factors, such as
temperamental characteristics of both parents and infants (among others), should have an impact in the development of different attachment styles.

Given the virtually infinite possible combinations between environmental conditions, parental temperament, caregiving predispositions, and infants’ temperamental characteristics, I view the attachment system as a continuum that ranges from “extremely adapted” to “extremely unadapted” to the local environmental conditions where the child is born. I do not believe we can speak of a categorical difference between the various types of attachment. I think there is a multitude of situations that can lead to a multitude of outcomes in a variety of settings. For these reasons, a more appropriate approach to the study of attachment would be to consider each pattern as uniquely adapted to the environment where it evolved and where it is expressed, without forcing it into discrete categories. This does not necessarily imply that each attachment pattern is “the best available developmental option” within certain circumstances because, as Sroufe et al., (2005) point out, early parenting does not always predict attachment. Conversely, caregiving behavior can lead to outcomes that attachment does not predict, and vice versa. Furthermore, different early experiences and attachment relationships are not the only critical forces acting on the developing individual, nor their effects are

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14 This view is supported by studies on non-human primates; the attachment relationship within non-human primates’ mother-infant dyads varies along the secure-insecure continuum as a function of the foraging conditions and the demands of the physical environment. Secure infants are found in higher proportions when resources are abundant and easily accessible, whereas opposite conditions are more likely to foster insecure base-like behaviors in infant monkeys (Rosenblum & Paully, 1991).
unequivocal or unavoidable (Sroufe et al., 2005). These (undeniable) factors are seldom considered by attachment scholars.

**Attachment continuum and the Strange Situation Procedure**

The view of attachment as a continuum instead of a construct divided into discrete categories naturally leads to analyzing the SSP, which is the assessment tool that has provided attachment research with a topological view of attachment in the first place. In an original article entitled “Are infant attachment patterns continuously or categorically distributed? A taxometric analysis of strange situation behavior”, Fraley and Spieker (2003) raise the question of whether individual differences in attachment organization reflect a continuous or a categorical model. A series of commentaries were formulated in response to Fraley and Spieker’s article and many researchers have raised concerns on the validity of the categorical classifications of attachment found in the SSP. They agree that attachment theory does not predict nor require discrete attachment patterns, and that the discrete attachment types A, B, C, and D are mere artifacts of the SSP (Cassidy, 2003; Cummings, 2003; Fraley & Spieker, 2003; Sroufe, 2003; Waters & Beauchaine, 2003).

Referring to Ainsworth et al.’s (1978) study on the SSP, some authors point out that the fact that categories were decided to be used was incidental and adopted for economical expression (Fraley & Spieker, 2003), and not because Ainsworth and her collaborators were making assumptions about taxonicity (Waters &
Beauchaine, 2003). Interestingly, Ainsworth herself “viewed the strange situation as a tool, not a topic” (Waters & Beauchaine, 2003), arguing that “the more we use the SSP, the sooner we can be finished with it” (Ainsworth, 1979, cited in Waters & Beauchaine, 2003). Therefore, although a continuous scale was able to account for all core features of attachment, Ainsworth et al. (1978) decided to adopt a typological model of attachment and such system has since then become the norm in attachment research (Sroufe, Egeland, & Kreutzer, 1990). For this reason, it is generally (mistakenly) assumed that discrete patterns are part of the theory and that variations in attachment security are a “matter of kind rather than degree” (Fraley & Spieker, 2003).

However, viewing attachment as categorically distributed represents a problem in those (quite frequent) cases when patterns do not fit the classification system because an individual might present features that are at the borderline between different categories (Cummings, 2003; Sroufe, 2003). As an example, Cummings (Cummings, 1990; 2003) argues that problematic patterns of attachment (i.e., disorganized) may comprise attachment disruptions that are not revealed by categorical analysis and that, as a consequence, may not be appropriately addressed in such assessments. In these cases, adopting a security continuum is a better choice since it minimizes errors due to measurements that are in borderline zones and thus the statistical power of the analysis may be significantly enhanced (Cummings, 2003). A different view than Cumming’s is advanced by Cassidy (2003), who argues that that disorganized children only differ from others in their organization
of behavior during the SSP procedure. Thus, he argues that by only using a continuous classification system, the “D” pattern would have never been identified. Although Cassidy is in favor of a categorical classification of attachment, I think his arguments even further support the view of attachment as a continuum. The fact that he argues that the “D” pattern is a specific outcome of the SSP, indirectly implies that the disorganized type (as probably all other attachment types) are just artifacts of the procedure. Interestingly, in their original study on disorganized attachment, Main and Solomon (1986) recommended to score disorganized attachment along a continuum. Unfortunately, their suggestion has not followed through (Cummings, 2003). Concluding, authors agree over the fact that the exclusive use of categories is not sufficient in attachment research and scores on continua should be implemented as an improvement to the field (Cummings, 2003; Fraley & Spieker, 2003; Sroufe, 2003; Waters & Beauchaine, 2003). Even more drastically, Fraley and Spieker (2003) state, “The exclusive use of categorical models in the study of attachment may actually hinder the advancement of developmental science”. Recommendations are made in terms of using both categorical and continuous approaches (Cummings, 2003).

In conclusion, attachment is in my opinion better viewed as a relative concept since patterns that seem maladapted under certain conditions might be adaptive in different circumstances. Because of the adaptive advantage of phenotypic plasticity, what evolved, as Belsky (1999) contains, was a wide range of attachment behaviors and the ability to flexibly organize them into “different
patterns contingent on ecological and caregiving conditions, [...] and in so doing promote reproductive fitness”. I would add that if we argue that secure, avoidant, and ambivalent attachment patterns are adaptations, then we should include the disorganized pattern into this framework as well. The D pattern (as all other known or yet unknown patterns) could have been maintained by evolution through selection for plasticity in our species. Although considered a maladaptation by many authors, disorganized attachment could very well be an adaptation to extremely aversive circumstances.

**The Strange Situation Procedure: A critical view**

In addition to questioning whether attachment patterns are mere artifacts of the SSP or represent true constructs, I believe the SSP also contains many methodological limitations that make it no longer a valid means to measure attachment, despite being the most popular attachment assessment tool that has been used for the longest time in attachment research.

First, the SSP has not been revised since its inception and its whole idea is still based on Bowlby’s model of attachment in the service of infants’ survival in the EEA. Thus, at the time the procedure was developed, behavior during separation from the mothers and the infant’s fear response were considered the main features for assessing attachment. However, as we now know, survival is only one of the components of fitness and there are many other evolutionary implications for the development of the attachment bond in infants. As a
consequence, I think the SSP should be revised to reflect modern evolutionary
speculations.

Second, infants are assessed during a very stressful situation; they go to an
unfamiliar laboratory setting where they encounter unknown people (which is
comparable to the stress of going to a doctor’s visit), are placed in a room where
they are allowed to interact with the mother only for a few minutes before a
stranger is introduced in the scene and the mother is asked to leave. The child then
finds himself “alone”, in an unfamiliar room, and with a stranger. Of course, this is
a very stressful and uncommon situation for a one-year old that seems to measure
his fear response rather than attachment15. In this respect, it is to be noted how the
title of Ainsworth and Wittig’s (1969) original paper on the SSP, “Attachment and
exploratory behavior of one-year-olds in a strange situation” suggests an analysis of
behavioral predispositions during a very uncommon situation rather than a
standardized measurement tool that could be used to measure attachment in an
ecologically valid context. In addition, although Ainsworth et al. (1978) identified
maternal sensitivity as the key variable in predicting attachment status, the SSP
does not specifically analyze the quality of maternal support to infants’ emotions,
concentration, and exploration (Grossmann, Grossmann, & Zimmermann, 1999).
Also, the SSP should not be used to assess attachment in cases of difficult life
circumstances since it entails various forms of stress (for the family to travel to a

15 We should also consider that it is precisely towards the end of the first year of life (age at which
SSP assessments are usually made) that the secure-base behavior and the fear towards strangers start
to emerge.
laboratory, for the child to experience separations from the mother and exposure to strangers, etc.) that would make it a non-ideal method for families that are already under stress (Howes & Ritchie, 1999). Finally, I believe the SSP should investigate behaviors other than those activated by the fear behavioral system, should look at the child’s behavior in familiar settings where he can express himself free of constraints, and should also analyze behaviors in presence of other - but still familiar – figures.

Given these concerns, the attachment assessment tool that I chose for the present study was the Attachment Q-Sort (AQS, version 3.0, Waters, 1987). The AQS methodology has been proved to be a valid tool for assessing attachment (van Ijzendoorn et al., 2004). Along with the SSP, the AQS allows for an assessment of attachment in terms of a behavioral control system, which functions to maintaining a balance between proximity and exploration of the environment (Ainsworth et al., 1978; Bowlby, 1969; 1982; Sroufe & Waters, 1977; Waters & Deane, 1985). However, differently from the SSP, the AQS focuses on naturalistic observations of 1-5 years old children and mothers in the natural environment, such as the home setting (Solomon & George, 1999). Also, attachment is assessed in relation to the child’s behavior towards the mother and familiar figures during daily activities, not towards a stranger in an unknown environment and “strange situation”.

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16 Thus, an important advantage of the AQS is that it has a much broader range of applicability than the SSP. This is particularly important since, as pointed out by Sroufe (2003), “there is a great need for alternatives to the SSP, especially at other ages, and there remains a need for more detailed observational studies in infancy and childhood”.

Consequently, there are no stressors involved, neither for the child, nor for the parents and the focus of the measure becomes the attachment and not the fear behavioral system, thus providing for ecological validity. In addition, some AQS items do specifically analyze the influence of maternal sensitivity to infant’s behavior and to the development of the attachment bond, factors that are not accounted for in the SSP (Grossman et al., 1999). Moreover, the AQS does not yield categorical data on attachment, but instead it identifies subjects within a continuum of attachment classification, ranging from “most secure” to “least secure” subjects (Teti & McGourty, 1996), and a continuous assessment represents a better choice than a topological measurement (Cummings, 2003; Fraley & Spieker, 2003; Sroufe, 2003; Waters & Beauchaine, 2003). Finally, by analyzing behaviors in a variety of distinct social and physical situations, the AQS allows for an investigation of constructs that go beyond the mere purposes of assessing attachment security (D’Andrade, June 2002, personal communication). Therefore the method seems well suited to investigate relationships among affect, cognition, and behaviors in the attachment domain (D’Andrade, June 2002, personal communication; Waters & Deane, 1985). For these (and other) reasons, I believe the AQS represents a better methodology than the SSP for the purposes of the present study (refer to chapter 3 for details on the procedure and on its additional advantages).
CHAPTER 2 – FROM ATTACHMENT TO THE MIND

Introduction

In line with evolutionary developmental psychology, the second chapter explores child development as the evolving product of ontogenetic and phylogenetic pressures acting on the maturing individual. Specific emphasis will be given to the implications for the evolution of humans’ unique cognitive capabilities as well as the role of attachment in the process. An analysis of the means by which the human infant’s ontogenetic and phylogenetic unique transitions may have favored the rise of theory of mind in our species will also be considered.

The aim of the first part of the chapter is to analyze recent studies on the subject and to identify variables involved in the socio-cognitive development of the individual. First, I will analyze how attachment security is related to socio-cognitive outcomes and how internal working models of self and relationships act as intermediaries in the process. Second, based on the finding that securely attached children outperform their insecure counterparts in a number of socio-cognitive tasks, I will speculate on the possible determinants for such cognitive disparity. Empathy, maternal sensitivity, and maternal cognitive engagement with the child are all factors that have been proposed as intermediaries in the development of higher cognitive capabilities in secure children. Causal relations between these factors will be considered but it will be concluded that it may be unnecessary to try
to determine the direction of causality because too many features - all developing at about the same time during early infancy and all intrinsically related - are involved in the development of the person, thus making it non-effective to try to determine causal relationships among them.

In the second part of the chapter I will present evolutionary arguments on attachment, theory of mind, and culture. I will discuss major theories on what made the difference in the hominid trajectory that led to the evolution of our unique cognitive capabilities and, ultimately, cultural evolution. Recent findings on apes’ cognitive skills will shed new light on the ontogenetic most important transition for the development of theory of mind in human infants, placing it at a much earlier age than previously believed. Contrasting opinions in favor of a parsimonious or non-parsimonious interpretation for the development of our distinctive cognitive abilities will be presented and I will combine seemingly contrasting views. Arguments will be made as to whether we should consider our cognitive capacities only quantitatively or also qualitatively different from those of our closest relatives. I will argue that in our rich evolutionary past the development of human’s large repertoire of cognitive capabilities was fostered through selection for plasticity, through the attachment system. Then, I will present an argument for why culture may have evolved uniquely in the human lineage. It is maintained that capability and motivation to share experiences and the ability to learn collaboratively are all necessary conditions for the evolution of culture in the human sense. Culture in the human sense will be presented as a selective element during hominids’
evolutionary history. Finally, I will integrate all these arguments with socio-cultural theories based on Vygotskian’s school of thought. From this perspective, collaborative learning and the presence of a pre-existing cultural environment are also considered as the most important human adaptations in the trajectory that leads to cultural evolution. Socio-cultural explanations will be integrated with evolutionary arguments. Lastly, an analysis of cognition and learning as collaborative processes will allow me to introduce the theoretically-informed, collaborative learning environment where the present study was conducted.

“From attachment to the mind”

One particular aspect of the relationship between the infants’ early social environment and later developmental outcomes that has been recently extensively investigated, is the connection between attachment representations and precocity in children’s understanding of others’ minds, the so-called theory of mind17 (ToM hereafter). Many studies have shown that attachment security is related to socio-cognitive development and ToM manifestation, and that internal working models of self and relationships (IWMs, see chapter 1 for details) provide a theoretical link between early attachment and the emerging socio-cognitive and personality development (Bowlby, 1969; Chisholm, 1999b; Fonagy, Target, Steele, & Steele, 17 It is to be noted that the relations between attachment and ToM refer to individual differences in attachment security on one side, and developmental differences in the rate of acquisition of ToM on the other, and not to the fact that children will develop ToM or not. Eventually, all normally developing children will acquire (at least some level of) ToM (Moore & Symons, 2005).
From an ontogenetic perspective, it is argued that ToM arises from IWMs that develop through the attachment system (Chisholm, 1999b). As anticipated in chapter 1, children construct IWMs according to the interaction patterns they experience with their principal attachment figure(s) (Bowlby, 1969). Depending on the quality of the established attachment relationship, secure and insecure children will differ in their awareness of the self, awareness of others, and the relations between the two; they will develop different representations of the caregiver’s availability and responsiveness as well as different conceptions of the self that will affect their own expectations of and predispositions toward others. Accordingly, children who have experienced a secure attachment relationship will construct a view of others as supportive and responsive that will translate into a positive attitude that will tend to foster such availability. On the contrary, insecure children, because of the experienced unstable and/or inappropriate care received, will have fewer expectations from others and will anticipate hostile responses that, when real, will actually confirm such unworthy views of the self (Main, 1991; Matas et al., 1978; Sroufe, 1996; Thompson, 1999). These mental representations of self and others, it is believed, are involved in the child’s socio-cognitive development and help the child regulate and understand his own thoughts, behaviors, and feelings,
even when the attachment figure is not present\footnote{Of course the attachment relationship is not the only determinant for developmental outcomes. Refer to chapter 1 for a discussion on the role of genetics in shaping the individual’s development.} (Bowlby, 1969; Bretherton & Munholland, 1999). As seen in chapter 1, Chisholm (1999a) proposed that infants’ mind develops by projecting representations of the environment and evaluating alternative images of the future. This, he argued, is achieved through the construction of IWMs of attachment. Under this view, IWMs are the phenotypical representations of reproductive value, and thus the substrate upon which selection operates in order to optimize the individual’s fitness. In this context, IWMs are seen as the means through which ToM was exposed to selection (Chisholm, 2003). Thus, the ability to understand one’s own behavior and the competence in reading other people’s minds (ToM), arises within the attachment process through the construction of IWMs that allow the child to understand his own and consequently his parents’ mind (Chisholm, 1999b).

Although the link between attachment and ToM has been recognized for a long time, attachment was believed to predict ToM in a direct way, with no intermediaries involved in the process. Early research on ToM focused on analyzing preschoolers’ cognitive development and mental understanding by testing them on false-belief tasks\footnote{False-belief tasks were developed to assess the presence of ToM in preschool-age children (Hughes et al., 2005; Tomasello & Call, 1997). At around four years of age, children start understanding that people may believe in things that are not true and this is usually tested using one of the many available false-belief tests. In the classic task (Wimmer & Perner, 1983), the child has to predict where an adult will look for a hidden object, after this has been moved to a new location during the adult’s absence by an experimenter. The child is allowed to follow the entire scene and has to predict whether the adult will look for the object in the same location where it was before} More recently, the focus of attention in ToM
research has expanded to include a broader range of ages (from infancy to late childhood) and many cognitive-related skills such as empathy, moral thought, and language (Astington & Pelletier, 2005). New studies have moved from looking for direct links between attachment and cognitive development\(^{20}\) and have examined how early parent-child relationships are indirectly implicated in the growth of ToM and how other intermediaries, and ultimately the entire social network, are involved in its formation (Fonagy & Target, 2005; Fonagy, 2003; Meins, 1997; Meins et al., 1998; Meins et al., 2001; Meins et al., 2002; Moore & Symons, 2005; Symons & Clark, 2000). In fact, in contrast with cognitive accounts that consider the formation of ToM by an isolated individual engaged in processing information by relying only on his own principles (see Perner, 1991), a new growing body of research assigns to the entire social environment an important role in determining the development of ToM (Fonagy & Target, 2005; Fonagy et al., 1997; Fonagy, 2003; Hughes, Jaffee, Happé, Taylor, Caspi & Moffitt, 2005; Jenkins & Astington, 2000; Meins et al., 2002; Moore & Symons, 2005; Symons & Clark, 2000). The acquisition of ToM is now viewed as arising from the intersubjective interactions between the infant and the attachment figure(s), more than from the internal cognitive processes of the child (Fonagy, Steele, Steele, & Moran, 1991; Fonagy &

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\(^{20}\) Only one recent study (Riquelme, Henríquez, & Álvarez, 2003), to my knowledge, proposes a direct link between attachment and ToM.
Target, 1997; Fonagy et al., 1997; Fonagy, 2003). The entire family context represents the closest social environment for the child during his first years of life and it has been proposed as a major determinant for children’s understanding of mental states and behaviors (Dunn, Deater-Deckard, Pickering, & Golding, 1999; P. Fonagy & Target, 1997; Symons & Clark, 2000). In specific, the number of siblings, particularly older ones, is found to be related to the understanding of false-belief tasks (Jenkins & Astington, 1996; Ruffman, Perner, Naito, Parkin, & Clements, 1998). In addition, the family’s socioeconomic status (SES) has been shown to correlate with children’s performance on ToM tasks, with higher SES related to better performances (Cole & Mitchell, 1998; Cole & Mitchell, 2000; Cutting & Dunn, 1999). Finally, children’s performance on ToM tasks has been found to positively correlate with their mothers’ educational attainment (Cutting & Dunn, 1999; Meins & Fernyhough, 1999; Meins et al., 2002). Specific elements of these family bonds (such as the intimate connection between the child and the primary caregiver) will be analyzed later in the chapter. I will now present broader implications for the relations between attachment and ToM that will lead to identify the specific components of the early social environment that are implicated in the formation of ToM.

**Attachment and ToM: How are they related?**

Regardless of whether we can talk of a direct or indirect relation, there is still debate as to whether the link between attachment security and ToM is
predictive of later development or just relates to concurrent development. Although Fonagy et al. (1997) argued for just a concurrent and not predictive association between attachment and ToM, more recent studies point to the opposite direction. Meins et al. (1998) and Moore and Symons (2005) reported a predictive relation and Symons and Clark (2000) found both a concurrent and a predictive association. They investigated how infant attachment security and maternal sensitivity predicted performance on ToM tasks at the end of the preschool period with the hypothesis that the types of mother-child relationships in infancy influence the development of socio-cognitive understanding three years later. They found that attachment security correlated with ToM and emotional understanding.

A number of studies support the idea of a predictive association between the quality of the child’s early environment and his development of ToM, and report how children with secure attachment relationships outperform insecure children in ToM tasks (Fonagy et al., 1997; Hughes et al., 2005; Meins et al., 1998; Moore & Symons, 2005; Symons & Clark, 2000). Why do securely attached children show superior competence and cooperation during joint-problem solving, during the execution of plans, are better skilled at applying newly acquired skills to a novel situation, display greater task orientation (Frankel & Bates, 1990; Frodi, Bridges, & Shonk, 1989; Matas et al., 1978), and are better able to think critically and show higher levels of planning than their insecure peers (Slade, 1987)?

A growing body of research has recently pointed at emotion, social understanding, and caregiver sensitivity during early development as the major
intermediaries for explaining the relationship between attachment and ToM. I will now analyze this in detail.

**Empathy as the mediator between attachment and ToM**

It has been proposed that ToM development is importantly determined by the emotional side of the attachment relationship (Moore & Symons, 2005). In a study aimed at understanding how the quality of the attachment relationship may predict later ToM development and oriented decision-making, Moore and Symons (2005) argued that the relation between attachment security and ToM is explained by an enhanced sensitivity to the attachment figure’s feelings and mental states (a capacity for empathy) that result in an “enhanced reasoning about mental states in ToM tasks” (Moore & Symons, 2005). But how are these social understanding and emphatic capabilities actually implicated in the development of ToM? An original ontogenetic model for the development of ToM (Baron-Cohen, 1994; 1995; Tomasello, Kruger, & Ratner, 1993; Tomasello & Call, 1997) included the abilities to detect other people’s intentions and eye direction, both emerging early in infancy (0 to 9 months). These capabilities, it was argued, would lead to abilities in sharing attention and engaging in joint-attentional activities that are in place by 14 months of age, and are paralleled by a greater tendency to identify with conspecifics. Later, at around 3-5 years of age, children would start developing an additional ability to understand the behavior of others as intentional and mental; they start developing a ToM.
Empathy as a fundamental connector between attachment security and the development of cognition has received a great deal of attention lately and a new model for the ontogeny of ToM, that assigns an even bigger role to empathy, has been advanced. Baron-Cohen (2005) proposed a new model called the “empathizing system”\textsuperscript{21}, which adds to the older model important empathy-related mechanisms as responsible for the formation of ToM. Such an empathic component has been added to account for the affective state that is activated when another person’s mental and affective states are appreciated (Baron-Cohen, 2005). In this new model, an emotion detector in early infancy and an empathizing system, arising at around 14 months of age, are added to the previous model as determinants of ToM. In particular, the empathizing system is supposed to predate the formation of ToM that occurs around three years later. In this new model, the uniquely human first ontogenetic transition for the ability for ToM is no longer the one taking place at four years of age when ToM is already expressed, but it is the one at around 14 months of age, when children start developing an empathizing system. I will return to these arguments at the end of the chapter, when I will integrate them with additional ontogenetic findings that will give a better understanding of the development of human cognition, both ontogenetically as well as phylogenetically.

Returning to the main argument, we can see how, by entailing the capacity of identifying with others and understanding things from another perspective that

\textsuperscript{21} An “empathizing system” is defined as “the drive to identify another person’s emotions and thoughts, and to respond to these with an appropriate emotion” (Baron-Cohen, 2005).
arise from sensitive and mental interactions between infants and their attachment figure(s), ToM is conceptually closely related to empathy (Brockway, 2003; Chisholm, 1999b; Fonagy et al., 1997; Sroufe, 1996). Individual differences in attachment are related to measures of empathy, in addition to measures of ToM (Chisholm, 1999b; Brockway, 2003; Baron-Cohen, 1995). Securely attached children are found to be more empathic (Kestenbaum, Farber, & Sroufe, 1989) and more socially competent (Troy & Sroufe, 1987) than insecure children. This capability of being empathic to others’ perspectives is the outcome of a process of reciprocity in which the sensibility of the parent, who regards the infant as an intentional agent, fosters the infant’s construction of mental models of the self and of others’ mental states. As posed by Tomasello (1994), “for a learner to understand intentions of another individual requires that the learner be treated as an intentional agent”. These skills will be easily practiced by children with secure attachment histories because they experience the affect of their sensitive and responsive caregivers through the scaffolding and mirroring process they engage in. On the contrary, they will not be as easily practiced by insecure children because they lack such sensitive and mental engagement with their attachment figures (Sroufe, 1996). Therefore, the empathic bond that develops between mother and highly dependent infant should be the place where to look for the ontogenetic and phylogenetic appearance of mentalistic insights and ToM. An important component of such empathizing system is maternal sensitivity. The role that maternal sensitivity has on ToM development will be analyzed next.
The role of maternal sensitivity on ToM development

Maternal sensitivity is definitely a major component of the above-mentioned empathizing system. It has been argued that secure children’s superior cognitive performance is mediated by feelings of self-confidence (Cohn, 1990; Jacobsen, Edelstein, & Hofmann, 1994; Moss, 1992), and this, in turn, is related to information-exchange patterns within caregiver-child dyads (Moss, 1992). In fact, mothers in secure relationships are more likely to communicate about internal states and to encourage in the child a sense of control over the problem-solving process, all factors that promote an environment where ToM can prosper (Meins, 1999a; Moss, Gosselin, Parent, Rousseau, & Dumont, 1997).

Fonagy, Steele, Steele, & Higgitt, (1994) and Meins (1997) made a distinction between maternal sensitivity and “mind-related comments” as possible predictors (but see later for different interpretations) of attachment security. They argue, “responsiveness to the child’s physical and emotional needs should be clearly distinguished from mothers’ capacity or willingness to engage with their infants at a mental level” (Meins et al., 2001, original emphasis). In their original work, Ainsworth, Bell, & Stayton, (1971) already argued that mothers of secure children not only respond promptly and contingently to their infants’ needs, but their responses are also appropriate to their behavior. Building on this work, Meins (1997) coined the term “maternal mind mindedness”, defining it as “mother’s proclivity to comment appropriately on her infant’s mental states” (Meins et al., 2002). Maternal mind mindedness (MMM hereafter) is described, by Meins and
colleagues, by five types of mind-related comments, “a) comments on mental states, such as knowledge, thoughts, desires, and interests; b) comments on mental processes; c) references to the level of emotional engagement; d) comments on attempts to manipulate people’s beliefs; e) the mother “putting words into her infant’s mouth” so that the mother’s discourse took on the structure of a dialog between her infant and herself” (Meins et al., 2001). Therefore, mother’s sensitivity to the infants’ physical and emotional needs is distinguished from the concept of MMM, which instead represents “a more specific sensitivity to the child’s mental states and ongoing activity” (Meins et al., 2001). Thus, mentalization measured in the context of attachment, rather than sensitivity in general, has recently been considered as a better predictor of attachment security (Koren-Karie, Oppenheim, Dolev, Sher, & Etzion-Carasso, 2002; Meins et al., 2001; Oppenheim & Koren-Karie, 2002). One possible explanation for this, Meins et al. (2001) argue, is the “appropriateness of mothers’ responses when mentally engaged with their children, as opposed to just a recognition of their needs” (original emphasis). Such appropriate mental engagement of mothers with their infants might explain why secure children are found to perform better on ToM tasks than their insecure counterparts (Fonagy et al., 1997; Meins et al., 1998).

It is reported that secure preschoolers are more likely to use metacognitive strategies than their insecure peers during problem solving with mother, and mother’s enhanced cognitive sensitivity has been identified as the major determinant of secure children’s superior metacognitive competence (Meins, 1997;
Meins et al., 1998; Moss, 1992; Moss et al., 1997; Tarabulsy, Bernier, Provost, Maranda, Larose, & Moss, 2005). In this respect, it is interesting to note how disorganized children, who develop the most extremely disruptive behaviors among all attachment groups (refer to chapter 1 for details), are reported to have the lowest level of metacognitive skills (Moss et al., 1999), and most difficulties during socio-affective interactions (Moss, Rousseau, Parent, St-Laurent, & Saintonge, 1998) compared to children in other attachment classifications. Also, mother’s depression, that is associated with indistinct awareness of children’s behaviors and that has been related to disorganized attachment, negatively correlates with mind-related comments (Lundy, 2003).

But what does this mother’s (mental) sensitivity actually entail? How does it manifest itself and why is it so determinant for the child’s cognitive capabilities? In her original work on attachment, Ainsworth (1971) already informed us that a mother in a secure relationship is “capable of perceiving things from [the child’s] point of view, respects the child as a separate person”, and “respects his activity-in-progress and thus avoids interrupting him”. Meins expands on Ainsworth’s comments and argues that mothers in secure attachment relationships with their children are more likely to show close physical affection, are more instructive and less intrusive, give more positive than negative feedback, are more willing to transfer to the child responsibility for the tasks, are more likely to attribute intentionality to their children’s behavior, and are more aware of their children’s cognitive requirements (Meins, 1997). Exposure to such mental feedback from an
early age allows children to understand their behaviors through the scaffolding process they receive by their caregivers and this, in turn, helps them interpret the underlying mental states behind such behaviors. After many interactions, children start making sense, not only of their own and their mothers’, but also of other people’s mental states and how they determine specific behaviors (Meins et al., 2002). In turn, being involved in a sensitive manner, the child is believed to better internalize the tasks learned during these interactions, to be more skilled at following mother’s suggestions, and to display engagement in and responsibility for such tasks (Moss et al., 1997). Conversely, mothers in insecure relationships are less capable of reading their infants’ behavior because they are less competent or motivated at understanding the reasons underlying it. Their children are described as being less attentive and they seem not to look for reciprocal interactions with them. Thus, insecure children’s metacognitive difficulties during childhood may be explained as a greater vulnerability to emotional interference in the application of the skills rather than as a lower level of cognitive abilities. It is argued that during childhood, internalized representations of self and other based on early experiences continue to interfere with exploratory activity and may prevent insecure children from applying cognitive and metacognitive strategies to perform goal-oriented actions (Moss et al., 1997).

A closer look at the role of such maternal mental engagement in the development of ToM will be presented next.
Causal relations between attachment, theory of mind, and maternal mind
mindedness

Meins’ research group conducted a series of studies that looked at how ToM development might relate to attachment security and MMM (Meins, 1997; Meins et al., 1998; Meins, 1999b; Meins et al., 2001; Meins et al., 2002). They propose that the conversations about and the awareness of mental states are related to attachment security and the development of social cognition. Causal relations between these elements have been analyzed. Originally, attachment was considered to be related to ToM through individual variations in MMM, or, better, individual differences in attachment security were believed to determine differences in MMM that would be responsible for diverse performances in ToM tasks. Thus, the fact that secure infants performed better in ToM tasks was explained as a consequence of their mothers’ tendency to treat them as “individuals with a mind” (Meins, 1997). But, a later study by Meins et al. (2001) found that the individual differences in MMM predated the formation of attachment, and the development of ToM was considered to be related both to attachment security and to MMM, independently. Finally, a more recent study (Meins et al., 2002) found no relation between attachment security and ToM performance. Performance on a battery of ToM tasks at 4 years correlated with MMM, but not with attachment security (Meins et al., 2002). The authors concluded that the importance of MMM
lies in its perseverance into the preschool years, “at which point it may begin to play its part in instructing children about how mental states underlie behavior” (Meins et al., 2002).

It is evident from these studies that a problem with this multifaceted approach to the study of attachment and ToM is that the direction of causality between the various dimensions affecting socio-personality development from early infancy to childhood is difficult to determine since outcomes are multidetermined and children’s social experiences are not confined to the family environment or to relations with the primary attachment figure, but are likely to involve multiple attachments in a variety of contexts (Thompson, 1999). As an example of such difficulty in establishing direction of causality, Fonagy (2003) and Fonagy and Target (2005) challenge the reasoning of Meins et al., looking at how mentalization might lead to attachment security. They argue that attachment security should be seen as both the outcome of infants’ interpersonal environment, as its determinant as well. They propose that the development of various skills such as exploration, frustration tolerance, ego resilience, ego control, social cognitive capacities, and self recognition, is facilitated by the same characteristics of the interpersonal environment that lead to attachment security during the first year of life. According to Fonagy, attachment facilitates the development of capacities for interpersonal interpretation but it is such interpretative capacity that is the major determinant in the “processing of social experiences” (Fonagy, 2003).
I believe Fonagy’s work is very illuminating for it shows how intricate are the relations between these various components of the child’s socio-cognitive growth. Meins et al.’s and Fonagy’s research make us realize how the numerous early determinants of the child’s socio-personality development, that include attachment security and evolution of ToM (Bowlby, 1969), temperament (Meins et al., 2002), child’s sensitivity to maternal care (Belsky, 2005b; Seifer, Schiller, Sameroff, Resnick, & Riordan, 1996; Symons & Clark, 2000), maternal sensitivity (Meins et al., 2002), MMM (Meins et al., 2001; 2002), and the family environment (Dunn et al., 1999; Fonagy & Target, 1997; Symons & Clark, 2000), among others, are all intrinsically interrelated from the infant’s first day of life. Trying to determine the direction of causality between them might be not only a very difficult task to engage in, but also unnecessary in my opinion. Also, the role of genetic predispositions for certain traits should not be underestimated. Although gene expression is importantly determined by the child’s subjective experiences (Moore & Symons, 2005), it is undeniable that the individual’s genetic makeup has an important impact on developmental outcomes, particularly when certain traits are combined with particular environments. Unfortunately, genetic influences on development are seldom considered by attachment researchers, although they start now recognizing the need for studies that integrate genetic factors. As put by Meins et al. (2002), “genetically transmitted factors such as temperament might potentially explain the observed relation between mind-mindedness and children’s
theory of mind performance, and future research should attempt to investigate this possibility.”

Too many are the genetic and environmental factors affecting infants’ development that generalizations on causality directions are, in my opinion, not useful. Elements such as MMM, maternal sensitivity, attachment security, predisposition toward maternal care, temperament, family environment, SES, etc, all start acting on the child’s development from his first day of life, continuously channeling his development by their interactions, and it is likely that they will all influence each other in many ways so that causality will move in all directions. As an example, if we accept MMM as an important determinant of attachment security, we also need to consider how a secure attachment relationship between mother and child might foster a greater mental engagement within the dyad. And, if MMM is a predictor of the child’s cognitive capabilities, an infant who is genetically more predisposed to an early development of particular cognitive capabilities might foster in the mother a deeper attention to his own mental processes, and this would imply that the mother will be more interested in mentally engage with her infant, than if the infant did not express such interest. Also, a more educated mother will also be more likely to mentally engage with her infant, and will also be more likely to foster a secure attachment relationship, as well as higher cognitive capabilities. Moreover, given that mothers with higher levels of schooling are reported to engage more in verbal elucidations with their children than less educated mothers (Cole, 2006), they will be more likely to mentally engage with
their children independently from attachment. These are just some examples that do not even take much into account the role of the genetic makeup; an infant could already be predisposed to given behavioral tendencies regardless (at least to a certain extent) of mother’s or someone else’s contributions. It comes that the various combinations between environmental factors and the individual’s genetic makeup might lead to a virtually infinite number of causal relations, the analysis of which may, in my opinion, result futile. I will now turn to considering the evolutionary implications for the development of such maternal cognitive sensitivity to understand the phylogenetic foundations behind the rise of ToM in our species.

**Evolutionary considerations on attachment and ToM**

As happened with research on attachment, and as a general tendency in developmental studies, investigations of the development of ToM have moved away from questions on the “how” of the mental mechanisms responsible for it to questions about the “why” of the evolution of ToM itself (Astington & Pelletier, 2005), thus moving from proximate- to ultimate- level explanations. As a consequence, research attention has broadened to include investigations on the evolutionary implications of the rise of ToM capabilities in humans. We may ask, why would it be of evolutionary advantage for mothers to mentally engage with their children and why would this trait be selected for? When did it all start? Is complex mind reading an adaptation? If so, how has theory of mind been selected
for? Following Premack and Woodruff’s (1978) initial questioning on whether chimpanzees may have a ToM, many studies have attempted to answer such questions. Despite an initial excitement in the field that seemed to confirm that apes had - at least some level of - ToM (Povinelli, Nelson, & Boysen, 1990; Whiten & Byrne, 1988), later investigations (Heyes, 1998; Povinelli & Eddy, 1996) failed to replicate those findings and it was then generally believed that the human species is the only one in the animal kingdom to possess a ToM (Call & Tomasello, 1999; Tomasello & Call, 1997). However, in the past years, a growing number of studies has shown that some apes (mainly chimpanzees) do actually possess some elements constituting a human-like ToM, such as the understanding of others’ psychological states (see later for a detailed discussion of the new findings). Accordingly, the field has moved from questions such as “do chimpanzees have a theory of mind?” to questions that look at which particular aspects of a human-like theory of mind are shared by our closest relatives, and which ones are uniquely human (Tomasello et al., 2003). It is argued that human capacity to form ToM could have its phylogenetic origin in juvenile hominids’ IWMs of attachment relations (Chisholm, 1999b). Given that only humans are believed to have ToM, but all primates are presumed to have IWMs, we are left with the question of what made the difference in the hominid lineage that has led to the development of ToM.

From a phylogenetic perspective, it is proposed that it was in the context of parental investment that an improved ability to detect others’ intentions and ToM arose (Povinelli et al., 2005). During hominid evolution, the combination of having
developed bigger brains and a narrower pelvis (due to bipedal locomotion), led to the “obstetric dilemma”, which meant that human infants were to be born prematurely, and were thus extremely immature and helpless for a long period after birth. This led to a long period of dependence during which mothers had to provide adequate investment to slow-developing infants with limited mobility, and doing so in complex, dangerous, social contexts. This would have implied a need for even more parental care than what mothers could provide alone. Therefore, the possibility of investment by both parents, or other helpers, would have been adaptive. Here is where two of the main theories looking at the phylogenetic origin of ToM diverge significantly. While Brockway (2003) assigns responsibility to the mother, Chisholm (1999b; 2003) does it to the infant. According to Brockway (2003), the immaturity and dependency of the hominid infant created greater responsibility on the part of the mothers, which favored selection for “smarter mothering”. By engaging with their infants on a mental level, mothers could promote more successful learning experiences for their children, thus enhancing their social and cognitive development. According to this view, ToM evolved in the mothers when it became worthwhile for them to promote the infant’s cognitive advancement through a secure attachment relationship. On their part, hominid infants would have been “selected for their transparency and predictability, […] and these two selection pressures (for mentalistic insights and consequently for transparent infants), acting together, would have allowed quite rapid evolution of our theory of mind abilities” (Brockway, 2003).
This argument seems quite teleological (Moore, 2006) and thus, from an evolutionary perspective, does not seem plausible for a number of reasons. First, there does not seem to be an ultimate reason for mothers to engage mentally with their infants; why should mothers be selected for promoting their infants’ cognitive capabilities if “smartness” is not the direct focus of evolution and if their own fitness does not depend specifically on the cognitive capabilities of their offspring (at least to some extent)? After all, mothers have many options to increase their fitness, such as caring for other (older) offspring, investing in new ones, or even helping raising kin. Second, human infants should not be “selected for their transparency and predictability”; they are naturally very vulnerable because they are born extremely prematurely. Third, if selection has really operated within the attachment process, it would be more reasonable to assume that it would be the infant, not the adult, to be under stronger selection pressure to develop new “mind-reading” skills since an action during early ontogeny should be more effective than one in adulthood. Also, because of parent-offspring conflict, it should be more in the interest of infants to receive a high quality of parental care, than it is in the interest of parents to provide for it. In this respect, based on Trivers’ (1974) suggestion that the ontogeny and phylogeny of infants’ cognitive skills may be understood in the context of parent-offspring conflict, Chisholm (2003) argues that the reasons why ToM evolved exclusively in the hominid line might lie in the evolution of male parental investment, changes in male-female sociosexuality, and the family. Parent-offspring “armsrace” (Chisholm, 2003) would be expected to
escalate if offspring evolved to require more parental investment. Because of parent/offspring conflict, and the fact that infants need extensive and continuous parental care, it is not only in the interest of parents to care for their offspring, but also in the interest of infants to receive the highest quality of care possible. Because parents only have a 50% interest in each of their offspring, while offspring have a 100% interest in themselves, infants should be selected for traits that enhance their possibilities for survival (and later reproduction) more than parents should be selected for their caregiving skills. Therefore, natural selection should favor qualities that enhance infants’ capability to elicit more parental care, and some infant behaviors might have evolved for this purpose (Povinelli, Prince, Preuss, 2005). As posed by Chisholm, “attachment is not for achieving love, happiness, or even security but: for offspring to identify likely sources of parental investment, and then to elicit these resources, and for parents to identify the best recipients of their limited resources and then to invest them wisely” (Chisholm, 2003, original emphasis).

The mother does also have an important role in scaffolding the infant’s attempts at reading her mind, since it is also in her interest to devote her caring efforts to those individuals who will be more likely to reach reproductive age and spread her own genes. As posed by Povinelli et al (2005), “All other things being equal, parents will invest more when the perceived quality of the infant is higher. In this case, we suggest that parents would have invested more in infants who exhibited behaviors similar to their own […]”. By mirroring the child’s affective
states, the mother treats him as an “individual with a mind” (Meins, 1997) and the child, in turn, learns that he does, in fact, have a mind. It is easy to see how this is a self-feeding process of positive feedback that has possibly allowed for higher forms of cognition in our species as children, through scaffolding, could learn that mothers, and by extension everyone else, have “beliefs, desires, and intentions” (Chisholm, 2003). ToM is thus considered an exaptation; it was originally selected for as an infant’s adaptation to detect parents’ intentions in a way to elicit more care, but has then developed as serving the function of detecting intentions in general (Chisholm, 2003).

I believe Chisholm’s argument is more convincing than the one proposed by Brockway (2003). According to Chisholm, selection occurs on those individuals who are mostly interested in it because it is infants’ survival (and fitness) that is at danger if the care they receive is not appropriate, while neither survival nor reproductive fitness are at danger for mothers since they can provide for themselves and they can still invest in other present or future offspring, or even kin.

I will now turn into an analysis of these arguments as they relate to our closest relatives in a way to understand the phylogenetic implications for the rise of ToM in our, and possibly other species.

**An ontogenetic and phylogenetic perspective on the evolution of ToM**

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22 Exaptation: A trait that now enhances fitness but was selected for other purposes than the ones it serves today (Gould & Vrba, 1982).
Measurements on false-belief attribution have for a long time led researchers argue that the biological mechanism at the origin of the distinctive forms of human cognition arises at around 3-5 years of age when children start developing an additional species-specific/social-cognitive ability of imagining oneself in the mind of another person; when they become capable of understanding the behavior of others, first as intentional, and then as mental (Tomasello & Call, 1997). As seen earlier, children in the preschool years start developing a ToM, which becomes evident in the ability to recognize the attribution of false belief, or the realization that beliefs are representations of reality and therefore can be false (Hughes et al., 2005; Tomasello & Call, 1997). This important step in human ontogeny - it was until recently maintained - would have been preceded by the ability to engage in joint attentional activities, understand other people as intentional, and show a deeper tendency to identify with conspecifics, all skills that arise at around one year of age in human infants (Tomasello et al., 1993). This ontogenetic step at one year of age was originally believed to be the first of a developmental pathway that leads towards the formation of ToM, and was considered of secondary importance in respect to ToM (Tomasello et al., 1993). It was also thought to be exclusively human, and apes were believed not to be able to understand intentions, goal-directed actions, or visual perception (Tomasello & Call, 1997; Tomasello, 1999).

Recent findings have challenged these long-held views. In an experiment in which chimpanzees were presented with food by an experimenter who was either
unwilling or unable (but willing) to give it away, it was shown that chimpanzees reacted differently to the two situations even if the outcome, of not receiving any food, was the same in both cases (Call et al., 2004). Chimpanzees were overall more impatient when the experimenter was unwilling than when he was unable to give away the food, suggesting that chimpanzees understood goal-directed behavior and were able to discriminate between “good” and “bad” intentions behind the two gestures. This finding would imply that chimpanzees are capable of understanding intentions and goal-directed actions, contrary to previous beliefs (e.g., Tomasello, 1999; Tomasello & Call, 1997).

In a similar experiment conducted with human infants at 6, 9, 12, and 18 months of age, where a toy was used in the place of food, it was shown that starting at nine months of age, infants became more impatient when the experimenter was unwilling to give away the toy than when she was unable to do so. Six month old infants showed no difference in the two situations (Behne et al., 2005). Thus, only when infants reached approximately nine months of age, they began to discriminate between the two different intentions even if the outcome (of not receiving any toy) was the same in the two situations. These two experiments add evidence to how the understanding of intentional action is present in adult chimpanzees and it ontogenetically arises at around nine months of age in human infants.

Another important experiment has recently added evidence that apes may understand not only something about intentions and goal-directed behavior, but also about visual perception. Hare et al. (2000) conducted a series of experiments in
which a subordinate chimpanzee was to compete with a dominant individual over a piece of food. In situations in which only subordinate individuals had visual access to the food item, it was shown that, not only they were able to “understand” if the dominants could or could not see it, but they also used such knowledge to develop strategies during the competition over food, thus approaching the food item when they believed the dominant did not have visual access to it. This experiment shows that (at least in some situations) chimpanzees can understand something about visual perceptions in other individuals and use such knowledge to develop particular strategies (but see later, for a different interpretation by Povinelli & Bering, 2002).

Since from these experiments chimpanzees seem to possess cognitive capabilities similar to nine-month-old human infants, being able to understand intentionality, visual perception, and goal-oriented behavior, we are left with the question of what makes the ontogenetic difference in the human trajectory that leads to the formation of ToM. In trying to answer this question, new research by Tomasello, Carpenter, Call, Behne, and Moll (2005) argues that the understanding of intentional action and perception actually emerges at two different points in human ontogeny, at nine and fourteen months of age. Before that, at around six months, infants understand that others are animated beings that produce action, but they still do not understand that such actions have goals, nor that actions can lead to different outcomes (success or failure). At nine months of age infants start

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23 Detection of visual direction develops during the first nine months in human infancy (Baron-Cohen, 1995).
understanding that others have goals behind actions and usually continue pursuing their goal in the face of failure, until they succeed in their action. This represents the first step in understanding intentions and perceptions, and it is labeled the “pursuing goals” stage (Tomasello et al., 2005). Finally, at around 14 months, infants understand that others choose plans in order to achieve certain goals and attend to specific things in order to pursue such targets (Tomasello et al., 2005). This last phase of “choosing plans” (Tomasello et al., 2005) is uniquely human and is of fundamental importance since it is argued that it represents infants’ first step towards ToM (Behne et al., 2005). It is concluded that apes might share the first ontogenetic step (“pursuing goals”) with humans, but not the second (“choosing plans”) (Tomasello et al., 2005). The underlying cognitive ability of this “choosing plans” phase is referred to as “shared intentionality”, which is two (or more) individuals collaborating towards a common goal (Tomasello & Carpenter, 2005). Under this new ontogenetic picture, the four-year old transition no longer represents the first, but the second most important step in human cognition that builds on the previous one, adding many years of linguistic interactions, perspective taking, and collective and reflective communication (Tomasello et al., 2005).

Analyzed from a phylogenetic perspective, Tomasello’s group (Tomasello & Carpenter, 2005) argues for the existence of two different evolutionary trajectories for the development of human cognition; one is a general primate ability to understand others as animate beings with perceptions and goal-directed
behaviors, the other a species-specific capacity to “share intentionality”, which pertains to humans only. According to this interpretation, evolution would have worked on already existing cognitive properties and would have transformed them into something uniquely human (Suddendorf & Whiten, 2001; Tomasello & Call, 2004). However, this parsimonious interpretation (that assumes a homologous origin of traits) of human cognition as developing from already existing processes, is not shared by all. Differently from Tomasello’s, Povinelli’s group (Povinelli & Giambrone, 2001; Povinelli & Bering, 2002) argues against a parsimonious interpretation that would account for the same psychological mechanisms at the origin of human and non-human primate behavior. Instead, Povinelli et al. argue that humans may have evolved other capacities in addition to already established behaviors, and both systems may coexist in our cognitive repertoire (Povinelli & Vonk, 2003). They refer to ToM as “second-order intentional state”, which differs from the “first-order intentional state”, shared with great apes (Povinelli & Giambrone, 2001). Povinelli et al. (2005) recognize that some apes, particularly chimpanzees, exhibit complex behaviors that may resemble actions associated with ToM in the human species. What differs in their proposal from the one by Tomasello’s group is that, in humans, the exact same behaviors could be activated by either one of the intentional states (which would not hold true in non-human primates). This makes comparisons of similar behaviors in the two species ineffective since, in humans, alike behaviors could be activated by different cognitive systems. Povinelli et al.’s argument has been labeled the “reinterpretation
hypothesis” to emphasize the fact that humans’ specific cognitive abilities are part of a mental system that interprets behaviors in addition to an already existing system that was possessed by the common ancestor (Povinelli & Vonk, 2003). Similarly, Byrne (talk at UCSD, May 2006) is in favor of a secondary adaptation for humans’ mentalizing abilities, which is unique to our species because strictly linked to language. In line with Povinelli, Byrne argues about the presence, in our species, of two different systems that may lead to similar behavioral responses; one shared with apes (which does not require high-level processes) and the other, purely human, mentalizing ability.

Having replicated Hare et al’s experiments with dominant/subordinate chimpanzees, and having partially confirmed their results, Karin-D’Arcy and Povinelli (2002) conclude that chimpanzees show “no reasoning about what each other can or cannot see”. They argue that, although the behaviors observed suggest something from a human perspective, the actual understanding of the situation and the mechanisms underlying behavior may differ dramatically once we have abandoned the anthropocentric interpretation that we, humans, tend to apply when investigating other species’ behaviors and psychological states (Povinelli & Bering, 2002; Povinelli & Vonk, 2004). With respect to the experiment with dominant/subordinate chimpanzees, Povinelli and Vonk (2003) argue that subordinate chimpanzees might have based their decision as to whether pursue the food or not, on behavioral cues other than the ones underlying mental understanding. For instance, instead of understanding the connection between
seeing and knowing, subordinate chimpanzees could have based their decisions according to previous experience, such as “don’t go after the food if that dominant has oriented towards it <\emph{because he has seen it, and therefore knows where it is}>’’ (Povinelli & Vonk, 2003, original emphasis). They argue that we should not assume that evolution progresses linearly and we should consider that different species might employ diverse cognitive skills to solve the same problems (Povinelli & Bering, 2002).

Although Tomasello’s and Povinelli’s theories are presented as antagonist in the literature, I believe that they contain more common elements than the authors wish to recognize. In fact, Povinelli and Vonk’s (2003), “the capacity for behavioral abstraction was already present in the common ancestor, and humans added another system for coding the behaviors in an additional, mentalistic fashion […] the fact that humans interpret certain constellations of behavior as evidence of theory of mind would thus be a trivial byproduct of the fact that theory of mind evolved by exploiting the existing systems for behavioral abstraction” appears to be quite a parsimonious argument. It does not seem to be much different from Tomasello’s parsimonious interpretation according to which evolution would have transformed already existing cognitive capacities into something uniquely human. As posed by Tomasello et al. (Tomasello et al., 2003), “It would seem that at some point in recent evolution human beings found a way to comprehend and deal with a much wider variety of psychological states than their nearest primate relatives […]”. Both propositions assume that humans added new capacities to already
existing ones, that were present in the last common ancestor. I believe that both theories contain important elements, the combination of which would be very illuminating in terms of better understanding the ontogenetic and phylogenetic processes involved in the development of cognition. As Tomasello et al., I also believe that ToM should not be regarded as something that is either “black or white” (Tomasello et al., 2003), but should include various quantitatively and qualitatively different components that need to be separately analyzed if we are to understand the unique capacities that made us human (and that made other species the way they are). Tomasello et al. propose to move beyond the belief of ToM as something that a species either does or does not have, and to look at ToM as comprehensive of various processes of social cognition (Tomasello et al., 2003; Tomasello & Call, 2004). This vision would account for the fact that some non-human primates possess certain elements of ToM even though they are considered not to possess ToM in the human sense. Again, I do not see much difference between this proposal and Povinelli et al.’s (2005), who argue, “Our current conclusion that theory of mind is restricted to our species does not imply that only humans exhibit complex social behaviors; indeed, many social species produce behaviors that, on the surface, resemble behaviors often associated in our species with the functioning of theory of mind. Certain complex social behaviors seem especially elaborated in primates, especially in chimpanzees (e.g., deception, gaze-following, reconciliation and ‘holding grudges’ after fights)”. Povinelli et al.’s argument seems to be quite similar to Tomasello et al.’s in my perspective.
In conclusion, I believe a better view of the phylogenetic history of ToM is given by combining the two (slightly different) hypotheses presented above; during the dramatic evolution that humans underwent after the split from the common ancestor, many different specializations arose, some building on a previous phylogenetic history, others unique to the human lineage. Thus, performance of humans in various cognitively engaging tasks needs to be reconsidered in light of the fact that the underlying cognitive skills may have more than one origin. Similarly, performance of apes on similar tasks needs to be compared, not only with particular skills that “make us humans”, but with the full array of possibilities underlying our behavior. One example is given by the case of gaze-following. While Tomasello’s group would argue that gaze-following is generated by interference about the thoughts and feelings of others, Povinelli et al. (2005) argue, “although we are certainly capable of attending to and following the gaze of others as a consequence of wondering what it is that they see, it is not at all clear that this is always or even usually the proximate cause of gaze-following in adult humans […] systems that enable reasoning about the behavior of others and its relationship to other observable events might often suffice”.

As elucidated in the first chapter, our species might have undergone important pressures under selection for plasticity. By combining Tomasello’s and Povinelli’s views, we can give account to the presence of various degrees of ToM in many species, and to the fact that humans may possess a number of qualitatively different cognitive abilities that may be responsible for activating a particular
behavior. Having a large repertoire of such diverse cognitive capabilities would have been adaptive in the unstable and unpredictable environments in which our species evolved, and selection for plasticity in our species could have fostered the process even further. As stated by Povinelli et al. (2005), “the initial selective advantage of theory of mind was for greater flexibility in combining and recombining old behavioral patterns”\(^\text{24}\). This position would also reinforce Tomasello’s multi-dimensional view of social cognition and ToM. Accordingly, both humans and apes might have specific capabilities not shared by the other, and experiments that aim at measuring determined capacities using the same methodology for human and non-human primates may be misleading and may direct our attention away from recognizing particular skills that only apes might have. As put by Povinelli and Vonk (2004), “Why devote so much energy to trying to determine if chimpanzees have a human-like theory of mind? Why not try to figure out what makes them chimpanzees, instead?” […] “The human mind is not the only psychological system in town […] in comparing the psychologies of humans and chimpanzees, we should not overlook fascinating questions concerning the unique abilities of chimpanzees”. I believe these arguments are important also in terms of the massive debate concerning culture. Although agreeing that a social

\(^{24}\) In this respect, Byrne et al (2004) have also analyzed the issue of whether culture “evolves as a by-product of cumulative change in cognitive mechanisms, or whether it is actually selected for its advantages”. However, purposely, no position in favor of one or the other views has been taken and no attempts to resolve the issue have been advanced (Byrne, 2006).
context was the means by which primates’ cognition evolved\(^{25}\), cultural evolution, according to some researchers, is believed to be an exclusive characteristic of human beings, one that has originated after the phylogenetic split that occurred between humans and other apes (Galef, 1992; Tomasello et al., 1993). Of course, culture is such a broad concept that, according to its definition (which differs tremendously among scholars in different disciplines), can be applied strictly to humans, apes, primates, or even to the entire animal kingdom, if we wish. Unfortunately, most of the research on culture in human and non-human animals has been polarized to one extreme or the other and arguments that look at “the difference” in humans have prevented interdisciplinary accounts of broader evolutionary patterns (Byrne et al., 2004).

From an anthropological perspective, culture may be defined as “the social heritage of learnings – that is, the constructs, propositions, beliefs, and techniques of doing things that people learn from each other and by which they adapt and adjust to the external world and to each other” (D'Andrade, 2002). By this definition, culture is evidently only applied to humans. However, if we define culture as a “group-specific behavior that is acquired, at least in part, through social influences” (McGrew, 1998), the term can be applied to some non-human primates as well. In fact, the view that culture is exclusively human is not shared by many.

\(^{25}\) A different view is proposed by Byrne (talk at UCSD, 2006), who argues that the evolutionary pressures that led to apes’ superior cognitive capabilities with respect to monkeys, were not driven by social-group living, but by selection for acquiring better feeding strategies over monkeys who were competing for the same resources and were more skilled in obtaining them for their increased agility over apes.
researchers, particularly primatologists (Goodall, 1986; Kawamura, 1959; McGrew, 1992; Nishida, 1987), who make extensive use of the words “culture”, “cultural transmission”, and “cultural tradition” when referring to particular non-human primate behaviors.

The second part of the chapter will investigate the evolution of culture in our species and the relations between the unique ontogenetic properties of human infants and our cultural history.

**Cultural evolution: An ontogenetic view**

“The phylogenetic perspective on cultural development of man posits that man is a cultural being by biological necessity” (Grossmann, Grossmann, & Keppler, 2005).

As seen earlier in the chapter, human beings would have evolved an additional species-specific/social-cognitive ability of imagining oneself in the mind of another person, and of understanding the behavior of others as intentional and mental, and this would have allowed them to engage in intersubjective interactions from which ToM would have arisen (Fonagy, 1997). Ontogenetically, this transition is evident at around 14 months of age, when infants begin to engage in joint attentional activities, understand other people as intentional, show a profound tendency to identify with others, share intentions and collaborate toward common
goals, internalize social perspective-taking (that allows for a reflection of their own thoughts and behavior), and finally be instructed by others (Tomasello et al., 1993; Tomasello & Call, 1997; Tomasello et al., 2005). This ontogenetic step is considered of fundamental value for the development of human culture, since the ability to engage in “shared intentionality” (Tomasello et al., 2005) requires not only the cognitive underpinnings to be able to do so but, even more importantly, the motivation to share experiences with other individuals (Tomasello et al., 2005). And this is exclusively of human nature since apes are shown not to understand anything that is socially shared, such as communicative, perspectival, or cooperative intentions (Tomasello & Rakoczy, 2003). These capabilities and motivations to engage in collective, cultural activities, come from the human infant’s social environment and his patterns of interaction with other people (Behne et al., 2005). In fact, the two stages of “pursuing goals” and “choosing plans”, earlier discussed, become apparent at the same time as particular types of social interactions between infants and other people start emerging. At nine months, infants start sharing attention, and at 14 months they start to engage collaboratively with other people toward common goals (Tomasello et al., 2005). Thus, the development of mental capabilities is closely associated with the social environment surrounding the child and the 14-months transition corresponds to the time when children start interacting and collaborating with others in a cultural way.

One necessary (but not sufficient) condition for infants to be engaged culturally is the presence of a pre-existing cultural environment, which exposes
infants and children to a “world populated by material and symbolic artifacts and social practices that members of their culture, both past and present, have created for the use of others” (Tomasello et al., 1993). Through their ability at perspective taking and intersubjectivity, children are able to learn to use such artifacts and participate in social practices that are specific to the cultural environment in which they develop. Humans are seen as “adapted for cultural life” (Tomasello & Call, 1997) because children grow up in a social cultural world that potentiates the development of new cognitive skills through exposure to collective cognitive products that have been previously created by conspecifics (Bruner, 1990; Cole, 1997; Rogoff, 1990; Vygotsky, 1978). D’Andrade goes even further, stating that humans are “culturally constituted” (D’Andrade, 2002). He argues that our long history of living in a cultural environment has selected for our “certain kind of body and a certain kind of psyche”.

These discussions represent a connecting bridge to theories based on Vygotsky’s insights on learning and culture, and a discussion of how socio-cultural theories are connected with this discussion on ToM development will be forthcoming later in the chapter. Now, I turn to describe the work done with apes (mainly chimpanzees) raised in human-like cultural environments to see how such studies may help us better understand the role of the cultural setting in determining human infants' unique socio-cognitive development.

“Enculturated” apes
The view of a pre-existing cultural environment as a fundamental condition in the development of human culture has for a long time been supported by studies with apes raised in human-like cultural environments (Gardner, Gardner, 1969; Miles, 1990; Patterson, 1978; Premack, 1976; Rumbaugh, 1977; Savage-Rumbaugh, 1986). Until recently, it was believed that enculturation of apes had the power of modifying their cognitive abilities and intellect (Call & Tomasello, 1996; Tomasello et al., 1993). “Enculturated apes”, it was held, develop some cognitive capabilities that would not otherwise be developed, and that are not part of their own normative ontogeny (Rumbaugh, Savage-Rumbaugh, 1992). By comparing performances of both enculturated and non-enculturated apes (with enculturated ones achieving skills of imitation and gestural communication that were not seen in non-enculturated ones), it was concluded that the different performances in the two groups consisted in being treated as intentional beings that “may lead to a fundamental change in the social cognition of [enculturated] apes such as they begin to view others as intentional agents” (Call & Tomasello, 1996). Given that the presence of a cultural environment is essential for the development of cultural learning skills in children, what Tomasello and Call (1997) identified as the fundamental socio-cognitive differences between children and encultultated apes was the fact that non human primates, as opposed to humans, did not show instances of spontaneous cooperation, intentional teaching, and did not seem to be socially motivated to share their experiences with other conspecifics.
Although these last insights still hold true, new data coming from studies on non-enculturated apes have recently put into question the above-reported beliefs. As seen earlier in the chapter, (non-enculturated) apes may actually have some understanding of intentions (Call et al., 2004), and some level of visual perception and psychological states in others (Hare et al., 2000). Thus, a previously proposed “enculturation hypothesis” (Tomasello & Call, 2004) has been recently changed into a (weaker) “socialization hypothesis”, which assumes that, being raised by humans, enculturated apes are subject to particular stimuli that allow them to “modify existing social interactional and attentional skills rather than creating new ones” (Tomasello & Call, 2004). In this respect, a different view is advanced by Bering (2004) who, despite the new findings, does not believe that apes understand intentions, whether they have been enculturated or not. He maintains that apes, through the process of enculturation, become attuned to human action in new ways rather than modifying existing skills. When observing enculturated apes, we are just more attuned in recognizing human-like behaviors versus observing species-specific skills (Bering, 2004; Byrne, 1995). This undisputable truth, in my opinion, applies not only to enculturated apes, but also to non-enculturated ones, as also to other animals.

Cultural evolution: A phylogenetic view
“There seems to be a growing number of scholars who are genuinely rejecting the bedeviling nature-nurture controversy and beginning to treat culture as a phylogenetically evolved property of human beings” (Cole, 2006).

As seen earlier, it is argued that during hominid evolution, infants who had the capacity for intersubjectivity and perspective-taking may have been better skilled at obtaining attention, protection, and parental investment in general (Chisholm & Wescombe, 1994). These uniquely human capacities may have been originally selected for in the context of attachment and characterized the human’s phylogenetic and ontogenetic pathways leading to new forms of cultural learning (Bråten, 1998; Chisholm & Wescombe, 1994; Tomasello et al., 1993), and finally to cultural evolution (Tomasello et al., 1993; Tomasello, 1999).

Evolution might have selected for the capacities of intersubjectivity and perspective taking in our species because they offered advantages in terms of fitness (Chisholm & Wescombe, 1994), and human culture might have evolved for the same reasons (Vygotsky, 1978); most importantly because it provided individuals with a means of accumulating modifications over time, and thus with a way of improving over generations (Tomasello et al., 1993). Through this process, individuals are able, not only to acquire specific cultural practices, but also to modify them and transmit the modified versions to others who, in turn, will also
add appropriate changes. This accumulation of modifications (or “ratchet effect”) is unique to the human species (Tomasello, 1990), and, it is argued that through their exclusive capacity at collaborative learning, humans are able to foster this process and form the basis for cultural evolution (Tomasello et al., 1993).

The reason why attachment could have represented the phenotypical mechanism on which selection might have operated, ultimately fostering ToM development, may be explained through the very powerful bond developing between infant and caregiver and because of the arising higher cognitive capabilities in our species; “The emergence of even the earliest components of ToM in adults would have established [these] kind of selection pressures on human infants” (Povinelli et al., 2005).

**Attachment within a socio-cultural framework**

Attachment theory and socio-cultural theories rooted in Vygotsky’s school of thought are intrinsically connected; the fundamental role of intersubjectivity, which we have seen as inherently related to attachment and ToM, is recognized also within a socio-cultural framework as fundamental for the development of human culture. Many of the qualities identified by attachment theory as characteristic of a

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26 Note that in this respect Cole (2006) argues, “the ratchet effect does not always work and it certainly does not always work rapidly. Boesch and Tomasello (1998) attribute this failure to ‘slippage’, but aside from the issue of specifying what makes a ratchet effect durable or subject to slippage, there seems to be more to the issue of the conditions of (relatively pervasive) cultural evolution among *Homo sapiens sapiens*.”
secure attachment relationship are the same that, from a socio cultural perspective, facilitate the emergence of cognitive functions in the child.

According to Bowlby (1969; 1982) the organization of the attachment behavioral system involves cognitive components that help individuals construct mental representations of the attachment figure, the self, and the environment. Socio-cultural theory maintains that full cognitive development is facilitated by participating in joint activities, particularly within what Vygotsky (1978) has called the “Zone of Proximal Development” (ZPD). Social interactions that take place in the ZPD, especially the ones that engage the child in sharing problem-solving responsibility, facilitate the process of internalization of socio cognitive functions and the development of higher mental capabilities (Goldstein, 1999; Meins, 1997; Vygotsky, 1978; Vygotsky, 1986). Thus, Vygotsky’s concept of gradual internalization of socio cognitive functions resembles Bowlby’s model of IWMs of self and early relationships (Moss, 1992). Both Bowlby and Vygotsky integrate social and cognitive domains when considering child development and focus on the dynamics of the interactions within mother-child dyads rather than on their individual characteristics (Meins, 1997). Moreover, mothers of securely attached children are described as more sensitive in identifying their children’s ZPD and in focusing their attention within its limits (Meins, 1997). In turn, being involved in a sensitive manner, the child is believed to better internalize the tasks learned during these interactions, and to display engagement in and responsibility for such tasks (Moss et al., 1997). Finally, both Vygotskyan and Bowlbyan theories predict that,
during early collaborative interactions, children gradually transfer socio-cognitive functions from an *interpsychological* to an *intrapsychological* (thus from a social to an individual) sphere.

According to socio-cultural theory the individual’s cognitive development grows out of social experiences that are situated in, and cannot take place outside of, the society’s cultural environment (Cole & Wertsch, 1996). As stated by Cole (1997), “there is an intimate connection between the special environment that human beings inhabit and the fundamental, distinguishing, qualities of human psychological processes”. Moreover, it is argued how intersubjectivity allows for the construction and transmission of new knowledge through the change, diversity, and tensions that arise during the learning process (Newson & Newson, 1975) and how such conflicts ultimately allow for socio-cultural learning and evolution (Tomasello et al., 1993). Referring to the cultural learning experience, Goldstein maintained that both novice and expert begin “any given task with different understandings of it, and, through a process of negotiation, conversation, compromise, and shared experience, each comes to a new, mutually held understanding” (Goldstein, 1999). These intersubjective conflicts characterize the interactions within a *Culture of Collaborative Learning* model (Nicolopoulou & Cole, 1993). The theoretical underpinnings of such model are rooted in a socio-cultural framework that considers the construction of the mind as socio-culturally mediated and learning as a self-motivated community process of transformation of participation in socio cultural activities (Rogoff, Matusov, & White, 1996; Vygotsky, 1978). Through the process
of cultural learning, individuals not only learn “from another”, but most importantly “through another” person (Astington & Pelletier, 2005 original emphasis).

The setting where this study was completed, which is a collaborative learning environment theoretically centered on Vygotsky’s theories on learning, represents the ideal environment in which to investigate questions on attachment and its relations with cognitive development. The study setting will be presented next.

The study setting: La Clase Mágica

The present study is centered in a theoretically informed collaborative educational environment called Mi Clase Mágica (MCM), a preschool version of La Clase Mágica (LCM) (see Vásquez, 1993 for details). LCM is an adaptation of the Fifth Dimension (5D), a computer-based literacy activity system based on a Culture of Collaborative Learning (Nicolopoulou & Cole, 1993). The adaptation of 5D into LCM began in 1989 by Dr. Vásquez and community members in order to better serve a bilingual and bicultural population part of a Mexicano community living in North San Diego County. Like other 5D programs, LCM focuses on Vygotsky’s ideas of a socio-culturally-mediated co-construction of mind, and its general goal is to create a context capable of promoting collaborative and self-motivated learning that encourages the “generation and transmission of shared knowledge” (Nicolopolou & Cole, 1993, original emphasis). LCM, as all 5D programs, is organized around an imaginary world in which play has a leading role in learning.
and cognitive development. During play activities the child learns that imagining a situation requires adhering to some implicit rules (Vygotsky, 1978), and, through the need of mastering such rules, play represents an important learning activity throughout child development (Nicolopolou & Cole, 1993).

While retaining the conceptual and theoretical principles of the 5D, LCM specifically offers a bilingual/bicultural literacy activity that provides language minority and underrepresented children the institutional support and educational resources that are necessary to succeed in higher education (Vásquez, 1996). At LCM children’s linguistic and cultural backgrounds are considered as a “resource in the learning process” (Vásquez, 1993) and form an integrated part of the activities. Such activities are held in a warm and supportive collaborative setting where children are free in their language choice while interacting with adults around meaningful problem-solving tasks (Vásquez, 1996). During the activities, each child is paired with a university undergraduate student whose role is not to tutor, but rather to facilitate his understanding. By interacting collaboratively, the adult is able to challenge and motivate the child towards higher levels of understanding and increased task responsibility by giving the child legitimated opportunities to take the lead role. This exchange of traditional power roles, that characterizes LCM sessions, encourages the child to develop and communicate such expertise. By needing to organize and present an understanding of the game, the child's identity formation and own perception as active contributor of his own learning are intrinsically enhanced (Vásquez, Pease-Alvarez, & Shannon, 1994). Moreover, using resources
other than language for succeeding in given problem-solving activities not only enhances children’s critical thinking and is a critical skill in academic settings (Vásquez, 1996), but also sets the stage for the empowerment of bilingual children (Cummins, 1989).

Previous research with children involved in a 5D program shows promising support for the contention that experience with educational technology within a collaborative learning environment enhances children’s cognitive outcomes (Mayer, Schustack, & Blanton, 1999). In particular, changes in four areas of cognition (computer literacy knowledge, comprehension skills, problem-solving skills, and academic skills), have been investigated with the aim of revealing whether skills acquired through experience with educational software in a collaborative setting could be transferred to the solution of traditional school tasks. The performance of students participating in 5D was compared to that of non-participating students in the same literacy tasks. It was found that students exposed to educational computing experiences developed comprehension and problem solving skills that were transferable to new problem solving situations. In addition, the study reported an improvement in computer literacy knowledge and academic skills (specifically reading and mathematics) for children participating in 5D, compared to a control group of non-participants (Mayer et al., 1999).

The present study investigates socio-cognitive development in a population of preschoolers attending MCM activities and explores whether attachment security influences children’s cognitive outcomes. While not targeting school-age children,
findings from this study promise to be applicable to later cognitive development and adaptation to the school setting. In fact, the organization of the attachment behavioral system involves cognitive components and shapes many aspects of the developing personality that may have life-long consequences (Bowlby, 1969). Moreover, it is argued that the development of ToM during the preschool years is part of the pathway toward children’s readiness for school since school success depends on a more sophisticated understanding of the mind (Astington & Pelletier, 2005). Thus, a focus on preschool children is important and socio-cultural foundations on the children’s cognitive development during the preschool years cannot be underestimated. In addition, few studies have examined the relations between attachment, later cognitive functioning, and achievement in school. Finally, this study is important since “a need for more extensive study of the link between attachment and variables related to achievement in the school setting” (Moss & St-Laurent, 2001) is recognized.

MCM is an ideal setting to investigate the impact of attachment quality on learning because it provides new social situations that offer more flexible ZPDs for participant children. The positive skills that characterize securely attached children – including cooperation in problem solving, task orientation, application of newly acquired skills to a novel situation, ability to think critically, and to negotiate meaning – are all emphasized during LCM’s sessions, and form the core of academic life and learning (Vásquez, 1996). Furthermore, MCM represents a place of transition – both at a theoretical and at a practical level- between home and school
realities. Given the importance of the affective, relational side of the interpersonal process of negotiating meaning in the child’s cognitive development (Baron-Cohen, 2005; Dean, 1994; Meins et al., 1998; Moore & Symons, 2005; van der Veer & van Ijzendoorn, 1988), the particularly warm and supportive environment offered by MCM shows much promise of affecting the child’s future social and cognitive development. In a study conducted on LCM, Stanton-Salazar et al. (1995, cited in Vásquez, 1996) report, “our findings indicate that the warm and supportive environment of *La Clase Mágica* facilitates trusting relationships which make it possible to intervene in the children’s identity formation and help them learn to view themselves as valid and contributing members in problem-solving processes”.

I look at the role of MCM on the cognitive performance of secure versus insecure children. By the preschool period maternal style is capable of affecting the child’s development of metacognitive skills when interacting in the ZPD (Moss, 1992), and secure children’s superior cognitive competence reflects their mother’s enhanced cognitive sensitivity (Moss et al., 1997). I speculate that attachment security predicts cognitive functioning by means of the mothers’ (or primary attachment figures) finer cognitive sensitivity, communicational patterns, and the particularly affective tone of the interactions with the child. Conversely, insecure children’s poorer performance in specific cognitive tasks could be attributed to some kind of “emotional interference” (Moss, 1992) in the relationship with the primary attachment figure.
I expect both secure and insecure children participating in MCM to perform better than peers who are not participating (although this hypothesis has not been tested for lack of appropriate control group). This, I speculate, could be achieved in two different ways: by reinforcing the already present capabilities in solving cognitive tasks for securely attached children, and by providing what is lacking in the experience of insecurely attached children at home or in the school setting. Given that the same skills that are encouraged in MCM’s environment are the same that are displayed more consistently by securely attached children, we should expect better performances by secure children participating in MCM as opposed to secure children who are not participating. Furthermore, given that the particular supportive and affective environment present in MCM setting could represent what is lacking in the insecure children’s experience at home, and because of MCM’s greater emphasis on distributing responsibility among all participants, and on negotiating meaning rather than solving a particular task, I predict that insecurely attached children participating in MCM should gain more confidence in their interactions, especially when engaged in collaborative tasks, and therefore perform better in cognitive tests than their insecure peers who are not participating.

I believe this study is important in that it helps identify those features of the attachment relationship that affect the development of higher metacognitive functions and future academic achievement, including the role played by a theoretically informed educational environment in achieving these outcomes. Moreover, being centered in a bilingual and bicultural environment, it also provides
valuable insights on how to design cognitively enhancing educational environments that are culturally specific and most conductive to learning and development.

Conclusion to the chapter

Some common themes arise from the various discussions on the ontogenetic and phylogenetic implications for the rise of ToM that were presented in this chapter. First, we realize how most fields of developmental research have abandoned a focus on the individual as the major actor in developmental processes, and are considering the entire social environment as involved in the individual’s learning processes and development. Second, most developmental research recognizes the role of the affectional, emotional side of social relations as fundamental for a proper growth of the individual. Third, in the past few years there seems to have been a “revolution” (in Tomasello’s words) in terms of defining the timing of the human ontogenetic transition that “makes a difference” in terms of cognition between our species and the rest of the animal kingdom. Although the literature on the topic is still highly controversial (Byrne et al., 2004), there seems to be common agreement on moving the timing of such shift to a much earlier stage in development than has been previously maintained. Ontogenetically, it is argued that around 14 months of age (and not 3-4 years as previously thought),

27 I agree with Cole (contra Rogoff, 2003) that learning and development are two interrelated but different processes. As put by Cole (2006), “learning implies accumulation of knowledge and skills, while development implies qualitative reorganization of different constituents of such knowledge and skills and a concomitant reorganization of the relationship between persons and their environments”.
human infants undergo a series of important changes, both in terms of cognition and of their interactions with the social environment, that are responsible for the uniqueness of the human trajectory that leads to cultural learning, and ultimately culture in the human sense.

This “14 months revolution” (Tomasello et al., 2005) is recognized by authors investigating the issue of ToM development from very different perspectives. From an attachment perspective, Meins et al. (2002)’s study has shown how ToM is already predicted by MMM during the first year of life. This gives a major role to the maternal mental engagement that takes place between mother and infant for the development of cognition, at an age when children have not yet acquired linguistic capabilities. In terms of ToM development, Tomasello et al. (2005) have argued that it is the transition at 14 months, when infants start engaging in “shared intentionality”, that is the first and uniquely human step in line with a later development of ToM. This transition also occurs at an age when children start interacting with conspecifics in a collaborative, shared fashion. It is argued that the reason why apes do not develop ToM in the human sense, is mainly because human infants are motivated to share experiences with their conspecifics, and this does not hold true for non-human primates. Thus, again, it is the socio-cultural environment that allows these higher forms of cognition to flourish. Lastly, it has also been argued that at 14 months of age infants start developing an “empathizing system” (Baron-Cohen, 2005) and that the adaptive advantage of empathy in humans is to assure that individuals “feel a drive to help each other”
Such drive, although not directly linked with fitness in an “uncultured environment”, assumes great importance in a pre-existing cultural environment filled with collective cultural products and activities created by many different individuals and groups of individuals over historical time (Tomasello & Call, 1997), in which collaborative interactions are of fundamental value for the transmission of culture.

In summary, this ontogenetic “14 months transition” of human infants is in the trajectory for the adaptation for culture in that it entails a greater engagement of infants in the socio-cultural environment, an ability to share experiences, to mentally engage with caregivers, and to feel a desire to help others.

However, there is the possibility that such shift does not represent a real “revolution” (Moore, 2006, personal communication). In fact, it could be difficult to detect a process early on if development does not occur linearly, but instead follows an exponential trajectory. Under this view, the “14 months shift” could just represent an ability to lower the detection threshold, and thus an ability to earlier detect the developmental change. Accordingly, the developmental changes taking form during the beginning of the infant’s second year of life do not necessarily represent an earlier shift, but could be expression of developing traits that will lead to the development of theory of mind capabilities around 2 years later. This is an interesting area to investigate in future studies.

Concluding, sharing intentions, sharing perceptions, motivation to collaborate, to help others, and capability for empathy, are all at the origin of ToM
in our species and are not present in other animals. The complexity of the social
group is thus a necessary but not sufficient condition for the rise of ToM, which is
strictly linked to our unique evolutionary history. I have argued that ToM is not
only quantitatively, but, most importantly, qualitatively different between humans
and non-humans also because of the adaptive force of plasticity during our
evolutionary past.
CHAPTER 3 - METHOD

Participants

The sample consisted of 38 preschool-age children (22 girls, 16 boys) attending St. Leo’s preschool, a local Head Start program in the San Diego area. The age range of the children was 35 to 58 months and the mean age was 48.74 months (SD = 6.7).

Volunteer families were recruited at St. Leo’s preschool during Head Start’s monthly parents meetings. During the encounters, parents were told the purpose of the study and asked to commit about four to five hours of their time, at their convenience, allotted into two occasions. They were told that participation in the study was entirely on a volunteer basis and that allowing their children to participate would not affect their school attendance or performance in any way. Due to parents’ low and inconsistent participation in the school gatherings, recruitment was done over three different monthly meetings. Forty-one families volunteered for their children to participate in the study. Three families were later discarded from the study due to the difficulty of contacting them throughout the study (the families either moved or became unreachable).

Participant children came from an economically depressed area serving mostly Spanish-English bilingual families of Mexican origin and recent immigration to the United States. Children’s parents were all Mexicans with poor knowledge of English except for one father who was American and English
monolingual. Children were English/Spanish bilingual but, for the most part, preferred to use Spanish when engaged in conversations with the teachers, peers, and the observer (English/Spanish bilingual). Parents’ income and level of schooling were below the state average. Families’ average yearly gross income was $15,000 and average maternal education was 8 years, with about 40% of mothers having 8 or fewer years of education, and the rest having some high school-level education. None of the parents completed college, although a few have had some college education.\(^{28}\)

**Measures and Procedure**

**Overview**

The study comprised two parts: Assessment of mother-child attachment security and assessment of children’s cognitive performance. Security of attachment to the mothers was evaluated in the homes of the children, during after-school hours (usually on week days after 4pm, occasionally on Saturdays or holidays/school vacation days), and in the presence of at least the primary caregiver (usually only the mother was present, rarely only the father or both parents were present). The visits were about two to two and a half hours long and were conducted twice, on two different occasions. The assessment of cognitive performance was done at school, during school hours (in the mornings), in

\(^{28}\) Source: St. Leo Head Start’s admission files (2003-2004).
structured computer classes. Neither parent was ever present during the cognitive assessments.

**Assessment of attachment**

Children’s quality of attachment to their mothers was assessed using the Attachment Q-Sort (AQS, version 3.0; Waters, 1987). This instrument was designed to describe the secure-base behavior of 1-5 years old children to their mothers in the natural environment (home or public setting).

The AQS consists of 90 behavioral descriptors that uncover an extensive range of secure-base and exploratory behaviors such as: attachment/exploration balance, response to comforting and differential responsiveness, affect, social interaction, object manipulation, independence and dependency, social perception, endurance and resiliency, among other aspects of social cognition. Each of the 90 items is represented on a separate card, therefore each card describes a specific behavior. The combination of all cards provides a comprehensive description of the secure-base behavior of the child with respect to the caregiver. The AQS is completed by assigning each card to one of 9 categories according to a predefined distribution. Although agreeing that the distribution should be symmetrical, fixed, and composed of nine judgment categories, authors utilize different shapes according to the needs and logistics of specific projects (Waters, 1987). Three are

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29 Some of the AQS items, referred to as “filler items”, are actually unrelated to attachment and are included because a Q-Set is difficult to sort if all items are on the same topic (from the Attachment Behavior Q-Set, Version 3.0, Advisor, E. Waters, Posada, Crowell, & Lay, 1994).
the possibilities in terms of shape of a Q-Sort distribution; 1) unimodal (in which items are piled up in the middle categories of the continuum), 2) rectangular or uniform (in which there is an equal number of items in each of the categories), and 3) U-shaped (where there is a predominance of items in the extreme categories with a de-emphasis of item placement in the middle categories) (Block, 1961). In line with Waters, a rectangular distribution of items was used in the present study because regarded as easier to learn and use than distributions with different shapes (Waters, 1987).

The AQS distribution reflects how typical the behaviors are of the children. The sorting is accomplished first by dividing the items into three piles (high pile for most characteristic items, middle pile for neither characteristic nor uncharacteristic/unseen items, low pile for least characteristic items). Then, starting from the outer piles, decisions are made as to what behaviors are better suited for each of the 9 piles. High placement (piles 7, 8, and 9) is given to behaviors that are very characteristic of the child, low placement (piles 1, 2, and 3) is assigned to behaviors that are least characteristic, and items that are neither characteristic nor uncharacteristic and/or items that are not observed are sorted to the center of the distribution (piles 4, 5, and 6). The sorting is completed by adjusting the number of items per pile to fit the predefined distribution (10 items for each of the 9 categories in a rectangular distribution). Finally, the items are scored according to their placement (Waters & Deane, 1985).
The Q sorts obtained from a given child are then correlated to the criterion composite security score of a “hypothetically most secure child” provided by Waters and Deane (1985) to derive an overall Q-sort score for attachment security. Security scores thus represent a continuum in which values can range from +1.00 for the most secure child, to -1.00 for the most insecure. The fact that the AQS method generates a continuum is at times an advantage because it can highlight important information on significant differences within the groups and it allows for the standardization of assessments of the constructs across laboratories (Vaughn & Waters, 1990; Waters & Deane, 1985). In addition, continuous variables are better suited to various statistical tests or research designs. However, since it is sometimes useful to work with categorical variables, AQS scores were conventionally converted into a secure/insecure dichotomy. The convention used by most researchers is to assume that the AQS methodology would yield the same proportion of secure and insecure children as if the SSP had been used. The cut score commonly used is 70 secure: 30 insecure, that is consistent with the distribution found with SSP studies on middle class home-reared children. The same convention was used in this study and it will be exemplified in the data analysis (chapter 4).

In the present research the observer conducted two home visits of approximately two to two and a half hours each, for a total average of 4.5 (SD = 41.8 minutes) hours of observation per child. Conversations during the home visits

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30 Note that such “hypothetically most secure child” is culturally specific to a middle-class, Anglo population. Culturally relevant comparisons should be developed to use in cross-cultural research.
were usually carried out in Spanish, both with the mothers as well as with the children (except for one occasion in which the father was English monolingual, and three other occasions in which the children preferred to use English, or a mixture of English and Spanish). During the visits, mothers were asked to behave as if a friend or neighbor were visiting and were encouraged to engage in their usual, daily activities. Following an initial “ice-breaker” conversation with mother and child that involved questions such as “Te gusta ir a la escuela?” (“Do you like going to school?”), “Qué haces en la escuela?” (“What do you do in school?”), or “Tienes amigos/as en la escuela?” (“Do you have friends at school?”), to the child, and questions on child’s sociability to the mother, the observer engaged in play sessions with the child, always monitoring his organization of behavior with respect to the mother. Following each visit, the AQS’ 90 cards, representing the child’s secure-base behavior towards the parent, were sorted into a forced and rectangular nine-category distribution, according to how characteristic each item was of the child’s behavior. For each child the scores assigned in the two visits were averaged, the resulting composite was scored according to the number each item received in the distribution, and finally a Q-Sort description, depicting the child’s secure-base behavior assessed in the context of caregiver-child interaction, was derived. The software QSTAT II (personally provided by Waters, 2003) was used to analyze the AQS data. QSTAT II numerically organizes the sorted items, scores from criterion

31 Note that AQS item # 79 was not used in this study due to a translation misinterpretation on the part of the observer. As a consequence, such item always received placement in pile #5 (behaviors that are not seen or are neither characteristic nor uncharacteristic).
sorts, averages the sorts, and computes reliability when several sorts are averaged together.

Mothers were also asked to complete the AQS procedure by themselves, based on their own observations and knowledge of their children’s behavior. During the home visits, mothers were given the Spanish version of the AQS (Waters, 1998), and were instructed on the Q-sort items and sorting procedure. As a way to ensure they understood the procedure, they were asked to describe the types of behaviors that made them place an item in the low, middle or high piles. They were provided feedback whenever misinterpretations occurred and were encouraged to ask questions if anything was unclear. Finally, they were asked to sort the 90 items into the 9 piles according to how typical the behaviors were of their own child. Some of the items were completed during the visit in the presence of the observer as to be confident they understood the procedure and would be able to complete the protocol without needing additional help. The AQS protocol was then left with them to be completed and was collected in the two to four weeks following the visit. Out of the 18 completed protocols that were returned by the mothers, four had to be discarded from the analysis because they were considered inaccurate (mothers did not fully understand the procedure or assigned all cards to only a few of the possible scores). Mothers were encouraged to place the items into a forced rectangular distribution, to make their distribution consistent with the observer’s. However, given the nature of the Q-sort procedure for which it is tempting for untrained observers to place the items into the most extreme
categories (either least characteristic 1, neither characteristic nor uncharacteristic 5, or most characteristic 9) (Waters, 1987), it was particularly difficult for them to achieve a correct rectangular distribution and their sorting ranged from 3 to 20 cards for each of the nine piles. This difficulty on the part of the mothers was not foreseen, and none of their sorts reflected a rectangular distribution (as it would have been expected). However, fortunately the software used to analyze the data, QSTAT II, allowed for a non-fixed distribution of the cards into the nine piles (as long as at least one card was assigned for each pile), thus security scores could easily be obtained by correlating mothers’ card placements with experts’ criterion sorts although mothers’ scores were not ideally presented (free distribution of items into the 9 piles instead of a forced rectangular distribution of 10 items per pile).

Concerns were raised on the use of mothers as observers in the present study; mothers did not seem to entirely understand the procedure given that they placed most of the items in a few piles, while leaving some piles with very few items (versus an equal distribution of items within the piles). In support to this, the appropriateness of using mothers’ sorts in studies using the AQS has recently been questioned, and the use of mothers as observers has been re-evaluated (van Ijzendoorn et al., 2004; Waters, 1998). It is now commonly advised not to make use of mothers to assess children’s secure-base behavior using the AQS unless it is necessary to do so (i.e., in cases in which the observer(s) cannot conduct all assessments) (Waters, 1998). This advice followed the realization that mothers are reported not to accurately monitor the secure-base phenomenon (van Ijzendoorn et
al., 2004; Waters, 1998). Generally speaking, secure mothers are more critical in their expectations of their own child and therefore tend to score their children lower than the observer, while mothers in insecure relationships, who are less attentive to their children’s behaviors, tend to score higher than the observer (van Ijzendoorn et al., 2004; Waters, 1998). Finally, it is advised not to use mothers’ sorts for correlational studies because correlations are significantly reduced when subjects are not scored accurately (Waters, 1998). Due to these concerns, and because of the small sample size of their sorts, it was decided not to make use of mothers’ scores in this study. Only the observer’s scores were used as indication of attachment security.

Since it is virtually impossible to see examples of all 90 behaviors on a single occasion (Waters et al., 1994), the observer deemed appropriate to ask the mothers about specific behaviors that could not be observed given the time and situation constraints of the home visits (some situations were not presented or could not occur during the visits). See table 1 for details.
Table 1. AQS item behaviors whose sorting heavily relied on the mothers’ suggestions.

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>When he is upset or injured, child will accept comforting from adults other than mother (*)</td>
</tr>
<tr>
<td>8</td>
<td>When child cries, he cries hard</td>
</tr>
<tr>
<td>10</td>
<td>Child often cries or resists when mother takes him to bed for naps or at night</td>
</tr>
<tr>
<td>13</td>
<td>When the child is upset by mother’s leaving, he continues to cry or even gets angry after she is gone</td>
</tr>
<tr>
<td>23</td>
<td>When mother sits with other family members, or is affectionate with them, child cries to get mom’s affection for himself</td>
</tr>
<tr>
<td>24</td>
<td>When mother speaks firmly or raises her voice at him, child becomes upset, sorry, or ashamed about displeasing her</td>
</tr>
<tr>
<td>26</td>
<td>Child cries when mother leaves him at home with baby sitter, father, or grandparent</td>
</tr>
<tr>
<td>32</td>
<td>When mother says “no” or punishes him, child stops misbehaving (at least at that time). Doesn’t have to be told twice</td>
</tr>
<tr>
<td>33</td>
<td>Child sometimes signals mother (or gives the impression) that he wants to be put down, and then fusses or wants to be picked right back up</td>
</tr>
<tr>
<td>34</td>
<td>When child is upset about mother leaving him, he sits right where he is and cries. Doesn’t go after her</td>
</tr>
<tr>
<td>42</td>
<td>Child recognizes when mother is upset. Becomes quiet or upset himself. Tries to comfort her, asks what is wrong, etc</td>
</tr>
<tr>
<td>44</td>
<td>Child asks for and enjoys having mother hold, hug, and cuddle him</td>
</tr>
<tr>
<td>47</td>
<td>Child will accept and enjoy loud sounds or being bounced around in play, if mother smiles and shows that it is supposed to be fun</td>
</tr>
<tr>
<td>53</td>
<td>Child puts his arms around mother or puts his hand on her shoulder when she picks him up</td>
</tr>
<tr>
<td>55</td>
<td>Child copies a number of behaviors or way of doing things from watching mother’s behavior</td>
</tr>
<tr>
<td>60</td>
<td>If mother reassures him by saying ‘it’s ok’ or ‘it won’t hurt you’, child will approach or play with things that initially made him cautious or afraid</td>
</tr>
<tr>
<td>71</td>
<td>If held in mother’s arms, child stops crying and quickly recovers after being frightened or upset</td>
</tr>
<tr>
<td>73</td>
<td>Child has a cuddly toy or security blanket that he carries around, takes to bed, or holds when upset</td>
</tr>
<tr>
<td>78</td>
<td>Child enjoys being hugged or held by people other than his parents and/or grandparents</td>
</tr>
<tr>
<td>88</td>
<td>When something upsets the child, he stays where he is and cries</td>
</tr>
</tbody>
</table>
(*) As a convention, in the interest of simplicity, the term “mother” is used in place of the primary caregiver, and “he” refers to either boys or girls.

Given that the observer heavily relied on the mothers’ suggestions to score these 20 items, the scoring of such questions were very similar between mothers’ and observer’s ratings (but not exactly the same since what mothers said during the visit and what they scored alone after the visit was completed did not always match), and this possibly explains the quite high correlation (.84) found between mothers’ and the composite of the observer’s sorts. However, the correlation for the remaining 70 items (the ones that were scored without mothers’ input) was .81, which is still prominent. Considerations on this high correlation between observer’s and mothers’ scores will be provided in chapters 4 and 5.

**Child cognitive engagement**

**Overview**

The main skills assessed when scoring children’s performance were: “cognitive ability” (i.e., understanding vs. not understanding the game questions, answering correctly vs. answering incorrectly), critical thinking (assessed by looking at how children responded to specific critical-thinking questions posed before each game), motivation, goal orientation, and cooperation. For each game the following variables were recorded: the amount of time the child was engaged playing, the number of right and wrong answers, the number of trials the child
engaged in and the number of trials successfully completed. The measure used to assess cognitive performance was accuracy, that is the number of right answers, divided by the total number of trials completed, times 100 (i.e., % correct, Palinkas, personal communication, December 2004).

**Software**

The software “Reader Rabbit Personalized Kindergarten” from *The Learning Company®* was used for the cognitive assessments. This software consists of six games, three of which were chosen for the purposes of this study. The games selected were those promoting problem solving skills, critical thinking, ability to follow verbal instructions, shapes and colors recognition, memory, ordering and sequencing, and basic mathematical concepts and relationships.

This study aimed at identifying qualities and skills that typically characterize secure from insecure children (i.e., cognitive engagement, motivation, competence and cooperation during joint problem solving, task orientation, and critical thinking; see chapter 2 for details). In the protocol used to assess cognitive performance, the following were considered: cognitive performance (right vs. wrong answers), motivation (number of attempts in time, level of engagement in the activities), critical thinking (performance on 3 critical thinking questions), goal orientation (task orientation), and cooperation (willingness to ask for help). Details are provided below.
The children were introduced to the novel software during their regular “Mi Clase Mágica” (MCM, refer to chapter 2 for details) sessions that took place in the computer room of the St. Leo’s preschool on Mondays and Wednesdays from 9am to 12noon. At St. Leo MCM consists of 12 weekly half-hour long sessions, each one involving an average of 3 children (the number of children allowed to the computers each time ranged from 1 to 6, depending on the availability of adult volunteers). During MCM sessions each child is paired with an adult and is encouraged to play a specific set of educational software (different from the one used in the present study).

Having long been part of the MCM program and therefore already known as a volunteer among the children, the observer acted as a regular adult participating in the sessions so as not to give the children the impression they were being tested. As part of the philosophy of MCM program, bilingual children were allowed to choose what language to carry the conversation in. Almost all children preferred to converse in Spanish, although they could all understand at least some level of English, and the observer translated the software from English to Spanish whenever needed. Given the 30 minutes long computer sessions, an average of 10 minutes were allotted for each of the three games for each child. However, although the children were encouraged to play each of the three games for an average of 10 minutes each, they were not compelled to play if they didn’t feel like it, nor they were told to stop playing and move to the next game in the case they were very engaged in a given activity, therefore the actual number of minutes spent
on each of the three games ranged from 5 to 15, depending on the child’s level of engagement. Children were tested in two different occasions in order to control for their different predispositions in different days. The first (chronologically speaking) complete test was usually used in the analyses. However, since occasionally the tests were incomplete because the child did not play all games or did not play them long enough to produce a valid assessment, the first test was at times incomplete. In such cases, an average between scores on the two tests was used for the analyses.

**Games and assessment procedure**

An evaluation instrument was developed to assess performance in the three games. For each game the observer took note of the amount of time the child was engaged playing, the number of right and wrong answers, the number of trials he/she engaged in and the number of trials successfully completed. The three games adjusted to performance, meaning that the trials got more difficult following an increased performance. However, very few children played a single game long enough to proceed to a higher level, probably due to the short attention span of children that young.

Get your bearings (GYB): In addition to critical thinking capabilities, this game assessed problem solving given spatial and directional cues. It consisted of a 5x5 grid where the child was to look for a hidden object (an alarm clock, see figure 1). Four other objects (a green bowl, a red book, a blue cup, and a white ball) were shown in 4 pre-determined cells in order to provide for physical reference. To find
the hidden object, the software provided verbal instructions such as to look
“near/close to”, “far from”, “above”, “below”, “to the left of” or “to the right of” in
relation to one of the 4 reference objects. The child had to click on a box to uncover
it and see if the alarm clock was found. If it was not, the software would either
repeat the same clue (in the case the child clicked on the wrong side of the grid), or
provide a new clue (if the child clicked on the correct side of the grid, but did not
find the hidden object). A trial was considered completed when the alarm clock
was found.

An attempt was considered right if the child clicked on the correct side of
the grid, and wrong if the child clicked on the incorrect side of the grid (according
to the directions provided by the software). After two consecutive wrong attempts,
the software would highlight the target area, which included a limited number of
cells, as a way to simplify the task to the child. Each attempt was considered
separately; the observer did not consider the child’s ability to remember what was
asked in the previous trials, but only evaluated the ability to answer the given
question at the time it was posed (this adjustment was made after the pilot study
was completed because it was realized that the ability to add old cues to new ones
appeared to be a very difficult task for children this young). For this reason,
sometimes an answer was considered right even if it could not have led to finding
the hidden object (because of cues provided in previous trials). One point for right
answer was assigned whenever the child clicked on the correct side of the grid, and
one point for wrong answer was given if he/she clicked on the wrong side of it. A trial was considered completed when the hidden object was found.

**Diner Lineup (DL):** In addition to basic mathematical concepts and relationships, this game assessed ordering and sequencing as well as the ability to follow precise verbal instructions. It consisted of three objects that needed to be ordered from shortest to tallest (or vice versa), smallest to largest (or vice versa), or longest to shortest (or vice versa). The objects were initially presented on a single surface and needed to be dragged and placed (by clicking after dragging with the computer mouse) on the correct location on another given surface positioned above the first one on the computer screen (see figure 2). The software would provide a vocal cue as for the rationale on how to order the objects at the beginning of each trial (e.g., “order the objects from shortest to tallest”) and this was repeated after each wrong attempt. Given the young age of the children, the “dragging and clicking” action was at times difficult to accomplish, therefore, if needed, the observer would manually help the child with the computer mouse (by placing my hand over his on the mouse, but always letting the child take the decision on where to position the objects). After all objects were placed on the upper surface, the software would automatically move the ones set on the wrong location, back to the initial surface, while leaving the correct ones, on the right location, on the upper plane. An attempt was considered right if the object was placed on the correct location (according to the software instructions), and it was considered wrong if the object was placed somewhere else. One point for right answer was assigned for
each object positioned on the right place, while one point for wrong answer was
given for each object that was not placed in the correct location. A trial was
considered completed when all objects were placed in the right sequence.

Canoe Match (CM): This game primarily assessed memory skills, in
addition to shapes, colors, letters, and numbers recognition. It consisted of a card-
matching game with 5 pairs of cards to be uncovered in order to find the right five
matches (see figure 3). The cards represented geometrical shapes of different
colors, capital letters, basic numbers, or animal shapes. The children were
prompted to uncover the cards, two at a time, to look for the matches. After
uncovering the first card, they had to choose a second and, if the match was right,
the software would exclude the 2 cards from later choices, whereas if the match
was not right, the 2 cards would be covered again and could be chosen in later
trials. If the child answered correctly after having gathered the information to
perform right, one point for a correct answer was assigned. But, if the answer was
right only due to chance (for instance in the first trial), no point was assigned. A
point for wrong answer was assigned if the child answered incorrectly but he/she
was in possession of all the information to make the right choice, while no points
were assigned if he/she answered incorrectly but would not have had enough
information to take the correct decision (i.e. in the first trial). Finally, if the child
chose the same card he/she chose in previous trials as first choice in later trials, a
point for wrong attempt was assigned because it was considered to be a bad
strategy to be adopted in the game (if the player already knows what a certain card
represents, he/she should consider other choices before choosing that one).

Decision on this was made after the pilot study was completed, because it was realized that this is a very common strategy for children this age. Since it is considered to be a bad strategy from an adult perspective, the fact that preschoolers seem to perform poorly in this respect, probably represents something interesting to investigate in terms of developing cognitive capabilities during the preschool period.

**Other cognitively engaging trials**

Along with the games, three critical thinking questions, embedded in the software and presented before each game, were also posed to the children. The child had to 1) shorten/lengthen a ladder in order to reach a higher spot by clicking on an arrow pointing either up or down, 2) choose and click on the right-sized missing step in a stairs from a choice of three, 3) match a shaped key (circle, square or star) to open a gate with a matching lock. Also the ability to sign in by typing the first name on the keyboard was recorded. For all these tasks, a three-point scale was used; a score of 2 was given if the child could solve the problem independently, 1 if he/she needed help (in terms of suggestions, cues) in order to answer correctly, and zero if he/she could not answer properly, even after being helped. The scores from the three questions were combined, yielding a range of scores from 0 to 6 (0 being poorest performance and 6 being best performance on
the three questions combined) for each child. To facilitate calculations, the values have been scaled to a 0-1 range.

Finally, the level of engagement in the activities, goal orientation, the willingness to ask for help, and the general understanding and performance in the game were also recorded for each child. A three-point scale was also used;

**Level of engagement in the activities:** If children were excited and willing to play, they were given a score of 2; if they needed some encouragement to continue playing, they were given a score of 1; if they kept wanting to change game, or asked to do something else, they would receive a score of 0 (a score of 0 was also assigned if the child chose not to play the game).

**Goal Orientation:** This measure described the level of engagement toward a goal (e.g., finish the game vs. move on to the next game). If children played because they wanted to finish the game and/or get as many right answers as possible, they received a score of 2; if they played needing continuous encouragement, they were given a score of 1; if they would not have played were they not prompted continuously, they were assigned a score of 0 (a score of 0 was also assigned if the child did not play the game).

**Asking for help:** This measure described the willingness to ask for help in order to succeed in a given problem-solving situation. If the children continuously asked for the observer’s input (whether asking directly for help before attempting to give an answer or asking for her approval while answering), they were assigned a score of 2; if they eventually asked for the observer’s approval or help but mainly
tried to solve the problems alone, they would receive a score of 1; if they never asked for approval nor help, a score of 0 was assigned.

Performance: Observer’s feeling for the child’s overall performance (in the three games) was recorded. This measure was used in order to distinguish situations in which the child was getting the right answers by chance (e.g., conspicuous random clicking). When children performed well overall, in all 3 games, a score of 2 was assigned; when they performed well in some games and poorly in others, a score of 1 was given; if they did not perform well overall, a score of 0 was assigned (a score of 0 was given also if child did not play the game).

An alternative use of the AQS

Because of the depth and breath of the AQS methodology that uncovers multiple behavioral constructs in addition to attachment security, uses other than the mere assessment of attachment can be advanced. In the present study the behavioral items of the AQS are used to investigate specific behavioral constructs of mother-child attachment patterns (i.e., disorganized attachment and maternal cognitive engagement with child). In fact, as a behavioral assessment tool, the AQS has a much wider range of applicability than the SSP. While the SSP only assesses the secure-base phenomenon exclusively in laboratory sessions, the AQS explores a broad variety of behaviors within a variety of naturalistic settings (van Ijzendoorn et al., 2004). In addition, while the SSP focuses solely on secure-base behaviors, the AQS’ 90 behavioral descriptions include most of the social, affective, and
cognitive states part of the relationship between the child and the primary attachment figure that they undergo on a daily basis and within familiar environments. Although measures of security from AQS and SSP are quite correlated (Howes & Hamilton, 1992; van Ijzendoorn et al., 2004; Vaughn & Waters, 1990), there is some variance in the AQS scores that is not accounted for in measures of attachment security obtained with the SSP (Van Bakel & Riksen-Walraven, 2004). In addition to attachment security measures that are accounted for in the SSP, AQS security scores are also a function of the level of the child’s sociability, the environment (both social and physical), the family situation, parental quality of interactions, parental ego-resiliency, child cognitive development and task orientation, maternal sensitivity, the child’s anger threshold, and finally temporary states such as mood, levels of pleasure, health status, etc. (Solomon & George, 1999; Van Bakel & Riksen-Walraven, 2004). These elements affecting child behavior that are not related to attachment security are revealed in the AQS’ “filler” items, which are included to facilitate the sorting procedure. They make the focus on security less obvious in order to reduce social desirability effects (Waters et al., 1994). The presence of filler items is a great advantage of the AQS since it allows investigation of aspects of behaviors between child and mother that go beyond the attachment behavioral system. This, in addition to the fact that in the AQS all behaviors are scored independently one from the other, makes the AQS a valid tool to investigate behavior aspects that go beyond secure-base measures,
allowing analyses of different constructs to be conducted at the level of the items of interest.

Van Bakel and Riksen-Walraven (2004) are among the first engaging in an alternative approach in their study conducted to validate the AQS relative to the SSP. After assessing attachment with the SSP, and thus being able to classify infants in the A, B, C or D categories, they looked at how infants differed in specific behavioral items. Their study for the first time showed how disorganized (D) infants are significantly different from secure (B) infants at the level of specific behavioral AQS items. Although the SSP is not used in this study, their methodology is applied to investigate the possible presence of disorganized children, and of behavioral features that denote affective engagement of the mothers with their children.

In conclusion, the use of the AQS at the items level is an efficient tool to investigate behavioral constructs that are not related to the attachment behavioral system. In addition, the AQS methodology presented various advantages for the purposes of this study, not only during the observational phase, but also during sorting and final analysis. The procedure is particularly suited to both qualitative and quantitative analyses (Solomon & George, 1999), it limits social desirability and response biases (decisions have to be made as to what items to place in the most extreme categories), and the fact that some of the items are just filler items prevents biases because the observer is unaware of which constructs will actually be scored and used in the analysis of AQS data (Waters & Deane, 1985).
Attachment Security and observer’s subjective ratings of child’s behavior

Securely attached children, compared to insecure, are reported to be more cognitively engaged, motivated, competent in the execution of plans and in cooperating during joint-problem solving. They tend to be more cooperative, including looking for help from a more capable person, and are better skilled at transferring recently acquired skills to a new situation. Finally, they are also found to be better skilled at thinking critically, to have higher levels of planning and to be more task-oriented than insecure children (refer to chapter 2 for details). Given these differences between secure and insecure children, especially evident during cognitive engagement, we should expect a different frequency of certain behavioral features when we cognitively engage with them. During the present study, in addition to quantitatively measuring cognitive performance, the observer also took qualitative notes on the children’s performance and their overall behavior during the test. It was hypothesized that the comments associated with secure and insecure children would differ substantially. Because, generally speaking, the characteristics associated with secure attachment are more desirable than the ones related to insecure attachment, the adjective “positive” will be conventionally used when referring to the comments for secure children, while “negative” will be used for comments on insecure children. This part of the analysis was conducted by looking at the positive and negative keywords associated with particular behaviors within five cognitive characteristics that are related to attachment security; cognitive ability/performance; motivation/persistence; critical thinking/problem solving.
strategies; task orientation; cooperation (see table 2). For each child the observer scored the number of comments in each of the categories and divided them into “positive” or “negative”.

Table 2. Cognitive characteristics analyzed and the types of “positive” and “negative” keywords used to describe children’s behaviors that were used in the analysis.

<table>
<thead>
<tr>
<th>Cognitive characteristics related to security of attachment.</th>
<th>Related “positive” keywords in the notes taken after the tests.</th>
<th>Related “negative” keywords in the notes taken after the tests.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive ability/performance</td>
<td>“Understands well”; “good”; “excellent”; “uses mouse correctly”</td>
<td>“Does not understand”; “cannot finish exam”; “has problems with mouse”</td>
</tr>
<tr>
<td>Motivation/persistence</td>
<td>“Excited to play”; “concentrated”</td>
<td>“Does not want to play”; “distracted”; “is bored”; “does not like it”; “does not try”; “is not happy”</td>
</tr>
<tr>
<td>Critical thinking/problem solving strategies</td>
<td>“Thinks carefully before answering”</td>
<td>“Says cannot do it”</td>
</tr>
<tr>
<td>Task orientation</td>
<td>“Likes challenge”; “learns fast”</td>
<td>“Quits/wants to change”</td>
</tr>
<tr>
<td>Cooperation</td>
<td>“Asks for help”; “waits for confirmation/approval on my part”; “learns from suggestions”</td>
<td>“Does not ask for help”; “does not interact with me”; “does not listen to suggestions”</td>
</tr>
</tbody>
</table>
Questions and hypotheses

In conclusion, the present analysis attempted to answer the following questions:

1) Do securely attached children perform better than insecure in various socio-cognitive skills (such as joint problem-solving competence, cooperation, motivation, goal-orientation, and critical thinking)?

2) Do secure children display more critical thinking skills than insecure children?

3) Are secure children perceived as having more “desirable” characteristics than insecure children?

4) Are the children in the low score AQS cluster disorganized or are they outliers?

5) Is maternal sensitivity/affection more consistently present in secure than in insecure dyads, and are secure children more empathic than insecure ones.

It was hypothesized that:

1. Secure children outperform insecure children in the three games (and thus in all the different cognitive skills that underlie them);

2. Secure children display more critical thinking skills than insecure children;
3. “Positive” comments are more often associated with secure children, while insecure children are more consistently described with “negative” remarks;

4. Children in the low end of the attachment continuum are disorganized children and do not represent outliers in the data set;

5. Maternal sensitivity and affection are more evident in secure relationships as opposed to insecure. Secure children are more empathic than insecure children.

Data analysis and discussion of the results will be presented in the following chapters (4 and 5, respectively).
Figure 1: The GYB game

Figure 2: The DL game

Figure 3: The CM game
CHAPTER 4 - DATA ANALYSIS

Overview

To investigate whether attachment security was associated with child cognitive performance and to variables such as task-orientation, motivation, cooperation, and critical thinking, several analyses were undertaken. Given the exploratory nature of the study, a description of how the process of data analysis evolved will be presented. This includes the initial approach to the analysis of the data, the problems/questions that arose during the analysis process, and finally the different approaches that were employed to answer particular questions that were not foreseen at first. Although an alpha level of .05 was used for the statistical analyses, in some cases (i.e., when sub-samples of the population were used in particular statistics, and thus a significance at p<.05 was difficult to detect due to the reduced sample size), results with an alpha level between .05 and .1 will be presented to show possible important tendencies that would otherwise be overlooked.

Attachment Security

AQS security scores derived from the observer’s sorts (N=38) ranged from -.17 to .60 (M = .35, SD = .18). Test-retest reliability between scores from the two visits was .70.
AQS security scores derived from mothers’ sorts (N=14) ranged from -.06 to .63 (M = .36, SD = .21). A one-way analysis of variance (ANOVA) between the observer’s and mothers’ scores revealed the mean difference not to be significant, $F(1, 51) = .0025$, $p = .960$.

The mean correlation between mother- and observer- derived security scores was .84 ($p << .01$). This high correlation could be due to the low sample size of mothers’ sorts (N=14) and/or to the fact that the observer scored 20 out of the 90 AQS items by heavily relying on the mothers’ suggestions because of the impossibility of witnessing such behaviors during either of the two visits (refer to the method section for details). When computed without considering those 20 items, the correlation only slightly decreased ($r = .81$, $p << .01$). However, because of the low sample size of mothers’ sorts and the fact that they may not represent valuable observers (see chapter 3 for details), their AQS scores were not used in the analysis.

Because this study aimed at comparing secure and insecure children in various aspects of their cognitive and social skills, the continuous AQS security scores were conventionally converted into a secure/insecure dichotomy, as to be suitable to statistical analyses that required the use of categorical variables. A cut score of .30 was used since it designates the same proportion of secure and insecure children as if the Strange Situation had been used (70 secure: 30 insecure, Waters, 1998). In the present sample, this convention yielded 25 secure and 13 insecure (including avoidant, resistant and, possibly, disorganized) children. Figure 4 shows
the AQS score distribution for the sample with the secure/insecure division given a cut-score of .30. The circled area represents a cluster of subjects with lowest AQS scores, a discussion of which is provided below.

Figure 4: AQS score distribution showing the secure-insecure partition with a .30 cut score.

**Attachment security and cognitive performance**

To investigate whether secure children were more cognitively advanced than insecure children, a series of t-tests was performed comparing the measures of accuracy in the three games by whether the children were secure or insecure (see
Insecure children were significantly less accurate in completing the GYB test, $t(36)= 2.18$, $p<.05$. Insecure children were also less accurate in both the DL and the CM tests, $t(36)= .97$, ns, and $t(36)= 1.47$, $p< .1$ respectively. Overall, in the three games, insecure children were less accurate than secure children, but, only in the GYB game, the differences were not statistically significant. However, if looking at significance at an alpha level between .05 and .1, secure children outperformed insecure children in all three games. Thus, a general trend in the expected direction was detected.

Figure 5. t-tests on measures of accuracy in secure and insecure children, in the three games (GYB, DL, and CM).
Attachment Security and Critical Thinking Skills

Correlations were run between AQS security scores and scores on the three “critical-thinking questions” (refer to chapter 3 for details) that were posed before each of the three games. Each question was scored using a three-points scale ranging from 0 to 2 (0 not able to perform, 1 able to perform but only under guidance, 2 able to perform independently). The overall correlation between security score and performance on the three critical-thinking questions was $r=.18$ (see figure 6). As evident from the figure, the correlation is slightly positive, but not enough to conclude that the two variables are significantly correlated. However, when excluding from the analysis the cluster of four subjects at the lower end of the AQS continuum (circled area), the correlation between security and critical thinking becomes significant, $r=.45$, $p<.01$ (see figure 7). This interesting finding shows how those four subjects may alter the results. Considerations on the nature of the subjects in the cluster are provided later in the chapter.
Figure 6. Correlation plot and regression line between AQS security scores and performance ($r = .18$, ns) on the “critical thinking questions” for all subjects (N=38). The four subjects in the circled area are the ones with lowest AQS scores.
Correlations were also run between AQS security scores and the observer’s own ratings on the following skills displayed by the children: ability to sign in their name, level of engagement in the activities, goal orientation, willingness to ask for help, and overall performance in the tests. None of these skills was strongly associated with attachment security. The outcomes of the correlations were: for signing in, r=.03; level of engagement, r=.09; goal orientation, r=.02; asking for help, r=-.01; and performance, r=.18. Performance shows a weak positive
association, whereas willingness to ask for help shows a weak negative correlation with AQS scores, but none of them is statistically significant.

**Child Cognitive engagement: Correlations between variables**

Tables 3, 4 and 5 show the correlation matrixes on the three games (CM, GYB, and DL respectively) for the following continuous variables: age, AQS security score, total number of tasks completed, time spent on the game, number of goals achieved, and accuracy. Such variables were selected in order to assess children’s cognitive performance, motivation, and goal-orientation. As the tables show, the relatively low correlations between AQS and accuracy suggest a non-significant association between security and performance on the cognitive tasks, although a positive association was detected. Correlations between AQS and accuracy were .071, .144, and .073 in CM, GYB, and DL games respectively (none of which is statistically significant). However, although no significant correlation was found between security of attachment and performance, additional significant correlations indicated the presence of other important relations between variables. More specifically, in the CM game, AQS security score was positively correlated with time spent on the game, $r = .301$, $p < .05$. Total number of tasks completed was associated with percent accuracy, $r = .349$, $p < .05$. Finally, accuracy was correlated with time, $r = .562$, $p < .01$. Also in the GYB game accuracy was associated with time spent on the game, $r = .518$, $p < .01$ and with total number of tasks completed, $r = .439$, $p < .01$. In the DL game, accuracy correlated with number of tasks completed,
r = .298, p < .01, and a significant negative association between time and attachment security was detected, r = -.278, p < .05.

In all three games, percent accuracy correlated with total number of tasks completed. This could indicate that the more accurate the children were, the more tasks they completed (implying engagement, increased performance, etc.), that the more tasks they completed, the more accurate they became (practice effect), or that the easier they found the game, the faster they became. In both the CM and GYB games, accuracy was associated with time spent on the game. This is probably because the longer the children played a game, the more accurate they became since they had more time for practice. However, the possibility that the more accurate the children were, the longer they liked to be engaged in a game (because of positive reinforcement), cannot be discarded. In the CM game, AQS security score was positively associated with time spent on the game. This could indicate that, either secure children spent more time on the game than insecure children, thus denoting longer attention span or more interest in the game, or they better understood the game and thus they liked to be engaged in it for a longer time, indicating higher cognitive skills. Finally, in the DL game, time and attachment security presented a negative correlation. This indicates that secure children spent less time engaged playing than insecure children. There are some possible explanations for this; secure children could have become more easily bored about the game (either because too easy or too difficult for them), their level of activity was higher, thus requiring frequent changes in activities, they had a shorter attention span than insecure
children, or they performed better in a shorter time frame to require a more frequent change in activity.

Table 3. Correlation Matrix for the CM game

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>AQS</th>
<th>Total #</th>
<th>Time</th>
<th># goals</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1</td>
<td>0.251</td>
<td>0.359*</td>
<td>0.411**</td>
<td>0.383**</td>
<td>0.158</td>
</tr>
<tr>
<td>AQS</td>
<td>1</td>
<td>0.201</td>
<td>0.301*</td>
<td>0.255</td>
<td></td>
<td>0.071</td>
</tr>
<tr>
<td>Total #</td>
<td>1</td>
<td>0</td>
<td>0.704***</td>
<td>0.817***</td>
<td>0.349*</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>1</td>
<td>0</td>
<td>0.752***</td>
<td></td>
<td>0.562**</td>
<td></td>
</tr>
<tr>
<td># goals</td>
<td>1</td>
<td>0</td>
<td></td>
<td>0.615***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

(*) significant at p<.05  
(**) significant at p<.01  
(***) significant at p<.0001
Table 4. Correlation Matrix for the GYB game.

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>AQS</th>
<th>Total #</th>
<th>Time</th>
<th># goals</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1</td>
<td>0.251</td>
<td>0.392**</td>
<td>0.1</td>
<td>0.403**</td>
<td>0.348*</td>
</tr>
<tr>
<td>AQS</td>
<td>1</td>
<td>0.067</td>
<td>-0.175</td>
<td>0.025</td>
<td>0.144</td>
<td></td>
</tr>
<tr>
<td>Total #</td>
<td>1</td>
<td>0.546**</td>
<td>0.707***</td>
<td>0.439**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>1</td>
<td></td>
<td>0.62***</td>
<td>0.518**</td>
<td></td>
<td></td>
</tr>
<tr>
<td># goals</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0.729***</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

(*) significant at p<.05
(**) significant at p<.01
(***) significant at p<.0001
Attachment Security and variability in Cognitive Performance

To investigate whether insecure children were more variable in their cognitive performance than secure children, the coefficient of variation (CV) for measures of accuracy in secure and insecure children in the three different games; GYB, DL, and CM, was analyzed. Secure children’s CV was 39.42, 47.38, and 33.01, in the three games respectively, and insecure children’s CV was 53.40, 46.75, and 53.15, in the three games, respectively (see figure 8). A t-test for independent samples revealed that insecure children were significantly more variable in measures of accuracy than secure children, t(4) = 2.38, p<.05 (see figure 9).
Figure 8. Coefficient of variation (CV) for secure and insecure children in the three games, considered separately.
Attachment Security and observer’s subjective ratings of child’s behavior

This part of the analysis attempted to answer the following question; in the qualitative notes taken at the end of every interaction with a child, were there more “positive” (refer to the method for details) comments for secure children and more “negative” comments for insecure children?

Wilcoxon signed-rank test revealed that there were significantly more positive comments for secure children, \( W=-74, p<.01 \), and more negative
comments for insecure children, W=62, p<.01 (see figures 10 and 11). But, was this analysis biased given that the same observer ran both the AQS and the cognitive assessments? The observer could have been biased if the cognitive test was run after the AQS because she would have personally interacted with the child in an intimate setting (the child’s home) before conducting the cognitive test, and she could have developed a desirability bias.

To control for subjective biases, situations where the cognitive assessments were conducted before the AQS (N=13), were analyzed. The same tendency of more positive comments for secure children and more negative for insecure children was detected, but the differences were not statistically significant, W=42, p=.05, p<.1 (see figures 12 and 13). Another of such situations of AQS and cognitive analyses run independently one from the other, was presented by the AQSs that were done by the mothers (N=15): In this case the same tendency was detected and the results were partially significant. For “positive” comments, Wilcoxon signed-rank test yielded W=-28, p=.01. For “negative” comments, W=49, p<.05 (see figures 14 and 15).

In conclusion, a tendency for more positive comments associated with secure children and more negative comments for insecure children was detected in all situations, although they were at times not statistically significant, probably due to the reduced sample sizes.
Figure 10. Frequency of positive comments for secure and insecure children for the entire sample (N= 38).
Figure 11. Frequency of negative comments for secure and insecure children for the entire sample (N= 38).
Figure 12. Frequency of positive comments for secure and insecure children in situations in which the cognitive assessments were conducted before the AQS (N=13).
Fig 13. Frequency of negative comments for secure and insecure children in situations in which the cognitive assessments were conducted before the AQS (N=13).
Figure 14. Frequency of positive comments for secure and insecure children for those situations in which the AQSs were provided by the mothers (N= 14).
Figure 15. Frequency of negative comments for secure and insecure children for those situations in which the AQSs were provided by the mothers (N= 14).

Investigating the nature of the subjects in the low-score cluster

With reference to figure 4, we can see how a cluster of four subjects\textsuperscript{32} in the lower end of the attachment continuum stands out from the AQS scores distribution. The AQS values associated with those four subjects are: -.17, -.07, -.01, and .08 (M=-.04), while the mean security score for secure children is M= .45.

To better understand whether those four subjects in the low end of the continuum represent statistical outliers or disorganized children, correlations were

\textsuperscript{32} In the benefit of simplicity, the term “cluster subjects” will be applied to those four children hereafter.
computed between AQS scores and values of accuracy, excluding the cluster subjects. The correlations for GYB and CM games became stronger when excluding those four subjects; they went from .18 to .22 in GYB and from .07 to .30 (p<.05) in CM. The correlation did not change for the DL game (r= .20 with and without the cluster). Figure 16 shows the outcome of the correlations between AQS and accuracy in the three games. Figures 17 and 18 show the regression line of AQS and accuracy for the CM game with and without the cluster, respectively. The figures indicate no relation in the first case (figure 17), but a significant positive association when the cluster was not included (figure 18).

![Figure 16. Correlations AQS-Accuracy with and without the negative cluster.](image-url)
Figure 17. Regression line between accuracy and AQS (r = .07, p = n.s.) with all subjects for the CM game (N = 38).
For the CM game, the four subjects with lowest AQS score do actually bias the results; when excluded from the analysis, a positive correlation between security and accuracy is found. This finding, which is interesting since it highlights a specific skill (short-term memory) in which secure children tend to outperform insecure, will be discussed in chapter 4. Meanwhile, there is still no indication as to whether those subjects are outliers or are possibly disorganized children. We might want to speculate on the nature of the four lowest points in the AQS distribution. Could they be outliers in the data? To test the hypothesis that the cluster subjects
are outliers in the data, Grubbs’ test for outliers was performed. For the most negative point (-.17), the test yielded a value of Z= 2.89. This is not statistically significant, therefore -.17 cannot be considered an outlier. However, the fact that the four most negative points are part of a cluster could weaken the test itself, therefore the test was also performed excluding the cluster from the analysis. Excluding the other three points in the cluster (points -.01, -.07 and 0.08), the test gave a value of Z=3.44, p<.05, for the -.17 point and Z=3, p<.05 for point -.07. For point .01, Z=2.78. This is not significant, therefore .01 cannot be considered an outlier (nor does .08 by default). We can conclude that, having performed Grubb’s test for outliers in this particular way, only the two most extreme negative points in the distribution can tentatively be considered as outliers in the data.

The possibility that the cluster subjects in the present set of data could represent children who are disorganized unfortunately cannot be tested by only using the AQS as assessment measure. However, an alternative approach to identify disorganized children in a set of AQS-based data will be advanced in the following section.

**Use of the AQS item subsets to identify disorganized attachment**

Not being possible to categorize children in the three insecure attachment categories (A, C, and D) by only using the AQS as attachment assessing tool, the possibility of identifying disorganized children with a different approach was investigated; by looking at individual AQS items.
In their study with 15 months old infants conducted to validate the AQS measure relative to the SSP, van Bakel and Riksen-Walraven (2004) found that, not only AQS security scores of disorganized infants were significantly lower than the ones of secure infants, but D-infants also distinguished themselves from secure in the qualitative aspect of many of the AQS items. To investigate the variance present in the AQS scores that went beyond attachment security found with the SSP, they looked at how infants in the distinct attachment categories (A, B, C and D, classified with the use of the SSP) differed in terms of specific behavioral items. In the present study, their approach was used, not only to investigate the possible presence of disorganized children in the sample, but also to speculate on the incidence of behavioral features that indicate some level of affective engagement of mothers toward their children, that might distinguish secure from insecure children (discussed later).

In their study, van Bakel and Riksen-Walraven identified 12 AQS items (numbers 1, 2, 4, 6, 18, 19, 38, 53, 65, 71, 74, and 79) that distinguished disorganized from secure infants. Looking closely at such items, disorganized infants were described as “noncompliant (Items 1, 18, 19) and fussy, angry, easily upset, and difficult to comfort (Items 2, 6, 38, 65, 71, 74, 79)” (van Bakel & Riksen-Walraven, 2004). I ask, are those AQS items, recognized in that study as characteristic of disorganized infants, also characterizing the cluster subjects of the present study? If they do, this would further support the hypothesis that those four subjects are disorganized children, and this might have important implications in
terms of data analysis, and, most importantly, in terms of intervention measures since disorganized children are considered at high risk for behavioral problems (Howes & Ritchie, 1999; Moss et al., 1999; Zeanah et al., 1999).

A series of t-tests between the cluster subjects and secure children (i.e., those with AQS score > .3) yielded significant results on the following four items that were found significant in the previously mentioned study: 1, t(26) = -3.07, p<.01; 2, t(26) = 2.78, p<.01; 19, t(26) = -3.42, p<.01; 38, t(26) = 4.12, p<.001. The remaining seven items (4, 6, 18, 53, 65, 71, 74) did not yield significant results. Therefore, the hypothesis is only partially supported; as a group, the cluster subjects did not seem to be significantly different from secure children in the items reported in the study by van Bakel and Riksen-Walraven (2004).

However, there still remains the possibility that the cluster subjects score different from secure children in items that underscore analogous behavioral constructs characteristic of disorganized attachment, but that were not identified as such in the van Bakel & Riksen-Walraven study. To investigate this possibility, a series of 90 separate t-tests was performed on the present sample, with the two attachment classifications as the grouping variable and the 90 AQS items as the dependent variable. This was pursued to examine whether the cluster subjects and the subjects in the secure end of the continuum differed with regard to specific behavioral items. Twenty four items (1, 2, 5, 7, 8, 9, 10, 15, 19, 25, 28, 38, 39, 48, 50, 52, 54, 58, 60, 66, 70, 76, 78, and 81) were significantly different in secure vs. cluster subjects children at p<.05 (see table 6).
Table 6. Summary of the outcome of the t-tests (in order of significance) at the item level between secure and clustered children and the qualitative features underlying each item found significant. The sign (+ or -) of the t-test values is related to the directionality of the question.

<table>
<thead>
<tr>
<th>Item #</th>
<th>t-tests, secure vs. cluster subjects</th>
<th>Item description (from the rationale of the AQS, Waters, 1998).</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>t(26)= -7.24, p&lt;.0001</td>
<td>Cluster subjects (*) are less confident in social interactions, in the presence of the attachment figure. They also pay less attention to caregiver’s signals to evaluate the risk or safety of social and other situations.</td>
</tr>
<tr>
<td>58</td>
<td>t(26)= 8.92, p&lt;.0001</td>
<td>Cluster subjects show lower levels of sociability than secure children.</td>
</tr>
<tr>
<td>66</td>
<td>t(26)= -4.45, p&lt;.0001</td>
<td>Cluster subjects seem to be less emphatic and less emotionally open than secure children.</td>
</tr>
<tr>
<td>76</td>
<td>t(26)= 4.94, p&lt;.0001</td>
<td>Cluster subjects are more oriented towards toys than adults.</td>
</tr>
<tr>
<td>38</td>
<td>t(26)= 4.12, p=.0001</td>
<td>Cluster subjects behavior reflects a history of maternal interference. Mothers are not very sensitive to their infant signals, they are not cooperative with the infant’s ongoing behavior, are not physically and psychologically available, and do not easily accept the infant’s needs and demands.</td>
</tr>
<tr>
<td>54</td>
<td>t(26)= 3.68, p=.0005</td>
<td>Cluster subjects probably have a history of maternal interference and have difficulty using the mother as a source of information during play and exploration.</td>
</tr>
<tr>
<td>52</td>
<td>t(26)= 3.58, p=.0006</td>
<td>Cluster subjects have less fined-tuned motor development.</td>
</tr>
<tr>
<td>7</td>
<td>t(26)= -3.47, p=.0009</td>
<td>Cluster subjects have lower sociability level or have higher threshold for positive affect than secure children.</td>
</tr>
<tr>
<td></td>
<td>t(26)</td>
<td>p</td>
</tr>
<tr>
<td>---</td>
<td>----------------</td>
<td>-----</td>
</tr>
<tr>
<td>81</td>
<td>t(26)= 3.46, p=.0009</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>t(26)= -3.42, p=.001</td>
<td></td>
</tr>
<tr>
<td>8 (* *)</td>
<td>t(26)= 3.35, p=.0012</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>t(26)= -3.21, p=.0017</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>t(26)= 3.17, p=.0019</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>t(26)= 3.16, p=.0019</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>t(26)= -3.07, p=.002</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>t(26)= 2.78, p=.004</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>t(26)= -2.72, p=.005</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>t(26)= -2.72, p=.005</td>
<td></td>
</tr>
</tbody>
</table>
Table 6. Continued

<table>
<thead>
<tr>
<th></th>
<th>t(26)=</th>
<th>p</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>-2.61</td>
<td>.0074</td>
<td>Cluster subjects show less positive affect than secure</td>
</tr>
<tr>
<td>48</td>
<td>-2.55</td>
<td>.0085</td>
<td>Cluster subjects do not display positive responses or positive expectations in relation to the mother.</td>
</tr>
<tr>
<td>39</td>
<td>2.39</td>
<td>.012</td>
<td>Cluster subjects show less affection and lower activity levels.</td>
</tr>
<tr>
<td>78</td>
<td>-2.34</td>
<td>.013</td>
<td>Cluster subjects are less affective than secure children.</td>
</tr>
<tr>
<td>60</td>
<td>-2.21</td>
<td>.018</td>
<td>Cluster subjects are less prone to trust or have confidence in mother's support and reassurance. This behavior reflects an interaction of the child's history with the attachment figure that influences how worried or afraid the child is.</td>
</tr>
<tr>
<td>25</td>
<td>2.08</td>
<td>.023</td>
<td>Cluster subjects are less easy to keep track of than secure (they do not play an active role in the secure-base pattern).</td>
</tr>
</tbody>
</table>

(*) The term cluster subjects is used to refer to the four subjects in the negative cluster.

(**) Items in bold are the ones characterizing cluster subjects versus secure subjects, after controlling for insecure ones (see text for details).

Despite the high number of significant items, however, since the analysis was conducted between cluster subjects (which is here considered a sub-category of insecure) and secure children, there remains the possibility that some of these items could also be characterizing insecure versus secure children, in general, and not cluster subjects in specific. After controlling for this possibility by performing the same procedure between secure and insecure groups, the items that are exclusively
characterizing the cluster subjects in this study are items 5, 8, 10, 48, 50, 60, and 78 (in bold in Table 5). Figure 19 shows the outcome of the t-tests on the single significant items between cluster subjects and secure children.

Figure 19. AQS security scores in secure children and the cluster subjects. Secure children scored significantly higher than the children in the cluster on items 5, 8, 10, 48, 50, 60, and 78.
Maternal sensitivity at the items level

As done for disorganized attachment, we can make use of the properties of the AQS method to investigate the presence of maternal sensitivity, empathy and affection in secure versus insecure relationships, as a way to investigate the impact they have on the development of cognitive capabilities (see chapter 2 for details). In order to investigate whether mothers in secure relationships were engaging more on a sensitive/affective level with their children than mothers in insecure relationships and if secure children were more empathic than insecure children, a series of 90 t-tests at the item level between secure and insecure children was performed. Due to the large number of tests performed, a significance level of .01 was selected for use. Scores for 24 items (1, 2, 7, 9, 15, 18, 19, 21, 25, 28, 29, 30, 35, 36, 38, 39, 52, 54, 58, 66, 70, 76, 81, and 90) were significantly different between secure and insecure children at p<.01 (see table 7 for details).

<table>
<thead>
<tr>
<th>Item #</th>
<th>t-test, Secure vs. Insecure</th>
<th>Item description (from the “rationale” of the AQS, Waters, 1998) underlying each item.</th>
</tr>
</thead>
<tbody>
<tr>
<td>58</td>
<td>t(36)= +4.65, p&lt;.0001</td>
<td>Insecure children show lower levels of sociability than secure children.</td>
</tr>
<tr>
<td>9 (*)</td>
<td>t(36)= -4, p=.0001</td>
<td>Secure children display more positive affect than insecure children.</td>
</tr>
<tr>
<td>15</td>
<td>(t(36) = -3.94, p = .0001)</td>
<td>Secure children are more confident in social interactions, and pay more attention to caregiver signals.</td>
</tr>
<tr>
<td>-----</td>
<td>-----------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>66</td>
<td>(t(36) = -3.52, p = .0005)</td>
<td>Secure children seem to be more emphatic and more emotionally open than insecure children.</td>
</tr>
<tr>
<td>28</td>
<td>(t(36) = -3.44, p = .0007)</td>
<td>Secure children enjoy physical contact with mother and find such contact comforting if distressed.</td>
</tr>
<tr>
<td>1</td>
<td>(t(36) = -3.3, p = .001)</td>
<td>Insecure children expect the mother to be intrusive and/or unresponsive.</td>
</tr>
<tr>
<td>29</td>
<td>(t(36) = +3.14, p = .001)</td>
<td>Insecure children seem to display the temperament trait “depth of attention” more consistently than secure children.</td>
</tr>
<tr>
<td>35</td>
<td>(t(36) = 3.17, p = .001)</td>
<td>Insecure children are more independent from mother than secure children.</td>
</tr>
<tr>
<td>54</td>
<td>(t(36) = 3.33, p = .001)</td>
<td>Insecure children probably have a history of maternal interference and have difficulty using the mother as a source of information during play and exploration.</td>
</tr>
<tr>
<td>81</td>
<td>(t(36) = 3.19, p = .001)</td>
<td>Insecure children have a history of insensitive care, have limited communication skills and interrupted play and exploration.</td>
</tr>
<tr>
<td>19</td>
<td>(t(36) = -3.07, p = .002)</td>
<td>Secure children are more compliant with mother as a reflection of mother’s non-interfering behavior. Secure children have a history of harmonious interactions with her.</td>
</tr>
<tr>
<td>39</td>
<td>(t(36) = 2.97, p = .002)</td>
<td>Insecure children show less affection and lower activity levels than secure children.</td>
</tr>
<tr>
<td>90</td>
<td>(t(36) = -2.98, p = .002)</td>
<td>Secure children manage to coordinate play with active efforts to monitor and maintain access to mother (indicative of competent secure-base behavior).</td>
</tr>
<tr>
<td>36</td>
<td>(t(36) = -2.82, p = .003)</td>
<td>Secure children more consistently display secure-base cycles that are considered a criterion for the existence of an attachment.</td>
</tr>
<tr>
<td></td>
<td>t(36)=</td>
<td>p</td>
</tr>
<tr>
<td>---</td>
<td>--------</td>
<td>-----</td>
</tr>
<tr>
<td>2</td>
<td>2.79</td>
<td>.004</td>
</tr>
<tr>
<td>52</td>
<td>2.77</td>
<td>.004</td>
</tr>
<tr>
<td>76</td>
<td>2.78</td>
<td>.004</td>
</tr>
<tr>
<td>70</td>
<td>-2.76</td>
<td>.0045</td>
</tr>
<tr>
<td>21</td>
<td>-2.65</td>
<td>.005</td>
</tr>
<tr>
<td>18</td>
<td>-2.5</td>
<td>.008</td>
</tr>
<tr>
<td>38</td>
<td>2.5</td>
<td>.008</td>
</tr>
<tr>
<td>7</td>
<td>-2.51</td>
<td>.0083</td>
</tr>
<tr>
<td>25</td>
<td>+2.41</td>
<td>.01</td>
</tr>
<tr>
<td>30</td>
<td>+2.36</td>
<td>.01</td>
</tr>
</tbody>
</table>

(*) In bold are the significant items that include elements of maternal sensitivity.
Among these 24 items that are significantly different in secure versus insecure children, 15 (62%) contain features that are indicative of maternal sensitivity (items in bold on the table; numbers 1, 2, 7, 9, 15, 18, 19, 30, 38, 39, 54, 66, 70, 76, and 81). Figure 20 shows the outcome of the t-tests on such significantly different items.

Analysis of the remaining, non-significant, 76 behaviors showed that only 20 (26%) possess elements of maternal sensitivity, empathy and affection (numbers
Thus, at a speculative level, there are more items indicative of maternal sensitivity, empathy and affection among those that differentiate insecure children from secure children than there are among those that are not significantly different between secure and insecure children.

Discussion of these findings will be provided in the following chapter.
CHAPTER 5 – DISCUSSION & CONCLUSIONS

This study investigated the possibility that secure preschool-age children outperform insecure children in specific cognitive measures. Also, the higher variability in cognitive performance that is found in insecure children as a group is investigated within an evolutionary framework and hypotheses are advanced for considering attachment as a continuum of patterns versus being a categorically distributed construct (as indicated by the SSP). The possibility that certain attachment patterns – that seem maladapted because they compromise the child’s socio-cognitive development – are adaptive from an evolutionary perspective is also investigated. The observer’s perception of secure versus insecure children’s behavioral desirability is analyzed and evolutionary implications are advanced. Finally, the AQS measure is exploited to investigate behavioral and personality traits that go beyond the purposes of attachment classification.

Attachment security

The mean AQS score was .35 (SD = .18), which is comparable to values found in previous research. A recent meta-analysis on 34 studies in which attachment was measured using the AQS, and in which the attachment relationship between mother and child was also sorted by an observer, reported a mean security score of .31 (SD = .16) (van Ijzendoorn et al., 2004).
Scores provided by the mothers averaged .35 (SD = .18). However, due to the small sample size (recall that only 14 maternal sorts were collected), mothers’ sorts were not used in the analyses.

**Attachment security and accuracy**

Secure children were found to be significantly more accurate than insecure children in the GYB game (see figure 5). Therefore, the hypothesis that secure children are more accurate than insecure children was supported for the cognitive skills needed to succeed in this specific game (mainly critical thinking and problem-solving given spatial and directional cues). Differences for the other two games were not statistically significant, but a trend in the expected direction was detected in both.

The presence of higher critical thinking skills and abilities to problem-solve in secure versus insecure children support previous findings. From an evolutionary perspective, this result can be accounted for in terms of different reproductive strategies of secure and insecure children. As seen in chapter 1, it is argued that individual differences in attachment security may reflect evolved strategies that enhance the individual’s reproductive success in a particular environment. According to Belsky (Belsky et al., 1991; Belsky, 1999), by experiencing high investment and care on the part of their caregivers and by living in stable and resourceful environments, secure children are expected to allocate resources to maximize the quality of development. Thus, their optimal developmental strategy would be to exploit long-term learning and delay procreation. On the other hand, insecure children
experience insensitive, inconsistent, or rejective parenting and live in risky and uncertain environments. As a consequence, they should allocate resources to maximize reproductive at the expense of developmental quality, and their optimal reproductive strategy should be to invest in early mating (and procreation). The fact that in this analysis secure children displayed higher critical thinking skills than their insecure peers can be explained, from an ultimate-level perspective, as a result of having more opportunities and resources than insecure children to enhance socio-cognitive development\(^{33}\).

**Attachment security and critical thinking skills**

Despite showing a positive correlation between attachment security and performance, secure children in this study did not significantly outperform insecure children on the “critical thinking questions” (refer to chapter 3 for details) (see figure 6). Therefore, from this analysis alone, it cannot be concluded that secure children had better critical thinking skills than insecure children, although a trend in that direction was detected. However, it is interesting to notice that, when the cluster of four subjects with lowest AQS scores was excluded from the analysis, the correlation became significant (see figure 7). This implies that those four subjects skew the results and, when not considered, secure children outperform insecure children in measures of critical thinking. A discussion of the nature of the four subjects at the

\(^{33}\) Recall from chapter 1 that some limitations apply to this theory. For instance, it does not account for the different reproductive strategies of the two sexes (Amin & Thompson, 2001; Kirkpatrick, 1999; Buss & Greiling, 1999) or for the role of genes in developmental outcomes (Rushton, 2001).
lower end of the AQS continuum is provided below. In terms of evolutionary implications, the same arguments outlined in the previous paragraph can be applied to this finding; secure children tend to possess higher cognitive skills than insecure children, ultimately because of the different reproductive strategies of the two groups.

In the correlations between security and the observer’s own judgments of children’s abilities, securely attached children showed a tendency to perform better than their insecure peers. But, based on this procedure and analysis, I cannot advance major conclusions on these findings. First, the ratings may not reflect a real situation because they heavily rely on subjective judgments. Second, the very low correlations found in this part of the analysis could be due to the restrictions of a 1-3 point scale.

Attachment security and variability in cognitive performance

The finding that measures of accuracy were significantly more variable in insecure versus secure children (see figures 8 and 9) implies that insecure children, as a group, were more inconsistent in their cognitive performance than secure children. This is interesting if we consider the variability in terms of attachment classification. While there are three attachment descriptions that are associated with insecure (A, C, and D)\textsuperscript{34}, only one refers to secure (B) children. In addition, secure children are reported to represent about 70% of normal populations of middle-class samples. Therefore, the variability of the insecure part of the continuum is even more

\textsuperscript{34} Since the methodology used in this study did not allow to distinguish A from C subjects, and given that the identification of the D group is only speculative (see later for details), the above considerations apply to insecure children, as a group, versus secure children (and not to A, C, and D as separate categories).
prominent if we adjust it to the number of individuals pertaining to each one of the categories. The fact that variability in attachment classification is reflected in cognitive measures has not been discussed in the literature yet and it allows interesting speculations in terms of evolutionary explanations for the development of the different attachment types. As seen in chapter 1, insecure attachment could indicate possible adaptive developmental strategies (Belsky et al., 1991; Belsky, 1999; Chisholm, 1996; 1999a). Ambivalent and avoidant (and, I add, disorganized) types of attachment, it is argued, are related to distinct future “cognitive, social-emotional, and perceptual difficulties” (Chisholm, 1999b). Thus, the fact that data from the present study reveal a higher variability in cognitive performance in insecure (as a group) versus secure children is interesting in light of modern evolutionary theories. We might wonder what is the origin of such substantial cognitive variability; does it reflect variations in cognitive performance among the different attachment patterns or does it just represent a greater cognitive variability of insecure children as a group? We might question what is the extent of such variability and whether different kinds of insecurity actually yield various cognitive outcomes.

According to Chisholm (1999a;b), different cognitive capabilities between secure and insecure – as well as within A and C attachment types - are explained in terms of reproductive strategies. Under this perspective, both avoidant and ambivalent attachment types are considered adaptive, but for different reasons. While avoidant attachment is fostered by parent/offspring conflict that promotes parents’ unwillingness to care for the infants, the ambivalent type is fostered by adverse
environmental conditions that promote inability for the parents to properly provide for their young. The developmental strategy for avoidant children would be to maximize current survival and avoid a rejective parent. In contrast, ambivalent children would try to maintain investment from a “poor” parent, and to have an earlier onset of puberty (Chisholm, 1999b). Chisholm does not further discuss the implications of such different reproductive strategies as they specifically relate to cognitive outcomes in A and C types, nor he does consider the D type in his arguments. I believe that finding the foundations for the different cognitive skills in avoidant and ambivalent patterns would be illuminating in terms of explaining the evolutionary implications of A and C even further (see later discussion ‘investigating the nature of the subjects in the low-score cluster’). In addition, it would allow us to speculate on the evolutionary scenario responsible for the disorganized attachment pattern, which has not been investigated in the literature yet.

Why would differently attached children display different cognitive capacities? Why would they use different cognitive abilities to problem-solve? Is it a quantitative or qualitative difference? Two are the possibilities in terms of cognitive performance (see figure 21): a) either the three insecure types, taken individually, are much more variable than the secure type (thus more of a quantitative difference), or b) each one is just as variable as the secure type but, because they uncover separate portions of the “cognitive spectrum”, they display more variability as a group (thus more of a qualitative difference). The first scenario suggests that each of the three insecure attachment classifications (A, C and D) yields a broad variety of cognitive
capabilities that range from “very low performance” to “performance in the range of secure children’s”. The second scenario would indicate that each of the insecure attachments occupies a separate (but partly overlapping) portion in the cognitive performance spectrum (with a strong indication that D falls at the lower end of the performance range, but with no indication as to the relative position of A versus C).

Figure 21. Variability in cognitive performance: two scenarios.
I believe that an appreciation of the foundations of distinct cognitive outcomes in differently attached children could help us better understand whether we can speak of categorical attachment classification or if we should view attachment as a continuum of patterns. Under scenario a) we would argue that the different attachment types are category-specific, while scenario b) would indicate that they are distributed along a continuum. Because of the arguments raised in chapter 1 in favor of a continuous view of attachment classifications, I am more inclined to accept scenario b), whose continuously distributed cognitive outcomes support the notion of continuity in attachment classifications.

Future studies should aim at investigating the cognitive skills of the three insecure attachment classifications to see in what important way they differ and to better understand the whole construct of attachment security; its distribution and its evolutionary implications.

Attachment Security and observer’s subjective ratings of child’s behavior

Povinelli et al. (2005) argued that parents are more likely to invest in infants who reflect higher quality. As they put it, “all other things being equal, parents will invest more when the perceived quality of the infant is higher […] we suggest that parents would have invested more in infants who exhibited behaviors similar to their own, especially when the behaviors caused adults to attribute a higher degree of infant social understanding”. The authors argue that, by employing these strategies, infants are capable of exploiting additional care by eliciting positive affect from their
caregivers. They conclude, “by producing behaviors that lead to positive regard and affect, and increasing the attachment between caregiver and infant, the infant’s behavior can reduce the very real possibilities of suffering neglect, abuse, or abandonment” (Povinelli et al., 2005). This is an interesting hypothesis but it is based on theoretical assumptions and not on empirical data. The present study is the first, to my knowledge, that attempts to test this hypothesis, although on a qualitative basis. As expected, it was found that secure children were more often described using positive remarks, while the opposite was true for insecure children. Thus, the hypothesis that secure children are more likely to be associated with “more desirable” characteristics, and insecure children with “less desirable” ones is supported. When analyzing situations where the AQS analyses were run independently from the cognitive assessments (to control for subjective biases), significant differences were partially detected but the same trend was always confirmed. Lack of significance was most likely due to the reduced sample sizes of the sub-samples.

Future studies should aim at further testing this possibility using quantitative analyses and larger samples in order to be able to detect significant differences, especially in cases in which sub-samples need to be used (e.g., when needed to control for subjectivity biases).

**Investigating the nature of the subjects in the low-score AQS cluster**

Figure 4 shows the distribution of AQS scores for the 38 subjects. There are two possible explanations for the nature of the circled cluster; they could either be
statistical outliers (unusually great “noise”), or they could represent children who are conceptually different from the rest of the sample and are not classifiable in any of the A, B, or C categories (i.e., disorganized children, D, see chapter 1 for details). In fact, although the AQS methodology is not designed to discern among the different insecure categories (A, C and D; avoidant, resistant and disorganized, respectively) (Solomon & George, 1999), the discontinuity of the AQS scores in this sample suggests the possibility that the lower values represent disorganized children. Previous studies have reported disorganized infants’ and preschoolers’ AQS security scores being significantly lower than those in other attachment classifications (Seifer et al., 1996; Van Bakel & Riksen-Walraven, 2004). Seifer et al. (1996) report an average AQS score of -.20 for disorganized infants (and an average of .43 for secure infants), while van Bakel and Riksen-Walraven (2004) report a mean of .04 for disorganized and .32 for secure infants. Given the similar values in the present study, and because those four children are clustered, there is the possibility that they represent disorganized children. Although it is not possible to test this hypothesis based only on the AQS procedure, speculations based on the nature of the AQS classifications for those four subjects are later advanced (see ‘use of the AQS items subset to identify disorganized attachment’).

In order to investigate whether the clustered subjects represent outliers or disorganized children, correlations between AQS and accuracy were computed both including and excluding those four children. When the cluster was not included in the analysis, the correlation between AQS and accuracy of the GYB, and especially the
CM game, became stronger (see figure 17). The clustered subjects in effect skew the results; when they are not considered as part of the data set, the remaining children perform significantly better than when the cluster is included, especially in the CM game. This suggests that the clustered subjects have some cognitive capacities that differ from the rest of the distribution, and thus they are more likely to represent a disorganized attachment pattern versus just being outliers.

Being able to identify disorganized children and their cognitive capabilities allows for speculations on the evolutionary implications of D attachment, especially as to whether we should consider it is an adaptation or a maladaptation (refer to chapter 1 for details). The fact that those four subjects perform more poorly than the rest of the distribution could either indicate possible evolutionary, adaptive strategies of the disorganized attachment pattern, or the fact that the D pattern is a maladaptation. Chisholm (1999b) has argued that A and C attachment patterns represent different developmental strategies in response to various kinds of adverse conditions, but has not made any inferences about type D attachment. Belsky (1999) has pointed out that, for the moment, it is not possible to advance similar evolutionary considerations as they relate to disorganized children because the D pattern has been discovered too recently (in 1990) for longitudinal studies to provide data on the reproductive success of individuals classified as disorganized in infancy. Thus, we do not yet know if disorganized attachment hinders later reproductive success and we cannot base our hypotheses based on the relative reproductive fitness of disorganized individuals, as can be done for A and C. I believe that this gap can be resolved by
investigating the cognitive outcomes of disorganized children (refer to earlier
discussion on ‘attachment security and variability in cognitive performance’). As
argued in chapter 1, I believe that the disorganized attachment pattern may represent
an adaptive response to extremely unfavorable conditions and that it is fostered by
selection for plasticity in our species. Future studies should aim at investigating the
long-term reproductive success and cognitive development of disorganized
individuals as a way to raise hypotheses on whether they are adaptive or maladaptive.

With reference to figures 18 and 19, the fact that in the CM game the
correlation between security and accuracy becomes significant when the clustered
subjects are excluded from the analysis raises interesting hypotheses. The main skill
assessed in the CM game is short-term memory (unlike problem solving given spatial
and directional cues, basic mathematical concepts and relationships, ordering and
sequencing in the GYB and DL games, respectively). Thus, the results indicate that
there is something about memory that distinguishes those four subjects from the rest
of the distribution. In this respect, it has been reported that attachment has
implications for children’s memory, especially in the preschool years, and that
attention has a major role in mediating the relation between attachment and memory
(Alexander, Quas, & Goodman, 2002). Most studies on attachment and memory in
infancy and childhood focus on infants’ memory for positive versus negative social
events (Belsky, Spritz, & Crnic, 1996), preschoolers’ memory for potentially stressful
stories (Kirsh & Cassidy, 1997), and children’s memory for attachment-related
storytelling (Alexander, et al., 2002). Most authors agree that children with secure
attachment have better memory for stories (although Belsky et al., 1996 make a distinction and report that insecure infants have better memory for negative events, while secure infants have better memory for positive events) and are less distractible than insecure children (Kirsh & Cassidy, 1997). In this study, clustered subjects had significantly poorer memory skills than subjects in the rest of the distribution. Thus, the fact that the relation between accuracy and security becomes significant when the cluster is not included in the analysis might confirm previous findings that secure children have better memory skills than insecure children. However, since the analysis was conducted between the clustered subjects and the rest of the security distribution (which includes secure and insecure children), and not between secure and insecure subjects, such finding needs further testing.

Use of Grubbs’ test failed to demonstrate those four subjects as outliers in the data. Thus, also in light of the previous considerations, we can conclude that clustered subjects most likely represent children classifiable as disorganized, versus being mere outliers in the data set.

Use of the AQS items subset to identify disorganized attachment

To further investigate the possibility that clustered subjects represent disorganized children, behavioral characteristics of the 90 AQS items (for both the clustered and non-clustered subjects) were independently analyzed with the intent to identify disorganized children by their different scores on the items of interest (items underlying behavioral constructs that characterize disorganized children).
Items number 5, 8, 10, 48, 50, 60 and 78 have been found to significantly characterize the clustered from non-clustered subjects in the present study (Table 6 and figure 20). Looking closely at the qualitative features of such items, the resulting picture for the children in the cluster is that they present more negative affect and less positive affect, do not display positive responses or positive expectations in relation to the mother, and are less confident in her availability or responsiveness. Moreover, they are less prone to trust or have confidence in mother’s support and reassurance, and they have a negative orientation toward people. These behavioral characteristics are all associated with children classified as disorganized. Thus, by displaying most of the characteristics associated with disorganized attachment, those subjects should, at least on a qualitative basis, represent disorganized children.

Given the importance of identifying disorganized attachment that I have outlined above, and given the critiques I advanced to the use of the Strange Situation Procedure in attachment research (see chapter 1 for details), I believe that the use of the AQS at the items level to identify disorganized children is a valid and useful approach to investigating questions on children’s behavior that go beyond dichotomous secure-insecure measures. The AQS has a great potential for exploring behavioral constructs that go beyond attachment security and future studies should exploit and standardize the methodology.

**Maternal sensitivity at the AQS items level**
As an example of the use of the AQS to analyze behavioral constructs that are unrelated to the mere secure-insecure classification, a similar procedure as the one for disorganized children was used to identify characteristics of maternal sensitivity, and empathy in mother-child secure and insecure dyads. Children in secure relationships, compared to insecure ones, were found to have higher sociability and lower threshold for positive affect, more confidence in social interactions, more attentiveness to caregiver’s signals, more compliance with their mothers, a history of sensitive care and harmonious interactions, more secure-base behaviors, and were more empathic and emotionally open. Conversely, insecure children expected the mother to interfere with their activities, showed more negative affect than secure children, had lower tolerance for frustration, displayed less affection, and had limited communication skills that also translated into difficulty using the mother as a source of information. On their part, the same analysis revealed that mothers in secure relationships, as opposed to mothers of insecure children, were more sensitive to their child’s behavior modifications, displayed less interfering/intrusive behavior, and were more responsive to the child’s signals. Thus, the hypothesis that in secure relationships mothers are more sensitive and show more affection, and infants are more empathic, is supported.

An analysis of the role of maternal sensitivity and infants’ empathy within the attachment relationship is important since empathy and maternal sensitivity (along with maternal cognitive engagement that was not analyzed here) act as intermediaries in the development of ToM through an enhanced sensitivity to the others’ feelings.
and mental states (Baron-Cohen, 2005; Moore & Symons, 2005). As seen in chapter 2, it is argued that individual differences in attachment are related to measures of empathy and theory of mind (Baron-Cohen, 1995; Brockway, 2003; Chisholm, 1999b). Given that the empathic bond developing between mother and infant should represent the place where to look for the ontogenetic and phylogenetic appearance of mentalistic insights and ToM, an analysis of its features within the attachment relationship is very relevant. Future studies should aim at improving and standardizing the methodology in order to explore these findings even further.

In conclusion, most of the hypotheses advanced were supported and a trend in the desired direction was always detected:

1) Attachment security significantly correlated with accuracy in the GYB game. Thus, the hypothesis that secure children outperform insecure children in critical thinking and problem-solving (given spatial and directional cues) was supported. A trend in the expected direction was also detected in the other two games, although the differences were not statistically significant. Secure children also outperformed insecure peers in measures of short-term memory. This was a product of the analysis that was not hypothesized at first.

2) Secure children outperformed their insecure counterparts in measures of critical thinking skills (although there is the important limitation of using a 1-3 point scale);
3) Insecure children were found to be more variable than secure children in cognitive measures. This possibility was not foreseen before the start of the project;

4) Secure children were more often associated with “positive” comments and insecure children with “negative” remarks. Thus, the hypothesis that secure children are perceived as being of better quality was also supported;

5) Children in the low end of the attachment continuum (clustered subjects) could tentatively be considered as disorganized;

6) The hypothesis that mothers in secure relationships are more sensitive and affective and secure infants are more empathic than mothers and infants of insecure dyads, was supported.

Limitations and suggestions for future research

Some limitations to the present study need to be addressed. An important constraint was the small sample size that often did not allow detecting significant differences that may have been found if the sample had been larger. Although statistically significant results at an alpha level of .05 were not always detected, a trend in the expected direction was almost always found. Finally, the sample size limitation was even more prominent in those cases when given analyses required a break down of the subjects in smaller samples (for instance, in the analysis of the “positive” versus “negative” comments in secure and insecure children).
A second important limitation was that the whole research was conducted by only one observer. However, I believe this presents advantages as well as disadvantages. On the negative side, there is the possibility that the observer could have been biased. For instance, since the AQS analysis was performed at times before, and at times after the cognitive assessments, the observer could have been biased in either of the two assessments because she would have already met a given child on a personal level in the previous occasion. Moreover, a part of the analysis was based on the observer’s subjective ratings of behaviors, and this is obviously an important limitation that needs to be addressed. However, I also believe that having only one observer doing all the assessments had its positive sides. First, there was consistency in how the cognitive assessments were conducted. Given that the software used was not self-explanatory and was in a language (English) that the children did not well understand, the observer was in charge of translating and explaining the various parts of the games. Also, at times, the children needed to be led to the right direction by receiving some suggestions on the part of the observer. The means through which this was done was always very consistent. Such a consistency would not have been possible (at least in part) if more observers were doing the assessments. Moreover, also with respect to the AQS evaluations that were conducted in the children’s homes, a consistency in approaches that was always maintained by the observer, and this consistency would have been difficult to obtain if more observers conducted the observations. Finally, consistency in the way the items were sorted was an important factor in guaranteeing fairness of AQS scores. Such objective
procedures could not have been guaranteed if more observers conducted the different assessments.

Finally, it is important not to forget that this study was of an exploratory nature. I believe this also has its positive and negative aspects. In fact, although some predicted hypotheses were not supported, other findings, that were not foreseen, led the research in an interesting direction that would have not been possible if the approach had not been exploratory.

In conclusion, the present study confirmed previous findings on the improved cognitive performance of secure children compared to insecure. It also went beyond this by analyzing other important predictors and outcomes of the attachment relationship that have not been analyzed in the literature yet. I believe this study presents interesting suggestions for future investigations. Attachment research has just started to broaden its ultimate perspectives on the mother-infant relationship by considering important proximal determinants for the development of attachment and theory of mind. Future studies should aim at considering attachment under an even wider perspective that takes into account genetic factors, such as temperament, as interacting with the environment in producing developmental outcomes. I believe ultimate and proximate considerations on the development of attachment and how they relate to the development of theory of mind need to be integrated. Finally, a view of attachment as a continuum versus being categorically distributed should be more informative. Accordingly, the AQS methodology should be exploited and
standardized to investigate constructs that go beyond the attachment classification and to explore the evolutionary implications of individual differences in attachment.
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