University of Minho
Institute of Education and Psychology

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PSYCHOPHYSIOLOGICAL CORRELATES OF ATTACHMENT ORGANIZATION:
Linear and non-linear analysis of autonomic regulation during the Adult Attachment Interview

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Doctoral Dissertation
Speciality Area : Clinical Psychology

Advisors:
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Professora Doutora Isabel Soares

December 2007

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John M. Klein

FCT
Fundação para a Ciência e a Tecnologia
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1.Gebot:

Et es, wie et es!

2.Gebot:

Et kütt, wie et kütt!

3.Gebot:

Et hätt noch immer joot jejange!

4.Gebot:.

Wat fott es, es fott!

5.Gebot:

Et bliev nix, wie et woor!

6.Gebot:

Kenne mer nit, bruche mer nit, fott domet!

7.Gebot:

Wat wellste maache?

8.Gebot:

Maach et joot, ävver nit ze of!

9.Gebot:

Wat soll dä Quatsch?

10.Gebot:

Drink doch eine met!

In memory of my father

Helmut Klein

PSYCHOPHYSIOLOGICAL CORRELATES OF ATTACHMENT ORGANIZATION:

Linear and non-linear analysis of autonomic regulation during the AAI

Abstract

During the last half century, Attachment Theory reached an evermore crucial place inside developmental psychology. In fact, since Bowlby's theoretical groundwork (1962/82, 1973, 1980) in association with Ainsworth's empirical drives (e.g., 1967, 1982, 1983), attachment research grew astonishingly fast not only to explain the normative processes of human development, but also considering psychopathological processes. As an extension of the research, lately, there has been a rising interest on the role of biological measures (electrodermal and cardiac activity) and their relationship with adult attachment organization (Dozier & Kobak, 1992; Roisman, Tsai & Chiang, 2004; Roisman, 2007).

Under this umbrella, the present study aims to explore, with linear and non-linear data analysis models, the relationship between attachment organization and autonomic activity in an non-clinical context. The sample comprised 50 female participants from the north of Portugal, aged between 17 and 27 (M = 21.20, SD = 3.26), which were monitored, with a multimedia system (Bio-Dual channel and Representation of Attachment Multimedia System), for skin conductance and heart rate while answering to the *Adult Attachment Interview* (AAI, George, Kaplan & Main, 1985). The AAI was scored with Kobak's Q-sort method (Kobak, 1993), allowing to classify each participant in three attachment patterns (secure, dismissing or preoccupied), and two attachment strategies (security vs. insecurity and hyperactivation vs. deactivation).

The results, using a linear data analysis approach based on the mean, evidenced an attachment organization patterns differentiation, throughout the AAI questions, only for skin conductance, but not for heart rate. The non-linear data analysis approach, addressed the variability and sudden shifts not explained by the mean, revealed attachment organization differences in terms of heart rate in some of the critical attachment questions of the AAI. The analysis of the heart rate variability, using the LF/HF ration evidenced no differences at all between attachment patterns.

The main results are discussed in terms of attachment theory and how the psychophysiological approach may contribute for a deeper understanding of the biological correlates of attachment.

Key words: Attachment, Adult Attachment Interview, Attachment patterns, Skin conductance, Heart rate.

CORRELATOS PSICOFISIOLÓGICOS DA ORGANIZAÇÃO DA VINCULAÇÃO:

Análises lineares e não-lineares da regulação autonómica durante a Entrevista de Vinculação do Adulto

Resumo

Durante o último meio século, a Teoria da Vinculação alcançou cada vez mais um papel relevante nos meandros da Psicologia do Ddesenvolvimento. De facto, desde as bases teóricas de Bowlby (1962/82, 1973, 1980) até às pretensões empíricas de Ainsworth (e.g. 1967, 1982, 1983), a investigação da vinculação tem crescido a um ritmo alucinante, não só explicando os processos normativos do desenvolvimento humano, mas também considerando os processos psicopatológicos. Recentemente, na extensão do seu campo de investigação, tem surgido um crescente interesse relativamente ao papel das medidas biológicas (actividade electrodérmica e cardíaca) e a sua relação com a organização da vinculação no adulto (Dozier & Kobak, 1992; Roisman, Tsai & Chiang, 2004; Roisman, 2007).

Neste sentido, o presente estudo pretende explorar, com modelos de análise linear e não-linear, a relação entre a organização da vinculação e a actividade autonómica no âmbito de um contexto não clínico. A amostra é constituída por 50 participantes femininas do norte de Portugal, com idades compreendidas entre os 17 e os 27 anos (M = 21.20; DP = 3.26) de idade, que foram monitorizadas com um sistema multimédia (Bio-Dual channel and Representation of Attachment Multimedia System) em termos de condutância da pele e frequência cardíaca, enquanto respondiam à *Entrevista de Vinculação do Adulto* (Adult Attachment Interview; AAI, George, Kaplan & Main, 1985). As AAI's foram cotadas mediante o método do Q-sort de Kobak (1993), permitindo enquadrar cada participante em termos dos 3 padrões da vinculação (seguro, desligado ou preocupado) e duas estratégias vinculação (segurança vs. insegurança e hiperactivação vs. desactivação).

Os resultados, usando uma abordagem linear de análise de dados baseada na média, evidenciaram uma diferenciação em termos de condutância da pele, mas não de frequência cardíaca entre os padrões da vinculação, no decorrer das questões da AAI. As abordagens não-lineares de análise de dados, focadas na variabilidade e nas alterações súbitas não explicadas pela média, revelaram que os diferentes padrões de vinculação se distinguiam em termos de frequência cardíaca em algumas das questões da AAI. As análises de variabilidade cardíaca, usando o rácio LF/HF, não evidenciaram quaisquer diferenças entre os padrões de vinculação.

Os principais resultados são discutidos em termos da teoria de vinculação e da forma como a abordagem psicofisiológica poderá contribuir para uma compreensão mais profunda dos correlatos biológicos da vinculação.

Palavras-chave: Vinculação, Entrevista de Vinculação do Adulto, Padrões de vinculação, Condutância da pele, Frequência cardíaca

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If this would be a story it should start “once upon a time”, but it much more the end of what was for me a unique journey. A journey with up and downs, with joy and grief, with matchless experience and some troublesome turbulence, but it was worthwhile for my development as a researcher and as a person; and where along all my steps forward, foremost, a series of personalities were key-players in taking me there. It is to them that I will dedicate the following lines as a tribute to them and as an expression of my most felt gratitude.

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And to all others, that I might have forgotten, which were important for me along these journey, my deepest gratitude for everything you have done for me.

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Abbreviation/ Symbol	Definition
AAI	Adult Attachment Interview
AMBIANCE	Atypical Maternal Behavior Instrument for Assessment and Classification
Bpm	beat per minute
BioDReAMS	Bio Dual-channel and Representation of Attachment Multimedia System
CNS	Central Nervous System
CRI	Current Relationship Interview
DH	Deactivation-hyperactivation
DR	Defense response
PAMaDeP	Developmental markers of psychopathology; Protocolo de Avaliação de Marcadores do Desenvolvimento na Psicopatologia
DRD4	Dopamine D4 receptor
ECG	Electrocardiogram
EDA	Electrodermal activity
EEG	Electroencephalography
FFT	Fast Fourier Transformation
HR	Heart rate
HRV	Heart rate variability
IBI	Interbeat Interval
LF/HF	Low frquency/ High frequency (ratio) waves of the heart rate
MAOA	Monoamine oxidase A
NICHD	National Institute of Child Health and Human Development
OR	Orientation Response
RMSE	Root-mean square error
SCL	Skin-conductance level
SS	Strange Situation
SCL 90-R	Symptom Checklist
ß	The slope of the regression line
TAS	Toronto Alexythymia Scale

INTRODUCTION

The present research, supported by a doctoral grant of the Portuguese Foundation for Science and Technology (ref. SFRH/BD/22261/2005), is part of a larger research project about attachment evaluation and autonomic regulation along the *Adult Attachment Interview* (George, Kaplan & Main, 1985), using a multimedia system called BioDReAMS (which its development was supported by the Grants 43/96 and 25/02 of the BIAL Foundation).

Neither Bowlby, when he started his first observations about the connection between maternal deprivation and juvenile delinquency, nor Mary Ainsworth when she applied to work with Bowlby and her later move to Uganda, could at that time imagine what their first impressions and theoretical groundings would become an impressive wide-spreading research line with an huge impact on modern psychology. Maybe the secret for such an success across the boundary areas of psychology (clinical, social, emotional, developmental, physiological, etc), is hidden inside the definition of attachment itself - "any form of behavior that results in a person attaining or maintaining proximity to some other clearly identified individual who is conceived of as better able to cope with the world. It is most obvious, whenever the person is frightened, fatigued or sick, and is assuaged by comforting and caregiving"(Bowlby, 1988, pp. 26-27). Even if the bulk of attachment research has addressed infants' and young children's behavior, with this definition Bowlby justifies his inclusive view that attachment is an essential, life-long human need; and in fact, longitudinal data and studies in adulthood had progressively proven such argument.

The actual study evaluates the link between attachment organization and physiological indicators of autonomic regulation - skin conductance and heart rate and heart rate variability - in an non-clinical sample. The *Adult Attachment Interview* evaluation was performed in a laboratory-like setting using the BioDReAMS (**Bio D**ual-channel and **Re**presentation of **A**ttachment **M**ultimedia **S**ystem) as monitoring device. This system allows a synchronized integration of audiovisual data, with the biological signals and behavioural features along the interview. Further, this system has statistical modules that allow topursue several analyses with cardiac and skin conductance activity data.

This thesis strives to empirically explore the connection between attachment and autonomic regulation in a non-clinical sample. This exploration is accomplished by a twofold vector methodological strategy. The first vector crosses the evaluation of the quality of attachment organization regarding the three attachment patterns (autonomous-secure, insecure-preoccupied and insecure-dismissing), and the two strategies classification (secure vs. insecure and hyperactivation vs. deactivation). With this conception, attachment evaluation integrates two different approaches, a categorical (patterns) and a dimensional (strategies), that complete each other.

The second vector refers to the evaluation of autonomic regulation indicators as measured with BioDReAMS. The data analysis entails skin conductance, heart rate and low frequency/high frequency ratio as indicators of the variability throughout all the questions of the *Adult Attachment Interview,* and those questions where specific critical features of attachment relationships (and its development) were asked.

With the integration of these methodological-driven vectors, applied to a sample of non-clinical participants, a double-crossing of aspects and variables of biological and psychological nature in the context of interpersonal relationships as analyzed by the attachment theory is allowed. Thus, the consequent empirical exam between attachment-related variables and autonomic activity is explored throughout four interwoven methodological and theoretical aims.

The first one pursues to develop a psychophysiological evaluation procedure (data collection and analysis), integrated into the natural course of the adult attachment evaluation method of the AAI.

The second aim, intimately linked with the previous one, tries to test the physiological evaluation procedure on a non-clinical group of participants, during an attachment evaluation situation.

A third aim strives to explore the quality of narrative and discursive organization of attachment, especially on those issues that are linked with the attachment developmental history of the participants. Therefore, the Attachment Q-sort method (Kobak, 1993) is used, allowing to obtain attachment patterns and strategies which able to preview attachment evaluation both on a categorial and as on a dimensional approach.

Finally, this study aims to combine the usage of linear and non-linear data analysis strategies for physiological data. It is expected that, especially, the non-linear

physiological data analysis will show a more detailed view about the physiological changes during attachment-related themes.

This dissertation is organized into three main parts: a first one that sets the theoretical groundwork and contextualization of the study - attachment and psychophysiology - by revising relevant researches on that topics; a second part is dedicated to the empirical study - method and results; and finally, a third part, that presents the discussion and conclusion of this work.

Along the first chapter, the cradle of attachment theory is presented, introducing the three main figures and their contributions. Bowlby's (1969/82; 1973; 1980) seminal insights and theoretical breakthroughs are presented. Mary Ainsworth's development of observational methods and her drive for empirical foundation for most of Bowlby's theoretical assumptions that influenced her so much are discussed. And of course "the move to the representational level, Mary Main's landmark with the Adult Attachment Interview (AAI, George, Kaplan & Main, 1985) is emphasized. Additionally, the core concepts on which attachment theory is grounded are revised. Moreover, the two main methodological lines of attachment - questionnaire-driven measures and interview-driven measures - are critically presented, reflecting their "Ying-Yang" and their existence as "two-faces of the same coin". In fact, both methodological traditions pushed further attachment research to the well evolved point as we nowadays have; the more academic-social-psychology oriented used mainly questionnaires and were responsible to link attachment and its variables with a large amount of fields, from social-emotional themes to sports and work issues, and of course it gave emphasis to large samples. Otherwise, the more clinical-psychiatric-influenced line, and therefore more linked with interviews-based approaches, deepened our understanding about the role of attachment in psychopathology, stressing research to pursue the developmental process of attachment throughout childhood and even adulthood. Given the scope of this dissertation, the last attachment methodological approach is presented with a detailed increment on the importance of the AAI. Definitely, the AAI was a step forward in attachment research that opened new empirical routs, mainly, the quest of (a) find predictors of SS based on parental attachment quality and the existence of the "transmission gap", (b) determine normative data about adult attachment as assessed by interview classification, (c) describing with a longitudinal study design possible factors

that mediate attachment development from infancy to adulthood. Studies of these three vectors are presented and discussed in terms of their contributions for attachment theoretical building.

In the second chapter, the importance of psychophysiology studies, which aboard behaviour from a standpoint that encompasses the biological mechanisms underlying behaviour, is highlighted. Within this project context the two biological measures - electrodermal and cardiac activity - are presented, and their biological foundations, measuring procedures and (possible) psychological significance are described. At continuation, some key concepts of psychophysiology as law of initial values, arousal and activation, orienting response and defensive response are briefly portrayed. The final part of this chapter is concerned with bridging the actual state of the art of attachment and its physiological correlates. Here, a revision of studies that since the 1980's have assumed a psychobiological perspective of attachment are presented, first those which were concerned with children and then those which were accomplished with adults.

The second part of the dissertation is dedicated to the outline of the empirical project performed with 55 young non-clinical females, which were monitored for electrodermal and cardiac activity with the BioDReAMS (a system which also were improved along the accomplishment of this dissertation). All these females were screened for psychopathology, and fulfilled several self-report questionnaires about developmental markers, emotional features and sociodemographical issues. In addition, data analysis procedures and the corresponding results are outlined.

The last and final part of the dissertation is confined to the data discussion and main conclusions, which of course take into account the methodological contributions and the links between attachment and autonomic regulation, the central topic of this project, as measured with electrodermal and cardiac activity. Some hypothesis and possible future study designs are also suggested

CHAPTER I: ATTACHMENT: A PREVIEW ABOUT HOW EVERYTHING BEGUN

With more than five decades since the first formulations about attachment theory, the purpose of a complete review of the literature on attachment is almost unfeasible by its sheer volume. The American Psychological Association PsycINFO_1887 database, by instance, referred a total of 16.674 entries mentioning attachment, being 1068 of those entries just published during 2006, which is a clear evidence of attachments relevance in the scientific community. A purposeful approach will be outlined, selecting and referencing those views, approaches, studies and methods reckoned to have major impact on the field and as most apposite to the aims of the present dissertation. Thus, this chapter will be composed by three main parts. The first part will draw a brief historical review of the main prominent personalities for attachment research. In the second part, the theoretical and conceptual framework will be presented. The third part will be dedicated to adult attachment, its concepts and definitions, and highlight the methodological issues and their major studies.

1. Tracing attachment to its roots

Independently how we may consider the field of attachment it is impossible to not stumble over names like John Bowlby and his six-year younger colleague Mary Ainsworth. As John Bowlby is considered the "founding father" of attachment field by his theoretical and conceptual formulations, Mary Ainsworth is considered the "founding mother" of attachment as an experimental research field by introducing methods and research protocols. What nowadays seems a natural consequence of combining ideas and studies is far more a wrong idea or as Freud stated (1926) when we looked backwards the "chain of events appears continuous" although if we would start from the premises to the final results "we no longer get the impression of an inevitable sequence of events which could not have been otherwise determined. This is because attachment theory were in some aspects determined by episodical oddity in which both John Bowlby and Mary Ainsworth received important contributions and insights from others (not)withstanding. Therefore, a review of the major circumstances that lead

Bowlby and Ainsworth to the theoretical and methodological milestones for the origin and progress of attachment theory will be presented.

1.1. Edward John Mostyn Bowlby (1907–1990) and the birth of attachment

Before outlining the main professional landmarks that stimulated and conducted Bowlby to the foundation of attachment theory, let us consider some issues about his family background that can be stated as playing a key role for his later work. In Robert Karen' book (1994) "Becoming attached" an extensive description about John Bowlby is offered. Bowlby was the fourth of six children of a prominent baronet and surgeon of the British King's Household and as in many other families from this social status, Bowlby was raised by a nanny, having only few contacts with his parents. In fact, as Karen pointed out (1994, p. 30), his parents had a "stiff upper lip approach to all emotional things". This parental attitude of shortcutting relational contacts in association with the loss of Bowlby's favourite nanny, at the age of four, may have had major contributes to his character and in modelling his (later) interests for family interaction: "He was considered aloof and emotionally distant – a quality some attributed to shyness and awkwardness, others to a protective shell that made it difficult for him to express his feelings. Indeed, he rarely spoke of his feelings, was completely inarticulate when he tried, and seemed almost without curiosity about himself" (Karen, 1994, p. 29).

Once asked in his later years what important experiences guided his work, Bowlby highlighted three. In first place, he pointed out his six month volunteer work in two residential schools for maladjusted children. There he realized the connections between the disturbed behaviours observed in children and their ill-fated interpersonal stories. In fact, he was so deeply impressed by his young patients that he stated to a colleague "when I was there, I learned everything that I have known; it was the most valuable six months in my life, really" (Senn 1977, cited in van Dijken 1997, p. 45). This seminal impression was the foundations for his later work at London Child Guidance Clinic on which he based his 1944 published paper "Forty-four Juvenile Thieves". This paper was greatly improved by Bowlby's experience on officer selection procedures during World War II, where he substantially incremented his knowledge about methodological and statistical procedures, capabilities that allowed him to describe clinical cases with detailed statistical measures. The mothers of these children,

described in the article, were portrayed by social workers as "immoral, violent and nagging," "extremely anxious, fussing, critical," " drunken and cruel," "did not want the child," "unstable and jealous," etc. These children were hardly able to establish long-term relationships and showed few signs of guilt for their social misdeeds, a behavioural problem that Bowlby labelled “affectionless psychopathy”. One common factor was prolonged early separations of the child and mother, separations where children never had developed a true attachment, and after separation had no opportunity to develop a true attachment. These assertions were cemented in his monograph *Maternal Care and Mental Health,* wrote under commission from the World Health Organization (1951), to document his research of the impact of loss on children, and where he stated that it is psychological deprivation rather than economic, nutritional, or medical deprivation that is the cause of troubled children.

The second landmark influencing his work arises from his work at Tavistock Clinic with James Robertson, a young social worker hired by Bowlby in 1948 to help him observe hospitalized and institutionalized children who were separated from their parents. After two years of intensive observations Robertson were borrowed of only watching passively the cases and felt compelled to take action for the observed children. Out of this intend, with no great filming experience and limited means, emerged the documentary *A Two-Year-Old Goes to the Hospital* (Bowlby, Robertson, & Rosenbluth, 1952), where a random selected child was filmed at regular periods along the day. This internationally recognized film made obvious the impact of loss and suffering experienced by young children separated from their primary caretakers. Along with Bowlby’s paper *Maternal Care and Mental Health* (1951), the film had habitually been credited as a primary influence in the change in public health policy to having parents stay with children while they are in the hospital. Although, only slowly the reality of children’s distress and forthcoming consequences were achieved with necessary recognition by the medical and political authorities, influencing changes in hospitals and policies (Karen, 1994, chap. 6).

As a third important experience for his work development, Bowlby refered his work with Melanie Klein during his psychoanalytic training, though here, to be sure, the influence was a paradoxical one. While in supervision with Klein on his treatment of a three-year-old boy who was anxious, agitated, and hyperactive, Bowlby was impressed that not only the boy, but also the boy’s mother, appeared to be extremely anxious and

distressed. But Klein forbade Bowlby to ever speak to the boy's mother. When some three months later the mother was sent to a mental hospital and Bowlby informed Klein of it, she responded by saying, "What a nuisance, you will have to get a new case." Bowlby believed the woman's breakdown was of no clinical interest to Klein, and this horrified him (Bowlby, 1988). Bowlby's problem with Melanie Klein and her followers was the excessive weight on fantasy life and sometimes questionable confidence in interpretation (for a detailed description see Segal 1973, Karen, 1994). For Klein (1932) the emphasis on the influence of fantasy and internal experience were central, assuming that children's emotional problems are almost entirely due to fantasies generated from internal conflict between aggressive and libidinal drives, rather than to events in the external world; as for Bowlby it was more the importance of early relationships and actual family experiences that created the disruption (Bowlby, 1969, 1988). Thus, Bowlby focused his attention on how the inadequate parents' behaviour gave their children in fact stemmed from the parents' own inner conflicts (Karen, 1994, p. 34). This fact evidenced his interest in the intergenerational transmission of parents-children relation. As a critic to Kleinians and classical Freudian theory, Bowlby published his first paper (1940), a theoretical assertion showing the passiveness and fantasy-moved field in which psychoanalysis was turning, combined with an exposition of modern psychoanalytical theories, and suggestions that a psychoanalyst should study the "nature of the organisms, the properties of the soil and their interaction". With progressive disaffection from Kleinianian orientation, Bowlby tried to pursue his research emphasis on actual family interaction patterns, especially on mother-child separation, with the aim of empirically opposing Klein's positions.

1.2. Mary Dinsworth Salter Ainsworth (1913–1999) and the empirical grounding of attachment

Mary Ainsworth's importance for attachment theory and for psychology in general is made clear by the fact that her contributions to the scientific study of attachment led to ground-breaking changes in how we think about the bond between an infant and its care-givers. Similar words about her were proffered on the occasion of

receiving The Gold Medal Award for Life Achievement in the Science of Psychology, American Psychological Foundation in 1998:

> "Mary Ainsworth stands out as one of the major figures of the twentieth century in the study of the relations between young children and their care-givers. Her work on the nature and development of human security, her exquisite naturalistic observations of attachment—caregiving interactions, her conceptual analyses of attachment, exploration and self-reliance, and her contributions to methodology of infant assessment are cornerstones of modern attachment theory and research. The patterns of attachment that she identified have proven robust in research across diverse cultures and across the human lifespan. Her contributions to developmental psychology, developmental psychopathology, and ultimately to clinical psychology, as well as her teaching, colleagueship, and grace, are the secure base from which future generations of students can explore" (Ainsworth, 1998).

Mary Ainsworth (born Salter), was born in Glendale Ohio (USA) and grew up in Toronto. She was the oldest of three sisters out of a model middle class family with a strong emphasis on education. Although, this was a "model family" as referred by Karen (1994, p.129), Ainsworth recognized some "troubling emotional currents in the home" were responsible for the "nagging doubts and hesitancies she had about herself". Even so, by those who met her, like Klaus Grossmann and Karin Grossmann, she was referred as "enthusiastic", "always challenging the thinking of colleagues", "stimulating", "deeply sympathetic and very supportive", "generous", "admirably succinct", "precise and vividly clear" (Grossmann & Grossmann, 1999). At another level, it may be stated that probably these feelings in association with William McDougall's book (1927) *Character and the Conduct of Life "*gave life" to her interest for psychology at the University of Toronto.

Contemplating Ainsworth's scientific path we can easily identify some milestones which drove her to the development of attachment theory, especially to her valuable empirically grounded methods. First, anti-Freudian atmosphere of the University of Toronto and especially William Blatz (1940, 1966) for his "security theory", which explains personality types on the basis of security, were of major influence for her (maybe because of her insecurity). The central issue of Blatz theory is that children need to develop a secure dependence on parents prior to enrol in unfamiliar situations. Ainsworth's doctoral dissertation, entitled "An Evaluation of Adjustment Based Upon the Concept of Security" (Salter, 1940) was embedded in this theoretical

framework, involving the construction of self-report questionnaires to assess the degree to which a person's security had bases on immature dependence, independence, mature dependence, or defence mechanisms. Besides the self-report measures she tried to support the validity collecting autobiographical narratives about family and non-family security. With this she proved the usefulness of pattern scoring to attain an individual classification according to previously theoretical based prototypes. Considering the validity scores she highlighted the constraints of self-report measures to assess most of the relevant constructs of the "security theory". And, of course this methodological approach was only a forecast of what would be her contributions for assessment, diagnosis and research in the attachment field.

As a second milestone we can point out the Ainsworth's work at Tavistock Clinic in England. After her marriage with Leonard Ainsworth in 1950, her husband was admitted to a PhD program at the University of London, and Ainsworth accompanied him. Once there and without a job, Ainsworth answered to a job advertisement placed by Bowlby, for a project at the Tavistock Clinic investigating the effect on personality development of separations from the mother in early childhood (Ainsworth & Bowlby, 1991). One of the main functions of Ainsworths' work at Tavistock was analysing and re-analysing the great amount of James Robertson's records of children's behaviour. She attributed to Robertson the inspiration and acknowledgment of the importance of naturalistic observation and the importance of the revealing character of reunions (after a parental separation) to distinguish three different patterns of children's behaviour (Ainsworth, 1983). The theoretical angular stone for the Strange Situation (SS) procedure, one of the most widely used procedures in child development research, was set (for a detailed review see Ainsworth, Blehar, Waters, & Wall, 1978, chap. 2). Although, her work with Bowlby brought Ainsworth's earlier interest in security into the developmental realm, and after the work with Robertson, she more then ever wished to conduct a longitudinal study of mother-infant interaction in a natural setting at her earliest opportunity.

That opportunity came in 1954 when Ainsworth's husband accepted a post-doctoral position in the East African Institute of Social Research in Kampala, Uganda. This move can be seen as the third milestone. It was in Uganda that Mary Ainsworth studied mothers and infants in their natural environment, observing and recording as much as possible, and analyzing and publishing the data years later at Johns Hopkins

University in Baltimore (for details see Ainsworth 1967). She observed on a regular basis (every two weeks for 2 hours during a maximum of 9 months a sample of 28 babies, aged of 1-24 months, with the purpose of examining the onset of proximity-promoting signs and behaviours, especially those which were focused on the mother. Besides initial scepticism about Bowlby's ethological perspective of infant-mother attachment (published in 1957, 1958, 1960), which will be described in the next section, Ainsworth found in her first observations convinced herself that Bowlby insights were right. Indeed, far from passive recipients of food, babies interact actively to ensure the proximity and availability of their mothers, particularly in threat, unavailability or hurt situations. Further, based on her original observations in Uganda and later studies in Baltimore (see Ainsworth & Bell, 1969, Ainsworth et al., 1978, Ainsworth 1982), Ainsworth concluded that there are qualitatively distinct patterns of attachment that develop between infants and their mothers throughout the initial years of life. Even though a majority of these patterns are manifested by comfort and security, some are tense or conflicted, and Ainsworth found evidence suggesting that these relationships were related to the level of responsiveness that mothers showed toward their infants from the earliest months. In one study she found mothers who responded more quickly to their infants' cries at three months were more likely to have developed secure attachments with their babies when they reached one year of age.

2. The Conceptual framework of Attachment Theory

2.1. Attachment and Attachment Bond

For Bowlby attachment is "to say of a child (or older person) that he is attached to, or has an attached to, someone means that he is strongly disposed to seek proximity to and contact with that individual and to do so specially in certain conditions, notably when he is frightened, tired or ill. The disposition to behave in this way is an attribute of the attached person, a persisting attribute which changes only slowly over time and which is unaffected by the situation of the moment" (1969/1982, p. 371). Ainsworth, Bell and Stayton (1971) underlined that attachment is an "affectional tie" that a person

or an animal form between him/herself and another special one, a tie that persists in space and time. In fact, this emotional feature is a central issue in attachment definition, several authors emphasised the social-emotional role within attachment which prompt the milestones for self-efficacy and feelings of competence in many cognitive, emotional and social interactions and challenging activities along an individual's life (e.g., Sroufe & Waters, 1977; Cicchetti et al., 1991; Belsky & Cassidy, 1994; Oppenheimer & Waters, 1995; Thompson, 1999; Soares, Lemos & Almeida, 2005). This tie was for Bowlby a bond like (…) "falling in love, maintaining a bond as loving someone, and losing a partner as actual grieving over someone. Similarly, threat of loss arouses anxiety and actual loss gives rise to sorrow; while each of these situations is likely to arouse anger. The unchallenged maintenance of a bond is experienced as a source of security and the renewal of a bond as a source of joy" (1980, p. 40).

Besides this static descriptions of attachment, Bowlby reinforced much more the dynamical process of what he meant by attachment and attachment bond. Therefore, he described attachment and the attachment behaviour within the framework of a system that evolves, changes, influences and organizes itself along the lifespan.

2.2. Attachment behaviour and Attachment behavioural system

In an atmosphere of discredit for psychoanalysis and based on his previous work with maladapted and disturbed children, and a handful of promising results out of ethological studies, especially the naturalistic observation work of Lorenz and the empirical studies of Harlow, Bowlby developed the first hallmarks of the attachment theory. Lorenz's (1935) ethological conceptions of "impriting" in geese and the precocial birds attracted him, especially because this approach also challenged the social bonds only fostered by feeding. Harlow designed a study with an infant rhesus monkey that he took away from their mother for a short period of time, and raised with two different surrogate mothers as a substitute. One mother was made of bale-wire mesh and the other was covered with terry cloth. Even if the bale-wire mother was the only one the feeds, the infant monkey were continuously more attched to the terry cloth mother, staying more time with her and using her as a secure base to explore the surroundings so as employing her as save harbour when threats arise (Harlow, 1958; Harlow &

Zimmerman, 1959). These results fostered the importance of contact and comfort, challenging psychoanalytical (Freud, 1960) and social learning theorists (Hull, 1943) findings that feeding is not the most important factor tying a child to his/her caregiver. Similar results were obtained by Shaffer and Emerson (1964) in humans, when studying toddlers which were frequently separated from their parents during daytime and slept alone, developed a strong emotional tie with a soft and cuddly blanket or toy. With this ethological empirical groundings and Bowlby's (1957) own evidence that it was not the lack of feeding that disturbed the children of abusive mothers, he found shelter for his claims against psychoanalysis and began to develop his theoretical claims anchored inside the ethological and evolution theory field.

In a paper entitled "The Nature of the Child's Tie to His Mother" Bowlby (1958) proposes that the infant's bond with his/her mother is mediated by just such species-characteristic behaviour patterns and not by the mother's role in feeding or otherwise satisfying the infant's biological needs. Thus attachment behaviour is held to be a kind of social behaviour tantamount to that of mating or parental behaviour and is deemed to have a function specific to it. Throughout this paper he draws on ethological theory to define attachment behaviours such as crying, smiling, vocalizing, approaching, following and searching, constitute adaptive responses with the aim of (a) alert the mother to the child's interests, (b) alert the mother for a threatening situation that the child is facing, and (c) an active intend of the child to get closer to the mother. Because human infants, like other mammalian infants, cannot feed or protect themselves, they are dependent upon the care and protection of "older and wiser" adults. Bowlby (1958, 1969, 1982; Ainsworth & Bowlby, 1991) argued that, over the course of evolutionary history, infants who were able to maintain proximity to an attachment figure (i.e., by looking cute or by expressing in attachment behaviours) would be more likely to survive to a reproductive age.

According to contemporary evolutionary thinking (see Belsky, 1999a; Maestripieri & Roney, 2006), structures and behavioural systems are now present in the population because they contributed to the reproductive success of the bearers in the environment of evolutionary adaptedness (the environment in which the species emerged). The biological function of attachment which gives survival advantage to the individuals genetically biased to seek and keep proximity between infant and caregiver is protection of the infant from harm. Under certain ecological conditions, natural

selection favours those who invest heavily on childcare and upbringing. These parents protect their offspring from predatory and parasitic animals, and thus they are actually protecting their own genes. During evolutionary time, strong selection pressures have led individuals to discriminate between their own and other children (Bateson, 1979). Filial imprinting (see Lorenz 1935) is a phenomenon whereby the young quickly learn to recognize their parents thereby following them everywhere, keeping proximity to them and avoiding contact with any other but close kin. The young need to discriminate between the parent that cares for them and other members of their species because parents discriminate between their own offspring and other young of the same species and may actually attack young which are not their own. Equally selective pressures, protection from predation and filial imprinting contribute in important ways to the formation and strengthening of attachment bonds, serving the purpose of obtaining and maintaining an optimal proximity between young and parents.

According to Bowlby, “attachment behaviour (…) refers to any of the various forms of behaviour that the person engages in from time to time to obtain and/or maintain a desired proximity” (1969/1982, p. 371). These attachment behaviours are species-universal and are thought to be organized in a motivational-control system, which he named as the attachment behavioural system was progressively “laboured” out by natural selection to regulate proximity to an attachment figure. Therefore, it stands for a developmental adjustment for survival with strong underlying phylogenetic purposes). The expression “behavioural system" has been borrowed by Bowlby from the ethologists (Tinbergen, 1963; Hinde & Spencer-Booth, 1967; Hinde, 1982) who use it instead of the term 'instinct', insofar as this term is viewed as nonexplanatory and furthermore leading to simplistic theorization. The term "behavioural system" stands for the underlying organizational structure mediating a variety of observable discrete behaviours. Each behavioural system is a set of interchangeable, functionally equivalent behaviours. As noted by Sroufe and Waters (1977) it is “not a set of behaviours that are constantly and uniformely operative” but instead it reveals a “functional equivalence” in which a wide bunch of behaviours accomplish and have similar functions and meanings at the same time. The attachment system essentially "asks" the following fundamental question: Is the attachment figure nearby, accessible, and attentive? If the child perceives the answer to this question to be "yes," he or she feels loved, secure, and confident, and, behaviourally, is likely to explore his or her environment, play with

others, and be sociable (Bowlby 1969/1982). If, however, the child perceives the answer to this question to be "no," the child experiences anxiety and, behaviourally, is likely to exhibit attachment behaviours ranging from simple visual searching on the low extreme to active following and vocal signalling on the other (see Waters & Cummings, 2000; Fraley & Shaver, 2000). These behaviours continue until either the child is able to re-establish a desirable level of physical or psychological proximity to the attachment figure, or until the child "wears down," as may happen in the context of a prolonged separation or loss.

This interchanging care-seeking and caregiving role between a child and his attachment figure are the semen for an increasing maturation and organization of the attachment behavioural system during the first (and subsequent) years of life. Initially, these behaviours are simple behavioural manifestations, or as Bowlby described: “When a baby of four months or so sees his mother after a brief absence he is likely to smile. In response to this, his mother is likely to approach closer, to smile and to talk to him, and perhaps to pat him or pick him up. Thus a predictable outcome of a baby’s smile is his greater proximity to mother” (1969/1982, p. 251). Throughout the first year these behaviours become more and more complex and organized forming a goal corrected system, a system that we might easily identify in a one year old baby: “Not infrequently a child keeps a close eye on his mother, content to play while she is present but insisting to following her whenever she moves. In such circumstances, the child’s behaviour can be understood by postulating that it is governed by a system that remains inactive as long as the mother is in sight or in touch but that is apt to become activated when those conditions change” (Bowlby, 1969/1982, p. 252). Consequently, what started as certain reflexes ended up in more flexible, feasible and efficient behaviours allowing the child to cope with the changing environment in order to attain his goals. Thus, behavioural systems are assisted by feedback mechanisms (the goal corrected system) allowing the individual to correct the ongoing behaviour which may show certain degrees of discrepancy with the behaviour which is necessary to attain the desired goal.

The attachment system has particular goals so as various activating and terminating conditions. Both the activating as the terminating conditions possess thresholds that attends to endogenous (e.g., thirst, hunger, illness) as to exogenous factors (e.g., threats, contextual features of potential danger, distance to the attachment figure). The range of stimuli able to provoke attachment responses become more and

more restricted as infants become adults. Even so, both in infancy as in adulthood, the primary goal of the attachment system is to seek proximity to a supportive other (*the attachment figure*), and consequently obtain protection from physical and psychological threats and to alleviate distress. It is this inborn proximity-seeking behaviour, as part of the behavioural attachment system, that constitute the affect-regulation function of the individual, and that when successful result in a sense of security – the world is safe to be explored and even if threats arise there is someone to count on (Bowlby, 1988). For that reason, the individual gains positive expectations about himself and others availability, seeing him as an active and competent agent in his environment, and so he organizes his affect-regulation strategies around this positive outcomes and beliefs.

Although, attachment-figure unavailability grades in attachment insecurity, which compounds the distress a person might experience when encountering a threat, and no significant others are available or are unresponsive to the persons' needs. As consequence, the person experiences doubts about self-worth, preoccupation about others, in sum a negative representation about him and the world; this will take him to engender strategies of affect regulation other than proximity seeking – *secondary attachment strategies*. This shift in response system highlights the constant monitoring and feedback loop that the behavioural system controls between the individual and his/her environment (Waters, 1981). Shaver and Mikulincer (2002), based on Bowlby (1973), proposed that this state of insecurity forces a "decision"- conscious and/or unconscious - regarding the viability of proximity seeking as a means of self-regulation, which in turn leads to activation of a *specific secondary attachment strategy*. The appraisal of proximity seeking as a viable option can result in very energetic, insistent attempts to attain proximity, support, and love. In the scientific community on attachment, these active, intense secondary strategies are called *hyperactivating strategies* (Cassidy & Kobak, 1988); they require constant vigilance, concern, and effort until an attachment figure is perceived to be available and a sense of security is attained. Hyperactivating strategies include a strong approach orientation toward relationship partners, attempts to elicit their involvement, care, and support through clinging and controlling responses, and cognitive and behavioural efforts aimed at minimizing distance from them (Shaver & Hazan, 1993). These efforts at closeness can be aimed at establishing not only physical contact but also perceived self other similarity, intimacy, and "oneness" (Mikulincer, Shaver & Pereg, 2003). These strategies are also indicated

by overdependence on relationship partners as a source of protection (Shaver & Hazan, 1993) and perception of oneself as helpless and incompetent at affect regulation (Mikulincer & Florian, 1998). According to Shaver and Mikulincer (2002), hyperactivating strategies involve excitatory pathways that increase the monitoring of threats to the self and of attachment-figure unavailability. These strategies result in a tendency to detect threats in nearly every transaction with the physical and social world and to exaggerate the potential negative consequences of these threats. They also intensify negative emotional responses to threatening events and heighten mental rumination on threat-related concerns, keeping them active in working memory. Since signs of attachment-figure unavailability and rejection are viewed as important threats, hyperactivating strategies foster anxious, hypervigilant attention to relationship partners and rapid detection of possible signs of disapproval, waning interest, or impending abandonment. Hyperactivating strategies produce a self-amplifying cycle of distress in which chronic attachment-system activation interferes with engagement in nonattachment-related activities and makes it likely that new sources of distress will mingle with old ones, thereby creating a chaotic and undifferentiated mental architecture. Hyperactivating strategies are common in people who score relatively high on the attachment anxiety dimension. Research shows that attachment anxiety is associated with exaggeration of the appraisal of threats, negative views of the self, and pessimistic, catastrophic beliefs about transactions with other people and the nonsocial world (e.g., Bartholomew & Horowitz, 1991; Mikulincer, 1995; Mikulincer & Florian, 1998). People who score high on attachment anxiety tend to react to stressful events with intense distress and to ruminate on threat-related worries (see Mikulincer & Florian, 1998, for a review). They also have ready access to painful memories and exhibit an automatic spread of negative emotion from one remembered incident to another (e.g., Mikulincer & Orbach, 1995). Moreover, their representations of attachment figures and attachment-related worries are activated even when there is no external threat (Mikulincer et al., 2000; Mikulincer, Gillath, & Shaver, 2002).

The appraisal of proximity seeking as a nonviable option can result in deactivation of proximity seeking, inhibition of the quest for support, and active attempts to handle distress alone. These secondary strategies of affect regulation are called *deactivating strategies* (Cassidy & Kobak, 1988), because their primary goal is to keep the attachment system deactivated so as to avoid frustration and further distress

caused by attachment-figure unavailability. This goal leads to the denial of attachment needs; avoidance of closeness, intimacy, and dependence in close relationships; maximization of cognitive, emotional, and physical distance from others; and strivings for self-reliance and independence. With practice and experience, these deactivating strategies often broaden to include literal and symbolic distancing of oneself from distress whether it is directly attachment-related or not. For Shaver and Mikulincer (2002), this distancing involves active inattention to threatening events and personal vulnerabilities as well as inhibition and suppression of thoughts and memories that evoke distress and feelings of vulnerability. Some of these coping strategies, such as motivated inattention, have been characterized as "preemptive" (Fraley, Garner, & Shaver, 2000), because they avoid or short-circuit the experiences of vulnerability and distress, whereas others, such as suppression and repression, are "postemptive," because they are aimed at minimizing perceived threats and vulnerabilities that have already been encoded. We view these temporally distinct strategies as similar to two lines of defence: A pre-emptive strike is preferred when its use is viable; the post-emptive strategies are called upon if the pre-emptive approach fails or the defensive system is attacked from behind, so to speak—for example, when a memory is aroused by association and is experienced as threatening in a particular context. These strategies also foster disengagement from challenging activities and avoidance of new information, because challenges and novelty can all be sources of threat. Moreover, extreme self-reliance may encourage the denial of personal imperfections, because personal weaknesses suggest threats in one's only source of protection (Mikulincer, 1995). Deactivating strategies are characteristic of people scoring relatively high on the attachment avoidance dimension. Research shows that attachment avoidance is associated with low levels of intimacy and emotional involvement in close relationships, suppression of painful thoughts, repression of negative memories, lack of cognitive accessibility to negative self-representations, projection of negative self-traits onto others, failure to acknowledge negative emotions, and denial of basic fears (e.g., Dozier & Kobak, 1992; Fraley & Shaver, 1997; Mikulincer, 1995; Mikulincer, Florian, & Tolmacz, 1990; Mikulincer & Horesh, 1999; Mikulincer & Orbach, 1995). Recent findings indicate that high scores on attachment avoidance are associated with lack of mental access to attachment related worries (Mikulincer et al., 2000) and deactivation of

representations of attachment figures following reminders of separation (Mikulincer, Gillath, & Shaver, 2002).

For Bowlby, the attachment behavioural system is far from being an alone standing system; it is much more an integrated, biologically rooted and commanding system that manages other systems. One of such systems is the exploratory behavioural system which is responsible for guaranteeing survival by providing information about the environment. This system is mainly activated by stimuli that represent novelty and/or higher complexity, and is deactivated in the presence of familiarity. Thus, as the attachment system's function is protection and proximity to a caregiver, the exploratory system provides learning experiences and contact with the environment and interactions beyond the caregiver. Apart from this distinction both systems are intertwined because it is necessary a certain kind of protection to explore, a certain kind of security to engage in learning expeditions, so as Ainsworth et al. noted "the interlocking permits a situation in which an infant or a young child is prompted by intriguing objects to move away from his 'secure base' to explore them, and yet tends to prevent him from staying too far away or from remaining away for too long a time; and the reciprocal maternal-behavioural system provides a fail-safe mechanism, for 'retrieving' behaviour will occur if the child does in fact go too far or stay away too long" (1978, p. 22). The caregiving system is another system intimately related to the attachment behavioural system, and so as this it has "in some degree preprogrammed" (Bowlby, 1969/1982, p. 271) biological roots. This caregiving system evolved from the innate urge of offering care and protection to a child, but not exclusively because individual differences in caregiving may largely be explained by learning. Bowlby emphasized mostly the uniqueness of mother's tie to her child, writing little about the caregiving system and in particular about parental side of attachment development across lifespan. Even so, we may constrain this caregiving system to those parental behaviours that assure proximity and comfort when parents perceive their children in dangerous situations. And therefore, the most prominent behaviour inside this system is retrieval (Bowbly, 1969/1982).

In summary, the attachment behaviour may be observed under conditions of stress situations and is characterized as "any form of behaviour that predictably results in a person attaining or retaining proximity to some other preferred individual" (Bowlby, 1991, p. 305) which is in position of providing caregiving behaviour. These

behaviours are context dependent, coordinated in chain-linked sequences of simple behaviours that progressively get more complex and organized themselves in goal-corrected behaviour patterns within the individual. This goal-corrected behaviour organization supposes that an individual has a specific complex, dynamic, internal representation of pertinent facts of the self, his/her own behaviour, from others and environment, and of course from the aspects, person or object that elicit or to which the behaviour is directed. The attainments of these goals are mediated cognitive and affective processes that underlie each attachment-related strategy. Whereas the goals of security-based strategies are to alleviate distress, build a person's resources, and broaden his or her perspectives, the goals of secondary attachment strategies are to manage attachment-system activation and reduce or eliminate the pain caused by frustrated proximity-seeking attempts. For secondary strategies, distress-regulation stops being the main regulatory goal and instead hyperactivation or deactivation of the attachment system becomes the goal. Hyperactivating strategies keep the attachment system chronically activated, constantly on the alert for threats, separations, and betrayals; deactivating strategies keep the attachment system in check, with serious consequences for cognitive and emotional openness. This representational feature of the attachment system will now be discussed.

2.3. Internal Working Models

One of the fundamental postulations of attachment theory is that the attachment system can only work, efficiently and effectively, by activation and deactivation of the *internal working models*, developed throughout the first year of life and embedded in the bond between the child and his/her caregiver. Throughout the childhood, what starts with an almost mechanical nature of attachment behaviours turns out to be a more complex, goal-driven and wider system of behaviours that progressively moves into a representation of interactions between an attached child and the caregiver. Thus internal working models derive mostly from the interactional legacy out of the child's experiences of seeking proximity to the primary caretaker. These working models include beliefs, expectations and goals that able individuals to predict and plan the future and to focus their thoughts, feelings and behaviour in interactions with others

(Bowlby, 1973). They provide regulation, interpretation, and prediction of the attachment figure's and the self's attachment behaviour, their thoughts and feelings. Furthermore, as referred by Bretherton and Munholland "if appropriately revised in line with developmental and environmental changes, internal working models enable reflection and communication about past and future attachment situations and relationships, thus facilitating the creation of joint plans for proximity regulation and the resolution of relationship conflicts" (1999, p. 90).

The expression internal working models was imported by Bowlby (after reading Young's work 1964) out of Kenneth Craik (1943) evolutionary perspective and artificial intelligence ideas asserting that organisms were capable of forming "internal working models" of their environment as an advantage to increase the odds of survival; and it is this ability that fosters flexibility and more adaptive actions in an ever changing environment. Additionally, Craik stated as a crucial aspect of the internal working models the existence of a relation-structures, which provides a spatiotemporal causality that links events, objects, actions and images; besides this causality needing not to be a reliable copy of the reality but rather to conserve the relation-structure of the features that made it possible to evaluate and predict the behavioural outcomes. Relying on this, Bowlby favoured the use of the map metaphor as a reliable symbol of what he meant with internal working models within the attachment theory. "A map is a coded representation of selected aspects of what is maped" (Bowlby, 1969/1982, p. 80). This map allows the subject to perceive, understand and interpret his/her surrounding events, anticipate and take action over the future, and elaborate plans. Bowlby (1969/1982) also emphasised that these representations are *models* of interactions, in which each individual is guided in his/her development by present relational experiences, and form usually quite objective representations of these interactions. Although they are not the interactions by themselves as the term model might imply but rather as Main et al. (1985, p. 85) stated "the working model… reflects not an objective picture of the parent, but rather a history of the caregiver's responses to the infant's actions or intended actions with/toward the attachment figure". Representations are *working* because they are not static but rather *dynamic,* representing actions instead of stable characteristics, submitted to revision, and employed in finding ways to solve practical problems. Finally, they are *internal* because they are internally stored and carried over to future

interactions with the same or different partners, in addition to being subject to change by means other than actual interactional experiences (e.g., physical contact, language).

The internal working models, as conceived by Bowlby, are not like windmills that change with wind conditions, they exhibit a considerable resistance to change. To explain this resistance Bowlby relied on Piaget's process of assimilation, arguing that previous mental representations of interactions bias and regulate present and future experiences with the attachment figures. Thus, there is a (relative) stability that defies misinterpretations or discrete episodes of attachment interactions, be they more positive or negative. Therefore, if a caregiver fails once to provide security because of stress at work; it will not undermine the child's cognitive and emotional bond to this caregiver. Although, if this lapse becomes frequent then the child will re-interpret his/her working models and expectations, and conclude that the old model no longer works, developing a new one. It is "within the framework of these working models that he evaluates his situations and makes plans. And within the framework of the working models of his mother and himself he evaluates special aspects of his situation and makes his attachment plans" (Bowlby, 1969/1982, p. 354). Progressively, this interaction spinning of acting, feeling and thinking that once were purely conscious starts to be less conscious and more automatic. "Because these models are in constant use, day in and day out, their influence on thought, feeling and behaviour becomes routine and largely outside of awareness" (Bowlby,1988, p. 4). It is this automatic processing that increases the efficiency of the system by decreasing the need for high attentional states, and let space for flexibility to occur in face of a changing interactional environment.

2.4. Attachment Patterns

Based on extensive observational data in Uganda and in Baltimore, but especially relying on the SS research paradigm, Ainsworth were able to identify specific patterns of infant response. She observed the mother-infant dyads throughout the first year of life in order to clarify the direction of attachment behaviour and the internalized movers of attachment – the internal working models. By studying successive separation-reunion episodes, interactions with a stranger and exploration episodes with toys, it was found evidence that infant's behaviour at the reunion was characterized by

particular response patterns (Ainsworth et al., 1978). These patterns were not only a one time manifestation, restraint to the SS experiment day; they were present at home observation ratings along the previous year before the laboratory procedure. Ainsworth et al. (1978) were able to identify three distinct patterns of attachment: secure, anxious-resistant and avoidant.

The secure classified children (labelled as "B" by Ainsworth and followers) correspond to most part of the children evaluated by the SS and as such they constitute Bowlby's "natural prototype" (1969/1982, 1973). They become upset with the parent leaving the room, but, when he or she returns, they engage actively in seeking the parent, being easily comforted by him or her, and return freely to explore the room. The anxious-resistant children ("C") are ill-at-ease initially, and become extremely distressed with separation. With the reunion, these infants are difficult to soothe and display conflicting behaviours that evidence a desire to be comforted but also a revenge-like impulse to punish the parent for leaving. Their preoccupation with the caregiver is so elevated that they may reduce or rule out exploration. Finally, the last pattern described by Ainsworth and collaborators was the avoidant ("A"), which characterizes children with an appearant absence of distress upon separation so as with reunion. These children deliberately avoid seeking contact and comfort from their parent, preferring sometimes to focus their attention in playing with toys. At the reunion episode they seem unaffected with the 'come and go' of the caregiver, avoids the wish of contact and comfort, exploring the room in the same way with or without the caregivers' presence.

Beside children's patterns Ainsworth et al. (1978) became progressively aware of the characteristics of the caregivers with the amount of home visits they made. Thus, the primary caregivers of secure attached children were available, sensitive and responsive to infant's signals and distress; as the caregivers of "C" pattern children were characterized by inconsistency to children's signals, 'sometimes there sometimes' unaware, combined with intrusiveness and/or overwhelming affection. On the other hand, the avoidant caregivers were found as declining and tend to stay 'far away' or reject their infants' needs for proximity, mostly physical but also psychological.

In the end of the 1980's, several researchers (Main, Kaplan & Cassidy, 1985; Lyons-Ruth et al., 1987; Main & Solomon, 1986, 1990; Main & Hesse, 1990; Crittenden, 1995) have become more a more aware of classifying difficulties with

certain infants that did not fit within any of the three patterns observed in the SS and described by Ainsworth. Out of this need for clarification and classification, a fourth style labelled "D" (disorganized/disoriented) was proposed by Mary Main and Judith Solomon (1986). These authors run a longitudinal study aiming to analyse the SS behaviour of almost 200 underprivileged and high-risk infants who could not be classified among the Ainsworth typology. The results evidenced what could be seen as a pattern of unexplainable, bizarre, violent or conflict driven behaviours, showing ingredients of all the three Ainsworth's attachment styles, but with no organization or aim at all. Main and Solomon (1990) proposed that this category defines children that (a) sequentially exhibit contradictory behaviour patterns, (b) display at the same time these contradictory behavioural patterns (e.g., they smile and evidence signs of rage), (c) show incomplete, misdirected and undirected movements and expressions (they direct their attention to the caregiver and suddenly interrupt this progress), (d) use anomalous postures, and stereotypical, mistimed and asymmetric movements, (e) demonstrate freezing, stilling, slowed expressions and emotions, (f) display direct signals of apprehension toward the parent, and (g) reveal direct signals of disorganization and disorientation (e.g., approaching the parent as the parent enters for reunion). The parents of these infants exhibit frightened, frightening or disoriented characteristics along the communication process with their infants. Regarding this, Main and Hesse (1990) argued that the non-organized form of attachment means that the infant faces a "paradoxical injunction", in which his/her parent, the real source of fear, mistrust and disorientation, turns it impossible to reach an organized, adaptive and effective state to cope with himself and with the environment. Beside this, the authors found that parent' behaviour evidence sudden shifts during the SS, shifts that may explain the infants' behaviour. These shifts are (a) unusual vocal patterns (e.g., a sudden shift in the voice pitch, changing it to a much higher or lower pitch), (b) unusual movement patterns (e.g., a sudden physical approach to the child exhibiting looming behaviours), and (c) unusual speech content (e.g., a car is thrown by the child and the parent says: "Ohhhh, what a crash! They must have all died!") (Main & Hesse, 1990).

Table 1. Brief overview of Infant Strange Situation Categories in relation to corresponding Adult attachment Interview

Infant Strange Situation Categories	Adult Attachment Interview Categories
Secure (B): Exhibits signs of missing parent on first separation and cries during second separation. Greets parent actively (e.g., seeks to be hold). After a brief contact with the parent, settles and returns again to play.	*Secure-autonomous (F):* A coherent and collaborative discourse is maintained during description and evaluation of attachment-related experience, independently if these experiences are described as favourable or unfavourable. The person seems to value attachment while being objective regarding any particular experience or relationship. .
Avoidant (A): Avoid crying on separation, engaging with toys or environment throughout protocol. Deliberately avoids and ignores the parent on reunion, moving and turning away, or even leaning away when picked up. Shows unemotional attitude, and expressions of anger are absent.	*Dismissing (Ds):* Evidence a normalizing attitude with unsupported and contradicted memories that describe the parents "only in a positive way" (e.g., "excellent, very good relationship"). Even if negative experiences are reported they tend to evaluate them as having no impact at all. Transcripts are usually short, with almost no detailed memories that may only arise after deepened insistence.
Resistant-ambivalent (C): Preoccupied with parents (presence) along the procedure. Evidence an active interchangeable mood, shifting between anger or passivity, seeking or resisting parent. Fails to return to settle or return to exploration on reunion and move on to focus on parent and cry.	*Preoccupied (E)*: Is concerned (preoccupied) wit experiences, appears angry, confused and passive, or fearful and overwhelmed. Frequent use of grammatically entangled sentences or filled with vague phrases ("talking about everything and nothing"). Long transcripts filled with irrelevant data.
Disorganized-disoriented (D): Displays disorganized or disoriented behaviours in parent's presence (eg., freeze and trancelike expressions, cling if leaning away). It is also possible to fit well into A, B, or C category behaviours.	*Unresolved-disorganized (U-d):* Shows lapses to striking lapses in the monitoring of reasoning or discourse when discussing loss or abuse (e.g., use of eulogistic speech, fall silent). May also fit into some features of the Ds, F, or E.

Within the framework of the SS and an evermore questing role to parents' contribution of infants' behaviour, Mary Main, Carol George and Judith Cassidy began asking the parents about their childhood experiences (e.g., Main et al., 1985). Based on these procedures the Adult Attachment Interview (AAI) was born and a move to the representational world of internal working models was done. With this shift, and based on Bowlby's (1969/1982) claim that working models of relationships have a tendency to become stable over time, Main and her collaborators explored and described the adult attachment styles as the ones branded by Ainsworth; and adding the recent discovered "D" pattern which in adulthood takes the label of "U" (unresolved). Thus, a four category model of infant attachment organization and their parallel in adulthood was defined. Table 1 summarizes the main features of the infant attachment styles and their (almost) mirror image of attachment style in adulthood. As can be seen, coherence is the

main issue in adult attachment as it was exploration in infancy. Furthermore, by considering discourse instead of behaviour, the adult attachment classification integer Grice's (1975, 1989) principles of cooperative and rational discourse, which suppose adherence to four maxims: *Quality* (showing evidence of what is said and truthful acting), *Quantity* (being succinct and even so complete), *Relation* (assuming a relevant position toward each topic discussed), *Manner* (exposing the topics clearly and with order). These four qualities are present in the discourse of adults classified into the autonomous style with the AAI.

3. Attachment in Adults

3.1. Defining Adult Attachment

The expression adult attachment is intimately linked to Bowlby's almost mythical expression "from the cradle to grave". Besides the cueing effect of such expression, the paragraph from which it was taken is almost forgotten, although this paragraph presents us with an essential notion of attachment across the life cycle, so clearly and clarifying that I could not avoid presenting here the entire paragraph:

> "Briefly put, attachment behaviour is conceived as any form of behaviour that results in a person attaining or retaining proximity to some other differentiated and preferred individual, who is usually conceived as stronger and/or wiser. Whilst especially evident during early childhood, attachment behaviour is held to characterize human beings from the cradle to the grave. It includes crying and calling, which elicit care, following and clinging, and also strong protest should a child be left alone or with strangers. With the age the frequency and intensity with which such behaviours are exhibited is diminished steadily. Nevertheless, all these forms of behaviour persist as an important part of man's behavioural equipment. In adults they are especially evident when a person is distressed, ill, or afraid. The particular patterns of behaviour shown by an individual turn partly on his present age, sex and circumstances and partly on the experiences he has had with attachment figures early in his life"(Bowlby, 1979, pp. 129-130).

In fact these words brew the seminal bases of a conception of adult attachment. The adult attachment should be similar to infancy in at least three aspects: a) adults

show the desire of proximity when stressed; (b) exhibit comfort in the presence of attachment figure; and (c) evidence anxiety when the attachment figure is inaccessible (Weiss, 1975, 1979). With the course of the years, attachment's function remains (almost) the same, to boost chances of survival by entangling the support of specific others and to guarantee the availability of that support by ensuring the caregivers' availability. The behaviours by which it works also remain the same, incorporating the learned experiences and the natural developmental and ontogenical changes. In moments of closeness and danger or distress, the activating and deactivating functions stay alike. At last the continuity and maintenance of the system from childhood to adulthood, attachment styles are to somewhat reflected on adult functioning. Although, adult attachment differs from that in children in numerous ways, it turns to be more complex, transactional and involving more attachment figures (caretakers, peers, sexual partners) (Weiss, 1982). Thus, adult attachment has a reciprocal nature of partnership where each of the figures receives and provides security to the other. The attachment figures in childhood are generally adults as in adulthood it emerges from an equal one that turns into a unique figure among the peer group. Furthermore, contrarily to children that approach caregivers for contact aiming to alleviate distress, adults may approach the other not only for comfort (or security) but also for sexual attraction, companionship, sense of competence and shared purpose or experience (Ainsworth, 1985, Weiss, 1973). Finally, adults activate less the attachment system than infants, even in critical situations (e.g., separation) they show principally more tolerance if the situation is felt as positive for him and the other.

Similarly to Bowlby, Ainsworth (1985, 1989) also emphasised an extension of attachment into adult life, by arguing that attachment in adulthood is mostly visible in what she referred as "affectional bonds", a specific relationship with an irreplaceable other where a desire for proximity assumes a central role. These bonds, "some of them may be identifiable as attachments, some as having attachment components, whereas others may not resemble attachments in some critical way" (Ainsworth, 1985, p. 799). One example of such a relationship is the case of a sexual pair-bond in which we have an intertwined (or a singular) enrolment of three separate behavioural systems: the reproductive or mating system, the attachment system (seeking support from a partner) and the caregiving system (providing care to a partner and/or providing care to an offspring). By instance, if the sexual contact prevails for a longer time, it is quite

possible that the attachment system and caregiving system become more active; while if a rupture in that relation arises both the caregiving and mating system diminish their activation as the attachment system may be active for longer periods (for details see Gunn & Furstenberg, 1989).

Based on the previous claims we may define adult attachment as a relatively stable propensity to actively engage and mobilize behaviours to seek and maintain proximity to one (or more) figures of the person's interpersonal environment with the aim of obtaining security and comfort, both physically and psychologically. The stability of this propensity is mediated by internal working models, which as exposed in previous section are cognitive, emotional and motivational schemes that form a mind image of the self, the attachment interaction and situational characteristics, and the attachment figures.

3.2. Adult attachment: the shift to the representational world and its measures

The shift from children focused attachment to adult attachment seems nowadays a natural consequence of all the theoretical empire described along Bowlby's trilogy (1969, 1973, 1980). Even so, this empire would not have passed from theory to practice without the support and incentives of: a) the studies of social problems during the 70s, namely adult bereavement (e.g., Bowlby & Parkes, 1970) and marital separation (e.g., Weiss 1973); and b) the longitudinal studies of Minnesota (Morris, 1980; Sroufe, 1983), and Bielefeld and Regensburg (Grossmann et al., 1985) about parent-child relationships and intergenerational transmission of attachment. The results of these studies highlighted the importance of adult attachment, the study of the representational world of what have been the early attachment experiences and how they now influence present attachment experiences. Waters (1994) pointed out several aspects for which the representational ability of attachment is crucial for attachment theory. Primarily, as already referred the mental representation of attachment extents and clarify the weight of early relationships on later behaviour and development. Secondly, the importance of previous (and present) subjective experience and outlook that each individual carries with him and that may constrain, interact or reinforce the objective ingredients of an experience and behaviour. This aspect is consistent with Bowlby's (1969/1982)

assertions of attachment changes across life and how these changes rely on the interaction of early bonds with actual bonds, allowing the individual to reverberate over and (re-)interpret the meaning of past and present experiences. Thirdly, by taping and tracing the internal representation we are able to gather explanations for the activation of the attachment system and their responses in a new situation. Finally and closely related to the previous aspects, mental representations allows to understand how the bonds between people are maintained and developed across time and space (Waters, 1994), and as such the understanding of attachment provides a way to comprehend developmentally the past and the future of each individual's relationships.

With this shift, new challenges for empirical methods were set given the fact that infant attachment behaviours, contrarily to representations, are easily traceable both in naturalistic as in laboratory settings and that attachment behaviour is expressed through action and not as in adults through language (Ainsworth et al., 1978). With the intention of operationalize constructs like secure base behaviour in the context of adult life, with all the ingredients that differentiate adult attachment from child attachment, many researchers embarked in this endeavour and developed many different forms of assessing adult attachment. The study of adult attachment, after three decades since his birth, has been characterized by two main methodologically like chalk and cheese traditions (see Table 2), which only recently have begun to approach one another in some way (Pietromonaco & Barrett, 2000; Jacobvitz, Curran & Moller, 2002). Given the scope of this chapter and the fact that dozens of attachment-linked questionnaires, inventories and interview based procedures exist, the review will be restricted to the most well known self-report and interview measures of adult attachment. Even so, the focal goal is to provide and brief presentation of the assessment tools and drawing an overview of what they measure (see Table 3).

One of these approaches is well identified with Cindy Hazan and Philip Shaver (1987), two representants of the social psychology and personality field. This route of thought descends from academic psychology, mistrustful of clinical approaches, especially psychoanalysis and their basic concepts of defensive mechanisms and unconscious mental processes. Hazan and Shaver, much influenced by Weiss's (1982) position that chronic loneliness is associated with insecure attachment and based on their own studies with adolescent and adult loneliness, started from the standpoint that the feelings, behaviours and dynamical interactions between child and caregiver were in

many aspects similar to the ingredients of a romantic experience, a love bond in adulthood. By analysing romantic relationships they found the ground-forces of attachment relation, partners evidenced urges for (a) seeking and maintaining (physical) proximity, (b) checking availability and turning to the partner for comfort and security when threatened, and (c) showing longing and distress when a separation, a loss or critical situations for the relationship arises. As such, the authors considered the adult romantic relationships within the framework of attachment theory, for that they developed a three-item self-report measure patterned after Ainsworth's et al.'s (1978) three group taxonomy, aiming to recapture the infants' attachment styles in adulthood.

Table 2. Foundations of the two methodological traditions in attachment research

	Questionnaire-driven approach	**Interview-driven approach**
Theoretical Foundation	Social Psychology: - Hazan & Shaver. (1987); - Bartholomew & Horowitz (1991);	Evolutional theory, Developmental and Clinical Psychology: - Mary Ainsworth et al. (1978); - Mary Main et al. (1985, 1990);
Focus	Emphasize the behavioural level of analysis Feelings, cognitions and behaviours about: - Romantic relations; - Interpersonal relations;	Emphasize the representational level of analysis Attachment organization; Representations about: - Parent-child relationships; Past and present experiences ; - Lost or separations;
Measure Type	Categorical and Continuous	Categorical
Relational Context	Romantic, Friends, Mother and Father;	Mother, Father and Others
Instrument	Questionnaires and Interviews	Interviews
Examples of Measures	- Adult Attachment Styles (Hazan & Shaver, 1987); - Reciprocal Attachment Questionnaire (West, Sheldon & Reiffer, 1987); - Current Relationship Interview (Crowell, 1990); - Relationship Questionnaire (Bartholomew & Horowitz, 1991);	- Adult Attachment Interview (George, Kaplan & Main, 1985); - Attachment Style Interview (Bifulco, Lillie & Moran, 1998); - Attachment Interview (Bartholomew & Horowitz, 1991);

The central issue of this approach was assessing socially adult attachment by directly asking people about their behaviours or as stated by Kelly (1963) “if you want to know what people think, why not ask them? They might just tell you”. As such, the studies of this tradition were mostly hubbed on personality traits and social interactions, focusing in normal large subject samples, preferring simple formulated questionnaires and where adult attachment relationships are viewed in terms of peer groups, friendships, professional relationships, dates, and marriages. Issues like social desirability or other self-presentational concerns would be overcome with specific items and/or surpassed with careful rephrasing of item questions. Moreover, this approach brought "new music" into the attachment field, by extending research along the wide spectrum of human relationship, covering relationships between pairs and friends (e.g. Bartholomew & Hororwitz, 1991; Shaver et al., 2000; Matos, 2002), so as romantic love relationships (e.g., Hazan & Shaver, 1987; Shaver et al., 2000) and intimate relations (e.g., Hazan & Shaver, 1990; Shaver et al., 2000); but also including clinical and emotional themes (e.g., Golder et al., 2005; Newcom-Rekart et al., 2007; Sund & Wickstrom, 2002), educational and academic settings (e.g., Burge et al., 1997; Perris & Andersson, 2000), and the labour-occupational context (e.g., Krausz et al., 2001; Mikulincer et al., 1990).

The other approach followed the roots of Bowlby’s and, especially, of Ainsworth’s work. As such, it was embedded in a tradition of child psychiatry and clinical developmental psychology. The theoretical and empirical guidelines were formatted by psychodynamic constructs and theories, a substantial interest in clinical problems, a major emphasis on observation and interview based measures instead of questionnaires, a almost exclusively focus on parent-child relationships and a substantial preference for studies with small groups of subjects. Most of the names associated to this tradition were students’ of Ainsworth’s (e.g., Mary Main, Jude Cassidy, Nancy Kaplan, Roger Kobak, Ruth Goldwyn) or/and have been associated with one of her original students. Ainsworth’s empirical drives influence within this tradition is clear in many ways. Especially, is the fact that her most important goal has been the achievement of an understanding of the reasons why caregivers enact behaviours, which are known to result in their children as insecure attachment. This issue is especially clear in many studies during the early 1980’s (for details see Hesse,

1999) in which the aspects of caregivers functioning were explored as an attempt to explain their behaviours with regards to the children. But also because the application of similar methodologies, where observation is not exclusively emphasized as a way of access to attachment variables, and where the care and depth put in the usage of highly trained judges that analyse qualitative and quantitative data are central. Independently of these reasons and others we might add, the bottom line is that the followers of this tradition generally refuse that individual's self-descriptions can be of great use and validity for the attachment study, or as Main et al. (1985, p. 76) posted "attachment styles have an existence outside of consciousness". This assumption is consistent with Maier et al. (2004) that found evidence for the implicit and unconscious process that underlie attachment organization. Thus, all measuring procedures and methods of this tradition underline an implicit way of attachment research for which semi-structured interviews and expertise of interviewers and judges are the essence of validity and (clinical) usefulness.

Table 3. Summary of some examples of questionnaire-driven and interview based attachment assessment procedures.

Questionnaire-driven measures	***Brief Description***
Adult Attachment Styles (Hazan & Shaver, 1987)	Based on the concept of infant attachment patterns, Hazan and Shaver (1987) developed a self-selection measure to measure adult attachment styles with respect to feelings about the self in relationships, especially romantic relationships. The secure style characterizes theparticipant as comfortable with intimacy, dependency, and reciprocity in relationships, as well as low in anxiety about loss. The avoidant style highlights a lack of trust, and discomfort with intimacy and dependency. The ambivalent style portrays a desire to be close, anxiety about rejection, and awareness that the individual desires intimacy to a degree greater than most people.
Reciprocal Attachment Questionnaire (West, Sheldon & Reiffer, 1987)	This questionnaire considers the quality of an individual's most significant adult attachment relationship for the reason of designing therapeutic interventions and predicting treatment outcome. The participant is questionned to rate the person to whom he/she feels closest and with whom he/she has had a relationship for at least 6 months (not a member of family of origin). The measure consists of scales of secure base, separation protest, proximity seeking, feared loss, reciprocity, availability, and use of the attachment figure. Two factors are derived from these scales: Separation anxiety and reciprocity.
Relationship Questionnaire (Bartholomew & Horowitz, 1991)	The questionnaire uses the four category model described above, and the adult rates self-descriptions on 7-point scales. The secure description describes someone who is comfortable with closeness and dependency, and does not worry about being rejected or alone. The dismissing style emphasizes independence and self-sufficiency. The preoccupied style describes an individual who is desirous of great intimacy, concerned about being alone, and worried that others won't value him/her as much as they are valued. The fearful style is one of discomfort with closeness, difficulty with trust, and fear of being hurt.

Interview-driven measure	*Brief Description*
Adult Attachment Interview (George, Kaplan & Main, 1984)	Mary Main and colleagues developed a semi-structured interview about childhood attachment relationships, and about the meaning which the individual currently attributes to past experiences. The narrative is analysed for material purposely expressed by the individual, and for material the individual seems unaware of (eg., apparent incoherence and inconsistencies of discourse). The scoring relies on (a) descriptions of childhood experiences, (b) language used in the interview, and (c) ability to give an integrated, believable account of experiences and their meaning. The language and discourse style used is considered to reflect the state of mind with respect to attachment.
Attachment Interview (Bartholomew and Horowitz, 1991)	It is an interview that assesses prototypes of adult attachment. These prototypes were based on Bowlby's conception that an attachment model involves ideas concerning both self and others. Inconsistent from Bowlby's original postulate, the scoring system previews the models of self and other as independent (Griffin & Bartholomew, 1994), and hence a four category system is delineated. The secure prototype reflects an individual who is comfortable in relationships, values relationships, and can be both intimate and autonomous (positive view of self and others). The preoccupied prototype is characterized by anxiety and emotionality and over involvement and dependency in relationships (negative re: self, positive re: others). The dismissing prototype is characterized by a person who values independence (positive self) and denies a desire for intimacy (negative re: others). The fearful individual is anxious, distrustful, and fearful of rejection (negative re: self and others).
Attachment Style Interview (Bifulco, Lillie, Ball & Moran, 1998)	It is an research-based interview assessed respondents' attachment styles on the basis of ability to make and maintain supportive relationships, together with attitudes about closeness/distance from others and fear/anger in relationships. Inter-rater reliability of the measure is satisfactory (Bifulco et al., 2002, Bifulco et al., 2004). The ASI includes an assessment of (1) support and (2) attachment style.
Current Relationship Interview (Crowell, 1990)	The interview analyses the attachment representation within the adult partnership by examining descriptions of the attachment behaviour of the self and partner using a format similar to the AAI. The scoring system (Owens & Crowell, 1992) parallels the AAI scoring system in that experiences with the partner, discourse style, and believability/coherence are assessed using a number of scales. Rating scales are used to characterize (a) the partner's behaviour, (b) the subject behaviour, and (c) the subject's discourse style: anger, derogation, idealization, passivity of speech, fear of loss, and overall coherence.

As easily can be drawn out of the two measuring traditions, adult attachment is a multidimensional and complex construct that incarcerates many difficulties for the measuring process. Each measure comprises a distinctive formulation on adult attachment, their patterns and applied evaluation strategies. In fact, the adult attachment research measures tradition differs in terms of *method* (self-report or interview), *dimensionality* (dimensions or categories), *covered domains* (peers, families, early relationships or romantic relationships) and *categorization system* (e.g., Q-sort, Ainsworth's patterns). Theoretically seen, these approaches showed different emphasis and correlates, one more of explicit nature and one more of implicit nature regarding to

the interpretation of the internal working model inside attachment nature, the *self-report driven approach* determine that each individual is capable of consciously expressing his/her feelings and perceptions about his/her relationships, as the *interview-driven approach*, using lexical and/or narrative methods, recognize that much of what characterizes attachment lies outside awareness of the individual. Bartholomew (1994) pointed out that self-report measures emphasise the respondents' capabilities to accurately identify and describe their perceptions and expectations of attachment experiences, while the interviews rely heavily on the refusal of such ability. Furthermore, as self-report measures are low economical, easily to use, rate and evaluate a large amount of subjects in a short period of time, the interview measures are expensive, time consuming and need extensive training. Actually, these arguments are common jargons inside both traditions and are easily outspoken as critics against each other. Normally the main claim of the interview based approach is that self-report measures have low reliability and validity values and a greater proneness for error, but a closer look at the literature will reveal that this is untrue (Feeney & Noller, 1990; Shaver & Brennan, 1992; Kirkpatrick & Davis, 1994; Sperling, Foelsch & Grace, 1996; Shaver, Belsky & Brennan, 2000; Fraley, Waller & Brennan, 2000; Shaver & Mikulincer, 2002). It has been the growing empirical evidence that made both approaches come to sit on the same table and discuss the relevant topics and independently to which approach we might feel more committed one thing is for sure, if we use multiple measures (interviews and self-report) of attachment the research outcomes are improved (for a detailed discussion see Crowell & Treboux, 1995; Bartholomew & Shaver, 1998; Lopez 2003; Bartholomew & Moretti, 2002). All the measures follow Bowlby's and Ainsworth's theoretical prepositions and as such they are much more two-sides of the same coin as archenemies. Regarding this Crowell and Treboux (1995) highlighted the joint work of both approaches and the need for increment in cross-disciplines collaborations to extend research on adult attachment to improve methods and theoretical issues. By the same token, Bartholomew and Shaver acknowledge that both approaches with their scopes and methods distribute their measuring power along a continuum where several aspects of adult attachment can be tapped. Lopez advice that by combining both approaches, we may track the conscious and unconscious processes and products of the internal working models, and thus providing a more comprehensive view of adult attachment. Similarly, Bartholomew and

Moretti advised for the joint use of both methodological traditions as possibility to "open windows" to provide data that best describe the conceptual hallmark of attachment. Many of these presumptions are described and discussed in Shaver and Mikulincer's (2002) paper which illustrated how this can be a real endeavour, presenting innovative and ingenious approaches or as Kobak (2002) commented they were responsible for "building bridges between social, developmental and clinical psychology" (2002, p. 216).

3.3. Contributes from Social Psychology and self-report measures: The Romantic Relationships research and Adult Attachment

Embedded on the empirical framework of Ainsworth's (1985, 1989), which claimed that romantic love impose a three system behavioural action (attachment, sexual mating and caregiving) where the attachment system were the central one, and the need for a theoretical framework that would extend Bowlby's ideas (1979/1980) about the phenomena of love, Hazan and Shaver (1987) and Shaver and Hazan (1988) put their efforts in conceptualizing romantic love both theoretically as empirically inside the attachment field. According to these authors, the emotional bond that grows between two adult romantic partners is (partly) a function of the same attachment behavioural system that raises the emotional bond between children and their caregivers. They defined romantic love as "(…) a biological process designed by evolution to facilitate attachment between adult sexual partners who, at the time love evolved, were likely to become parents of an infant who would need their reliable care" (1987, p. 523). They added that (…) "all important love relationships – especially the first ones, with parents, and later ones with lovers and spouses – are attachments" (1988, p. 75).

Implicit to these assertions are Bowlby's view of attachment as continuous process (1979). Thus, Shaver, Hazan and Bradshaw (1988) offered an extensive overview of the main common features of attachment in childhood and romantic love relationships in adulthood: (a) the quality of the bond depends highly on the partner's sensitivity, (b) provides a sense of security, (c) availability and close contact promote happiness, (d) implicate behaviours like, holding, touching, caressing, kissing, smiling,

crying, following, clinging, etc, (e) seeking contact when afraid or distressed, (f) separation cause distress, (g) happiness and seeking contact on reunion (if the bond is secure), (h) pleasure in sharing news and experiences, (i) prolonged eye contact and exploration of physical features, (j) occasional feelings of fusion, requiring reassertion of autonomy, (k) tendency to be concentrated on one preferred person at a time, (l) adversity increasing (to a point) the intensity of bonding desires and behaviours, (m) use of baby talk, relationship-specific idioms, (n) much of the communication is non-verbal, (o) feeling of being understood, (p) conceiving the partner as special, ignoring shortcomings, (q) deriving pleasure from approval and a smooth relationship, and (feeling anxious and hypersensitive when the relationship is on risk or doubts arise (Shaver, Hazan and Bradshaw,1988). Consistent with these similarities, Fraley and Shaver (2000) argued that children and adults are controlled by the same motivational, emotional and behavioural system (the attachment behavioural system), which is responsible for crystallizing similar individual differences, that resulted out of early attachment interactions and their relationship histories; but contrarily to childhood romantic bonds implicate sexual behaviours.

Underneath Hazan and Shaver's (1987) empirical plan where their strain to fulfil three aims: (a) overtake the Ainsworth's SS attachment classification to the study of love relationships; (b) analysing attachment continuity across life-span by studying the representational world of the individual (the internal working models); and (c) exploring the influence of early attachment relations over the romantic love bonds in adulthood. Therefore, they translated Ainsworth's three attachment styles and adapted their formulation to adulthood features. With this, they formed a self-report measure of adult attachment, in which subjects were asked in a forced-choice procedure to select one of three paragraphs (based on Ainsworth's attachment styles) as the one that best described their feelings in close relationships. To test these three category measure, the authors collected data out of a sample of 620 (aged 14-82) respondents from a news paper and 108 undergraduate students (with a mean age of 18 years). The results underline that the distribution of categories was similar to that observed in infancy (e.g., Ainsworth et al., 1978; Waters, 1978). In other words, 56% of the adults were classified as secure, 25% as avoidant and 19% as anxious-avoidant. Congruent with attachment theory, differences in the organization of the three attachment systems were found regarding their early family relationship reports, love experiences and their working models

(1987). Beside the paragraph-measure, a list of 37 adjectives to evaluate retrospectively the subjects perception of past attachment history, mainly of college and with adult subjects, was also considered. The results revealed that secure individuals described their mothers as respectful, caring, responsive, accepting, good confident and undemanding; as the insecure group mothers (avoidant and anxious-ambivalent) were portrayed as opposite. The main differences between the insecure groups were about: the mothers of avoidant individuals were described as behaving in a cold and rejecting manner, whereas the fathers of anxious-ambivalent individuals were emphasised as being "unfair", unstable or inconsistent (probably).

Along the results discussion, Hazan and Shaver (1987) highlighted the studies limitations out of the constrains of data collection, the usage of brief measures, only one romantic relationship was described, but even so their contribution raised much interest and followers among the research community (e.g., Feeney & Noller, 1990; Mikulincer et al., 1990; Rothbard & Shaver, 1994) which gave from now on a significant increment of attention to romantic relationship. Feeney and Noller (1990) designed a replication of Hazan and Shaver (1987) work, to assess links between attachment theory and other conceptions about love. Their results of a large sample aged between 17 and 58, supported the earlier work by verifying attachment group differences both on family history and working models measures. Different of the consistency findings with Hazan and Shaver (1987), but in line with attachment theory, Feeney and Noller showed that avoidant attached individuals reported more experiences of prolonged separation from their mothers during his childhood. Similarly, Mikulincer et al. (1990), in an Israeli adult sample, confirmed that avoidant individuals remembered episodes of their childhood relationships in less favourable way than secure or anxious-ambivalent individuals. Further, anxious-ambivalent individuals described their fathers in less positive terms than the secure group. Rothbarth and Shaver (1994), in an improved approach of the previous used checklist design of measuring attachment histories, confirmed strongly the previous feedings, stating that the three adult attachment styles remember childhood histories of relationships with their parents in a predictable way based on child-parent literature.

Despite these persistent findings, Kim Bartholomew (1994) started by asserting that Hazan and Shaver (1987) paragraphs failed to provide a distinction, a quite crucial one for attachment in adults, between individuals who, while admitting needs, avoid

satisfying them because of their fear of intimacy, and those who deny all attachment needs and assume a detached approach to relationships. She claimed that Hazan and Shaver avoidant category may cover-up important differences between two different types of avoidant adults, which probably in childhood are not relevant, one she labelled "fearful" and the other "dismissing". With this, she stretched the number of basic attachment styles from three to four, by introducing the "fearful category. This assertion was based on Bartholomew's (1990) empirical findings that evidenced that dismissing adults were predisposed to idealize parental memories as indirectly signalising that their parents were rejecting or emotionally distant. The secure adults saw their parents as supportative, affective and accepting, but they also admitted that their parents commit mistakes. Similarly to Hazan and Shaver's (1987) avoidant, fearful adults described to have had low episodes of parental involvement, high numbers of parental rejection and separation anxiety, during infancy. In the same way, preoccupied adults, like Hazan and Shaver's anxious-ambivalent group, admitted overprotection and clumsy behaviours by their parents mixed with an occasionally accessible and responsive parental acting.

Grounding on Bowlby's constructs of internal working models of the self and other, Bartholomew (Bartholomew, 1990; Bartholomew & Horowitz, 1991) proposed a four-group model of adult attachment in which the four prototypical attachment patterns were described regarding to two dimensions: positive vs. negative dimension of the person's model of self and the person's model of others. One critical aspect of this model is *attachment-related anxiety*, and if someone score high on it that means he or she worries whether their partner is available, responsive, supportive, etc; if it is low then this person is more secure in the perceived responsiveness of their partners. Another critical aspect is the so called *attachment-related avoidance*. Individuals high in this dimension have a preference in not relying on others, choosing to stay close to others. Individuals who score low on this dimension enjoy and feel comfortable on being intimate with others, exhibit a sense of security when they need to depend on others or helping others who depend on them. Within this conceptual model, the secure prototype is characterized by a dual positive model of the self and others; and, as such, they possess an internalized sense of self-worth and feel comfortable within intimate relationships. Preoccupied attached individuals are defined by a negative self model and a positive model of others. They exhibit an anxious way of acting in their attempt to achieve acceptance and approval from others; it seems that they are convinced of

gaining security by elicitation others to respond to them in an appropriate way. The fearful prototype has a negative self and others model. They evidence, alike the preoccupied ones, a high dependency of the acceptance and affirmation from others; but even so, they tend to avoid intimacy with the purpose to escape of possible loss, rejection or pain. The dismissing prototype is defined by both a negative model of the self and a negative model of others. As the fearful, they avoid intimacy and closeness, but they preserve a sense of self-worth that is constructed on their defensive rebuff of the importance and impact of close relationships on them.

The shift from a categorical to a dimensional approach of adult attachment raised an interesting debate with some arguing for a typology structure (e.g., Brennan, Shaver & Tobey, 1991; Brennan & Shaver, 1995) as others for a dimensional-conceptual structure (e.g., Griffin & Bartholomew, 1994; Fraley & Waller, 1996, 1998). In an attempt to find an optimal dimensional system to describe individual attachment differences in romantic love bonds, an impressive set of models and measures were applied, filling out a total of 320 self-report items applied to a large sample. The undertaken cluster analysis, using the higher-order factors of anxiety and avoidance, supported Bartholomew's four-group typology. This underlined that individual romantic attachment differences may be summarized in a two-dimensional axis (see Fraley, Waller & Brennan, 2000, for details).

As noted by Crowell et al. (1999), the emphasis on the theoretical dimensions of positive vs. negative models of the self and other impinge a greater weight on the *beliefs* they have about themselves and others, while adopting attachment styles as the central referent for measurement entails upholding the importance of the *behavioural system* involved in anxious monitoring of partner's availability and responsivity, and in the management of closeness vs. distance to (the attachment figure) in attachment-related situations. Regarding this, as asserted by Waters and Cummings (2000), these models entail an expanded position in terms of considering a cognitive reflection of the self and others to understand the adult attachment. This cognitive aspect is present, for example, in the Pietromonaco and Barrett's (1997) findings which show that a person high in preoccupation tends to overestimate, when making global judgements regarding their interactions with others across time, the level of emotionality they rated as being involved in those interactions, while dismissing avoidants clearly underestimate it. Although, the work of Mikulincer (1995) highlighted some aspects countering

Bartholomew's (too) simplistic approach that a only positive vs. negative dichotomy is enough to characterize self-representation within the attachment framework. His studies revealed other key dimensions as integration, differentiation, self-discrepancies as playing part of individual self and world view; but they also revealed that the model of self in secure and avoidants (as Bartholomew predicted) is in fact not identical. Secure individuals exhibit a greater degree of differentiation and integration of several aspects of themselves and, even if they are willing to recognize their negative issues they demonstrate lesser self-discrepancies. Contrarily, avoidant individuals demonstrate a lack of differentiation that can be attributed to their defensive style in avoiding painful memories and emotions. To complete this structure of the self, Mikulincer and Orbach (1995) analysed self-reports and laboratory tasks to tap the organization and functioning of affective memories. The results added to previous findings the fact that avoidants showed the highest levels of repressive defensiveness, having great difficulties in recalling negative emotional autobiographical memories and rating those emotions as less intense. The anxious-ambivalent individuals exhibited the lowest repressive defensiveness values, finding it relatively easy to recall episodes of negative emotions, but with a notably difficulty in preventing activation in face of the recalled emotion from spreading to other negative emotions. Finally, the secure individuals showed intermediate repressive defensiveness scores, being able to recall freely any memory with negative features, but were also able to avoid their spreading into an undifferentiated negative reaction (Mikulincer & Orbach, 1995).

Even so, with the presentation of this adult attachment model Bartholomew (1990) contributed significantly to Hazan and Shaver's (1987) aims, and improved notably the theoretical spinal cord of adult attachment romantic relationships. In fact, contrarily to others (e.g., Collins & Read, 1990, 1994; Simpson et al., 1996; Crowell, 1990; Feeney, Noller & Hanrahan, 1994) which centred their efforts in developing, improving and validation of measures, Bartholomew and colleagues (e.g., Brennan et al., 1991; Bartholomew & Horowitz, 1991; Griffin & Bartholomew, 1994; Scharfe & Bartholomew, 1995; Bellg, 1995; Bartholomew & Shaver, 1998) were more concerned in establishing "bridges" of convergence between the self-report driven approach and the interview driven approach, which would allow to analysing the intergenerational data and adult romantic relationship data within the same referential of attachment organization. With this bridge, a confluent stream of combined use of measures from

both adult attachment measurement traditions was initiated, allowing a synergic data analysis (see Holtzworth-Munroe et al., 1997, for example) and an increment of both theoretical and empirical understanding of what attachment is about in adult life (e.g., romantic love, peer relations, couple and marital relationships). Following, we will briefly review some of the major contributes of the empirical studies for the comprehension of attachment organization in romantic love relations.

Hazan and Shaver (1990) argued that love and work are the adult life domains that model those of attachment and exploration in infancy. Their results evidenced that secure individuals enjoy their work, manage in a balanced way their work and relationship valuing more their relations, and are not troubled by fears of failure. The anxious-ambivalent frequently see that love relationships interfere with their work, fear of being rejected due to work failures, and attempt to use work to compensate and satisfy unmet needs for love through the gain of respect and admiration from others. Avoidants, even admitting that work interferes with their relationships, argue that they use work to avoid engaging in interpersonal contacts and social interaction; thus, report to be less satisfied with their jobs than secures, and they are also less prone to enjoy their vacations (see also Mikulincer, 1997). Other studies have found that avoidants, when compared to secures and anxious-ambivalents, are less open to new information about a specific person (Green-Hennessy & Reis, 1998), and they are also less eager to change their judgements in response to new information, especially if this information will change their view to a positive direction (Zhang & Hazan, 2002). It should be added that the preoccupieds are particularly impulsive in their judgements, requiring much less information to shift positively or negatively their judgments about others (Zhang & Hazan, 2002).

Another central issue to attachment theory, beside the exploring system, is the separation context. Fraley and Shaver (1998), studying romantic couples in a separation airport context, verified that contact-seeking and maintaining behaviours were significantly more frequent between those who were separating, and were also more common among those who had relationships for a shorter period of time. The attachment style differences were more prominent among women. Between those who were not separating from their partners, a greater avoidance was linked to more caregiving and less avoidance while, among the ones who were separating the results pointed out the opposite (for similar results see also Feeney, 1998).

A central issue of a large bunch of studies has been in fact the quality and quality-related issues of romantic attachment relations. Individuals with secure attachment style have more optimistic ideas about the nature and duration of feelings of romantic love (Hazan & Shaver, 1987), but also about human nature broadly viewed (Collins & Read, 1990) and what future might reserve them (Whitaker et al., 1999); they tend to report more positive expectations about trust, dependence and closeness to their partners (Mikulincer, 1998). In a context of decision-taking over a relationship, Boon and Griffin (1996) underpinned that those individuals with a positive model of self (secure and dismissing) lean to frame them in terms of what can be gained, instead of what can be lost, which is much more typical of those with negative models of self (preoccupieds and fearful avoidants). In general, secures live, as they report, their romantic relationships with much more satisfaction, happiness, trust, intimacy, acceptance, and commitment (e.g., Mikulincer & Erev, 1991; Carnelley, Pietromonaco, & Jaffe, 1994; Feeney, 1993; Tucker & Anders, 1999). Secures' relationship tend to last longer (Shaver & Brennan, 1992; Kirkpatrick & Hazan, 1994) and are less likely to end up in divorce (Hazan & Shaver, 1987; Mickelson, Kessler & Shaver, 1997), but if a relationship ends they are less distressed (Simpson, 1990; Feeney & Noller, 1992; Whisman & Allan, 1996). Besides this, insecure attached adults also tend to react in a more destructive mode to relational transgressions of their partners (Gaines et al., 2000), using less adequate attitudes and seek less solutions for relational fights or conflicts (Levy & Davis, 1988; Simpson, Rholes & Phillips, 1996; Sharpsteen & Kirkpatrick, 1997). Regarding this, Pietromonaco and Barrett (1997) stated that preoccupied individuals were those who felt more positively toward their partner after a fight; this aspect may be a reason for their higher probability for staying in unsatisfying, harsh or abusive relationships, and investing in that relationship even after a break-up (Kirkpatrick & Hazan, 1994).

At another level, there has been some evidence that link attachment style with sexual behaviour and attitudes. Thus, secure individuals value sex within devoted, true love relationships, and as such loathe casual, uncommitted sexual intercourse (Stephen & Bachman, 1999), while the avoidant attached individuals exhibit more than any other attachment style, a accepting attitude toward casual sex, involve in "one-night stands" and defend vigorously that sex without love is gratifying (Feeney, Noller & Patty, 1993; Brennan & Shaver, 1995). Even so, Bogaert and Sadava (2002) found that avoidant

women tend to engage less often than man in relationships and intimate intercourse (see Kirkpatrick & Hazan, 1994, for similar results). Herewith, it is much easier to understand Feeney, Noller and Patty (1993) results that avoidant women and anxious-ambivalent men are likely to have sex less often. Consistently with these findings, it has been found that avoidant and preoccupied individuals possess a more negative perspective on sexuality (Cyranowski & Andersen, 1998). These negative perceptions and expectations reflect their working models, and as such the attachment style is omnipresent the view of how the relationship work (Simpson, Rholes & Phillips, 1996; Feeney, 1998).

The attachment groups also differ in terms of how they cope in stress situation. Mikulincer, Florian and Weller (1993) studied such situations (missile attacks) in Israel during the Gulf War, and found that secure individuals were those who sought more support from others, while avoidant ones opted to distance themselves from the threat (mostly by trying to forget everything). The ambivalent individuals tended to use emotional responses, blaming themselves and/or desiring to feel in a different way. Furthermore, this study also revealed that the insecure groups (avoidant and ambivalent) described themselves as having more psychosomatic symptoms and hostility. Additionally, ambivalent individuals also exhibited more anxiety and depression symptoms (Mikulincer, Florian & Weller, 1993). The presence of depressive symptoms linked with insecurity were also found in other studies (e.g., Roberts, Gotlib & Kassel, 1996; Whiffen et al., 2001), so as with anxiety (e.g., Eng et al., 2001). Similarly, at a psychopathological level, Mickelson, Kessler and Shaver (1997) verified in large American sample that secure attached individuals were negatively associated, except for schizophrenia, with a lifetime prevalence of DSM-III-R psychiatric disorders. The anxious-ambivalent individuals were less prone to engage in alcohol and drug abuse, but as the avoidant ones they were positively linked with every single type of disorder. Additionally, Dozier, Stovall and Albus (1999) argued that dismissing attachment organization is particularly prone to externalizing disorders (e.g., conduct disorders, substance abuse).

At the interpersonal level, Bookwala & Zdaniuk (1998) took into account relationship length and satisfaction, showed that preoccupieds and fearful avoidants were more engaged in reciprocally aggressive dating relationships. At a deeper level, analysing the data for interpersonal problems, the authors verified that only preoccupied

individuals were seen as a predictor of relationship violence. These findings underpin that the preoccupied style is driven by his/her perception of lack of power to control the relationship and as such he/she reacts with a dominant behaviour (violence). Although, out of this reciprocal relationship context, more severe forms of aggression (especially by men) have been more linked to fearful avoidant pattern than to preoccupied (Dutton et al., 1994; Rholes, Simpson & Oriña, 1999). Criminal behaviour has shown that most of the offenders have insecure attachment styles, being dismissing attachment specially linked of those who commit violent crimes and sexual crimes. This link has been analysed by Baumeister and Campbell (1999) which asserted that serious violence is most likely to be authored by people with high self-esteem, nurtured by narcissistic egoism and active despising to others. Although, when considering child abuse the criminals were more likely to be classified as fearful and preoccupied, and less as dismissing (Ward, Hudson & Marshall, 1994).

Finally, Schmitt et al. (2004), integrated in the International Sexuality Description Project, analysed a total of 17,804 individuals out of 62 cultural regions with the broad aim of analysing cultural influences over the Model of the Self and Others are similar in many different cultures. The results showed that in 79% of the cultures the secure attachment style were the most prevalent one; although in East Asian cultures, preoccupied romantic attachment were more common. These results highlighted many claims in the literature (Belsky & Isabella, 1988; van IJzendoorn & Sagi, 1999) for the importance of cultural features and their influence on attachment and romantic love relationships. Given the fact that secure attachment is not always the dominant pattern of attachment and romantic relationships across all cultures, it does not challenge the main assumptions of attachment theory, namely the universality, normality and sensitivity-competence inside the cargiver-careseeker relationship. It is much more a sign of the dynamical interplay between biology and environment, in which sometimes secure attachment is not of advantage against insecure, especially when environmental conditions are harsh or elicit such insecureness. Recognizing the importance of environmental conditions, especially culture, Schmitt et al. (2004) advanced three possible explanations of how culture may influence attachment development and its patterns: (a) the bionetworks and natural balance of the individual's environment may be at the core as an eliciting factor of more insecure features among the attachment behaviours and attitudes throughout the relationships; (b) social and

historical aspects may be strong underlying factors influencing each individual to be more egocentric-independent or altruistic-group oriented, aspects which more directly or indirectly are reflected on attachment relationships; and (c) differences in attachment and romantic love relationships from region to region may be explained with differences on how each culture conceive the Model of Self and Other and where the religious, political, economical and social values are central issues (see Schmitt et al., 2004, for details).

A couple of years ago, Rothbaum et al. (2000) challenged that Bowlby's model would describe precisely Japanese infant-mother relationships, and as such, attachment theory were unable to provide knowledge of close relationships across culture and subculture. This paper generated considerable debate inside the attachment research community, being mainly criticised because of (a) existing data of secure base relationships in different countries and cultures was ignored, (b) the concept of secure base relationships for socialization process was misinterpreted, and (c) the secure base relationships were seen as a conception of Western way of thinking.

To underpin the critical argument against Rothbaum et al. (2000), we may consider the Ainsworth's (1967) classical study in Uganda that showed that the secure base phenomenon is observable in different cultural and social contexts. More recently, in an attempt to test the universality of the phenomenon, Posada et al. (1995, 1999) considered secure base behavior in samples from seven different countries: China, Colombia, Germany, Israel, Japan, Norway, and the United States. The findings demonstrated considerable empirical support for the hypothesis that the secure base phenomenon is present during child–mother interactions in all cultures studied. Other attachment studies performed in asian countries (e.g., Chen, 2003 cit. in Schmitt 2004; Mallinckrodt & Wang, 2004; Wu cit. in Schmitt, 2004) also argues against Rothbaum et al's, especially because similar to U.S.A., significant relationships between attached individuals, their adjustment and psychological well being were found.

At another level, instead of outlining a review of the cross-cultural research about the connection of security and competence, Rothbaum and colleagues (2000) relied heavily on the cultural specificity inherent to the construct of competence. Based on that they consider that competence is culture-dependent and as such it varies from culture to culture; this might be so but without empirical grounding these arguments are hooked on thin rope, especially if there are studies that prove the opposite, even if there

is a cultural variability, regarding the security-competence issue inside Japanese cultural context (see Takahashi, 1990; Wang & Mallinckrodt, 2006). Beside the possible hick-hack around conceptual definition, there is one important thing related to this controversy, it is that all human beings have the ability to develop a secure base relationship with one (or more) caregivers, even if this ability is not possible in every family or every cultural context. Therefore, culture and family crucially model how caregivers and infants communicate among themselves and use secure base relationships, and as such, cultural values and backgrounds should not be taken too easily as in many studies but neither too naïve as in Rothbaum and colleagues approach.

The third major critic against Rothbaum et al.'s (2000) position concerns the argument that current theory of attachment is ethnocentric, Western culture-driven and annoying cultural differences. Indeed, Western and Eastern cultures are more miscellaneous with all the globalization process, and attachment theory is less restrictive than Rothbaum and his colleagues posted. For them, researchers must develop "an indigenous approach to the psychology of attachment" (Rothbaum et al., 2000, p. 1093) to integrate a multicultural psychology. Although such arguments has considerable mistakes because what is meant by culture, countries, social-economical status, attitudes, norms, values and/or behaviours; it is not really made clear throughout Rothbaum and colleagues paper (2000). But higher than that, in my personal opinion, by positioning themselves as Maecenas of cultural diversity and specificity they are losing out of sight the empirical grounding of theorization and killing generalization of attachment theorization. I will not say that they are completely wrong, rather than that their suggestion should be considered by every attachment researcher with rigour and reflection, and also tested with structure, method and flexibility to adopt culture-sensitive theory of attachment, if the empirical evidence point that way. Even so, fact is that the present state of art supports the universality of the secure base phenomenon and therefore attachment theory justifies its claims of cross-cultural validity; but it does not preclude the existence of cultural or within-culture differences.

3.4. Contributes from Developmental and Clinical Psychology and their interview measures: The Intergenerational Transmission

Until 1985, almost all attachment research was focused on behavioural observation, mostly linked with Ainsworth's SS. These behavioural driven research comprised home observations (see Belsky, 1999b for a review), SS protocols (see Solomon & George, 1999 for review) follow-up studies aiming to analyse the correspondence of the behaviour along the first year, kindergarten and preschool (see Weinfeld et al., 1999 for a review); although discourse or verbal behaviour was (mostly) never taken into account. Therefore, when Main, Kaplan and Cassidy (1985) came up with the monograph (see Bretherton & Waters, 1985) named "Growing Points of Attachment Theory and Research: A Move to the level of Representation", it marked a turning point in attachment research. First, attachment "grows" to consider adulthood of interest to be studied. Second, attachment behaviour were no longer the only feature to be considered for judging attachment, now there was a "move" to discourse and narrative analysis that grasps the representational world. Third, despite Ainsworth longitudinal aims, a deeper comprehension of attachment organization and attachment's individual differences is provided by integrating developmental features and the history of intergenerational transmission. Fourth, at discovering and describing attachment disorganization in childhood and extending it to adulthood a new window was opened to understand psychopathology, attachment disruption and their associated factors. Finally, the development of a discourse-based methodology (AAI) enabled to uncover the attachment organization.

The contributions of this publication were largely embedded into the SS context. In fact, Main and colleagues interviewed (with the AAI) parents of children's which five year before have been observed in the SS paradigm (see Ainsworth, Blehar, Waters & Wall, 1978 for a description of those results), about their own experiences with their parents in infancy and adolescence. Results supported the intergenerational transmission of attachment in two ways: (a) infant attachment classification, symbolizing mother-infant interaction quality, predicted the discourse responses in the Separation Anxiety Test (see Kaplan, 1987 for details), five years after the SS; (b) father and mother narratives about their own parental interactions in infancy and adolescence were predictive of SS behaviour toward their child. With such findings Main and his

colleagues substantiated a verbal behavioural approach if attachment, an approach for which the AAI development was crucial in the same way as for Ainsworth the SS was; the bridge between these two evaluation procedures is made clear in Main, Kaplan and Cassidy's (1985) work.

The AAI addresses the individuals' representational world by confronting and stressing him to describe his behaviour and the behaviour of these caregivers in specific situations, such as personal or family problems, diseases and accidents, separations, rejection experiences, threats, punishment, abuse and violence, and loss. Each of these situations is grounded in a question which elicits memory search and general appreciation of the relationship with attachment figures, and thus, activates the attachment system. The activation is not a simple questioning about such situations, it also involves querying about the implication of such event for the individual's life, for his personality and the way he behaves. Therefore, it can be stated that when an individual enters the AAI, he/she steps into the arena where memories are displayed, where he/she actively can think about them, avoiding or changing them; it is a moment where confrontation and metacognition of behaviours, cognitions and emotions are aroused, and as such internal working models reprint the attachment organization of that individual. For this reason, a secure internal working model will give full access to all situational-relevant knowledge of relationships with caregivers, and may also open the possibility of integrating positive and negative situational feature in a coherent way, and consequently the individual will behave in a objective, collaborative, clear and reflexive mode during his attachment history presentation. Contrarily, insecure internal working models will drive the individual to an absence of integration ability and also to important restrains in his attention, memory, language, emotions and thought during his attachment history 'print out'. A more detailed review of AAI description, procedures and scoring methods can be found in several publications (Main, Kaplan and Cassidy, 1985; Main, 1991; van IJzendoorn, 1995; Soares, 1996; George, Kaplan & Main, 1996; Hesse, 1999).

By running a meta-analytical study, van IJzendoorn and Bakermans-Kranenburg (1996) compiled 33 studies that implicated more than 2,000 AAI classifications distributed in samples of nonclinical mothers, fathers, in adolescents, in different cultures samples, and in clinical groups, with the aim of determining normative data for attachment representation in different samples. Table 4 presents a brief summary of the

distributions of classifications in normal and clinical samples. As can be seen, the combined distribution of nonclinical-mother samples seems to be very similar to the distribution of nonclinical mothers. These results are quite similar to those found with the combined samples of nonclinical infant-mother dyads evaluated with the SS, namely 67% secure, 12% ambivalent and 21% avoidant (van IJzendoorn et al., 1992). Of notice are the underrepresentation of autonomous mothers (58%) and a overrepresentation of preoccupied mother (18%) in AAI distribution, when compared with SS distribution. When the unresolved category was considered (n = 487) the mothers nonclinical distributed as follows: 55% secure/autonomous, 9% preoccupied, 16% dismissing, and 19% unresolved. Again no significant difference was found regarding the fathers whose values were quite similar (see van IJzendoorn & Bakermans-Kranenbourg, 1996, for details). By the same token, adolescents' distribution was remarkably similar to mothers and fathers distribution.

Table 4. Distributions of AAI Classifications in Normal and Clinical Samples.

	Distribution (%)		
Population	Secure/autonomous	Preoccupied	Dismissing
Mothers (n = 584)	58%	18%	24%
Fathers (n = 286)	62%	16%	22%
Adolescents (n = 237)	56%	19%	26%
Low Socioeconomic Status (n = 254)	57%	15%	28%
Parents of Clinical Children (n = 148)	14%	45%	41%
Clinical Adults (n = 291)	12%	47%	41%

Note: Based on van IJzendoorn and Bakermans-Kranenburg (1996).

Furthermore, five studies on adult attachment in 226 couples (Cohn, Silver, Cowan, Pearson, 1992; Crittenden, Partridge, & Clausen, 1991; Miehls, 1989; Steele, Steele, Fonagy, 1993; van IJzendoorn et al., 1991) evidenced secure/autonomous wives and husbands got married more often than expected by chance (r = .28); even so, about one third of insecure wives were married with an insecure (dismissing or preoccupied) husband (but this was not found in the opposite direction). This result seems to support a stabilization of security or insecurity at partners picking, but evidenced also some assertions that this is by no way the rule of a shared similar working model. Moreover, van IJzendoorn and Bakermans-Kranenburg (1996) stated that the verified correlation of

attachment security of wives and husbands may be equated as possible explanation for the modest association of infant-parents attachment security (e.g., Fox, Kimmerly, Schafer, 1991). The socioeconomic status or nationality was not found to influence attachment distribution. Even so, the unresolved category was overrepresented among low socioeconomic status groups, as the secure category tended to be underrepresented. Analogously, in clinical samples a strong overrepresentation was found, but no significant relation could be found in respect to diagnosis and attachment category.

However, other studies have found results in supporting a diagnostic specificity. In one of these studies, Rosenstein and Horowitz (1996) used the AAI with a sample of 60 adolescents admitted to a psychiatric hospital, so as with 27 of their mothers. Contemplating the three main categories, a significant concordance (.62) between mother and child classification was found. Moreover, the attachment classification of adolescents was related to clinical diagnosis, and at a lesser degree, to self-report personality measures and its dimensions. The link between attachment categories and diagnosis was also significant, namely dismissive adolescents were associated with disturbances involving minimization of distress (substance abuse, conduct disorders and narcissistic or antisocial personality disorders); the preoccupied ones showed more committed to suffer from disorders involving expression or exaggeration of distress (affective or obsessive-compulsive, histrionic, borderline or schizotypical personality disorders). The self-reported measures of psychopathology and personality traits indicated quite similar results. Cole-Detke and Kobak (1996) verified that a preoccupied representation was related to depressive symptoms, while dismissiveness was more related to an indirect expression of distress (eating disorders symptoms), what was especially evident when depressive symptoms were statistically controlled. Analogously, Pianta, Egeland and Adam's (1996) using the MMPI-2 in a high risk poverty sample of young mothers, found findings that support differences in distress expression in line with attachment categories. Their results point out that preoccupied category yield the largest number of signals of distress and relationship problems, while the dismissive group reported almost no distress and highlighted their independence.

With the development of the AAI empirical work evolved to the study of intergenerational transmission focusing on determining how parents' mental representation of past experiences influences the actual parental behaviour and the

quality of their relationship upon their children (Bowlby, 1973; Main, Kaplan & Cassidy, 1985). This step forward in attachment research was focused on developing two main empirical routs, based on longitudinal designs, namely (a) find predictors of SS based on parental attachment quality (b) identify factors and mechanisms that moderate or mediate attachment development from infancy to adulthood.

3.4.1. The link between parents and infants attachment: uncovering the transmission gap

Building upon Main, Kaplan and Cassidy's (1985) results, a great amount of research (e.g., Ainsworth & Eichberg, 1991; Fonagy, Steele & Steele, 1991; Radojevic, 1994; Benoit & Parker, 1994) addressed the correspondence of adult attachment as a predictor of SS classification of infants. These studies showed high degrees of parent-infant attachment correspondence of 80% (Ainsworth & Eichberg, 1991), developed methodological designs to avoid possible bias (mothers were interviewed prior to child's birth, Fonagy, Steele & Steele, 1991), extended the three-way model including the unresolved category (Radojevic, 1992), and provided an overview of intergenerational transmission with a three-generation study (Benoit & Parker, 1994). In fact, Benoit & Parker (1994) completed a three-generation study, involving 96 infants, their mothers and maternal grandmothers. Both SS and AAI were used to classify subjects in three- and four-category systems. The mothers' AAI classification prior to child's birth was found as a predictor of SS category in 81% of the cases and 68% depending if a three or four category system were used; and grandmothers AAI classification were predictive of 75% (3 categories) and 49% (4 categories) of cases. Further analysis revealed a simple and direct parent to infant transmission of attachment organization, in which grandmothers' adult attachment category contributed significantly to those of their grandchildren (Benoit & Parker, 1992).

In an attempt to summarize many of these studies, van IJzendoorn (1995) compiled almost a decade of AAI studies with the aim of providing an overview of the parent-infant correspondence of attachment categories. This research performed three meta-analyses in which 18 samples (n = 854 dyads) out of 14 studies from six different countries were considered. The first meta-analysis highlighted a 70% rate of

correspondence across studies; this correspondence rate was higher in studies with mothers (r =.50) as with fathers (r =.37). A comparison between those five studies (Benoit & Parker, 1994; Fonagy, Steele, & Steele, 1991; Radojevic, 1992; Ward & Carlson, 1995), which assessed attachment representations of parents prior to their first-born child, and those assessing simultaneously AAI and SS or even applying the AAI some years after the SS, revealed no effect-size differences underpinning the equivalence of these two approaches. Moreover, as Hesse (1999) pointed out, this highlights "the likelihood that individual differences in infants' contribution to interactions with the parents could not account for the relation between the interview and SS behaviour". A second meta-analysis explored the correspondence of the infant's avoidant attachment with parent's dismissing attachment representation; and in fact, this correspondence was found (r = .45) with a more pronounced correspondence for mothers (r = .50) than for fathers (r = .32). The last meta-analysis focused in analysing infant's ambivalent classification and its relation with parents' preoccupied AAI classification confirmed a combined effect size of r = .42 (without any difference between mothers and fathers (van IJzendoorn, 1995).

Beside the transmission supporting evidence of such findings, one thing is for sure, this transmission is far from being 100%. There are cases where secure parents raise insecure children and vice-versa. Most of these cases has been hidden or excluded from data analysis under the conviction that they were errors of measurement. But this assumption is completely untrue when facing the good reliability and validity studies that link AAI with SS (e.g., Bakermans-Kranenburg & van IJzendoorn, 1993; Sagi et al., 1994; Crowell et al., 1996). Based on this, van IJzendoorn (1995) posted the expression "transmission gap" to remind that many factors that link child and adult attachment together remain unexplained. Indeed, transmission is a dynamic process where many factors interact and as such it would be unexpected in light of the internal working models to reduce the transmission to a one-on-one transcript of attachment organization.

Similarly to van IJzendoorn's (1995) findings, some years later, Fraley (2002) conducted a meta-analysis with 218 cases out of five longitudinal studies which yielded a cross-time linkage regarding the attachment assessments. All participants were evaluated with the SS protocol at 12 months of age, and later assessed with the AAI when they were between 16-21 years. The results heavily support the assumption of a

transmission gap, which Fraley labelled as "lawful discontinuity", in the way that only a moderate stability coefficient (r =.27) was found between attachment assessed in infancy and attachment in adulthood. These two meta-analytical approaches let the door wide open for studies which focus more the factors that would fill the transmission gap.

One of the equated gap-related factors has been sensitive responsiveness (Meins, 1999, Serbin & Karp, 2003) – the "ability to perceive and to interpret accurately the signals and communications implicit in the infant's behaviour, and given this understanding, to respond to them appropriately and promptly" (Ainsworth, Bell & Stayton, 1971, p. 127). Caregivers' sensitivity is inside the attachment field, a key component of whether a child develops a secure or insecure bond with the caregiver. Even so, van IJzendoorns' results (1995) (apart from their limitations with insecure categories differentiation) revealed only a moderate association between parents' attachment representations and parental support/sensitive responsiveness of r = .34, and the correspondence of parental attachment representations and infants' attachment classification was .47, which means that the unexplained part accounts for .36. Although, only considering sensitive responsiveness as a mediational factor of the strong link between children's and parents' attachment seems to be scarce. Still under the scope of such results, a wide spreading amount of research was undertaken exploring the role of sensitivity in filling the gap. Following, studies will be presented that clearly tap this line of thought.

Belsky and Fearon have drawn their attention to early attachment relationships as a possible organizer of attentional systems (Belsky & Fearon, 2002, Fearon & Belsky 2004). Their findings posted that early insecure attached infants that received an increment of sensitivity showed more positive developmental outcomes (socio-emotional and cognitive linguistic) at age 3 than early attached children that are confronted with insensitivity. These results underline that once achieved security is by far no guarantee for maintaining it, and also foster the idea that sensitivity mediates intergenerational attachment transmission. Most of these results were extended in the National Institute of Child Health and Human Development study (NICHD, 2003), which supported that maternal sensitivity was the strongest predictor of all developmental outcomes measures in relation to child care. When mothers afforded more sensitivity in caretaking, their infants showed greater social competence, fewer problematic behaviours, and engaged less in conflicts with adults at 54-months and

during the kindergarten period; which was even more astonishing, was the fact that this increment in maternal sensitivity replied positive outcomes even for toddlerhood and preschool time - the effect was maintained (NICHD, 2003).

A meta-analysis of intervention studies revealed that intervene in attachment security is a difficult task and that interventions only provoke moderate shifts regarding sensitivity (Bakermans-Kranenburg et al., 2003). Moreover, Bakermans-Kranenburg et al. (2003) posted that the assertion that "less intervention is more", given the fact that attachment security even if it is linked with sensitivity, it is not directly dependent on the amount of intervention offered to mothers and fathers. Additionally, another study, with 81 primiparous Dutch mothers classified with the AAI as insecure, and as such an at-risk of raising insecure attached infants, verified that mothers of highly reactive children earned more from receiving sensitivity-fostered intervention than others (Velderman et al., 2004). The authors (Velderman et al., 2004) also noted that only in high negative-reactive group sensitivity played a role in predicting attachment security; therefore, they concluded the existence of a differential susceptibility to rearing practices evidenced by the fact that, highly reactive infants show an increased susceptibility to their mothers' change in sensitivity levels (see also Belsky, 2005, Kretchmar et al., 2005; for similar findings).

Further, Tarabulsy et al. (2005), in a sample of adolescent mother-infant dyads, verified that sensitivity was a significant mediator and state of mind no longer contributed to infant security. Moreover, sensitivity also proved to mediate an association between maternal education and infant attachment, suggesting that attachment transmission is embedded in a more global process of infant attachment development. Similarly, a recent research by Bailey et al. (2007), with an at-risk sample of 99 adolescent mothers, aimed to study the interrelations of maternal attachment representations, mother–infant interaction in the home, and attachment relationships underpinned several theoretical predictions relating interaction with autonomous maternal representations and secure attachment, nevertheless failed to support a mediating role for maternal sensitivity.

Other studies have highlighted genetic factors (e.g., Bakermans-Kranenburg & van IJzendoorn, 2006a e b; Caspi et al., 2002; 2003; Foley et al., 2004; Suomi, 1995, 1997; Widom & Brzustowicz, 2006) as ingredients to explain the transmission gap. Suomi (1991, 1995, 1999) studied two different genotypes of Rhesus Monkeys being

able to associate one genotype with the emergence of a reactive temperament (Suomi, 1991, 1999). He found that young monkeys of the reactive group were especially vulnerable to changes in early rearing conditions. These genotype when subjected to maternal deprivation during their first six months of life showed perturbations of their neuroendocrine functioning (especially cortisol), were much less exploratory in regard to their environment, and exhibit a variety of pathological symptoms into adulthood, such as incompetence in social interactions, ended up at the bottom of dominance hierarchy and evidenced incompetence in mothering (later) their own offspring (Suomi, 1999). On the other hand, young animals without that genetic risk factor showed themselves as much less shaped by maternal deprivation, being therefore more able to explore, engage and confront with the physical and social environment as those newborn monkeys with the reactive genotype. Similar results of cross-fostering work with a strongly reactive and a low reactive genotype have also been obtained with rodents (see Anisman et al., 1998).

In humans, Caspi et al. (2002, 2003), under the scope of a longitudinal study, with 400 New Zealand boys from age 3 to 26 with the purpose of establishing possible reasons why some maltreated children grow up exhibiting antisocial behaviour while others do not. The results showed that a functional polymorphism in the gene encoding the neurotransmitter-metabolizing enzyme monoamine oxidase A (*MAOA*) was linked as a mediator-effect of maltreatment. Even if maltreatments affected all children, they were disproportionally susceptible to those experiences. The maltreated children carrying a genotype which confers high levels of *MAOA* expression were less likely to develop antisocial problems, as the genotype that conferred low levels of *MAOA* fostered antisocial behaviour in the children that carried it. A somewhat similar study was accomplished by Foley et al. (2004) with a sample of white twins, aged between 8 and 17, in order to determine if *MAOA* genotype and childhood adversity interacted to predict risk for conduct disorder. Consistently with Caspi et al. (2002, 2003), Foley and colleagues supported the assumption that genotypes with low *MAOA* represent an increased risk for child conduct if these children are posed under adverse childhood environment (Foley et al., 2004).

Though, some caution should be dedicated to these results as the Widom and Brzustowicz (2006) study with white and non-white men and women evidenced. These authors started from the hypothesis that the high levels of MAOA genotype would

interrelate with child abuse and neglect to attenuate or protect against the risk of developing violent and antisocial behaviour. The results replicate previous findings (Caspi et al., 2002, 2003; Foley et al., 2004) for white participants, but for no main effect was found for non-white abused and neglected individuals - there was no high levels of *MAOA* genotype buffering from increased risk of behaving violently and antisocially. This study underpins clearly that intergenerational transmission is not only about having a genetic vulnerability, it also implies differential susceptibility which is regulated by means of the environment, and it is the interaction of genotype and environment that will set the transcript for transmission.

Let us now consider some studies that explored links between molecular genetics and attachment disorganization. These studies do not directly address the theme of intergenerational transmission, even though they show us triggering evidences of how attachment is linked with genetics. The first attempt of such studies was performed by Lakatos et al. (2000, 2002), which found a link between the dopamine D4 receptor (DRD4) gene polymorphism and attachment disorganization. This assumption received with some criticism since Bokhorst et al. (2003), in a study with 157 monozygotic and dizygotic twins, found evidence that the role of genetic factors in disorganized attachment were insignificant. Based on these divergences van IJzendoorn and Bakermans-Kranenburg (2004) made a replication of Lakatos et al (2000, 2002) study, using a sample of 132 infants, to examine the role of the DRD4 in disorganized attachment. The results showed no association between DRD4 and disorganized attachment, fostering Bokhorst's assumptions. The authors explained their empirical evidence in light that it seems more the parental factors as the genetic factors responsible for the presence (or not) of attachment disorganization.

Recently, Minnis et al. (2007) published a study in which a deeper look was performed concerning attachment disorder and its (possible) environmental aetiology; in detail the authors tested if the behaviours referred to attachment disorder were distinct from other childhood behavioural and emotional problems and if they were exclusively a product of the environment. The study comprised a large community sample of 13,472 twins that were asked to self-report behaviours indicative of attachment disorder, conduct problems, hyperactivity and emotional difficulties. A behavioural genetic model-fitting analysis was applied to explore the input of genes and environment. The data was submitted to factor analysis, which evidenced a comprehensible discrimination

of the behaviours associated with attachment disorder from conduct problems, hyperactivity and emotional problems. Moreover, the performed behavioural genetics analysis showed a strong genetic influence on attachment disorder behaviour, especially with male individuals, being the ones that evidenced higher heritability.

All these previously exposed studies showed that genetic is a factor to account for filling the transmission gap, but by itself it is insufficient. As might be noticed, these genetic predisposition seems to be strongly under a certain type of environment (rearing) but would this also be the case if the environment would not be like that?. In fact, there is evidence that genetic predisposition/vulnerability is not the full story, we will now address some evidences out of the environmental factors that contribute for the transmission gap, for instance, van IJzendoorn (1995) emphasizes the need for environmental and contextual constrains, and Sagi et al. (1997) found that attachment transmission throughout the generations is by no means a "universal phenomenon" but rather relies on "specific child-rearing arrangements". Analogously, Tienari et al., (1994) contrasted a large sample of adopted children in Finland, children with a schizophrenic biological parent in relation to adopted children without carrying that risk factor. The results showed that the at-risk children were more likely to develop psychiatric problems, but only when their environment of adoption was dysfunctional (see also Bohman, 1996, for similar results regarding criminal behaviour). Thus, there is a dynamical interaction between environment and genes. Based on this assumption, Kochanska (1995, 1997) focused her scope of interest upon the development of conscience in young children. She found that for shy, fearful and temperament reactive children, a parental attitude of power- assertion does not appear to promote conscience, instead a more gentler rearing practices are called for. But for those children that are low fearful and anxious, firmness is the most effective practice to deal and develop a close emotional bond with the child and to attune maternal responsiveness. This means that anxious children are more prone to socialization, more able to obey and feel more internal discomfort when caught transgressing (Dienstbier, 1984; Kochanska, 1997).

In line with such findings, Belsky et al. (1997) noticed that 36 months old children with high negative emotionality were more susceptible to rearing influences. Moreover, Deater-Decker and Dodge (1997) verified that maternal reports of harsh punishment functioned as predictors of externalizing problems, and these were particularly accentuated in children who reported to have been highly resistant and

persistent in infancy. Feldman et al., (1999) obtained results somewhat similar to the previous ones; she found that the interactional synchrony of mother-infant was a good predictor of self control at 24 months of age, though this was especially true when children had been classified as difficult infants. Following the already documented studies that underpin the effects of intervention programs on negative children's emotionality, Blair (2002) showed by reanalyzing data of 36-month old children's problem behaviour that designed treatment affect differentially infants in terms of their early negative emotionality. Even by considering recent findings out of the intergenerational transmission of child maltreatment, a field where (in the past) a maltreated child would become a maltreating father or mother, but is this true? Dixon et al. (2005a) using a mediational analysis showed the presence of three main risk factors involved in the intergenerational transmission, namely: parenting under 21 years, history of mental illness or depression, and residing with a violent adult. The total effect of these three factors combined explained 53% of the variance, which only provide a partial mediation of the intergenerational transmission of child maltreatment. Further, in another analysis, Dixon et al. (2005b) verified that the mediational effect of parenting styles accounted for additional 9% of the explained variance. Thus, the three risk factors and the parenting style explained 62% of the total effect, and as such, even in child maltreatment all these factors are unable to provide a full causal relation of intergenerational transmission.

After the failure of the genetic approach in fully explaining the transmission gap, and the well supported and promising results out of the studies exploring environmental effects on attachment, some researches embraced into a joint venture taking into account simultaneously the genes and the environment. One of such researches was performed by Bakermans-Kranenburg and van IJzendoorn (2006b) with the purpose of determining whether the *combination* of the DRD4 7-repeat polymorphism and insensitivity acting by mothers predicted a strong increased externalizing behaviour in preschoolers. The results indicated a gene-environment interaction effect, where maternal insensitivity was correlated with externalizing behaviours, but this was only the case under the presence of the DRD4 7-repeat polymorphism. The numbers evidenced that infants were differentially susceptible to insensitive parenting dependent on the presence of the 7-repeat DRD4 allele, but they also indicated that under high sensitivity environments the presence of the 7-repeat DRD4 allele was not enough to

elicit high externalizing behaviours. Almost as a retest of these findings, Bakermans-Kranenburg et al. (2006) designed a controlled study where mothers' sensitivity and positive discipline was manipulated. The main idea was if an experimental intervention focused to increment maternal sensitivity and foster positive discipline could reduce behavioural problems of toddlers, and will this be useful with children at risk, children with the 7-repeat DRD4 allele? In line with previous results, the intervention was effective for children with the 7-repeat DRD4 allele; the mothers became more sensible and practiced more positive discipline, and thus the toddlers decreased their behavioural problems. Finally, in a recent published paper, Feinberg et al. (2007) examined if latent genetic factors and measured parent-child relationships interact in predicting adolescent antisocial behaviour and depression. A total of 720 families with at least 2 children, 9 through 18 years old, stratified by genetic relatedness were recruited and assessed regarding antisocial behaviour and depression symptoms. The results highlighted an interaction effect of the genotype, being the genetic influence more expressive for adolescent antisocial behaviour when negative and less warmth parenting was present. Thus, parental negativity and low warmth were predictors of antisocial behaviour and interacted with the genotype.

Along this intense debate of how to fill the transmission gap, genetic factor perspective heavily invest on genetic vulnerability - a child that possesses a genetic characteristic will develop it under the presence of risk conditions - as the environmental factor perspective stated more on the differential susceptibility view - certain individuals that carry certain genotypes are disproportionately susceptible to both adverse and beneficial effects of rearing (e.g., Frazzetto et al., 2007). As the former researches evidenced, none of these two "sides of the coin" is ready by its own to explain intergenerational transmission, instead it is far more an integrative view of both perspectives that offers promising results and opens doors for interventional effectiveness. And as such, behavioural and psychological phenomena, given their immense complexity, need simultaneously genetic and environmental-experiential explanations to become much clearer on how they evolve, arise and maintain. Further, there are even claims that the primary causes of individual differences regarding attachment security are of the shared environmental kind (see O'Connor et al., 2000). Under this flag and letting these intense debate genes vs. environment aside, some researchers dedicated their efforts in studying the specificity of life events and their

importance for attachment continuity through generations; let us now consider some examples of recent findings. In one of these studies, Hamilton (2000) found by analysing the SS classifications and the later AAI classifications that negative life events are significantly related to change in attachment classification. Consistently with this, Weinfeld et al. (1999), in a study with 57 young adults out of a high-risk sample, noticed that the continuity and discontinuity in attachment classification from infancy to adulthood were given by differences on the basis of child maltreatment, maternal depression, and family functioning in early adolescence. These results provide proof that despite attachments stability over time, attachment representations are vulnerable to chaotic and harsh life events. Such results were extended in a later study also with a high risk sample (poverty) where Weinfeld et al. (2000) again found no support for continuity in attachment security. Moreover, disorganized children were significantly more likely than organized ones to be insecure or unresolved in late adolescence. Adding to that, children's disorganization predicted unresolved abuse scores on the AAI for those children who went through child abuse. More recently, Ryder (2007) published her data about the role of trauma and disrupted attachments in the development of adolescent girls' violent behaviour. A total of 24 narratives of young female individuals, in custody for an assault or robbery, were analysed based on grounded theory. The results fostered the idea that a history of extensive losses and violence exposure affected significantly the young women's attachment relationships to their caregivers, and mostly these experiences were ignored and trivially addressed. The experience of detachment and non-attendance of a supportive figure made these young females connect with a large variety of maladaptive behaviours and criminal settings.

Another equated and maybe the most promising factor to fill the transmission gap is the concept of reflective functioning (see Fonagy & Target, 2005, Giannoni & Corradi, 2006 for a detailed review), a concept that entangles the psychological processes beneath the capacity to mentalise. This concept comes out both from the psychoanalytic (Fonagy, Steele, Moran, Steele and Higgit, 1991) and cognitive psychology (Morton & Frith, 1995) literatures, and has been defined as "an overt manifestatio, in narrative, of an individual's mentalizing capacity (Slade, 2005, p. 269). By using the term mentalizing, which refers to "the capacity to understand one's own and others' behaviour in terms of underlying mental states and intentions, and more broadly as a crucial human capacity that is intrinsic to affect regulation and productive

social relationship" (Slade, 2005, p. 269), Slade relies heavily on Fonagy and colleagues conceptualization (1991, 2002). The main issue around this concept is the human ability to understand mental states (feelings, thoughts, desires, intentions, and beliefs) of themselves and of others, allowing coherently understanding and anticipating actions of others. And if they are able to make sense of their own mental states and of those of others, the more they get involved into comprehensive, productive, sustained and intimate relationships, feeling loved and connected to others, but still preserve their own autonomy and individual state of mind (Fonagy et al. 2002; Fonagy & Target, 2005). Based on these, Slade (2005) stated the need to assess mother's capacity to behave with her baby and grasp the essence of her mental states of mind. In pursuit of that, she and her colleagues have developed the Parent Development Interview (see Aber et al., 1985; Slade et al., 2005, for a detailed description), an interview where mothers are asked to describe with examples their actual relationship with her child; the core of this procedure is to tap lived and ongoing experiences but also to encompass representations that are being formed. With the aim of exploring whether reflective functioning would fill the transmission gap, Slade et al. (2005) designed a study with 40 pregnant mothers evaluated with the Parent Development Interview and the AAI, and the data out of these measures were confronted in correlation with the SS classification of their infants at 14 months. Even if the data reported a weak link of mothers attachment classification with the classification of her child, further results revealed a strong correlation (r = .51) linking adult attachment (AAI) and reflective functioning, as measured by the Parent Development Interview during pregnancy. In detail, secure mothers were those with the highest levels of reflective functioning, as the disorganized-insecure mothers exhibited the lowest levels; the dismissing and preoccupied classified mothers evidenced levels of reflective functioning in between the already mentioned groups. Furthermore, the data pointed out that maternal reflective functioning was moderately correlated (r = .41) to infant attachment, measured with the SS at 14 months. Again higher levels of maternal reflective functioning were associated with secure attached infants, as low levels of reflective functioning were linked with insecurity. Based on the findings, the authors concluded that maternal reflective functioning are intertwined with her attachment organization and also with the attachment status of her children (Slade et al., 2005).

To test and extend Slade et al.'s (2005) findings, Grienenberger et al (2005), using a similar design as the cited study but using the AMBIANCE (see Lyons-Ruth

1999, for description) instead of the AAI, determined whether maternal reflective functioning predicted the quality of mother-infant affective communication (as given by the AMBIANCE) on a sample of 45 mothers and their children. A strong negative correlation (r = -.481) between maternal reflective functioning and disruptive affective communication was found. Furthermore, data supported that negative maternal behaviour was linked to attachment status of the children. Mothers exhibiting high AMBIANCE scores had mostly children with resistant or disorganized attachment organization, whereas mothers with low AMBIANCE values were more likely to present a secure attachment organization toward their infants. Similarly, as in the previous study (Slade et al., 2005), maternal reflective functioning was moderately correlated with infant attachment (r = -.345), and the AMBIANCE scores showed to also be moderately linked with the infant attachment (r = .303). Thus, the authors verified that reflective functioning and maternal behaviour were closely connected - high reflective functioning by the mother prevented significant disruptions in affective communication process with infants. Therefore, it seems that reflective functioning plays a kind of "buffer" function that protects possible collapses in distressed moments of children's lives (Grienenberger et al., 2005). In sum, both Slade et al. (2005) and Grienenberger et al. (2005) showed promising results in explaining the transmission gap with the concept of reflective functioning; indeed, their results explained more of the variance as parental sensitivity pointed out by van IJzendoorn's (1995) meta-analysis. Another important feature was that this approach extended the conceptual framework to representational level of adulthood in everyday's interaction, putting aside the debate of genes vs. environment. Although, if these findings are sufficient to close the transmission gap as Fonagy and Target (2005) affirmed, I have some doubts about it, mainly because more data is necessary and especially some results out of preventive intervention research is needed to show how well reflective functioning explains the gap, even so it was a great start.

In conclusion, attachment's theoretical groundwork states the existence of a powerful consistency between early attachment patterns and later psychological functioning, even so, and as had been exposed, the traces of continuity are rather limited than a direct line of initial attachment status through the later behavioural patterns, and also between parental attachment and the attachment organization of their children. This discontinuity in attachment transmission is mediated by the transmission gap which we

have seen is multidetermined by rearing (sensitivity), genetic, environmental and states of mind (reflective functioning) factors, which in addition seem to interact dynamically with each other. What is true now to say is that none of these factors, even if reflective functioning was close, were able to fill the transmission gap; and, maybe, we must deal with the fact that there might be some important aspects of parenting and attachment transmission that will never be revealed throughout research.

3.4.2. Understanding attachment organization along form infancy to adulthood

Since the 1970's a couple of studies evaluated attachment along the first 18-20 years of life by comparing the nonverbal (SS) and the discourse attachment feature (AAI). It was Mary Ainsworth et al.'s (1978) Baltimore study that, in fact, motivated and inspired a number of younger and courageous researchers to invest in longitudinal studies to uncover the roots and roads of attachment development. In one of these studies, known as the Bielefeld longitudinal study, a non-risk group of 49 children and their parents were evaluated from birth to adulthood (Grossmann & Grossman, 1991; 2005). Actually this project started as an intent to replicate many of the results of the Baltimore study in a German middle class sample; although with time the authors pushed further their interests addressing not only the cross-cultural foundation of Ainsworth's results, but also exploring how the affectional bonds develop, how predictive are the early experiences with mother and father for the later representation of close relationships, and how does early attachment experiences influence the capacity to picture affectional bonds during adolescence and early adulthood. The Bielefeld Project comprised both observations (e.g., interactive play) and evaluations (e.g., SS, life events) of the parents and their children, used interviews (e.g., AAI, CRI) and scales (e.g., Brazelton Neonatal Behaviour Scales, Ainsworths Sensitivity Scales, Rutter Behaviour Problems Scale) covering four stages: (a) infancy – newborn till 36 months; (b) childhood – kindergarten and elementary school period (6 to 10 years of age); (c) adolescence – around the age of 16 years; and (d) young adulthood – when the children reached the age of 22. When this project reached the second evaluation stage – preschool and school years – authors designed a new longitudinal study, the Regensburg longitudinal study, including many of the innovative methods and hypothesis of

exploring attachment quality out of Main and colleagues works (Main, 1983; Main & Cassidy, 1988). The Regensburg longitudinal project comprised again German non-risk middle-class families and their infants (n = 51), which were studied in a similar four stage design as in the Bielefeld longitudinal study (even if the evaluation procedures only started with 11-month and not at birth), but also included innovations as the "Clown Situation (Main & Weston, 1981), the Reunion procedure (Main & Cassidy, 1988) and the California *Q-set* (Waters & Deane, 1985). In sum, the Regensburg Project tried to replicate certain results from the Bielefeld Project and, even more important, stressed new developments in relationship assessments in the field of attachment (for a detailed description please see Grossmann & Grossmann, 1991; Grossmann & Grossmann, 2004; Grossmann & Grossmann, 2005; Grossmann, Grossmann & Kindler, 2005).

The results of these two longitudinal studies, which completed each other, evidenced, mainly, that security in attachment and partnership relationships in young adulthood was linked with security in childhood and adolescence. The signs for an of adult coherence discourse were previously presented and observable at age six and ten (Grossmann, 1999; Grossmann et al., 2002). Additionally, both mothers and fathers' sensitiveness caring and their acceptance of the infant's behaviour were main predictors of the internal working models of later close relationships. Even though, infants develop attachment relationships with their mothers and fathers through an idiosyncratic trail. As a young child, in an alarm condition searches for the mother to gain reassurance and relaxation, and after experiencing safe haven move again to exploration behaviour; it will search for the father to gain father's attention to monitor the child's intentions and support for his or her actions along the exploration process. Even with this differentiation, mothers more linked with feeling safety from threats and fathers as supporting agents for exploration, both mothers and fathers were found to foster psychological security (Grossmann & Grossmann, 2004). Mothers' and father's sensitivity and play interaction experiences along the first years of life were predictors of the child's later representation of close relationships (Grossmann et al., 2002; Grossmann, Grossmann & Kindler, 2005). Further, both projects, but especially the Bielefeld study, showed the enormous complexity of developmental "roads" from infancy to adulthood. A high proportion of avoidant attachment found in the German sample was explained by cultural demands for early self-reliance and not a cause of

parental rejection (Grossmann et al., 1985; Grossmann & Grossmann, 2005). However, the results confirmed that most of those who were insecure in infancy reflected on their experiences and changed to security in adulthood. Even so, rejection by both mother and father along childhood was key risk factor for insecurity in adulthood and difficulties in developing and maintaining close relationships (Grossmann & Grossmann, 2004). In sum, the Bielefeld 22-years and Regensburg 20-years longitudinal study presented strong evidence for how attachment relationships are formed, developed and change along years, experiences and challenges. Parental acceptance and responsiveness were two key ingredients in the process of infants' attachment development, and if these two were positively combined and present a secure model of relationship were evolved; although as data (Grossmann, Grossmann, & Kindler, 2005) showed many aspects can disrupted the path of security along attachment development, especially those aspects concerned with family disruption. Finally, these longitudinal studies contributed greatly for the understanding of the debate of attachment stability and progress across a piece of the life span.

Contributions for this debate have also been made by Zimmerman (1994), using the Bielefeld longitudinal data, which noticed that important life event such as divorce, life-threatening illness of a parent and/or a loss of a parent and an important family member were assessed and considered. The results of 44 adolescents did not found a linear association between attachment security in childhood and security attachment representation in adolescence. Further, factors like divorce, life-threatening illness of a parental figure showed a link with insecure attachment representation in adolescence. In fact, 70% of the variance of adolescent attachment security was explained by life events, maternal attachment organization, but also by the children's perceived parental support at age 10.

A similar study (Hamilton, 1994) evaluated with the AAI data of 30 adolescents out of a larger California sample, who had been through the SS as they were 1-year old. First, the results evidenced an astonishing stability of attachment over a period of 17 years. Second, about 77% of the subjects classified as secure or insecure at 1 year of age maintained this classification at 17 years of age. By contemplating family circumstances, the author came to conclusion that attachment stability were explained by steady positive or negative circumstances. More specifically, the author found that insecure classified adolescents at both assessment times were out of families with

financial stress, with marital dissolution in early childhood, with family violence experiences and continued substance abuse (alcohol and drugs). Contrarily, secure classified adolescents in both evaluations had of such stressful events (Hamilton, 1994).

Another study was performed by Beckwith, Cohen and Hamilton (1995) examining attachment data of 86 premature babies (with at least 28 weeks gestational period) from their first month of life till they were 18 years old. The assessment design included an AAI at 18 years of age, and home observations when infants were 1, 8 and 24 months of age, although no SS was accomplished. Results indicated dismissing subjects as the ones with lower mother-infant responsiveness scores than the other two attachment groups. No significant differences were found between secure and preoccupied attachment regarding responsiveness scores. An important feature of this study is the emphasis on maternal behaviour, namely dismissing mothers were less involved along all three home observations, and show no changes in their uncaring behaviour, while some changes in mothers of autonomous and preoccupied subjects were noted. Further differences in terms of sensitivity and responsiveness were found in the mothers of autonomous and preoccupied boys, but not for girls. Mothers of autonomous subjects showed an increasing sensitivity along the three home observations and show no continued decrease in responsiveness as the mothers of preoccupied subjects evidenced. Similar as in the previous study family circumstances played an important role for attachment organization. Seventy-three percent of the preoccupied adolescents went through early family divorce (before they were 8 years old), as this was only the case in 28% of the autonomous and 20% of the dismissing adolescents (Beckwith, Cohen and Hamilton, 1995). Although one thing should be considered, this study sample included subjects with a wide spreading socioeconomic status and ethnic backgrounds that were not carefully considered for data analysis.

With a much more controlled sample characteristic, Waters et al. (1995) analysed the attachment during a 20 year period, both in infancy (SS) and early adulthood (AAI), of 50 white American middle class individuals. Results supported an amazing continuity of attachment across 20 years: 70% of the individuals maintained their classification of secure and insecure. This aspect was even more consistent when considering the three categories (secure, preoccupied and dismissing) the correspondence remained high (64%). Alike the previous findings (e.g., Zimmermann, 1994; Hamilton, 1994), attachment discontinuity were related to negative life events

(e.g., parental loss, parental divorce, parental illness, psychiatric disorders, sexual abuse, etc). Although when such negative factors were absent, the continuity increased to 78% of the cases. The authors discussed their results in line with the hypothesis that early attachment relationships determines prototypically later relationships, and that mental representation formed by the child along his/her first year of life account for this continuity. Additionally, they pointed out some key processes that might contribute to stability, namely: (a) the stability effects of personality traits; (b) temporal steadiness in caregiving behaviours; (c) the effects out of the individual-environment interaction; (d) the absence or low presence with moderate intensity of attachment-linked stressful life events; and (e) a bent for persistence in "early cognitive structures" (Waters et al., 1995). Although, given the fact that most of the families studied experienced stable family conditions, it should also be equated that it was this stability the reason for continuity of attachment. This assertion is consistent with the four exposed studies and with Sroufe (1988) presumption that lawful (dis) continuity is always dependent on family circumstances and life events that drives the subjects' representation out of his equilibrium.

In fact, Weinfeld, Sroufe and Egeland (2000) using a similar study design as previously exposed, found in a high-risk population (poverty sample) that only 39 % of the subjects were classified insecure regarding to their mothers in childhood, and 68% were classified as insecure (most of them as dismissing - 60%) in adolescence. Additionally, about 65% of those classified secure in infancy exhibited an incoherent and noncollaborative approach in adolescence during the AAI, whereas 78% of the adolescents that had been classified insecure in infancy evidenced the same approach. Consequently no direct association was found between the SS and the AAI, even so these results uncover the role of child abuse and maltreatment, maternal depression, family functioning to support the Sroufe's argument of lawful discontinuity. More recently Fraley (2002), in an attempt to summarize and underpin these arguments, conducted a meta-analysis of 218 cases, out of five longitudinal studies pertaining to cross-time linkage in attachment evaluations. Results of the individual studies indicated stability coefficients ranging from low (-.14) to high (.50), corresponding to a cross-time correlation of .27 (when sample size was weighted, and when not weighed the value was .30). The author argued that "there is a moderate degree of stability in attachment from infancy to adulthood" (Fraley, 2002, p. 135). Further, Fraley divided

the studies in two groups (high and low risk samples) and tested the effects of several factors such as relational discord, economic hardship and child abuse over the cross-time continuity. The cross-time stability was higher (0.47) when there was a low presence of risk factors, and lower (0.28) if these risks were there.

Beside this debate of attachment stability and progress across the life span, the longitudinal contributed greatly for the understanding of human development and of attachment development, so let us consider some of the most well known, apart of the already considered Bielefeld and Regensburg Longitudinal studies.

During the year of 1987 the London Parent-Child Project begun. This project incarcerated a wide range of aims both regarding methodological concerns and attachment organization and parent-child relationships along the time. The design framed a four-phase evaluation procedure, starting at the third trimester of the first pregnancy and finishing when the child was 16 years old: (a) phase 1 – infancy evaluation – AAI of the parents were collected prior to the birth of the child, and the SS was performed with the child and his/her mother (at 12-months) and the child and his/her father (at 18-months); (b) phase 2 – early childhood – children between 5 and 6 years were evaluated regarding cognition, affects, life events, attachment organization, and the parents AAI's were repeated; (c) phase 3 – preadolescence – the children were evaluated regarding their interpersonal relationships (friends and family), and cognition, affects and life events were again monitored; and finally (d) phase 4 – long term follow-up – where the child's AAI were collected, mental health and interpersonal relationships were again observed. The main aims of the longitudinal attachment study were (a) to uncover the process of cross-generational link between parents and their child both in terms of emotional-regulation and social influences out of that connection, and (b) to explore the utility and the power of the AAI as a predictor and an evaluation method of attachment. One of the findings out of this fruitful research endeavour was the association found between the pregnant women's AAI classification and the SS classification of their children at one year of age (see Fonagy et al., 1991); results that even with a less exciting drive were reported at some level for fathers too (Steele et al., 1996). Secure attached mothers evidenced a more lovely and coherent and less rejecting and ambivalent discourse with their infants (Steele et al., 1992). Moreover Steele and colleagues have found that the AAI besides its good psychometrics were a much better predictor of across development child emotion-linked variables than any of the data out

of the mother-infant or father-infant SS (Steele et al., 2002). Additionally, maternal AAI's quoted as secure-coherent predicted the ability of an organized method in resolving social and emotional dilemmas on their five-year old children's narratives (Steele et al., 2003). Moreover, maybe the most interesting finding out of this study has been the differentiation between mother-infant and father-infant relationships regarding their input on children's social and emotional development. It has been suggested that the infants' comprehension, confrontation and resolution of emotional internal conflicts were especially influenced by the mother-child relationship, as the understanding, coping and resolution of emotional external conflicts were more modelled by father-child relationship (Steele & Steele, 2005). Even if inner and outer world conflicts are sometimes difficult to delimit, this research highlights for differential roles of mothers and fathers throughout the developmental process, a finding that may be of crucial relevance when it comes to therapy process and mental health.

Another Longitudinal Study is the Stony Brook Adult Relationship Project, an endeavour coordinated by Everett Waters and Judith Crowell, started in 1990 and was specially focused on the adaptation of the AAI for evaluating working models of the marital relationship, to implement an observational approach to assessing secure-base in videotaped marital interactions, to use the prompt-word assessment method to gather information about the secure-base script from short narratives, and to develop an observational method to assessing parental secure-base support in preschoolars. In sum, this project design used a wide range of evaluation procedures (e.g. AAI, CRI) and videotaped tasks (e.g., marital problem solving, mother child, father child interactions), starting with an initial assessment at 3 month premarriage followed by several follow-ups until the evaluation of the couple's child at 36-48 months of age (Crowell, 2003; Crowell & Waters, 2005). The sample comprised 157 engaged couples and 101 steadily dating couples of Suffolk (Long Island, New York) that shared the same demographical features as them (see Crowell & Waters, 2005; Treboux et al., 2004 for details). One of the research results highlighted that the with transition to marriage 78% of the participants received the same AAI classification as previously assessed 3 month before marriage; and if we consider security vs. insecurity this number raises to 83%. Moreover, the data revealed that the stability among the secure classified participants showed to be 96% stability, as the among the insecure classified participants only 76% were found as stable; thus insecurity were much more reliable to change with the

marriage transition than security, and also it seemed that this transition increased coherence and security among those who were insecure (Crowell et al. 2002). Another interesting result showed that there was no difference in attachment classification between men and women who did not become parents (78% and 86% respectively); although in those who became parents, differences were found, namely: women evidenced much more AAI classification stability (94%) with motherhood than men (71%). The authors argued that as parenthood for men represents an opportunity to change (become secure or insecure), for women it consolidates the attachment representation (Crowell et al., 2002). Additionally, this longitudinal project uncovered evidence that attachment representations show development across early years of the marital relationship, and exerts impact on marital functioning (Crowell, 2003; Crowell et al., 2002). In fact, findings pointed that premarital configurations predicted break-up, especially individuals that were classified as secure on the AAI and had an insecure CRI classification were much likely to leave their partners. It seems that these individuals have an incoherent representation of their partner's availability, getting distressed because of it and decide to run off the relationship at an early stage (Treboux et al., 2004). Even more badly were the situation of those which were classified insecure in the AAI and insecure at the CRI, those exhibited the least frequency of secure-base behaviours and were fulfilled with negative feelings about themselves and the partner. On the opposite spot, and in line with attachment theory, the secure AAI and secure CRI classified individuals showed low stress, high positive feelings and secure-base behaviours in their relationships (Treboux et al., 2004). Recently Crowell and Waters (2005) argued that the success of the Stony Brook Adult Relationship Project only aroused given the interdisciplinary view of the investigators that participated in it; further one of the basic contributions of this research was the analysis of how adult attachment develops, how it changes in marital relationships, and how pregnancy can have a differential influence on men and women's attachment representation. Even so, the authors recognize the necessity of a much more detailed view of stressful life events in future attachment longitudinal intend s (Crowell and Waters, 2005). Under the scope of this longitudinal study, Waters and colleagues (2000) tested the stability of attachment representations by addressing a 20-year follow-up study, in which a group of children assessed with the SS paradigm were evaluated with the AAI at the age of 20-21. They found a correspondence of 64% across 20 years, and a correspondence of 72%

when considered the secure versus insecure continuum. Apart of such findings, what was even more interesting, is the fact that 85% of those children classified as secure maintained their classification in adulthood if they went not through a negative life experience (e.g. parental divorce, parental death); but attachment continuity was only true for one third of the secure infants in the case of dealing with the presence of such circumstances (Waters et al., 2000). Even so, this research found considerable support for demonstrating that parent-infant interaction may be a prototypical model for later love relationships.

Finally, one of the most well-known Longitudinal Projects made its first steps in the mid-1970's. Contrarily to others, already presented, this research was mainly focused on the development and attachment relationships of a high-risk sample. Based on the infant-caregiver attachment relationship, and especially on those experiences up-coming out of it, Sroufe and colleagues grounded their aims of their longitudinal study into the theoretical roots of attachment theory. The Minnesota Longitudinal Study was dedicated to study a high-risk sample, recruited out of public health clinics where economically disadvantaged children and their families of Minneapolis received assistance. A total of 267 pregnant women (in their third trimester of pregnancy) participated, being most of them unmarried and half of them were teenagers (see Sroufe et al., 2005a). The evaluation procedure and follow-up cast were based on an age-by-age assessment approach which started at birth, went through toddlerhood, preschool and middle childhood, considered adolescence, and is still ongoing. A huge set of comprehensive measures were applied in order to track the context and the attachment-related features out of the developmental process (see Sroufe, 2005a Apendix A-F, for details). The dynamic of the evaluation process was designed as a hierarchical organized view of development in which each developmental phase provides the ground for the next phase (Carlson, Sampson & Sroufe, 2003). Thus, the key evaluation theme during the first months of life period was caregiver's regulation of child arousal and parental sensitivity and responsivity. In toddler period the main evaluation issue was "guided self-regultion" (the progressive move of the child through a more autonomous autonomy). The preschool period emphasized the self-regulation (the base of autonomy acting and thinking), as in school years competence build the main frame of evaluation interest. Further, adolescence brought over the evaluation to deal with individuation (e.g., identity, first intimate and sexual relationships), and finally, in adulthood the

major concern was about emancipation (e.g., adult social competences, launching life course). It was under the flag of this key evaluation themes that Sroufe and colleagues pursued their major aim of explaining the cumulative nature of the attachment developmental process across several developmental phases, in which different issues play a role and interact with each other, taking the past into account for the presence, and designing a (maybe) new future. The results were extremely wide-spreading and of crucial importance for the understanding of development and attachment relationships, especially with high-risk population. So, when the children were evaluated at four and half years for ego resilience, self esteem and competence, self reliance and dependency, social competence, empathy, behaviour problems, and mental representation some interesting findings came along. These children classified as secure at 12 and 18 months exhibited at 54 months higher ego resiliency, higher self-esteem agency and involvement in activities, lower anger and frustration, and were seen as more competent than the resistant or avoidant attached children. Furthermore, resistant attached infants were those who evidenced most dependency, as rated by teachers. In fact, the results evidenced clearly how these 54-months old insecure children made visible their dependency differently: the avoidant minimized their needs, evade contacts with others and approach mostly others my accident; contrarily, resistant under stress situations seek immediately others (e.g., teachers) for comfort and assistance, staying on their side for long periods. Regarding social competence and empathy at this age, secure children were more empathic and “heart sharing”, and more willingly to initiate contacts with other children and responsively to others initiatives, being all these interactions coloured with positive affect and satisfaction. On the other hand, avoidant children were antiempathic and more disliked by play-partners. The resistant ones exhibited a false empathy competing with others for comfort even if they were not in a stress situation but others were; further they were neglected by other children because of their “neither cold nor warm pattern” (not hated nor liked). Concerning behavioural problems, avoidant children show demonstrated the most problems, being hostile, less compliant and frequently with tendency for isolation. Consistently with previous findings were also the data about mental representation, in which securely attached showed more positive expectations of being attended with assistance from caregivers, more cheer and with positive expectations as to their peers, and also were more flexible in facing and resolving problems. All these reported preschool attachment-related findings underpin

closely Sroufe et al. (2005a, p. 129) argument that the "dyadic regulation during infancy period is an important foundation for later self-regulation". And stresses also the arguments that if the child becomes aware and sure of have gained the emotional and physical availability of his/her caregivers, he/she will move toward and instrumental dependence, contacting the adult only in situations of incapacity to resolve a problem or when his/her own resources had been consumed. This means that the progressively gained autonomy, through an environment of security and responsively, pushes the children to not rely only on adults' guidance, direction, protection and emotional support, but trust in him/her to develop gadgets and abilities.

The Minnesota longitudinal data concerning middle childhood evidenced most of the previously reported results, for example, that secure classified children shared their time with peers, were less isolated or being almost exclusively in company of adults. The data also evidenced that early attachment pattern by itself is less predictive of later attachment, if the history of care and the history of competence are not considered. Therefore, Sroufe et al (2005a, p. 112) concluded that "the cumulative history of care is a more powerful predictor of outcome than quality of attachment alone". Once these children reached adolescence (around 16 years of age), secure and avoidant attached teens started dating, as the resistant postponed their intentions regarding intimate relationships. Although, secure and avoidant teens differed in their manner of conducting their relationships, secure ones were more likely of dating relationships with a longevity of 3 or more months, as avoidant were not. Further, regarding psychopathology measured in late adolescence (age 17), insecurity was clearly associated with psychopathologicals symptoms and measures, and especially with depression. Especially, disorganized attachment was more highly linked with global psychopathological measures than any other type of attachment relationship. Resistant attachment was mainly associated with anxiety disorders; and avoidant showed to be related with behavioural problems and conduct disorders but predicted also global pathology (Sroufe et al., 2005a, 2005b).

Along these three decades of intense longitudinal studies there have been a large amount of critical contributions to the attachment field. All these studies demanded major improvements on attachment theory, methodologies and even implications for clinical practice. Furthermore, there results showed that attachment is not circumscribed to infancy but also plays a determinant role in adulthood. At the present, thanks to these

research efforts, we have a much wider and deeper understanding of developmental trajectories, a clearer comprehension of the circumstances where our questions "play", and a wiser view about what and which methodologies to use. Undoubtly the move to the representational level of attachment started a little revolution, opened the field to cognition, emotional regulation and the states of mind (Main et al., 2005); in fact, the usage of the AAI allowed to extent research into adulthood, exploring the states of mind beneath the behaviours, and consequently deepened researchers curiosity in uncovering attachments development through time and space (Dozier et al., 2005; Grossmann et al., 2005). In fact, it was this attitude that made clear that the child is a constructor of his/her own reality and an active agent of his/her own development. The early built representations guide the dynamics of the developmental process, and are shaped by the consequences of ongoing daily interaction experiences. These representations are the “ingredients” and “nutrients” of the internal working models, which are guidebooks for encounters with the environment, but at the same time they may be changed based on new experiences. It was most of these uncovered facts about human development that was progressively uncovered along this epoch of longitudinal studies (Sroufe et al., 2005a). Definitely, development and attachment are not a forewritten book, but a book where each of the pages is written day by day.

Throughout this chapter, we highlighted the main characteristics and features of attachment theory and research. It was Bowlby’s theoretical insights associated to Ainsworth’s empirical ambitions that made the ship leave the harbour. And what a journey this ship had made, in less than a century, the attachment fields proved to be one of the most productive, creative and wide-viewing fields of Psychology. Indeed, this is not surprising, because attachment theory considers the life-span human development or as Bowlby stated explains human behaviour ‘from the cradle to the grave (Bowlby, 1969/1982, p. 208). The several interview measures and self-report measures focusing childhood and adulthood, as well as dozens of themes and variables, made that at an astonishing fast process many researchers from different areas “felt in love” with attachment and attachment-related themes. Even if the roots of attachment theory relied in psychoanalysis, Bowlby emphasized and combined insights from several disciplines, such as ethology, biology, physics, and developmental psychology, in order to clarify his theoretical groundwork and concepts. More than just a field of

theoretical arguments, attachment became with the time a field of empirical supported theories and models that is continuously updated with input of past and ongoing studies.

Moving now to the next chapter, we will highlight some biological measures that might be involved in attachment system and attachment responses. In fact, Bowlby emphasized the importance of biological systems and their connections with the attachment system. It is inside this broad scope that our empirical study was designed, aiming to examine the interrelation of psychophysiological correlates and attachment organizations. Thus, our idea for the following chapter is to describe physiological measures that have been found related as (possible) markers of the attachment organization, and to discuss the present state of the art of physiological measures in the study of attachment.

CHAPTER II: PSYCHOPHYSIOLOGY AND ATTACHMENT: HOW CAN PSYCHOPHYSIOLOGY HELP TO EXPLAIN ATTACHMENT PATTERNS

1. Introduction

Psychophysiology studies the biological mechanisms that underlie behaviour; the activity of many systems that lie beneath the control and execution of behaviour manifest themselves in signals that may be recorded from awake (or sleeping), behaving humans by means of non-invasive techniques. Cacioppo & Tassinary (1990) described this discipline as 'the study of cognitive, emotional, and behavioural phenomena as related to and relevant through physiological principles and events'. Further, psychophysiology tries to explain the gap between mind-body phenomena and its interfaces, and provide a conceptual framework and a methodological armamentarium that intercepts features of social, psychological, behavioural and biological sciences. This means that the responses of the mind (brain) and body, which occur under specific physical and social environmental conditions, highlight information about human nature (Hugdahl, 1995; Cacioppo, Tassinary, & Bernstein, 2000). Therefore, and as exposed in the previous section, psychophysiology opened a door for a (possible) deeper understanding of attachment and its psychophysiological correlates.

A large amount of physiological responses are captured by psychophysiological measures. These responses and the techniques to measure them are traditionally classified in terms of the registered physiological activity and the type of neurophysiological mechanism that controls it. Practically all physiological responses are under the direct or indirect control of the nervous system. Thus, the classification is a function of the *structural* and *functional* organization of the nervous system. Considering the structure and the function, human nervous system is divided into two main subsystems: the central nervous system and the peripheral nervous system. *The Central Nervous System* (CNS) is effectively the centre of the nervous system, the part of it that processes the information received from the peripheral nervous system. The CNS consists of the brain and spinal cord. It is responsible for receiving and interpreting signals from the peripheral nervous system and also sends out signals to it, either consciously or unconsciously. The *Peripheral Nervous System* comprises all the nerves

and nerve cells outside the central nervous system. Its task is to relay information from the brain and spinal cord to the rest of the body and from the body to the brain and spinal cord. The peripheral nervous system is divided into the *somatic nervous system* and the *autonomic nervous system*. The somatic nervous system includes all the neurons connected with muscles, skin and sense organs. It consists of afferent nerves that receive sensory information from peripheral and external sources, and efferent nerves responsible for muscle contraction. This system allows the voluntary control of body movements through the action of skeletal muscles, and with reception of external stimuli, which helps keep the body in touch with its surroundings (e.g., touch, hearing, and sight). The autonomic nervous system is also labelled visceral or vegetative nervous system, comprising the afferent and efferent nerves from internal organs (viscera, muscles, and glands); its functions are based on regulation of the basic visceral processes needed for the maintenance of normal bodily functions. It operates independently of voluntary control, although certain events, such as emotional stress, fear, sexual excitement, and alterations in the sleep-wakefulness cycle, change in interaction with the rest of the nervous system (including the central nervous system). The autonomic nervous system is divided into two subsystems: *Sympathetic* and *Parasympathetic* divisions which typically function in opposition to each other (see Figure 1). The sympathetic branch of the nervous system is constituted by nerves from the thoracic and lumbar portions of the spinal cord, as the parasympathetic branch nerves arise from the cranial area (vagus nerve) and from the sacral area of the spinal cord. The sympathetic nervous system responds to impending danger or stress, and is responsible for the increase of one's heartbeat and blood pressure, among other physiological changes, along with the sense of excitement one feels due to the increase of adrenaline in the system. The parasympathetic nervous system, on the other hand, is evident when a person is resting and feels relaxed, and is responsible for such things as the constriction of the pupil, the slowing of the heart, the dilation of the blood vessels, and the stimulation of the digestive and genitourinary systems (see Kandel, Schwartz & Jessell, 2000, for details).

Based on this organization of the nervous system, psychophysiological techniques may be divided into three categories (Castellar, 1996; Aranguena, 2002; Andreassi, 2000): (a) those dealing with the central nervous system activity; (b) those measuring the somatic nervous system activity; and (c) those measuring the autonomous

nervous system activity. Measures that represent the central nervous system include electroencephalography, event-related potentials, brain electrical activity mapping, source dipole localization and the imagiological-based methods (positron emission tomography, functional magnetic resonance imaging, regional cerebral blood flow). Physiological measures of the somatic nervous system include the electromyography, electro-oculogram, measures of the respiratory activity (e.g., strain gauge around the chest or a thermistor under the nose) to only cite the most well known and used. Autonomous nervous system measures include techniques like the electrodermal activity, electrocardiography, plethysmography and electrogastrography.

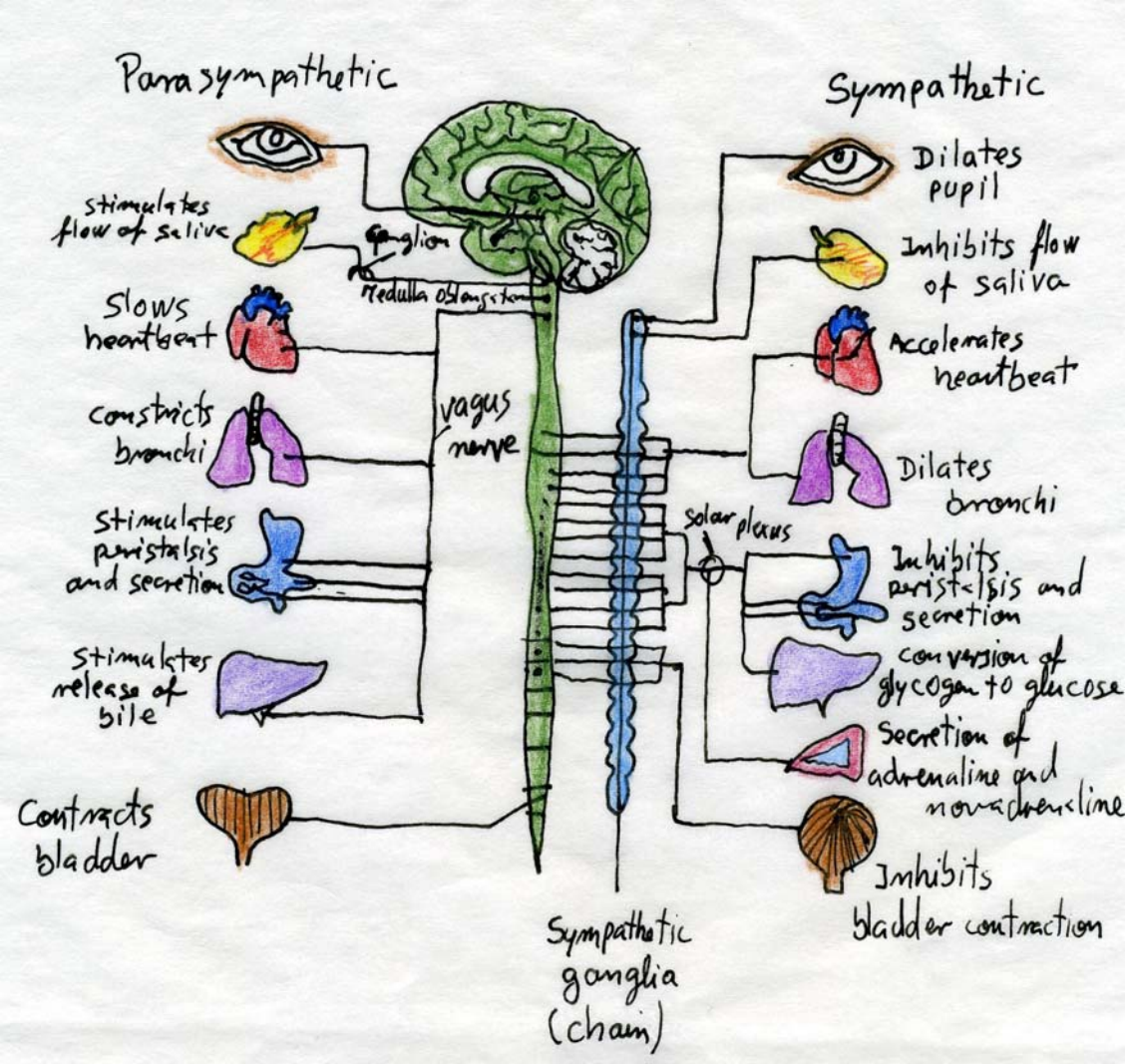

Figure 1. Detailed outline of the autonomic nervous system and its sympathetic and parasympathetic branches.

Next, we will review in detail two of the most used measures of the autonomic nervous system – electrodermal activity and cardiac activity. After that, the most

prominent concepts and theories of psychophysiology will be addressed; and finally, a review about the attachment studies that used physiological measures, mainly focused on electrodermal and cardiac activity, will be outlined. In fact, the use of these measures has become so wide spreading since their development, mostly because they are less invasive, and their low cost, when compared with central nervous system measures (e.g., electroencephalography, event-related potentials). Beside, these measures are so popular due to a more peripheral approach which avoids possible interpretation trouble caused by the complexity of the central nervous system. As such, by highlighting periphery measures, we are tented to monitor the more automatic and less conscious processes, and therefore, the obtained product-measure can be cautiously taken as a 'true output' or response of the organism to a stimuli or situation.

2. Electrodermal activity and its biological foundations

Electrodermal activity is by far one of the most widely used measures in psychophysiological history. It is also of notice to find that many of the early findings are still important aspects of electrodermal activity for research today, especially in regard to measuring methods and biological mechanisms.

To describe of skin conductance and/or skin potential one needs some understanding about the structure of tissues at and beneath the skin surface. The skin serves the function of a preventing barrier between internal setting of the organism and the external environment. As such, the skin also has selective mechanisms that regulate income and outcome of materials. Thus, skin's protective function enables the passage of some substances from the bloodstream to the outside world, and simultaneously prevents the body from substantial loss of water and other nutrients. Injury protection is also a feature assured by the skin, especially when the skin gets thick and though, forming the first body defence shield against abrasion and scratches (or other outside assaults of the body's equilibrium). The skin participates in communication processes with the environment, in which its sensitivity provides the organism with information about the environment and engenders the adaptive reactions possible. Another function of the skin is the regulation of body temperature, a process where cutaneous thermal

receptors, superficial cutaneous vascular beds and sweat glands interact dynamically with the environment to reach a thermo-equilibrium of the body (for details see Montagna & Parakkal, 1974; Sato, Kang, Saga & Sato, 1989).

Figure 2 presents the main anatomical features of the skin. The upper and most superficial layer is called the *epidermis* and is composed of the *stratum corneum*, the *stratum lucidum* (seen only on "frictional surfaces", mainly on palmar and plantar epidermis), the *granular layer*, the *prickle cell layer* or *prickle layer*, and the *basal* or *germinating layer*. The surface of the corneum (i.e., surface of the skin) is composed of dead cells, while at its base one finds healthy, living cells. Between these two sites there are transitional cells. This layer is also called the *horny layer*. Blood vessels are found in the *dermis* whereas the eccrine sweat gland secretory cells are found at the boundary between the dermis and the *panniculus adiposus*, also referred to as *hypodermis* and *superficial fascia*.

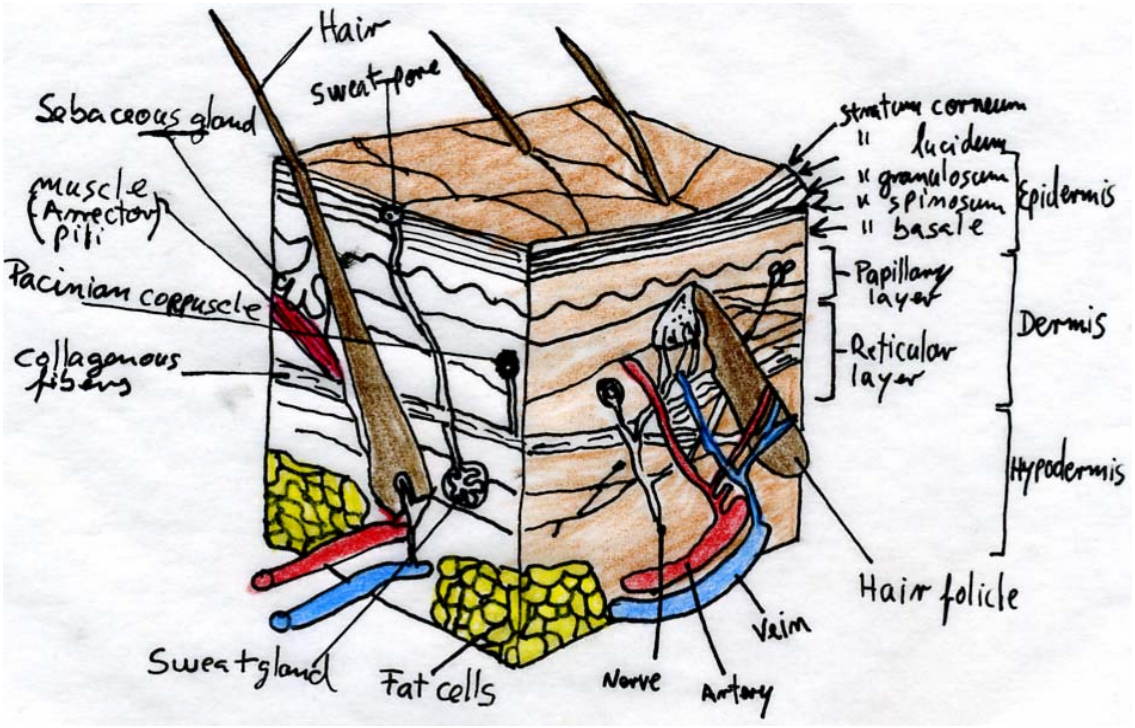

Figure 2. Portion of skin taken from the sole of the foot. Blood vessels have been injected

The skin aside from the various layers possesses various specialized structures, as sense organs, hair follicles, muscles, and of course the sebaceous glands (see Figure 2). Sebaceous glands are of two forms in the human body: the *apocrine* and the *eccrine* which are of particular interest for the psychophysiological study of electrodermal

activity. Their distinction is based on anatomical location and function (see Robertshaw, 1983, Jablonski, 2004; for details). Whereas the apocrine sweat glands normally open into hair follicles and are mostly found in large numbers in the axial, external auditory meatus, the areola region of the breast and the circumanal area, the eccrine sweat glands open directly onto skins' surface and cover most parts of the body (except genitals), being most dense on soles of the feet and palms (1000 glands/cm^2 compared with 100-200/cm^2 for trunk, legs and arms). Beside these aspects, when compared to amount of secretion, the aprocrine glands secrete scantly, as opposed to the copious secretions of eccrine glands. Moreover, concerning the chemical control of both glands, the dominant influence in apocrine glands is adrenergic as in eccrine glands it is cholinergic. Thus, apocrine glands fail to have a prominent neural innervation in humans, because the adrenergic influence exerted via sympathetic nerves may terminate on nearby blood vessels (inducing a vascular transmission to finish the biological response) and/or via circulating adrenalin secreted by the adrenal medulla. In this sense, the adrenergic stimulation will originate a contraction of neighboured myoepithelial cells, forcing them to expel previously stored excretory substances, and thus these glands are regulated by adrenaline (epinephrine) in the blood. The eccrine has an excretory duct which consists of a simple tube made up of a single or double layer of epithelial cells; this ascends to and opens on the surface of the skin. It is undulating in the dermis but then follows a spiral and inverted conical path through the epidermis to terminate in a pore on the skin surface. Thus, cholinergic stimulation via fibers from the sympathetic nervous system constitutes the major influence on the production of sweat by these eccrine glands. Therefore, given a more direct linkage with the sympathetic nervous system and a more well understood anatomical and functional nature, but also the easy access to the anatomical regions (palms and soles) of interest, the eccrine glands and its visibility on skin surface turned to be the main issue of interest for psychophysiological research. And as such, we will from now on focus on the effect of eccrine glands and their influence on electrodermal activity.

By contemplating Figure 2, where the main features of the electrodermal activity are represented, one can appreciate that the epidermis ordinarily has a high electrical resistance due to the thick layer of dead cells with thickened keratin membranes. This aspect is not surprising, since the function of skin is to provide a barrier and protection against abrasion, mechanical assaults, and so on. The entire epidermis (with the

exception of the desquamating cells) constitutes the *barrier layer*), a permeability barrier to flow. Experiments show its behaviour to be that of a passive membrane (see Edelberg, 1972; Ebling, Eady, and Leigh, 1992; for review). Although, the corneum is penetrated by the aforementioned sweat ducts from underlying cells; as these ducts fill, a relatively good conductor (sweat can be considered the equivalent of a 0.3% NaCl salt solution and, consequently, a weak electrolyte) emerges, and many low-resistance parallel pathways occur. A further increase in conductance results from the hydration of the corneum due to the flow of sweat across the duct walls (a process that is facilitated by the corkscrew duct pathway and the extremely hydrophilic nature of the corneum). As a consequence the effective skin conductance can vary greatly, depending on present and past eccrine activity. The aforesaid behaviour is particularly great in the palmar and plantar regions because while the epidermis is very thick, at the same time the eccrine glands are unusually dense. It should be noted that the loading of ducts with sweat can be taking place before any (observable) release of sweat from the skin surface and/or noticeable diffusion into the corneum. Further on, these eccrine glands respond upon two types of conditions: thermal and psychological. The first, as already exposed, is inherent to their function of thermoregulation, and is of special importance when environment temperature reaches values of 30ºC or more. The second condition is the one of interest in psychophysiology and is dependent of contextual features (e.g., emotional, cognitive or learning experience) which elicit the need of a biological response in order to promote an adaptation to the environment.

Despite the fact that the understanding of neuroanatomical mechanisms involved in central nervous system control of electrodermal activity is necessarily incomplete; there have been some attempts for clarification (see Wang, 1964; Wilcott & Bradley, 1970; Edelberg 1972, 1973) which highlighted that electrodermal activity is under the control of the excitatory and inhibitory centres of brainstem and cortex. In an attempt to resume the main findings of previous models, Hugdahl (1984) suggested that central nervous system controls electrodermal activity at a functional level based on the influence of three systems: the locomotor system, the orienting-arousal system, and the thermoregulatory system. The locomotor system encompasses the premotor cortex (Broadmann's area 6), the pyramidal tract and the brainstem. Its main function is assuring a supreme friction of the feet on the ground and optimal hand legerdemain to act and/or react on environment stimulus. The orienting-arousal system involves the

lateral frontal cortex, limbic system (amygdala and hippocampus), and the reticular formation. This system comprehends several structures involved in emotional and cognitive processes and therefore it can be seen as the most "intelligent system". It has been found that under threat situations it is specially the limbic system that is activated to promote attention and harm avoidance strategies (skin hydratation arises to protect the body from cuts and bruises). But when stimuli are novel and an orientation response (or an arousal) is desired, it is the lateral frontal cortex and not the limbic system that is activated. The thermoregulatory system comprises the anterior hypothalamus and is responsible to maintain the regulation of body temperature through the act of sweating. This systems' function seems to be very biologically linked but it is not limited to biological constrains as traumatic reactions showed (increased sweating activity accompanied with a vasoconstriction of the blood vessels which diminished heat loss provoked by the sweating activity).

Starting from this three-system model and incorporating much of its postulates, Boucsein (1992) specified much more the central control of electrodermal activity in its two-component system. This model proposed two components: an ipsilateral system that implies the hypothalamus, anterior thalamus and cingulated gyrus; and a contralateral system which engages the lateral frontal cortex (premotor cortex and some parts of the basal ganglia, respectively). Consequently, the brain areas that control de electrodermal activity involve ipsilateral mechanisms based on the limbic system through hypothalamic thermoregulatory areas, which is mainly responsible for electrodermal activity upon emotional and affective conditions; and contralateral mechanisms from premotor cortex and basal ganglia (especially the caudate nucleus and putamen) which assure electrodermal activity in orienting and cognition situations, but also the locomotion (Boucsein, 1992).

2.1 Electrodermal activity: measures and concepts

Intimately connected to its historical background but also with technical developments that have taken place since the first steps of its measurement at the end of the XIX century, there are two major measures of the electrodermal response. The first, involving the measurement of resistance or conductance between two electrodes placed

in the palmar region, was originally suggested by Féré (1888). Féré used a small current that passed across both electrodes placed on the skin, and the change in resistance of the skin to the current is interpreted as a function of increased sweat gland activity. This type of measurement is referred to as *exosomatic method*, since the current on which the measurement is based is introduced from the outside. The second method was pioneered by Tachanoff (1989), and argues that one could measure similar changes in electrical potential between two electrodes placed on the skin (one on a spot with high concentration of sweat glands – active electrode, the hypothenar eminence – and the other on a spot with less concentration – reference electrode, normally the forearm) without using an external current; therefore, this method is called *endosomatic*, since the source of voltage is internal, and is less commonly used because its interpretation is less well understood. Sometimes these two methods are also referred as bipolar placement (exosomatic method) and as monopolar placement (endosomatic method). Further, the Figure 3 shows the anatomical descriptions of these methods. From this point on, we will focus only on the exosomatic method of recording skin resistance and conductance since it is the method of choice of contemporary researchers (Fowles et al., 1981; Selva, 1995).

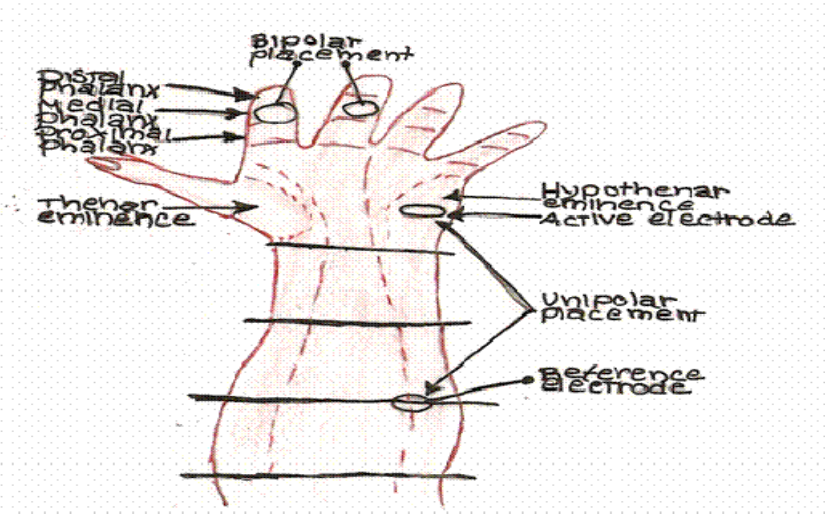

Figure 3. Representation of electrode spots on the palm and forearm for the measurement of electrodermal activity.

When an exosomatic method is used to record electrodermal activity two types of nomenclature are usually used to characterize the data – skin conductance and skin resistance. The resistance and conductance measurements are reciprocals, of course;

however, one or the other might turn out to be linearly related to the stimuli under study and be somewhat more useful as a result. The reason for such assumption relies, on the basis of the mathematical description of all electrical circuits, on Ohm's law, $E = R \; x \; I$, where E is the voltage of a circuitry, R refers to the resistance, and I represent the current that flows through the circuitry. Thus, the resistance results out of the quotient between the voltage and the current flow (R = E/I). As such, conductance is the amount of current that flow through a medium in the presence of a particular resistance. Hence, conductance is the opposite of resistance, then: C = 1/R. Similarly, the recording unit for resistance is *ohm* as for conductance it is *mho* (ohm spelled backwards) or μS (microsiemens).

Independently, if skin resistance or conductance, in an electrodermal dataset three different types of activity may be noted – *tonic levels* of activity, *phasic responses* and *spontaneous fluctuations* – they are closely interconnected, even if they reflect different psychological processes. The tonic levels of electrodermal activity refers to a (somewhat) baseline activity in the absence of a discrete stimuli, and is taken as a measure of vigilance, arousal and sustained attention over time. The normal range, considering amplitude, for tonic levels in skin conductance is 1-30 μS per cm^2. The phasic responses, on the other hand, occur as a reaction to discrete stimuli reflecting the impact of it, especially if it is of significance (Berlyne, 1958), and/or it represents an expected situation/experience (Sokolov, 1963); but also reflects the cognitive and emotional dimensions contained within the stimuli (Barry & Sokolov, 1993). These phasic responses are characterized by high frequency rates and amplitude between 0.01 and 5 μS, if recent computer recording devices are used. The spontaneous fluctuations are a particular type of phasic response where it is impossible to identify a stimulus; therefore, sometimes this type of activity is referred as "non-specific skin conductance response". Such responses can be elicited by means of deep breaths, sighs, body movements, cognitive and emotional automatic processing of stimuli (e.g., phobic reactions) is held to be some possible explanations for such fluctuations (Lader, 1967; Hugdahl, Fredrikson, & Öhman, 1977; Kvale et al., 1991; Selva, 1995). Usually the spontaneous fluctuations are measured per minute, typically occurring between 1 and 3 per min when subjects are resting.

Based on these three types of components of the electrodermal activity, some experimental paradigms have been developed to uncover the relationship between these

components and psychological variables (states and processes). Typically, there are three classical paradigms: (a) the measurement of individual differences; (b) the measurement based on discrete stimuli presentation; and (c) the measurement of chronic stimuli presentation. The first paradigm differs from the following in the sense that it treats electrodermal activity as an independent variable, considering the electrodermal variable a relative stable trait of the subject. Both the second and third paradigm forecasts electrodermal activity as a dependent variable under stimulus control. The second paradigm classically involves the repetitive presentation of a simple discrete innocuous stimulus (e.g., a tone) with interstimulus intervals that may vary between 20 and 80 seconds. On the other hand, the third paradigm exposes the subjects to a presentation of chronic, continuous stimulus or situation where an ongoing task has to be performed (e.g., arithmetic tasks). A more detailed description of these three paradigms may be found in several Handbooks (e.g., Hugdahl, 1995; Selva, 1995; Cacioppo, Tassinary, & Bernstein, 2000).

3. Cardiac activity and its biological foundations

The cardiovascular system in association with the cardiorespiratory system accomplishes vital functions for the organism: (a) distribution of oxygen and other nutrients across the body tissues; (b) returns carbon dioxide to the lungs and other products of metabolism to the kidneys; (c) plays an important part in the regulation of body temperature; and (d) transports hormones and other functional chemical components to target organs. Beside its vital functions, the cardiovascular system has become of interest for psychophysiology studies by means that the cardiovascular control centres in the brain mediate the effects of other factors on the circulation, such as those involved with basic needs (temperature regulation, hunger and thirst), behaviours related to pain, emotions, cognition and other psychological processes (Reis & Le Doux, 1987; Vila, 1996). Hence, cardiovascular system is controlled by both central and autonomic nervous system; psychophysiologists have focused their attention on psychological effects that interact with the circulation system to gather possible correlations of psychological phenomenon.

The cardiovascular system is composed by the heart, which is essential to pump blood through circulatory system, the vasculature, a collecting (venules and veins) and a distributing (arteries and arterioles) tubes, and the capillaries, a system of very thin-walled vessels that allow rapid exchanges between the bloodstream and the extracellular fluid outside the capillaries. From a functional viewpoint, the heart encompasses four chambers different chambers: a right and left *atrium*, and a right and left *ventricle*. The right-side of the heart (atrium and ventricle) is responsible for the *pulmonary circulation*, as the left-side accomplish to pump the blood through the *systemic circulation*. Therefore, the hearts function as two simultaneous working pumps, but where the two atria contract synchronically and in the same rhythm, filling the ventricles with blood, which after a fraction of a second after atria contraction, the now blood-filled ventricles contract in synchrony. The right atrium receives blood that has completed a tour around the body and is depleted of oxygen and other nutrients. This blood returns via two large veins: the *superior vena cava* returning blood from the head, neck, arms, and upper portions of the chest, and the *inferior vena cava* returning blood from the remainder of the body. The right atrium pumps this blood into the right ventricle, which, in a fraction of a second later, pumps the blood, through the *pulmonary artery*, into the blood vessels of the lungs. The lungs serve two functions: to oxygenate the blood by exposing it to the air you breathe in (which is 20% oxygen), and to eliminate the carbon dioxide that has accumulated in the blood as a result of the body's many metabolic functions. Having passed through the lungs, the blood follows the *pulmonary vein* entering the left atrium, which pumps it into the left ventricle. The left ventricle then pumps the blood back into the circulatory system of blood vessels (arteries and veins). The blood leaves the left ventricle via the aorta, the largest artery in the body. Because the left ventricle has to exert enough pressure to keep the blood moving throughout all the blood vessels of the body, it is a powerful pump. It is the pressure generated by the left ventricle that gets measured when you have your blood pressure checked (des Jardins, 2002).

Although, this blood movement through cardiovascular system is, only, possible with the controlling exerted by heart valves. It is these heart valves, between atria and ventricles, and between ventricles and arteries, that prevent the backward flow of blood. There are four heart valves, two *atrioventricular* valves and two *semilunar valves*, which are a series of one-way valves allowing a unidirectional flow. The

atrioventricular valves are two labelled by its shapes: the *tricuspid valve* ("three cusps") is the valve between the right atrium and ventricle, as the *mitral valve* ("two cusps", a shape similar to the Pope's hat); both allows blood to enter from the atria as simultaneously avoids blood from flowing back to the atria. Immediately after the contraction of the atria, an increase pressure within the ventricles forces the atrioventricular valves to close; this sudden snap shot of the valves is responsible for the first heart sound that we can hear. The second group of valves, the semilunar valves, prevents blood from flowing back into the ventricles. They are also two, the *aortic valve* located on the left ventricle, and the *pulmonary valve* on the right ventricle. With the ventricles contraction, the increasing pressure forces the semilunar valves to open and blood ejected to the systemic and pulmonary circulation; although, as the pressure decreases with a greater relaxation of the ventricles, these valves need to closure in order to prevent blood reflux. With the closer of these valves, the second of the two heart sounds happens. The Figure 4 presents a summary of the anatomical features previously discussed.

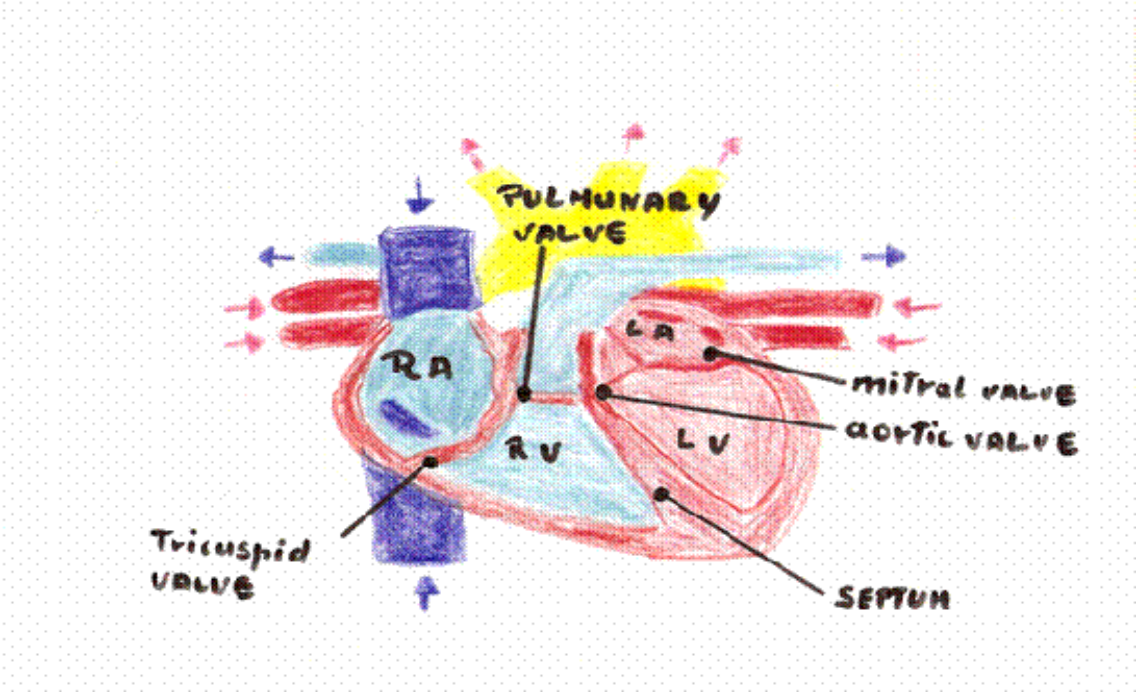

Figure 4. Diagram of the main heart anatomical features.

The functioning of the cardiovascular system depends on a series of intrinsic and extrinsic mechanisms that highlight the electromechanical properties of the heart. To understand propagation of electrical impulses throughout the heart, making it pump, two

types of cardiac tissue must be considered: ordinary myocardium (atrial and ventricular regions) and the specialized cardiac conduction system (sinoatrial, or sinus node; anterior, middle and posterior internodal tracts; atrioventricular node; his bundle; right and left bundle branches; anterior-superior and posterior-inferior divisions of the left bundle and the Purkinje network). Both the ordinary myocardium and the specialized conduction system allow conduction of electrical impulses. Most cells in the specialized cardiac conduction system also depolarize spontaneously, which enables these cells to function as cardiac pacemakers. Even if, all of the heart's cells possess the ability to generate these electrical impulses (or action potentials), only a specialized portion of the heart, called the *sinoatrial node*, is responsible for the whole heart's beat. The sinoatrial node is composed by a group of cells located on the wall of the right atrium, near the entrance of the superior vena cava. These cells of the sinoatrial node possess the ability to spontaneously depolarize, resulting in contraction, approximately 105-110 times per minute. This native rate is constantly modified by the activity of sympathetic and parasympathetic nerve fibers, so that the average resting cardiac rate in adult humans is about 60 beats per minute. Because the sinoatrial node is responsible for the rest of the heart's electrical activity, it is sometimes called *primary pacemaker*. But if the sinoatrial node has a misfunction, or the action potential is blocked before it may travel down the electrical conduction system, another group of cells located in an area between the atria and the ventricles will become the heart's pacemaker, this is known as the *secondary pacemaker* (or ectopic pacemaker). These cells form the atrioventricular node, and normally discharge at about 40-60 beats per minute. The atrioventricular node peter out into the *bundle of His*, which passes into the ventricular septum and divides into two bundle branches, the left and right bundles, that will cause the ventricular muscle to contract in synchrony. The bundle of His constitutes the *tertiary pacemaker*, because it also produces a spontaneous action potential that fires at a rate of 30-40 per minute. As can be seen, there are several pacemakers, each firing within a single rhythm, but how is order supposed to create a harmonious rhythm with these pacemakers? The reason the sinoatrial node controls the whole heart is that its action potentials are released most often, triggering other cells to generate their own action potentials. The action potential generated by the sinoatrial node, passes down the cardiac conduction system, and arrives before the other cells have had a chance to generate their own spontaneous action potential. This is only possible given the role of the *Purkinje fibers*, specialized

conductive myocardial fibers, which work with the sinoatrial node and the atrioventricular node to control the heart rate. Purkinje fibers are mostly located in the inner ventricular wall, just beneath the endocardium, but can also be found along the whole myocardium. Therefore, when the depolarization of cells in the sinoatrial node occurs, the action potential will flow through the Purkinje system through the atria causing its simultaneous contraction. The electrical wave flows through the *internodal atrial tracts* arriving at the atrioventricular node. Once there, and after a small delay to allow the ventricles to fill with blood, the race goes on through the bundle of His, both through the left and right branch, terminating only with the ventricular contraction in unison (see Price & Wilson, 1982; Fox, 1992; Hugdahl, 1995; Haïssaguerre et al., 2002, von Borell et al., 2007; for details). This is the normal conduction of electrical activity within the heart.

After describing the intrinsic mechanisms of the electromechanical properties of the heart, let us now consider the extrinsic mechanism. The three exposed pacemakers are under the control of external mechanisms, namely the autonomic nervous system. The heart is simultaneously innervated by the parasympathetic and sympathetic branches of the autonomic nervous system. As we have already referred, the sinoatrial node possesses fibers from both branches which can change the intrinsic rate of heart rhythm. Parasympathetic branch fibers influence the heart through the *vagus nerve,* releasing *acetylcholine* from vagus nerve endings which binds to *muscarinic receptors* on the pacemakers cells (sinoatrial node cells). These cells are acetylcholine sensitive, and therefore, acetylcholine provokes changes on the spontaneous depolarization of the sinoatrial node, in a way that decreases its firing rate. The increased parasympathetic activity over the heart causes a direct reduction on heart rate which is called *negative chronotropic effect*. This effect is the reason for a tonic level rate of 70 beats per minute instead of the 105-110 beats (the natural firing rate of the sinoatrial node) observed on normal healthy adults. Sympathetic fibers innervate the heart via cardiac nerves releasing the neurotransmitter *norepinephrine* that produces changes over the spontaneous depolarization of the sinoatrial node, increasing the heart rate – *positive chronotropic effect*. When the sinoatrial node receives sympathetic stimulation, norepinephrine released from the nerve endings binds to *β1-adrenergic receptors* on the pacemaker cell membrane, provoking an acceleration of the heart rate (Levy, 1990; Friedman, 1998, 2007).

The cardiac cycle comprises various mechanical, valvular and electrical events (previously described) linked with each heartbeat, and it is encompassed by two distinct phases that we now will consider. A heartbeat is a two-part pumping action that takes about a second. As blood collects in the upper chambers (the right and left atria), the heart's natural pacemaker (the SA node) sends out an electrical signal that causes the atria to contract. This contraction pushes blood through the tricuspid and mitral valves into the resting lower chambers (the right and left ventricles). This part of the two-part pumping phase (the longer of the two) is called diastole. The second part of the pumping phase begins when the ventricles are full of blood. The electrical signals from the SA node travel along a pathway of cells to the ventricles, causing them to contract. This is called systole. As the tricuspid and mitral valves shut tight to prevent a back flow of blood, the pulmonary and aortic valves are pushed open. While blood is pushed from the right ventricle into the lungs to pick up oxygen, oxygen-rich blood flows from the left ventricle to the heart and other parts of the body (Carlson, Ip, Messenger et al., 2003).

3.1. Electrocardiac activity: measures and concepts

Electrocardiac activity is measured by *electrocardiography* which refers to the recording technique of the electrical potentials generated by the heart during the cardiac cycle, and can be monitored on an *electrocardiogram* (ECG) – the output measured, the recording by itself. As the impulse or muscle tension spreads along the myocardium, electrical currents are conducted across the heart and surrounding tissues and to the surface of the body; there, these electrical currents are captured by electrodes properly placed on the limbs or body surface. There are several different proper spots to position the electrodes for ECG recording (see Figure 5).

These positions are given by electrodes located in arrangements known as *standard leads*, based on the Einthoven's triangle - an imaginary equilateral triangle with the heart at its centre, its equal sided representing the three standard limb leads of the electrocardiogram. One of these standard leads comprises on placing one electrode on the left arm and one on the right arm – Lead I. Lead II is about placing an electrode on the right arm and the other on the left leg. Lead III is the placement of one electrode

on the left arm and one on the left leg. These leads placements differ in terms of polarity, being Lead II the one which produces the biggest voltage, and as such it is the most used (Berne & Levy, 2001).

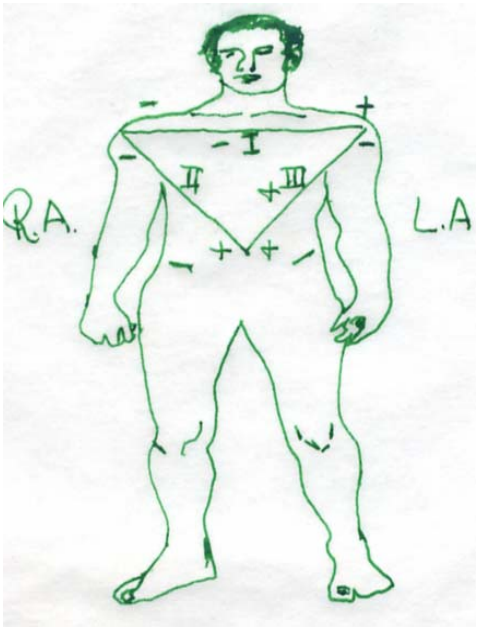

Figure 5. Representation of the Einthoven triangle with the standard limb leads I, II and III.

The normal ECG comprises waves and intervals which constitute their morphological features (Figure 6). Waveforms are identified by letters and intervals are labelled by the waves that mark their beginning and their end. The main ECG components can be summarized as follows:

a) The *P-wave* is produced by the electrical passage of currents generated by the atrial depolarization, and occurs prior to atrial contraction.

b) The *QRS-complex* represents the passage of the action potential from the sinoatrial node through the ventricles (this passage implies the depolarization of the ventricles). The *Q-wave* is the first negative deflection of this complex. The first upright deflection is labelled *R-wave*, independently if it is (or not) preceded by the *Q-wave*. This wave is held as the most outstanding element of the ECG because of the numerous muscle cells in the ventricle regions. The *S-wave* is a negative deflection immediately after the *R-wave*.

c) The *T-wave* corresponds to the repolarization of the ventricles and its configuration is smaller and broader regarding the *R-wave*, given the fact that ventricle depolarization is a much more synchronized process than repolarization.

d) The *P-R-interval* integrates both atrial depolarization and the extent of delay of the impulse at the sinoatrial node. It starts with the appearance of the *P-wave* and ends with the ventricular depolarization (*R-wave*).

e) The *Q-T-interval* comprises ventricular depolarization (*QRS-complex)* through the end of ventricular repolarization.

f) The *S-T-segment* encompasses the time-gap between the end of ventricular depolarization and the start of ventricular repolarization.

g) The *T-P-segment* represents the elapsed time between the end of ventricular repolarization and the (new) beginning of atrial depolarization.

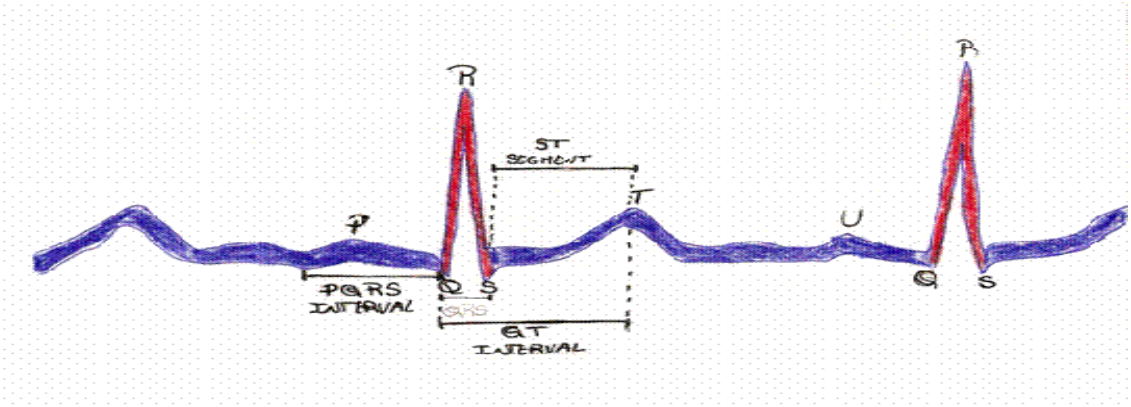

Figure 6. Conventional terms for electrocardiographic waves and intervals.

The main used cardiac activity measures have been the heart period, the heart rate, and heart rate variability. The *heart period*, also known as the interbeat interval (IBI) refers to the elapsed time between two successive heart cycles, and it is measured in milliseconds. As already described, *heart rate* (HR) is a term coined to describe the frequency of the cardiac cycle. Usually it is calculated by the raw number of contractions (R-waves - heart beats) of the heart in one minute and expressed as "beats per minute" (bpm). Beside this visual counting procedure, there are electronic devices (e.g., cardiotachometer) that provide an ongoing beat-by-beat measure of the R-wave. Both heart period and heart rate are interrelated measures given as follows: HR = 1/IBI x K (where K is the scalling constant, normally 60.000 miliseconds), and IBI = K/HR. Therefore, some psychophysiological studies may present the data using bpm as others use the IBI values; the fact is that the choice of HR or IBI is usually of no variation for

the results (Jennings et al., 1981; Hugdahl, 1995); much because of the modern computer collecting systems use IBI monitoring procedures based on a Schmitt-trigger (see Escalona, 1998; Ghassoul, 2001, for details) that detects inflection points of the R-wave with a resolution of miliseconds, allowing to convert the IBI value into HR values (Cacioppo, Tassinary, & Bernstein, 2000).

Heart rate variability (HRV) stands for the continuous beat-to-beat alterations in heart rate. While the rhythmic beating of the heart at rest was once believed to be monotonously regular, although this is untrue because the rhythm of a healthy heart under resting conditions is actually surprisingly irregular, exhibiting periodic variation in R-R intervals. These moment-to-moment variations in heart rate are easily overlooked when average heart rate is calculated. And, as such, it is important to measure HRV, which is a powerful tool in assessment of the autonomic function because of its accurate, reliable, reproducible measure and process.

The normal variability in heart rate is a result of the synergistic action of the two branches of the autonomic nervous system, which act in balance through neural, mechanical, humoral and other physiological mechanisms to maintain cardiovascular parameters in their optimal ranges and to permit appropriate reactions to changing external or internal conditions (Cerruti, Bianchi, & Mainardi, 1995; Friedman, 1998; Levy, 1990). A healthy individual's heart rate, measured at any given time, represents the lattice effect of the parasympathetic (vagus) nerves, which slow heart rate, and the sympathetic nerves, which accelerate it (Hainsworth, 1995; Kleiger et al., 1995). These changes mirror emotions, thoughts and physical exercise. Our changing heart rhythms affect not only the heart, but also the brain's ability to process information, including decision-making, problem-solving and creativity but also directly effect how we feel (e.g., Damasio et al., 2000; McCraty, Atkinson,Tomasino & Stuppy, 2001). Thus, the study of heart rate variability is a powerful, objective and non-invasive tool to explore the dynamic interactions between physiological, mental, emotional and behavioural processes (Kristal-Boneh et al., 1995; Porges, 2007; van Borell et al., 2007).

Based on the standards set forth by the Task Force of the European Society of Cardiology and North American Society of Pacing and Electrophysiology in 1996, there are two methods of analysis of HRV data, either relying on the interbeat intervals: *time-and frequency-domain analysis*. The *time-domain* HRV is by far the simplest parameter to be estimated. Prior to all calculation procedures, the abnormal heartbeats and

artefacts need to be removed. Examples either for long-term and short-term recordings include: Mean HR, Standard Deviation of all IBI measured (SDNN), and Root Mean Square of the Standard Deviation (RMS-SD). Some extra parameters can be calculated specifically for long-term recordings. The time-domain parameters are mostly associated with overall variability of HR over the time of recording, except RMS-SD, which is associated with fast (parasympathetic) variability.

The other method, the *frequency-domain* HRV, is a heart rate power-spectrum analysis performed by means of Fast Fourier Transformation (see Bracewell, 1999; James, 2002; for details), reducing the HRV signal into its constituent frequency components and quantifies the relative power of these components: *Total Power (TP), High Frequency (HF), Low Frequency (LF) and Very Low Frequency (VLF)*. The TP represents the joint effect of all physiological mechanisms contributing to the HR variability detected along the full recording period. The HF is a high-frequency component evaluated within the range from 0.15 to 0.4 Hz; it reflects parasympathetic (vagal) tone and fluctuations caused by spontaneous respiration known as respiratory sinus arrhythmia. The LF is a mid-frequency component found within the 0.04 to 0.15 Hz band, and is both associated with sympathetic and parasympathetic tone. The VLF is a low-frequency component measured from 0.0033 to 0.04 Hz. The physiological meaning of this band is most disputable. Beside these components, there is also the *LF/HF Ratio* which corresponds to indicate balance between sympathetic and parasympathetic tone. A decrease in this score might indicate either increase in parasympathetic or decrease in sympathetic tone. This ratio value needs to be viewed regarding together with absolute values of both LF and HF to verify what component contributes in autonomic imbalance (a marker of individual variability) (Eckberg, 1997; Porges, 2007; Friedman, 2007).

4. Psychophysiogical Concepts and Theories

The terrain of Psychophysiology is scarce in theories and good-defined concepts. One of the reasons might be because of its positivist science-making approach, where findings replication and consistency are the bottom-line; another one, might be because of the inherent challenges and difficulties to set clear and touchable differentiations

between the concepts grounded on physiological data and its (possible) psychological significance. Following, we will address some of these concepts like *law of initial values*, *arousal and activation*, *orienting response*, *defensive response*.

The *law of initial values* was advocated by Joseph Wilder (1931, 1958, 1967), assuming a relationship between the response to a stimulus with the prestimulus level of the responding system. The law of initial values is empirically based, being inferred from changes in the functional state of the end organ. The law says that the higher the prestimulus level (initial value), the smaller the tendency to rise with exciting stimuli, and the greater the tendency to drop following inhibiting stimuli. The magnitude of these phasic change in the response system relies on the tonic prestimulus baseline functioning. Thus, the closer the prestimulus is to the ceiling of the response system the lesser the phasic change elicited by a stimulus. In other words, the system propensity for increase is less if the baseline condition is 140 bpm than when the baseline condition shows a "calm" activity of 67 bpm; and, as such, the lower the prestimulus level, the higher the available potential response increase. Findings consistent with the law of initial values are often evident in psychophysiological studies, although they may not be universally observed (Furedy & Scher, 1989; Scher, Furedy, & Heslegrave, 1985; Myrtek & Foerster, 1986; Raykov, 1995; Stern, Ray, & Davis, 1980). For example, Myrtek and Foerster (1986) argued that most physiological measures are incongruent with the law, because the correlation between initial and final values is far from being perfect (below 1.00 and sometimes well below). Given the evidence of such studies, Geenen and van de Vijver (1993) questioned if the phenomena described by the law of initial values represented a threatening or an annoying fact for the studies. They advised researchers to avoid "correcting" procedures for the law of initial values, given that these procedures might alter and threat much more the study data than the law of initial values on its own (see Geenen & van de Vijver, 1993, for a detailed theoretical and methodological review). Therefore, what is called a law is indeed more a principle which does not suppose that all systems and response systems behave that way. A simple way to determine whether the law of initial values - the link between the levels of tonic activity with the levels of phasic activity - is "running" consists to correlate pre- and poststimulus parameters.

The concepts of *Arousal* and of *Activation* have generated plenty debate across all psychophysiological literature, mainly because of how they are defined and which

are their differences. Out of this debate, narrowly *activation* encompasses processes that take place in the central nervous system and relies on an activity increment to higher levels of consciousness. As a result this construct comprises changes of activity at a level of the brain (e.g., coma, excitement) and because of that it is measured with electroencephalography measures (Barry et al., 2005; Guillot & Collet, 2005; Hugdahl 1995). *Arousal,* by the way, is much more related to motivation and mobilization of body processes and resources, involving the autonomous nervous system, the endocrine system, and to a certain degree the immune system (Stern & Sison, 1990; Barry et al., 2005). But as we have already mentioned, the central nervous system (the brain) has control and influence over the peripheral function and organs, and thus arousal is influenced by cortical process. Therefore, it is common to find three kind of arousal responses in the literature, based on Lacey's model of arousal (1958) – behavioural arousal (behavioural changes), autonomic arousal (physiological changes of the body) and cortical arousal (changes in the brain waves). Even with the inherent concept definition problem, arousal is still commonly used as a research and clinical jargon, but it has been the methodological and technological break-through that pushed ahead a much clearer understanding of arousal and activation; concepts that for many are used as synonyms or interchangeable terms (Barry et al., 2005; Hugdahl, 1995; Pribram & McGuiness, 1992).

Orienting or *Orienting Response* (OR) is a concept coined by Sokolov (1963), which relying heavily on Pavlov's (1927) work on response patterns following novel stimuli, described the main characteristics of this concept. For Sokolov (1963) whenever an input fails to match a previously existing neuronal model of the environment an OR occurs. Although, this response is non-specific when it refers to the quantity and quality of the stimulus; and when the once novel stimulus is repeatedly presented then the OR is extincted and get habituated, but if along the habituation the stimulus changes in any of its features then a new OR takes place (Barry & Sokolov, 1993). Thus, OR is an example of what might be called 'behavioural plasticity', in a way that it characterizes the effects of the individual to reach appropriate response upon an ever changing environment. It represents a broad and generalized response to a novel and unexpected stimuli, and thus, it capacitates the individual to be more able and prepared to detect and react in time to an unexpected situation. It is a warning response with the biological aim of promoting the (early) detection of a novel (threat or joyful)

stimuli and to set ready the organism for adaptation. In fact, this 'novelty reaction' comprises a bunch of psychophysiological patterns as increased sensitivity of the sense organs, turning the eyes upon the stimulus, dilatation of brain's blood vessels, constriction of the peripheral blood vessels, delayed respiration with higher amplitude and lower frequency, decreased HR, increased EDA, predominate beta waves in the EEG, and a sudden progressive increment in muscular tonus (see, Graham, 1973; Stern & Sison, 1990). Hence, OR encompasses a complex scenery of sensory, somatic, central and autonomous nervous system changes, which jointly suspend ongoing behaviour and increases sensory alertness, it is an adaptation promoting response; and as such, of crucial importance across all neuropsychological science areas (Barry et al., 2005).

Another concept also developed by Sokolov (1963) is the *Defensive Response* (DR) which is, in fact, a mirror-image of the previous described OR concept. As such, DR's main function is to protect the organism from excessive and intensive stimulation (mostly linked with danger, pain and harsh thought and feelings). While with the OR the habituation process occurs quickly with repetitive stimulus presentation, the DR habituates very slowly and stimulus continuous display does not lead to habituation. It is linked with the inhibition of sensory input and it is brought forth with occurrence of a high-intensity stimuli of relevant emotional valence. Hugdahl refers to this as 'arousal amplification' – "an interruption of action plans due to increased arousal from limbic structures and the reticular formation" (Hugdahl, 1995, p. 140). From the psychophysiological patterns view, DR elicits constriction of both cerebral and peripheral blood vessels, decreased sensitivity of the sense organs, muscular preparation allowing moving away from the stimulus, and increased heart rate (Barry et al., 2005; Stern & Sison, 1990; Hugdahl, 1995). In sum, as the OR main issue was to move the organism to pay attention to external stimulus, the DR puts the organism in a position of shutting off from external environment; similarly Lacey et al. (1963) referred to DR as *environmental rejection* and to OR as *sensory intake*.

5. Psychophysiological correlates and Attachment

Following the "old school" of psychophysiological research, based on the measurement of physiological systems as correlates of overt (or covered) behavioural responses and their differentiation and classification in terms of individual differences, the field of attachment research got progressively more and more interested in testing such assumptions on attachment organization. In fact, since the 1980's some papers echoed around the scientific community advocating optimism about psychophysiological contributions to understand outcome and process in psychotherapy (e.g., Cacioppo, Berntson & Andersen, 1991), and to attune comprehension of the attachment theory's biological base (e.g., Field, 1985). Under this scope, psychophysiology constitutes an approach to gather data for a more successful nosology, to reveal and clarify psychological and biological mechanisms that underlie behaviour (and its disorders), but social and contextual issues should not be forgotten because they boast effects on those psychophysiological relationships. Therefore, and as Field (1985, pp. 415-116) highlighted:

> "(…) attachments are psychobiologically adaptive for the organization, equilibrium and growth of the organism. Because the organism's behavioural repertoire, physiological makeup, and growth needs are an integrated multivariate complex that changes developmentally, multiple and different types of attachments are experienced across lifespan."

Many contributes and incentives for studying physiological features of attachment came out of the empirical drives of Bowlby-Ainsworth's work and the ethological experiments with monkeys (for details see e.g., Seay & Harlow, 1964; Kaufman & Rosenblum, 1967). Under this framework, several research lines evolves, most of them are developed by Reite and his followers (for review, see Reite & Boccia, 1994), studying monkey infants' behaviour in social groups (e.g., Pauley & Reite, 1981), developing assessment methods based on separation-reunion episodes (e.g., Reite, Harbeck & Hoffman, 1981), emphasizing the contextual variables and their effect over physiological reactivity (Boccia et al., 1991), and using for instance rapid eye movements, circadian rhythms, immunological and heart rate measures (Reite, Short,

Seiler,1978; Reite et al., 1981; Laudenslager et al., 1990). These, in many ways innovative and challenging, methodological approaches constituted not only the starting point of an growing interest in physiological data inside the attachment field, but also an attempt to understand the hidden links between biology and attachment. Even if these studies were mostly focused around dyadic interactions and maternal behaviour, the results made clear the underlying behavioural, biochemical and physiological processes of attachment bonds and how attachment behavioural system reacts under stress conditions. The progressive rise of new fascinating findings, led some researchers to an attempt to study human subjects instead of only primates.

Human attachment and its psychophysiological correlates have been studied mainly with autonomic regulation measures (skin conductance and heart rate) and cortisol levels (inferred from plasma or saliva), being the Strange Situation and the Adult Attachment Interview the two key experimental procedures of data gathering. There have also been some tendencies in relating attachment with cortical brain measures (brain electrical activity and positron emission tomography), although there are no direct data that cortical brain processes predict attachment classification, most assertions relied heavily on findings of affective and cognitive neuroscience (see for example Fox & Davidson, 1986; Fox et al., 1992; Newcombe & Fox, 1994; Fink et al., 1996).

The first study linking physiological measures to human attachment organization was done by Sroufe and Waters (1977) by monitoring heart rate via telemetry (a small transmitter was attached to the chest of each child which sent the data by radio signal to a receiver) allowing the child to express his or her full mobility in the laboratory setting. They used Ainsworth's Strange Situation paradigm to assess attachment patterns differences in terms of cardiac responses during preseparation, separation and reunion episodes. The results evidenced that both secure, avoidant and resistant infants had heart rate increases following separation which persist even during the reunion episode. Although, when compared to insecure infants, the secure infants after the reunion decreased more rapidly to their preseparation cardiac activity level, and engaged calmly in playing and interacting to objects once set down by the mother. The avoidant and resistant infants also differed among themselves. The avoidant ones, beside their apparent tranquility and lack of distress to the absence of the attachment figure, evidenced continuous increase in heart rate from the start of the separation until almost

the end of the reunion phase. Resistant infants asked to be put down immediately after their reunion, even maintaining a high cardiac activity, and once on the floor they requested again to be held (Sroufe & Waters, 1977).

Based on these results, that set groundwork for viewing physiological measures as a relevant tool to validate the Strange Situation protocol, many other authors followed this line of studies, some of them exploring the heart rate (Donovan & Leavitt, 1985; Izard et al., 1991; Spangler & Grossmann, 1993; Bono & Stifter, 1995; Soares et al., 1999; Stevenson-Hinde & Marshall, 1999; Burgess et al., 2003) as others explored more the cortisol measures (Gunnar et al., 1989; Gunnar, Colton & Stansbury,1992; Spangler & Grossmann, 1993; Hertsgaard et al., 1995; Nachmias et al., 1996). We will only briefly outline the main results of the cortisol studies, before describing the studies of autonomic measures which are more central to this project. The results of cortisol studies in infants have been controversial, on one hand there were no differences in cortisol reactivity among infants classified as secure, avoidant and resistant (e.g., Gunnar et al., 1989; Gunnar, Colton & Stansbury,1992); on the other hand significant differences of cortisol levels were reported between infant attachment classifications (e.g., Spangler & Grossman, 1993; Hertsgaard et al., 1995). From the methodological point of view, these findings may be explained by several factors such as: salivar vs plasma cortisol measure, various cortisol laboratory manipulation procedures, time elapsed since the end of the session and cortisol collection (some studies collect after 15 min, others after 30 min and some even after 45 min), and finally differences in the conceptualization of the stress model that underlies the experimental measure procedures. Apart from this, and relying on the studies data, one thing is expectable Strange Situation stress the individuals and increases their cortisol levels.

Regarding heart rate, Donovan and Leavitt (1985), following the footsteps of Sroufe and Waters (1977), collected cardiac activity data of 29 children during the Strange Situation. Data analysis, even without performing statistical comparisons, revealed that secure children decrease heart rate, in relation to baseline, as a response to entrance and approach of an unfamiliar individual, as the insecure children did not appear to decelerate cardiac activity in that condition. Further, when the infants were in a condition of impending separation (the mother followed the protocol saying good-bye to their child), secure attached child's exhibited increasing trends of cardiac responses so as the insecure (avoidant and resistant) infants. The authors described these results by

stating that secure infants decrease their cardiac activity because of focusing on attention and orienting activities to the stranger, whereas the acceleration to separation is equated as a signal of a defensive response (Donovan & Leavitt, 1985). Similar conclusions were drawn by the authors out of the heart rate changes of the mothers and their infants examined during the same study. In fact, the major contribution of this study was the differential physiological response and their association to attachment, even so this contribution was more of descriptive value than of empirical supported value.

With the aim of analysing temperament and both their links with attachment and physiological activity, Izard et al. (1991) designed a study with 88 babies in which several indicators of cardiac activity (heart rate, vagal tone, heart rate variance, and heart-period range) were considered and measured in a longitudinal design (at 3-, 4-, 5-, 6-, and 9-month), similar to Ainsworth's et al. (1978). The results supported the assertion that developmental changes take place along the first 12 months of life regarding the functional mechanisms of all four cardiac indicators. All four cardiac indicators showed increases of cardiac activity during the five evaluation periods. The vagal tone and heart-period variance was the best and most reliable predictor of attachment security. The authors verified that higher heart rate variability was a feature of insecure attachment (Izard et al., 1991). Their main contribution was to show the cardiac maturational process - from a more sympathetic driven activation to a combination of both sympathetic and parasympathetic at the end of 9 months – and that secure infants were more able to gain behavioural and emotional control over their cardiac activity.

Spangler and Grossman (1993) based on improving the empirical support to distinguish secure from avoidant attachment organization, recorded cardiac activity of 41 infants during the strange situation. The results revealed no attachment classification differences in terms of heart rate at all reunion episodes. Differences were found in the situation where the infant is alone in the room (Episode 6); in this setting the disorganized children evidenced a higher heart rate than did the secure and avoidant infants. The authors argued that disorganized children act that way because they interpret this situation as an alarm that evidenced their incapability to consistently control their attachment behaviour in such situations (Spangler and Grossman, 1993). During this study, the heart rate of infant and their mothers were monitored during

interaction situation (object manipulation and play situations with the mother). The data indicates no heart rate increase when avoidant infants looked at their mothers, a physiological change that happened with secure and disorganized infants. Further, avoidant infants showed heart rate acceleration when interacting with objects while secure and disorganized infants exhibited a heart rate decrease. Undoubtedly, this study triggered some previous theoretical and empirical assumptions (e.g., Sroufe & Waters, 1977; Donovan & Leavitt, 1985) - what have secure and disorganized more in common than disorganized and avoidant? - but even so one thing was consistent – the Strange Situation is a powerful experiment to determine attachment classification differences and their psychophysiological correlates.

In another study, heart rate and its variability were compared before and after the strange situation at 18 months of age (Bono & Stifter, 1995). The data were analysed and reported in terms of attachment categories. Thus, resistant children showed higher heart rate values and reduced heart period variability than secure infants after finishing the strange situation. The authors hypothesized that such findings may be explained by the extreme level of upset behaviour of resistant attached infants, allied with their inability to cope with the stress and stress soothing situations of the experimental protocol (Bono & Stifter, 1995). The autonomic activation models the behavioural stress that these infants experience.

Soares et al. (1995, 1996), in a series of studies, using the Holter method to evaluate cardiac activity in Strange Situation test-retest design, found a good reliability and stability both for cardiac data and inter-relationship behavioural patterns. In a later study (Soares et al., 1999), the results evidenced that the Strange Situation was an activating and stressful experiment in which even the avoidant pattern had significant increases above the baseline value; moreover, the three infant attachment organizations (secure, resistant and avoidant) exhibited psychophysiological differences along the experiment. The resistant classified children were those which evidenced higher heart rate than the avoidant children. A major contribution of these studies, beside their consistent support to the results of Spangler and Grossmann (1993), was the development of synchronized multimedia system that integrates cardiac measures with the audiovisual data of all Strange Situation episodes (Soares et al., 1999).

Inspired by some scepticism about Izard and colleagues (1991) findings Stevenson-Hinde and Marshall (1999) conducted a study with 126 children (4.5 years)

to grasp the association between autonomic regulation and both attachment and behavioural inhibition. All children were evaluated with a modified version of the Strange Situation, and monitored in terms of cardiac activity (heart period variability and respiratory sinus arrhythmia). The authors found that secure children were the only ones exhibiting a predicting link between behavioural inhibition and cardiac activity, in which both cardiac activity measures were negatively associated with behavioural inhibition. The authors proposed that the secure children, as consequence of their coherent temperament expression, are able to reach a more consistent harmony between the two branches of the autonomous nervous system (parasympathetic and sympathetic). Another interesting finding of this study was that secure attachment and an absence of high behavioural inhibition are essential to assure a significant heart period increase at the 3-min after the reunion episode. Along the discussion, the authors emphasized that "there is only one way of being secure, however, there are several ways to be insecure – for example, being avoidant and keeping down emotions or being ambivalent and overexpressing emotions" (Stevenson-Hinde & Marshall, 1999, p. 813).

In a somewhat similar study, but more extensive in exploring individual temperament and parent-child relationship, Burgess et al., (2003) used a longitudinal design to evaluate cardiac activity (heart rate and respiratory sinus arrhythmia) of 140 children at 14 months (Strange Situation), 24 months (behavioural inhibition) and at 4 years old (social interactions with strange peers). Results of this study evidenced no cardiac measures differences between 24-month and the 4 years of age. Further, avoidant attachment was seen as a predictor of lower heart rate and higher respiratory sinus arrhythmia at the age of 4. Thus, avoidant dyads in infancy may influence the emotional and behavioural profile in early childhood. The authors conclude that their findings underline the importance of relationship quality in infancy arguing that "relationship quality in infancy seems to influence physiological functioning in early childhood, rather than the reverse" (Burgess et al., 2003, p. 829).

Following the shift of the attachment field study interests, from infancy and childhood to adulthood, the usage of psychophysiological variables in the study of attachment were a natural consequence. Under this umbrella, the AAI took the place of the Strange Situation as an activating stimulus of the attachment behavioural system. The seminal work within this flag was developed by Dozier and Kobak (1992). This study comprised a sample of 50 undergraduate students that completed the interview

(AAI) during which they were monitored for skin conductance level. The results evidenced a positive correlation link between deactivation and the mean skin conductance levels. Deactivation was associated with a greater increase of skin conductance from baseline when subjects were asked: (a) to describe adjectives for their relationship with the fathers in childhood, (b) to explain how affected they were by upbringing, (c) why parents behaved the way they did, and (d) how they explain changes in the relationship with their parents. But of special focus were the questions regarding the separation, rejection and threatened experiences questions. The results were analysed inside Gray's (1975) two-factor learning theory and Fowles (1980) empirical contributions which asserts the existence of two opposite components of the activation system that encompass different Autonomous Nervous System functioning. Thus, behavioural activation is closely linked with heart rate (cardiovascular system) and behavioural inhibition is connected to skin conductance (electrodermal system) (see Fowles, 1980). The fact that attachment deactivation strategies were correlated with increases in skin conductance was seen by the authors as a foremost indicator of behavioural inhibition and that subjects that use these strategies experience conflict or inhibition during the AAI (Dozier & Kobak, 1992). Consistently, the results highlighted some mismatch of deactivation strategy with his conceptual premises, namely the access restriction to attachment information, and minimizing effects and importance of attachment for the subject. Dozier and Kobak assert that what might be the case is "the elevation of skin conductance levels associated with avoidance indicates that the subject is effortfully engaged in diversionary activities, rather than having fully deactivated the attachment system" (1992, p. 1479). These assertions relies heavily on Main's (1990) view that besides the subjects effort in minimizing (and trying to look good or normal) negative childhood aspects and their importance in his/her life, the attempt fails because significant and evident signals of physiological activation and distress arise when he/she is asked about such themes. It is as Main pointed out that "the attachment system remains 'aware' of the 'real' status of environmental conditions" (1990, p. 58, cit. in Dozier & Kobak, 1992).

Even with promising results, allowing to discriminately link attachment (deactivation, i.e., dismissing) with physiological measures (skin conductance), it took almost a decade until more studies (Soares et al., 2002, Roisman, Tsai & Chang, 2004; Diamond, Hicks & Otter-Henderson, 2006; Roisman, 2007) followed this seminal work.

These studies extended Dozier and Kobak's (1992) assertions by considering cardiovascular data and by this, exploring at a higher level the hypothesis that deactivating strategy is not associated with heart rate, and consequently support the findings linking differentially electrodermal activity with behavioural inhibition.

Soares et al. (2002) presented preliminary data out of a larger study with eating disorders patients in which the patients' cardiac and electrodermal activity were monitored. The results of this four-case study allowed postulating the hypothesis that attachment organization has a specific physiological pattern both in terms of heart rate and skin conductance response. The secure attached subject, during the AAI, showed a decrease of heart rate without any significant change to baseline. The subjects with a dismissing attachment organization evidenced a strong sympathetic activation justified with the increase in skin conductance levels, but this increase was accompanied by a decreasing heart rate in a similar manner as the secure subject. The preoccupied subject evidenced a simultaneous increase both in heart rate and electrodermal activity along the AAI (Soares et al., 2002). These findings which support Dozier and Kobak's findings and, simultaneously, extend them to a clinical population and increase the depth of data analysis by considering heart rate and not only electrodermal activity to analyse the link with attachment's secondary strategies. Besides the inherent limitations out of the sample size, the main contribute of this study was relied on technical innovations. First, this study presented a multimedia system that synchronously collects physiological data (skin conductance and heart rate) and audiovisual data, integrating both into computer framework.

In another study, Roisman, Tsai and Chang (2004) studied 60 undergraduate students, 30 of them were American and 30 were Chinese American, and confirmed that (a) deactivation was associated to electrodermal activity (skin conductance levels) however cardiovascular activity had no link in the AAI, (b) security played no role at all in regard to electrodermal and/or cardiovascular activity during the AAI, and (c) these previous findings were both true for gender and ethnic groups.

Driven by contributes out of social psychophysiology (e.g., Gottman & Levenson, 1992; Smith & Spiro, 2002; Heffner at al., 2004), a significant amount of attention was dedicated to the context of romantic and marital relationships with the aim of studying psychophysiological correlates of attachment. Diamond, Hicks and Otter-Henderson (2006) designed a study with 74 cohabiting heterosexual couples that were

evaluated with the Experience in Close Relationship (Brennan, Clark & Shaver, 1998) to assess attachment style. All participants underwent a sustained exposure of a combination of attachment-relevant and distressing tasks (some of them based on the AAI protocol) during which skin conductance levels were collected. The main results evidenced that attachment avoidance, contrarily to anxiety, was correlated with the increase of skin conductance level (greater sympathetic nervous system reactivity) in all tasks, but it was more prominent in women. The authors emphasize the importance of these findings to understand the interactions between "(a) attachment-related strategies for emotion regulation; (b) gender-related patterns of emotional experience and expression within close relationships; and (c) the physiological correlates of both these dimensions can make unique and substantive contribution to future research on gender and adult attachment" (Diamond et al., 2006, p. 222).

In another study, 80 couples were measured for cardiac and electrodermal activity during the couple interaction task after the AAI (Roisman, 2007). The results were inline with the growing literature within the psychophysiological view of adult attachment, and evidenced that secure adults had different autonomic response patterns in interaction with their marital partners, namely low levels of electrodermal change compared to baseline along the experimental context. The adults that idealized caregiving care or normalized negative childhood experiences evidenced increases in electrodermal activity, while attempting to resolve conflict in their marital relationship, during the interaction task after the AAI. And those adults that responded with anger or passivity along the debate about their early experiences were those which showed heart rate increases during the marital interaction task. Roisman (2007) along his discussion underpins the importance of "emerging physiological methods to inform questions related to antecedents, correlates and consequences of adult security" (p. 49).

Recently, Dias (2007) tried to study the relation between attachment organization and autonomic regulation activity with 47 eating disorders patients, 24 with restrictive and 24 with purging symptoms. The participants answered to several self-report questionnaires concerning psychopathological symptoms and psychopathological developmental markers, and were monitored for heart rate and electrodermal activity during the AAI. The results of attachment organization revealed that most of the participants were classified as insecure, being the hiperactivation attachment strategy the most prominent among the individuals, especially among the

patients with purging symptoms. Regarding psychopathology and developmental markers, the presence of low self-reported eating disorders symptoms were noted in patients classified as dismissing. Moreover, a positive significant correlation was found between hyperactivation and eating disorders symptoms in general, a negative significant correlation evidenced the link between mega-items related with secure attachment and a couple of markers of psychopathology, and a positive correlation between the mega-items associated with attachment insecurity and several developmental markers. Concerning the physiological activity, the results showed evidence for the link between the two physiological measures (skin conductance and cardiac LF/HF ratio) and the attachment organization, both at a taxonomic (patterns) level as at a dimensional (mega-items and attachment strategies) level. Beside all these findings, the main contributions of this study was the extension of psychophysiological attachment correlates to clinical population, the usage of spectral analysis for cardiac measures, and of course the usage of a single system that integrates audiovisual and physiological data into the same and synchronized computer framework.

Along this revision, we have seen that physiological measures are complex and reflect the (in)direct processes of the nervous system, and therefore its usage became a wide spreading endeavour, with an evermore growing interest within clinical psychology. Inherent to its complexity is the difficulty in interpret them, especially if we want to do so in the way of mapping a human ability (e.g., cognition, emotion, personality, and so on). Electrodermal activity and cardiac activity are indeed two measures that can be confounded with the history of psychophysiology itself. With an immense legacy of papers aside, along the last two centuries, and even with the advent of more complex measures as EEG/ERP or imagery techniques (e.g., MRI, SPECT) could not turn apart their usage, these two measures are still current and valid measures for studying psychophysiological processes. When during the sixties the "joint ventures" of attachment and psychophysiology began it was more, indeed, a natural development of what has been the need for a deeper exploration of the biological roots of what characterizes attachment. As previously mentioned, most of the physiological measures were associated to the two main attachment organization evaluation procedures: the SS and the AAI. Although, as the SS is well defined and controlled protocol especially regarding the subjects' responses, the AAI even if the interview

protocol is “controlled and closed script” the answers to this script remain wide-open and it is unforeseeable what type of answers might each subject verbalize. It is this breeze of subjectivity that makes it harder for researchers to transform the AAI into an experimental psychophysiological situation. In fact, the main hurdle when compared with the SS is the lack of a well defined timeline protocol in the AAI; but even so we should never forget that both the SS as the AAI are two naturalistic procedures in the way they approach situations of the daily life, and as the first is much more concerned with behaviour, the second addresses mostly what may be transmitted through language. Beside this critical appreciation, both SS and AAI physiological research evolved into a promising field, evidencing some interesting results that contribute to a physiological attachment organization. Even so, all these studies along almost four decades are to view and far from being reasonably conclusive, especially in regard to studies in adults with the AAI.

CHAPTER III. OUTLINE OF THE EMPIRICAL STUDY AND METHOD

1. Aims and Research Questions

After contemplating the exposed in previous chapters, it should be clear that attachment research have been growing with vigour and is an alive field, where more than ever research is being undertaken across all five continents. Attachment research contributions for the understanding of human relationships, from basics to complexity, from childhood to elderlyhood, has been fruitful along all these decades, even though plenty issues praiseworthy of investigation are available, and many questions still open, both at a level of the development of theoretical models as at the empirical foundations. Along my literature review, I was concerned to deliver a broad outline of what has been the Attachment field, nonetheless limited by my focus on adult attachment. Maybe the biggest challenge in reviewing this field is to make a short review because of the immense amount of existing research; and I am truly aware that it would be impossible to deal with all literature without dedicating a couple of hundred pages, and even so it would be a short review, therefore my revision is only a humble view about attachment research..

An evidence of this being so, is the use of psychophysiological measures in the present study. In fact, the joint-venture of the attachment and psychophysiological turned out to be a fertile but at the same time a scarce explored ground. As we have seen, attachment research procedures constitute a striking challenge to the traditional psychophysiological evaluation protocols; however there have shown off some very promising findings inviting more and more other researchers to embark into this endeavour. In this very short section, I will present a brief overview of those problems I decided to dedicate attention in the empirical study, and succinctly highlight the study and its goals. This research was planned as an extension of Soares et al. (2001) paper and is intimately related to the development of the BioDReAMS version 2.0 (funded by a BIAL grant). The purpose of the current study was to extend the previous study in terms of methodological advances, with especial focus on improving the data analysis models. Thus, the present study examines the relations between attachment organization, heart rate (HR) and skin conductance level (SCL) during the Adult

Attachment Interview (AAI, George, Kaplan & Main, 1985), in a non-clinical group of young female participants. To collect data during the AAI, we used a multimedia system (BioDReAMS 2.0) that enables the synchronous collection and analysis of video information, ECG signal and SCL. The general aim of this study was to explore the contributions of psychophysiological data for the understanding of attachment organizations and experiences. In addition, this study tried to elaborate a more detailed model for the physiological data analysis. Thus, the current study has two main objectives. First, to replicate previous findings, (Dozier & Kobak, 1992; Roisman et al., 2004; Roisman, 2007) which highlighted attachment patterns differences in terms of skin conductance levels, but not in terms of heart rate. Although, a recent study (Dias, 2007) revealed differences in heart rate values for attachment patterns.. Therefore, the actual state of the art seems contradictory in terms if there is an attachment organization differentiation in terms of skin conductance or heart rate, or even both measures.

Second, to explore non-linear relationships between attachment patterns and the variability of psychophysiological response, that might not show in an linear approach. In fact, previous research has analysed the data, using simple data analysis models based on the mean. These procedures might be insufficient to uncover the complexity underlying physiological data analysis of skin conductance and heart rate. It is under this umbrella, that this study tries to explore the potentiality of non-linear methods of analsis. These methods help to explain the data variability that is not explained by the mean-based procedures, and as such to gain insight over, slight tendencies, sudden changes, and continous shifts that might occur along the AAI:

More specifically this study is guided by the following research questions:

Research Question 1: Are there psychophysiological differences in terms of electrodermal and cardiac activity between secure and insecure attachment throughout the AAI?

Research Question 2: Are there psychophysiological differences in terms of electrodermal and cardiac activity between attachment patterns (Secure, Preoccupied and Dismissing) throughout the AAI?

Research Question 3: Is there a relation between Kobak's (1993) two-prototype system (deactivation/hyperactivation, security/insecurity) and the psychophysiological measures in terms of electrodermal and cardiac activity during the AAI questions?

Research Question 4: How does alexithymia and its dimensions relate with to psychophysiological measures during AAI's critical questions?

Research Question 5: What contributions does the usage of non-linear data analysis methods make to explore the relationship between Attachment and Physiology?

2. Method

2.1. Participants

Fifthy female participants recruited from community services (schools, universities, enterprises, associations, etc) in the north of Portugal 76% (*n* = 38) from Porto, 14% (*n* = 7) from Braga, and 10% (*n* = 5) from Vieira do Minho participated in the present study. The participants' age ranged from 17 to 27 years with a mean age of 21.20 (SD = 3.26). None of the participants was, at the time of the study, taking medication, under medical treatment and/or in psychiatric or psychological treatment (never had been or had not been into treatment for 10-year previous to this study). As exclusion criteria we defined: any past or present medical condition with repercussion over the considered physiological measures (e.g., cardiac disease, respiratory disease, etc), the usage of any medication during the last month of the physiological experiment (because most medication has a direct or an indirect influence on physiological measures), and any present psychological disorder.

We included two participants which have had a psychological problem or had been in therapy in the past, but haven't been in therapy or any kind of psychological treatment in the past 10 years. And, for these cases, a Structured Clinical Interview of Diagnosis (SCID) was performed before deciding to include them in the study, to rule out any current diagnosis.

Table 5. Sample characteristics – demographical data

Variables	N	%
Marital Status		
Single	48	96
Married	2	4
Occupation		
Students	43	86
Psychosocial Worker	3	6
Teacher	1	2
Human Resource Manager	1	2
Researcher	2	4

Highest Educational Level		
High School	13	26
Undergraduate	30	60
Graduation	7	14
Living with parents		
Yes	41	82
No	9	18
Depends financially on parents incomes		
Yes	39	78
No	11	22
Social Economical Status: GRAFFAR		
I – High	3	6
II - High Middle Class	9	18
III - Middle Class	35	70
IV - Low Middle Class	3	6
V – Low	0	0

Most of the participants (96%) were single and (84%) were students. In terms of the Social Economical Status, the majority (70%) of the participants were from the middle class. Considering the highest educational level, 58% were university students. Forty-one participants (82%) live with their parents and thirty-nine (78%) are financially dependent of their parents' income (see Table 5).

2.2. Measures and Procedures

The Structured Clinical Interview for DSM-IV Disorders (SCID-IV, First et al., 1995)

The SCID is a semistructured clinical interview based on the Diagnostic and Statistical Manual of Mental Disorders and yields both current and lifetime diagnoses of Axis I and Axis II disorders. The SCID contains the obligatory questions and the operational criteria from the DSM-IV, it is a categorical system for rating symptoms, and an algorithm for arriving at a final diagnosis. The SCID allows the research

clinician to tailor a diagnostic assessment to fit the needs of a particular research protocol or a particular patient (First et al., 1995; Spitzer et al., 1992). Moreover, the SCID instructions promote the diagnostic interviewer to use all sources of information in rating the presence or absence of a symptom or sign of psychopathology. The purpose of the present research let us to the administration of the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I; First et al., 1995b), the Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II; First et al., 1997). The SCID-I is composed by six self-contained modules that can be administered in sequence: mood episodes; psychotic symptoms; psychotic disorders; mood disorders; substance use disorders; and anxiety, adjustment, and other disorders. The SCID-II was used to diagnose DSM-IV personality disorders. It closely follows the language of the DSM-IV Axis II Personality Disorders criteria, and therefore, there are 12 groups of questions corresponding to the 12 personality disorders.

Attachment Representation: Adult Attachment Interview (AAI; George, Kaplan & Main, 1984)

The AAI is a semi-structured, semi-clinical interview used to characterize individuals' current state of mind regarding past parent–child experiences (George, Kaplan, & Main, 1984). This protocol, exposes the individuals during approximately 1 hour with questions that incite participants to describe their early relationships with their parents, choose five adjectives to describe their relationship with each parent during childhood and support each adjective with a memories, revisit salient separation episodes, explore instances of perceived childhood rejection, recall encounters with loss, describe aspects of their current relationship with their parents, and discuss salient changes that may have occurred from childhood to maturity (see Hesse, 1999). The technique behind this interview is based on "surprising the unconscious" (George et al., 1984), and interview format provides wide opportunities for a speaker to contradict, or simply fail to support, earlier or succeeding statements.

Along twenty-questions, each participant is invited to reveal his state of mind through producing and reflecting upon memories related to attachment situations. The interview starts with a "warm-up" question, where participants are asked to describe in

general their family (e.g.,"who is your immediate family, and where you lived?). Next, participants are asked to describe the relationship with their parents when they were young. The idea behind this question is to focus the participants'memories in childhood and to explore how the relationship with the parents was. The third and forth question address in detail the characterization of "how was the relationship with the mother and with the father; for that participants need to describe those relationships with five adjectives and support each adjective with a memory. The fifth question gives informations about to "which parent the participant felt closer and why". Question six addresses childhood episodes when participants felt upset or had a problem, and what have they done (did they asked for help the parents?). After this question, participants are invited to describe their first separation (from parents), and how they cope with it and the emotions they have felt. The eight question aboards the rejection theme ("did the participant have felt rejected as a child"?; how did you deal with it?; "do you think that your parents realized they were rejecting you"). The ninth question encompasses threathened parental behaviuour by asking the participants if they "ever have been threatened by their parents for discipline or joke?" The tenth question focus a reflection about the overall impact of the early experiences - "how do you think that the early experiences have affected your adult personality"? Next, participants are asked to think about "why their parents behaved just like they did" during childhood. The twelfth question explores if the participants had other adults with which they had a similar relation as with their parents. Next, the participants are asked to talk about losses (experienced at childhood) of a parent, a family member or another person that were important for them. After exploring loss experiences, participants are asked for traumatic experiences and how they cope with it.Once talked about traumatic experiences, participants are invited to reflect about "changes between childhood and adulthood in the relationship with their parents", and how they explain such changes. The sixteenth question asks the participant to describe his/her actual relationship with his/her parents. Just after discussing the actual relationship with the parents, participants are invited to imagine they have to separate themselves from their child (or imaginery child), and how would they feel about this. The eighteenth question asks the participants to formulate three wishes for the future of their child (or imaginary child). Following next, participants are invited to think about (possible) lessons learned from their

childhood and the relationship with the parents. Finally, the last question, asks participants to describe what they would like to "teach their children".

Under these twenty-questions, there are some of them that can be labelled as critical attachment questions. Critical because they incite participants to think and remember key issues of their relationship with the parents. These questions are: adjectives for mother (question 3), adjectives for father (question 4), upset (question 6), separation (question 7), rejection (question 8), threatened (question 9), losses (question 13), and trauma (question 14).

In the current study, all interviewers were trained (20 hours) in the AAI procedures according to the recommendation of George, Kaplan and Main (1996), and performed several training interviews receiving feedback and supervision.

In accord with the established convention (see Main, 1995), AAIs were transcribed verbatim from the discourse record, and all personally identifying information was removed prior to coding.

The analysis of the AAI rests on repeated study by judges of the verbatim transcript. Therefore, to assess individual differences in attachment, we used the Adult Attachment Interview Q-Sort (Kobak, 1993), which consists of 100 descriptive cards that are sorted into a forced normal distribution across nine piles from least to most characteristic (5, 8, 12, 16, 20, 16, 12, 8, and 5 cards per column, respectively). To estimate interrater reliability, we double-sorted all of the AAI transcripts from this study, and a reliability of .6 or greater Spearman-Brown prophecy formula) was considered acceptable. The mean inter-ratter reliability, calculated using the Spearman-Brown formula was .80 (*SD* = .070; range = .69 - .97).

After reaching an acceptable interrater reliability an AAI interview, Pearson correlations were computed between each of the composited sorts (mean Q-sort value out of the scoring of the two judges or a third when necessary) and both a prototypic "secure/insecure" sort and a "deactivation/hyperactivation" sort developed by Roger Kobak and his colleagues (see Kobak et al., 1993, for details). Prototypically secure (in contrast to insecure) cards include "responds in a clear, well-organized fashion" and "is credible and easy to believe." Prototypically deactivating cards (in contrast to hyperactivating/preoccupied cards) include "subject persistently does not remember" and provides only minimal responses." On the basis of this analysis, participants were assigned continuous scores ranging from -1.00 to 1.00 on each construct, with higher

scores indicating greater resemblance to the prototypically secure and prototypically deactivating individuals. By definition, the deactivation/hyperactivation (DH) dimension is the variable of choice if one is attempting to demonstrate that an outcome is specifically associated with a dismissing as opposed to a preoccupied state of mind (or vice versa). In similar fashion, the security/insecurity (SI) dimension is a variable of choice if one is trying to show that an outcome is specially associated with a secure state of mind instead of an insecure one.

Besides the AAI classification, the Q-sort method allows to compute items into mega-items focusing various attachment issues. These mega-items reflect pre-established configuration in reference to attachment strategies and to the internal working models (e.g., Cole-Detke & Kobak, 1996). According to Kobak (1998), eight mega-items were proposed, both based on conceptual models and factor structures to establish their internal consistency. These mega-items, which from now on we will designate as AAI-Mega-items, were the following ones:

Mother Base (5 items, $\alpha = .90$) indicates the trust of a participant in his/her mother's response capacity (e.g., "Trusts in mother's acting capacity"; "the mother actively encourages the subject to develop his/her capabilities.");

Mother Availability (13 items, $\alpha = .97$), describes the judges' perceptions regarding the mother's support and availability (e.g., "The mother was a competent and supportive confident for the individual.");

Father Availability (12 items, $\alpha = .89$), describes the judges' perceptions regarding the father's support and availability (e.g., "The father was a competent and supportive confident for the individual.");

Harsh Father (7 items, $\alpha = .95$), indicates the father's severity and intimidation effect on the individual, and the father's tendency to emphasize realisation and success instead of emotional support. (e.g., "The father pressured the individual to reach early independence.");

Family Rupture (7 items, $\alpha = .95$), describes ruptures in parental caregiving and also marital and relationship conflicts (e.g., "The individual had recently the role of taking care of the parents and/or to a relative."; "Considerable marital conflict between the parents were noted.");

Preoccupied (17 items, α = .91), indicates the individual's excessive focus on attachment experiences and an exacerbation of disturbance signs (e.g., "Currently, are you preoccupied with negative experiences that you had with your parents.");

Dismissing (14 items, α = .85), indicates the individual minimizes disturbance signs and presents a vulnerable self (e.g., "The individual reports negative experiences without feelings of pain/suffering or disturbance.");

Coherence (28 items, α = .96), indicates the capacity to recall infancy memories, to acknowledge and to integrate contradictory experiences (e.g., "The individual spontaneously searches relevant memories for the interview topics."; "Recognize contrarieties that were overcome.").

Besides these eight Mega-items, we considered to include three additional AAI Mega-items, which were developed by Pinho (2000), dedicated to link attachment with eating disorders. Despite the initial aim of the development of these three Mega-items, we decided to include them given the fact that they encompass negative experiences of attachment which are far from being only linked to a specific psychopathology, but rather reflect important relationship aspects. Thus, the three Mega-items were:

Harsh Mother (5 items, α = .91), indicates the mother's severity and intimidation effect on the individual, and the mother's tendency to emphasize realisation and success instead of emotional support. (e.g., "The mother pressured the individual to reach early independence.");

Family Enmeshment (15 items, α = .78), the family is presented by the individual as over-protective and intrusive (e.g., "The mother asks for attention for her own concerns and needs.");

Parental Rejection (18 items, α = .83), indicates the "downsizing" of the importance of attachment relations, an emotional distance regarding parents and also the parental psychological unavailability for the individual (e.g., the mother and/or the father were psychologically unavailable.").

Physiological data: Multimedia Information System BioDReAMS (Soares, Cunha, Zhan Jian, Pinho & Neves, 1998)

The Bio-Dual channel and Representation of Attachment Multimedia System Version 2.0 is a PC-based tool for AAI analysis. BioDReAMS integrates functionalities

for collection, analysis and presentation of ECG, Skin conductance level and video/audio stream. It provides a wide range of features for AAI analysis. It saves in digital format both video, physiological data, and ratings. The workflow of *BioDreAMS* system in an AAI is shown in Figure 1.

The BioDreAMS version 2.0 was developed based on the version 1.0 developed in 1999. It runs under Windows XP and implements the concept framework and workflow of physiological measures and AAI assessment including synchronous ECG, Skin conductance, video/audio data collection, store and rating.

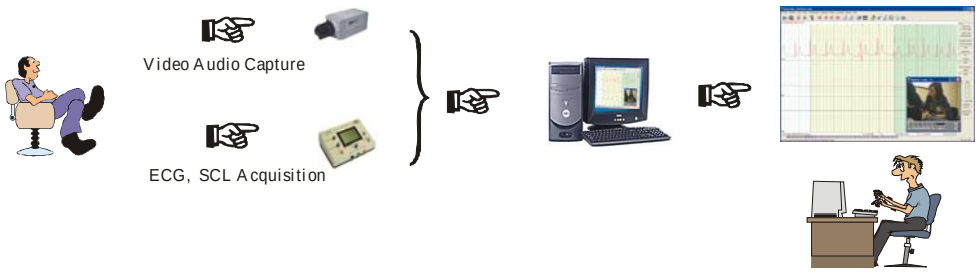

Figure 7. The System workflow of the BioDReAMS

The review and editing procedure can also be performed visually which enables raters to identify events over different types of data and to analyze relations between all psychological and physiological events. BioDreAMS Version 2.0 has greatly improved from the previous one in terms of data acquisition, backup, processing and analysis, which makes it easier for the raters to analyze and evaluate psychological-physiological events during review and to explore possible relations. Figure 2 shows the graphical interface of the system.

Figure 8. BioDReAMS's graphical interface

Developmental markers of psychopathology: PAMaDeP- Version B (Soares, Rangel-Henriques, Neves & Pinho, 1999)

The Developmental Psychopathology Markers Evaluation - *PAMaDeP* (Soares, Rangel-Henriques, Neves & Pinho, 1999) is a self-report measure based on Guidano & Liotti's (Guidano, 1987; Guidano & Liotti, 1983) conceptualization of the role between attachment organization and psychopathology, and on empirical studies linking psychological disorders in adulthood with disorders or symptoms during childhood and adolescence (Rangel-Henriques, 2000). The *PAMaDeP* comprises three questionnaires entitled "When I was a child", "Mother Form" and "Father Form".

The three questionnaires were elaborated in two distinct forms (M and F) for male and female individuals. All the questionnaires are composed of closed questions with answers in a Likert-type scale ranging from 1 (totally disagree) to 4 (totally agree). The questionnaires "Form Mother" and "Form Father" are composed of 3 sub-scales: Rejection, Overprotection, and Fusion/Inversion of roles.

The rejection sub-scale involves items regarding the perception of rejection in childhood of the father and mother (e.g., "My father made me feel as though I was a burden on him"; "My mother did not have time for me") The overprotection sub-scale is composed of items regarding the perception of having been overly protected in childhood by the father and the mother, limiting autonomy (e.g., "My mother treated me like a baby for a long time"; "My father would frequently do things for me that I would have been capable of doing") The Fusion/Inversion of roles sub-scale is composed of items regarding the perception of a fusional relationship with an inversion of care-giving with the mother and the father (e.g., My mother and I were best friends"; "I was my mother's confident concerning her problems and worries"; "My father needed all my support and attention").

The questionnaire "When I was little" is composed of three sub-scales: Abandonment, Dependency and Overpreocupation with the family. The Abandonment sub-scale consists of items regarding the perception of abandonment and rejection in childhood (e.g., "When I was little, I felt abandoned by my parents"). The Dependency sub-scale consists of items regarding dependency towards the adults during childhood (e.g., "When I was little, I felt excessively fragile when faced with obstacles and

problems"). Regarding the overprotection with the family subscale, it is composed of items concerning the excessive preoccupation with the family during childhood (e.g., "When I was little, I was afraid of my family getting separated"). Besides these subscales, the questionnaire "When I was little" is also composed of items regarding health issues ("When I was little, I suffered a lot with the illness of one of my parents"), death ("When I was little, my life suffered negative changes after the death of one of my parents"), or prolonged absence by one or both parents ("When I was little, I suffered the absence of one of my parents or both of them for a long period of time").

Globally underlying the construction of these instruments considerations and knowledge of different disorders were taken into account, especially agoraphobia, depression and eating disorders. The *Father Form and Mother Form questionnaires* considered theoretical aspects underneath attachment representation (Soares, 1992) and instruments like Kobak's (1993) Attachment Q-Sort, Parker's et al. (1979) the Parental Bonding Instrument (PBI), Parker, and Epstein's (1983) Mother, Father, Peer Scale.

For the development of the *When I was a child questionnaire,* the authors took into account the DSM-IV (APA, 1994/1996) criteria and conceptual frameworks out of cognitive-constructivist and narrative models about meaning organization (Guidano, 1987, 1991; Guidano & Liotti, 1983; Lorenzini & Sassaroli, 1987; Lorenzini & Sassaroli, 1992; Gonçalves 1989; Maia, 1998). This questionnaire is composed by three factors, Abandoned/rejected; Dependence and Overconcern with Family for which respectively the following Cronbach's alpha values were obtained .85, .71 and .67. The scales total internal consistency value was .81.

General Psychopathology: Symptom Checklist - Revised - SCL 90-R (Derogatis, 1977)

The Symptom Checklist Revised (SCL-90-R) is 90-items self report inventory which was primarily designed to reflect the psychological symptom patterns of psychiatric and medical patients. It is a measure of current (state) psychological symptom status. The SCL-90-R was introduced as a measure of nine primary symptom dimensions which can be computed into a total score (General Symptom Index), scored on a 5-point Likert scale (0 – never - to 5 - extremely), namely, somatisation, obsessive-

compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism. In this study, we used the Portuguese version (Baptista, 1993), this scale had shown adequate psychometric characteristics (Cronbach's α above .70, for all scales). The cut-off points derived for this study and based on 4th quartile values were: somatisation (1.08), obsessive-compulsive (1.50), interpersonal sensitivity (1.22), depression (1.17), anxiety (1.10), hostility (1.17), phobic anxiety (.57), paranoid ideation (1.33), psychoticism (.70) and General Symptom Index (1.10).

Toronto Alexithymia Scale – TAS-20 (Taylor, Bagby & Parker, 1994)

The Twenty-Item Toronto Alexithymia Scale (TAS-20) was developed by Bagby et al. (1994a) and is a revised version of the earlier 26-item Toronto Alexithymia Scale (TAS; Taylor, Ryan, & Bagby, 1985). The TAS-20 is composed of 20 items that participants endorse on a five-point, Likert-type scale ranging from 'Strongly Disagree' to 'Strongly Agree'. Alexithymia is not thought to be an all-or-nothing concept, and research has demonstrated that the negative impact of alexithymia on health is correlated with higher scores on the TAS-20. Therefore, the TAS-20 scores can range from 20± 100. However, total scores are used to determine if a participant is either alexithymic (score ≥ 61), possibly alexithymic (51< score <61), or not alexithymic (score ≤ 51).

The TAS-20 has demonstrated good internal consistency (α = .79) and test-retest reliability (r = .82 after one week, and r = .75 after 5 weeks). In the initial validation study, exploratory factor analysis of the TAS-20 with a student sample yielded a three factor structure congruent with the theoretical construct of alexithymia: (F1) – factor 1 - difficulty identifying feelings and distinguishing between feelings and the bodily sensations of emotional arousal; (F2) – factor 2 - difficulty describing feelings to others; (F3) - factor 3 - externally-oriented thinking. Despite the absence of items on the TAS-20 directly assessing daydreaming and other imaginal processes, which were included on the TAS-26, the third factor, together with factor 2, seem to reflect the *pensée opératoire* (operatory thinking) component of the alexithymia construct, viz., a cognitive style that shows a preference for the external details of

everyday life rather than thought content related to feelings, fantasies, and other aspects of a person's inner experience (Marty & de M'Uzan, 1963; Nemiah et al., 1976).

The replicability of the three-factor structure of the TAS-20 has been demonstrated with both clinical and non-clinical populations by the use of confirmatory factor analysis (Bagby et al., 1994; Parker et al., 1993). Although the first two factors correlate highly, a three-factor model provided a better fit to the data obtained from several different samples than either a one or two-factor model

In the current study, we used the Portuguese version (see Prazeres, 1996) which replicated the satisfying internal consistency values found in the original version, namely an α of .79 for the total score, and .83 for (F1), .65 for (F2) and .60 for (F3) respectively. In a later study, Ramiro (2001) using a confirmatory factor analysis and Cronbach's reliability calculation procedure, replicated with minor differences a three-factor solution and obtained acceptable reliability scores ($\alpha > .70$). Given the fact that the Portuguese studies obtained similar scale norms than those found in the original study, we will use the above mentioned scores as cut-off-points.

2.3. Psychophysiological measures

For the present study, two physiological measures that represent the autonomic response systems were used: the electrodermal activity and the cardiovascular activity. Electrodermal response was considered via skin conductance level (SCL), measured as exosomatic activity by a constant-voltage device which pass a small voltage between the nonpolarized silver-chloride (AgCl) electrodes, embed with paste of .05 molar NaCl concentration. A bipolar placement of electrodes of the non-dominant hand, one on the middle section (medial phalanx) of the second and third fingers, assuring that both electrodes are within the same dermatome, was used. SCL was measured in micromhos.

Cardiac response was considered by means of heart rate (HR, beats per minutes) and IBI (interbeat interval of successive R waves of the ECG, measured as time in milliseconds), collected using electrodes with Redux paste, positioned in bipolar configuration with two electrodes placed on opposite sides of each participant's chest. In light of the ongoing controversy in the field of psychophysiological methods (see Hughdahl, 1998; Berntson et al., 1996) regarding the use of IBI or HR as cardiac response, we performed all statistical analysis of this study in order to check possible

differences. No significant differences were found regarding the aims of this study and therefore we will use HR data, except for the spectral analysis, because it is commonly easier to understand and interpret.

2.4. Apparatus

Physiological. A system consisting of an ASUS Pentium IV computer, the BioDReAMS (Soares, Cunha, Zhan Jian, Pinho & Neves, 1998) software and a modified polygraph (UFI model SC 2000 – Simple Scope) was used to obtain continuous recordings of participants' physiological activity. Figure 3 shows the final version of polygraph used in this study.

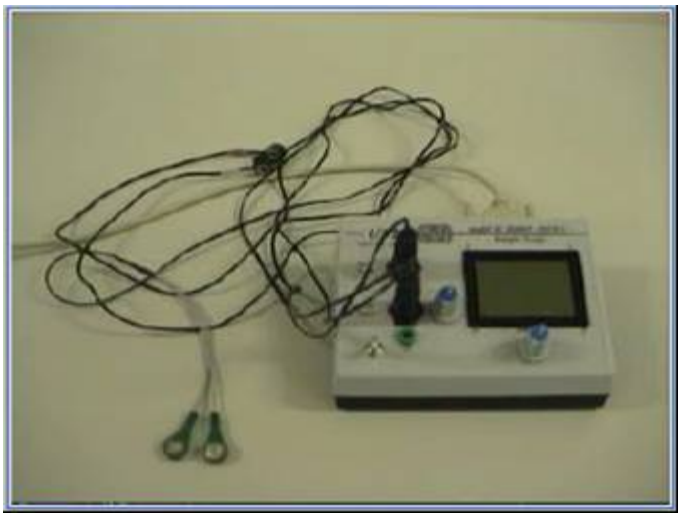

Figure 9. Representation of Polygraph wit ECG and EDA data collection devices.

Audiovisual. Remotely controlled, VH-8 color video camera recorded the participant during the study. Cameras were hidden from participants' view behind a one way mirror in the adjacent room. Lavaliere microphones clipped on participants' clothing were used to record their verbal responses to the AAI, which were subsequently transcribed verbatim.

2.5. Procedure

After a telephone contact with each participant, a first meeting was arranged in which the aims and ethical considerations were exposed. Once participation was agreed,

informed consent was signed, the study questionnaires (SCL-90-R, TAS-20, and PAMaDeP) were filled out, and a small clinical interview focused on past and present medical and psychological history.

After the evaluation session, an appointment for the experimental study was scheduled and participants were instructed not to drink coffee, tea, and/or soft drinks containing caffeine (this was checked before the interview, and if participants forgot to refrain from consuming caffeinated drinks, a new appointment was scheduled).

At the experiment day, before the interview, the participants were asked to spend some quite time (about 15 minutes) in a room with natural light, where they could read magazines or just rest. After this adaptation time (c.f., Hastrup, 1986), a trained and licensed technician put the physiological probe sensors in place. Physiological recordings were subsequently monitored from an adjoining room during the semi AAI interview as well as throughout a 3-min rest period prior to the interview, which provided a baseline rating for each participant. Participants, alone in the room, were instructed to be silent, and to empty their minds of all thoughts, feelings, and memories before the rest period commenced. The AAI was administered after the rest period.

2.6. Physiological data analysis

Given the high complexity of the autonomic physiological data the analysis deem the exploration of both linear and non linear qualities of the electrodermal and cardiac response.

Linear approach: Second-by-second measures of physiological responding were sampled from individuals' electrodermal and cardiovascular systems during the baseline period and AAI administration. Mean levels of physiological responding were considered during the baseline period and for each question during the AAI. Change in physiological responding was calculated by subtracting mean levels of physiological response during baseline from mean levels during each interview question, a practice commonly used in physiological research (c.f., Rogosa, 1995, Dozier & Kobak, 1992, Roisman et al., 2004). Student *t* test and one-way ANOVA (with Bonferroni post-hoc test) were used to test SCL and HR mean differences between secure and insecure attachment groups and differences regarding attachment patterns (secure, preoccupied

and dismissing). Finally, Pearson correlation coefficients were used to analyse possible association between Kobak's (1993) two-prototype system (security/insecurity, deactivation/hyperactivation) and physiological activity (EDA and HR).

Nonlinear approach:

a) First, using the BioDReAMS exporting module, we divided the questions into 5 second epochs for each participant answer the following key AAI questions: adjectives for mother, adjectives for father, upset, separated, rejected, threatened, loss, and trauma. The usage of a 5 second epochs were based on conclusions that highlight the importance of considering latency windows which reflect the peripheral mechanisms of response (e.g., Lockhart, 1966; Öhman, 1971; Cacciopo & Tassinary, 1990; Frederikson et al, 1993; Hugdahl, 1998). Second, the rate of change was measured as the slope of the regression line (β coefficient) for the HR and EDA values. The standardized Beta coefficient was used in all *t* test and ANOVA calculations. Third, we calculated the *root-mean square error* (RMSE), which represents the residual variance (Spread) not explained by the linear regression of the HR and EDA values on time. In effect, the RMSE is the standard deviation of residuals around the regression line. Fourth, possible mean differences in the participant's answers were tested for secure-insecure attachment and for secure vs. preoccupied vs. dismissing attachment (*t* test and ANOVA with post-hoc test).

b) In addition to the examining the total extent of non-linearity [see a)], we also calculated the difference between EDA and HR values at adjacent time points (epochs of mean values of 5 in 5 seconds) for all eight critical AAI questions in order to quantify nonlinear shifts in of the physiological systems as they may occur between the 5-sec epochs. Given the inexistence for EDA and HR of what could be called a "cut point" for defining a significant shift, we determined the standard-deviation of all AAI questions, using each 5-sec epochs along the AAI, for each participant. After that, we computed the mean of all standard-deviation both for EDA and HR. Thus, we obtained a 5-sec epoch cut-off value of 0.23 and a 2.17 as significant shift for EDA and HR respectively, since this was beyond one standard deviation in the difference between epochs-adjacent epochs. A value within the range of 0± 0.229 and 0± 2.169 were considered as *maintenance*. Positive values above the cut-off value were considered an *increasing*

shift as negative values under the cut-off value were seen as a *decreasing shift.* After that the number of *maintenance, increasing shifts* and *decreasing shifts* were counted, for each participant regarding each critical question, and weighted by the number of epochs (time divided into 5-sec) that each participant took in responding to each question. For example, a participant has 15 increasing shifts along 60 epochs (300-seconds), thus the result will be 15/60 = 0.4. Once determined this shift scores mean difference statistics (*t* test and ANOVA) were used to compare the EDA and HR' shifts and maintenance in each of the eight considered AAI questions regarding secure *vs.* insecure attachment, and to the attachment patterns. Pearson correlation coefficients were calculated to analyse possible links between security/insecurity and deactivation/hyperactivation and physiological activity (EDA and HR).

c) Frequency domain analysis of heart rate variability (HRV) was used to identify and measure the principal rhythmical fluctuations that characterise the RR interval time series and contain physiological information (Lombardi, 1997). The frequency domain analysis was performed by means of Fast Fourier Transformation (FFT). This method is simple in calculation but for fair representation of all frequency-domain HRV scores. FFT assumes that time series represents a steady-state process. The LF/HF Ratio is used to indicate balance between sympathetic and parasympathetic tone. A decrease in this score might indicate either increase in parasympathetic or decrease in sympathetic tone. It must be considered together with absolute values of both LF and HF to determine what factor contributes in autonomic disbalance. Once determined the LF/HF Ratio, *t* test and ANOVA statistics were used to determine possible mean differences between secure and insecure groups, and for attachment patterns.

CHAPTER IV: RESULTS

1. Descriptive Results: Attachment and Psychopathology

1.1. Attachment Classification

In terms of the attachment organization the results were as followed: 33 were classified as secure (66%), 6 as preoccupied (12%) and 11 as dismissing (22%).

Table 6. Mega-items scores for thee Attachment Organization groups.

Mega-items	Secure (*N* = 33) *M (SD)*	Preoccupied (*N*= 6) *M (SD)*	Dismissing (*N*= 11) *M (SD)*	*F*
Mother Base	28.73 (4.57)	22.50 (5.89)	26.64 (2.84)	5.295*
Mother Availability	78.15 (12.80)	70.67 (14.43)	66.09 (13.90)	3.732*
Father Availability	64.36 (8.57)	46.00 (4.60)	55.72 (9.15)	14.273**
Harsh Father	30.00 (6.31)	41.00 (6.66)	39.00 (8.76)	11.123**
Family Disruption	29.42 (4.78)	38.67 (4.89)	34.82 (3.97)	13.253**
Preoccupied	57.12 (8.97)	113.50 (16.40)	89.36 (5.64)	115.814**
Dismissing	49.91 (5.10)	67.50 (9.48)	81.64 (10.02)	90.405**
Coherence	191.88 (14.87)	107.17 (19.78)	74.27 (13.48)	282.221**
Mother –demand	21.45 (5.25)	24.00 (4.82)	24.73 (5.95)	1.809
Parental Rejection	66.36 (8.46)	98.50 (9.48)	112.55 (8.23)	136.371*
Family enmeshment	61.79 (6.48)	90.33 (11.11)	72.91 (4.39)	49.332**

*p = < .05; ** p = < .01

Table 6 presents the Mega-items scores of the three attachment organization groups in each Mega-item, as well as *F* values for the ANOVA test. Thus, we verified statistically significant differences for all Mega-items except for the Mother demand Mega-item, regarding which the three considered attachment styles revealed no differences. Further, even considering a *t* test analysis between secure *vs.* insecure attachment organization for Mother demand no significant differences were found [t(48) = -1.902, $p \geq .05$]. It can only be stated that there might be a tendency for the mothers of insecure attached participants (M = 24.47, SD = 5.43) made higher demands on their daughters than mothers of secure participants (M = 21.45, SD = 5.25).

Regarding DH dimension the values ranged from - .99 to .60 with an average of – .052 (*SD* = .33). Further, a significant mean difference [F(2, 47) = 71.26, $p < .01$] of DH values were found for attachment patterns. The effect size was very high (eta squared = .75). A Bonferroni post-hoc comparisons test revealed that the dismissing group (*M* = .47, *SD* = .11) had higher values than both the secure (*M* = - .17, *SD* = .19) and the preoccupied group (*M* = - .33, *SD* = .12). The secure group did not differ significantly from the preoccupied group.

1.2 Psychopathology

For validation check of psychopathology several questionnaires were used. Table 7 presents mean scores for the several psychopathology measures used for validation check. All results fall into the normal range.

Table 7. Descriptive statistics of Psychopathology measures.

	Mean	Std. Deviation	Minimum	Maximum
SCL-90-R				
Somatization	,72	,39	,00	1,50
Obsessive-Compulsive	,82	,31	,10	1,60
Interpersonal Sensitivity	,58	,32	,00	1,44
Depression	,80	,27	,23	1,31
Anxiety	,60	,35	,00	1,50
Hostility	,68	,43	,00	1,67
Phobic Anxiety	,32	,38	,00	1,43
Paranoid Ideation	,83	,53	,00	2,17
Psychoticism	,43	,32	,00	1,30
Global Severity Índex	,67	,23	,18	,98
TAS-20				
Identifying Feelings	16,04	5,75	7,00	31,00
Describing Feelings	13,50	4,65	6,00	22,00
Externally oriented thinking	16,26	4,30	8,00	27,00
TAStotal	45,80	12,17	26,00	72,00
PAMaDeP				
Mother Rejection	48,94	12,96	30,00	89,00
Mother Overprotection	35,62	6,98	21,00	53,00
Mother enmeshment	20,78	4,18	12,00	28,00
Father Rejection	56,26	17,25	30,00	97,00
Father Overprotection	30,18	7,56	15,00	53,00
Father enmeshment	12,80	3,56	6,00	19,00

Abandoned	14,62	4,69	8,00	32,00
Dependence	14,80	3,33	8,00	23,00
Hiperprotection	11,98	3,13	7,00	20,00

2. MAIN ANALYSIS: RELATIONS BETWEEN ATTACHMENT AND PSYCHOPHYSIOLOGY

2.1. Attachment and Psychophysiology during the AAI

2.1.1 Secure vs Insecure and Skin Conductance throughout the AAI

Table 8 presents the mean SCL values for secure and insecure attachment groups, as well as *t* values for the *t-test*. Thus, significant mean differences were found for all AAI questions, in which the secure group revealed higher SCL values, in all questions, than the insecure group.

Table 8. Mean SCL values for secure and insecure group along the AAI questions.

AAI Question	**Secure** N = **33** ***M* (*SD*)**	**Insecure** N = **17** ***M* (*SD*)**	***t***
Q1: Background	5.09 (3.25)	2.94 (1.93)	**2.49***
Q2: Describe relationships	5.23 (3.68)	2.56 (2.12)	**2.68****
Q3: Adjectives for mother	6.12 (3.97)	2.79 (2.45)	**3.15****
Q4: Adjectives for father	6.66 (4.01)	3.74 (3.36)	**2.57***
Q5: Which parent feel closest to	6.66 (4.15)	4.33 (3.38)	**1.99***
Q6: Upset	6.96 (4.22)	3.95 (3.24)	**2.57***
Q7: Separated	6.83 (4.14)	3.99 (3.79)	**2.37***
Q8: Rejected	6.88 (4.11)	3.94 (4.01)	**2.42***
Q9: Threatened	7.32 (4.17)	4.35 (3.80)	**2.46***
Q10: Experience affect personality	8.47 (5.07)	4.82 (3.93)	**2.59***
Q11: Why parents behaved	8.32 (4.45)	5.00 (4.15)	**2.56***
Q12: Close to other adults	8.31 (4.58)	5.05 (4.04)	**2.48***
Q13: Loss	8.33 (4.52)	5.21 (4.01)	**2.40***
Q14: Trauma	8.32 (4.41)	5.30 (4.42)	**2.29***
Q15: Changes in relationship	8.71 (4.30)	5.09 (4.11)	**2.86****
Q16: Current relationship with parents	9.41 (4.70)	5.48 (4.10)	**2.91****
Q17: Feelings when separated from your child	9.06 (4.72)	6.08 (3.94)	**2.23****
Q18: Three wishes for the future of your child	9.15 (4.33)	6.21 (4.16)	**2.30****

Q19: Lessons learned from childhood	8.97 (4.27)	6.38 (4.00)	**2.08***
Q20: Lessons to teach your child	9.28 (4.63)	6.58 (4.10)	**2.03***

* $p < .05$; ** $p < .01$

Neither security nor deactivation was significantly correlated with electrodermal activity measured in this study during all questions of the interview (range of Pearson correlations for security r = .01 to 0.14, M = .09; ps ranged from .33 to .95; range of correlations for deactivation r = - .16 to - .08, M = - .13; ps ranged from .37 to .57).

2.1.2 Secure vs Insecure and Heart Rate throughout the AAI

Table 9 presents the mean HR values for secure and insecure attachment groups, as well as t values for the *t-test*. No statistically HR mean differences between secure and insecure attachment were found for any of the AAI questions (see Table 9).

Table 9. Mean HR values for secure and insecure groups along the AAI questions.

AAI Question	**Secure** *N*= **33** ***M* (*SD*)**	**Insecure** *N* = **17** ***M* (*SD*)**	***t***
Q1: Background	8.45 (6.74)	7.03 (6.26)	.72
Q2: Describe relationships	9.67 (8.70)	9.33 (6.83)	.14
Q3: Adjectives for mother	6.57 (7.42)	4.69 (6.39)	.89
Q4: Adjectives for father	4.33 (7.33)	4.94 (7.85)	- .27
Q5: Which parent feel closest to	3.64 (7.95)	3.06 (5.85)	.26
Q6: Upset	3.34 (6.65)	1.65 (6.41)	.86
Q7: Separated	2.53 (7.44)	.20 (6.19)	1.11
Q8: Rejected	1.33 (6.50)	.55 (5.85)	1.00
Q9: Threatened	.85 (6.99)	-.13 (6.12)	.49
Q10: Experience affect personality	1.98 (7.03)	1.24 (6.54)	.36
Q11: Why parents behaved	2.25 (6.84)	.30 (8.05)	.90
Q12: Close to other adults	1.24 (6.78)	1.47 (8.69)	- .11
Q13: Loss	.78 (7.38)	- 1.72 (6.68)	1.17
Q14: Trauma	-.12 (8.29)	- 2.34 (8.70)	.88
Q15: Changes in relationship	2.00 (7.46)	- .55 (7.16)	1.16
Q16: Current relationship with parents	1.57 (7.28)	- 1.30 (7.48)	1.30
Q17: Feelings when separated from your child	-.16 (7.53)	-1.53 (7.24)	.62
Q18: Three wishes for the future of your child	1.06 (7.97)	.23 (9.24)	.33
Q19: Lessons learned from childhood	.001 (7.93)	-.85 (8.08)	.36
Q20: Lessons to teach your child	2.67 (8.43)	-.49 (7.36)	1.30

* $p <.05$; ** $p <.01$

Similarly to what happened with electrodermal activity, there was also no significant association between cardiovascular activity along all AAI questions and security or deactivation attachment dimensions (range of Pearson correlation for security r = - .03 to .11, M = .04; ps ranged from .44 to .99; range of Pearson correlation for deactivation r = - .09 to .04, M = - .04; ps ranged from .52 to .98).

2.1.3 Attachment patterns and Skin Conductance throughout the AAI

Table 10 presents the mean SCL values for the three attachment organizations, as well as F values for the *ANOVA* test Statistically significant mean differences between attachment patterns were found for Questions 1, 2, 3, 4, 6, 10, 11, 15, and 16. The effect size of the verified mean differences, using the eta-squared, were medium to large, respectively from Question 1 to 16, .12, .15, .18, .13, .12, .12, .15, and .15. Additionally, a Bonferroni post-hoc comparison test revealed that regarding Questions 1, 2, 3, 4 and 6 the participants with secure attachment had higher mean SCL values than the participants with dismissing attachment. The preoccupied attachment group did not differ from either secure or dismissing groups. Regarding Questions 15 and 16, the participants with secure attachment patterns had higher SCL value than the participants with preoccupied attachment, as those with a dismissing attachment pattern did not diverge from both secure and preoccupied. For Question 11 the post hoc comparison did not reveal any significant difference between any of the considered groups.

Table 10. Mean SCL values for attachment patterns during the AAI questions.

AAI Question	Secure (N = 33) M (SD)	Preocuppied (N = 6) M (SD)	Dismissing (N = 11) M (SD)	F
Q1: Background	5.09 (3.25)	3.65 (2.47)	2.56 (1.57)	**3.35***
Q2: Describe relationships	5.23 (3.68)	3.59 (2.89)	2.10 (1.61)	**3.94***
Q3: Adjectives for mother	6.12 (3.97)	3.55 (2.35)	2.37 (2.51)	**5.11****
Q4: Adjectives for father	6.66 (4.01)	4.42 (3.19)	3.37 (3.54)	**3.39***
Q5: Which parent feel closest to	6.65 (4.15)	4.65 (3.03)	4.16 (3.68)	1.98
Q6: Upset	6.96 (4.22)	4.23 (2.97)	3.80 (3.51)	**3.27***
Q7: Separated	6.83 (4.14)	4.24 (3.71)	3.85 (4.00)	2.76
Q8: Rejected	6.88 (4.11)	4.38 (4.27)	3.70 (4.06)	2.92

Q9: Threatened	7.32 (4.17)	5.09 (4.01)	3.94 (3.82)	3.12
Q10: Experience affect personality	8.47 (5.07)	5.07 (3.91)	4.68 (4.13)	**3.31***
Q11: Why parents behaved	8.32 (4.45)	5.37 (4.35)	4.79 (4.24)	**3.25***
Q12: Close to other adults	8.31 (4.58)	4.80 (3.98)	5.18 (4.25)	3.02
Q13: Loss	8.33 (4.52)	4.82 (3.38)	5.43 (4.45)	2.85
Q14: Trauma	8.32 (4.41)	4.86 (3.14)	5.54 (5.12)	2.62
Q15: Changes in relationship	8.71 (4.30)	4.23 (2.75)	5.56 (4.75)	**4.23***
Q16: Current relationship with parents	9.41 (4.70)	5.31 (3.54)	5.58 (4.54)	**4.15***
Q17: Feelings when separated from your child	9.06 (4.72)	6.43 (3.65)	5.89 (4.25)	2.47
18: Three wishes for the future of your child	9.15 (4.33)	6.37 (4.12)	6.13 (4.37)	2.58
Q19: Lessons learned from childhood	8.97 (4.27)	6.16 (3.66)	6.50 (4.35)	2.13
Q20: Lessons to teach your child	9.28 (4.63)	6.33 (4.18)	6.71 (4.25)	2.03

* $p < .05$; ** $p < .01$

2.1.4 Attachment patterns and Heart Rate throughout the AAI

Table 11 presents the mean HR values for the three attachment patterns, as well as *F* values for the *ANOVA* test. As can be seen no significant mean differences for attachment patterns were found for any of the AAI questions.

Table 11. Mean HR values for attachment patterns during the AAI questions.

AAI Question	**Secure (*N* = 33) *M* (*SD*)**	**Preocuppied (*N* = 6) *M* (*SD*)**	**Dismissing (*N* = 11) *M* (*SD*)**	**F**
Q1: Background	8.45 (6.74)	8.77 (4.74)	6.08 (6.98)	.57
Q2: Describe relationships	9.67 (8.70)	9.11 (6.03)	9.43 (7.44)	.12
Q3: Adjectives for mother	6.57 (7.42)	5.30 (8.75)	4.35 (5.18)	.42
Q4: Adjectives for father	4.33 (7.33)	3.97 (10.55)	4.35 (5.18)	.11
Q5: Which parent feel closest to	3.64 (7.95)	2.22 (8.35)	3.52 (4.39)	.94
Q6: Upset	3.34 (6.65)	- .10 (8.06)	2.60 (5.52)	.69
Q7: Separated	2.53 (7.44)	- 1.78 (7.93)	1.28 (5.12)	1.62
Q8: Rejected	1.33 (6.50)	- 3.58 (6.41)	1.11 (5.08)	.58
Q9: Threatened	.85 (6.99)	- 2.24 (7.37)	1.02 (5.35)	1.42
Q10: Experience affect personality	1.98 (7.03)	- 2.40 (6.13)	3.23 (6.10)	.88
Q11: Why parents behaved	2.25 (6.84)	- 2.40 (8.71)	1.57 (7.78)	1.37
Q12: Close to other adults	1.24 (6.78)	- 1.65 (6.95)	3.18 (9.36)	1.13
Q13: Loss	.78 (7.38)	- 4.45 (7.69)	- .23 (5.90)	2.14
Q14: Trauma	-.12 (8.29)	- 5.67 (7.32)	- .52 (9.16)	1.86
Q15: Changes in relationship	2.00 (7.46)	- 4.57 (8.57)	1.65 (5.41)	1.06
Q16: Current relationship with parents	1.57 (7.28)	- 4.66 (10.41)	.53 (4.98)	2.54
Q17: Feelings when separated from your child	-.16 (7.53)	- 4.72 (8.50)	.21 (6.20)	2.02

Q18: Three wishes for the future of your child	1.06 (7.97)	- 5.69 (8.63)	3.46 (8.17)	1.53
Q19: Lessons learned from childhood	.001 (7.93)	- 5.87 (8.42)	1.89 (6.75)	2.13
Q20: Lessons to teach your child	2.67 (8.43)	- 3.55 (9.42)	1.18 (5.81)	2.03

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

2.2. Attachment and nonlinear analysis of Psychophysiology during AAI

The following section will present a non-linear analysis of psychophysiological response during the AAI. This analysis was devised to try and capture the variability of psychophysiological responses, which could be confounded when looking only at the group mean. This data analysis useed two parameters; slope (β) and spread (RMSE) (see section 2.6. non-linear approach). The slope (β) of the regression line is a measure of the steepness, and is an indicator of physiological tendencies (increase, decrease or no change) over time. The Spread (RMSE) quantifies the error by which the observed scores vary around the estimated regression line, and is calculated by the sum of squares rather than the more intuitive sum of absolute errors. It gives us an indication of the values dispertion from the regression line, and as such it taps the variability non-explained by the mean values.

2.2.1 Secure vs Insecure attachment and nonlinear analysis of Electrodermal and Cardiac activity regarding AAI critical questions

Table 12 presents the SCL and HR slope (β) and spread (RMSE) values of the attachment groups in each critical attachment question, as well as *t* values for the *t-test*. Thus, we only found differences between secure vs. insecure attachment regarding to the slope of the HR regression line in the answers regarding adjectives for mothers and adjectives for fathers. When questioned to choose adjectives and respective episodes for the relationship with the mother the secure classified participants revealed positive mean slope values (M = .006; SD = .016) as the insecure classified ones [M = - .011, SD = .024; t(48) = 2.980; p < .05; eta squared = .16]. The actual difference in mean values between the groups was large. Whilst questioned for adjectives to describe the relationship with the father, those subject with secure attachment were significantly

different [$t(48) = 2.604$; $p < .05$; eta squared = .12] as hold to slope values when compared with those of insecure attachment, namely the secure one had positive mean slope values ($M = .007$; $SD = .017$) and the insecure ones negative values ($M = -.015$; $SD = .043$). The verified differences showed a medium effect size. For the spread (RMSE) no psychophysiological differences in terms of attachment organizations were found in any question.

Table 12. Mean spread and slope values of SCL and HR in AAI critical question for each attachment group

	SCL					
	Spread (RMSE)			**Slope (β)**		
AAI Question	**Secure ($N = 33$) *M* (*SD*)**	**Insecure ($N = 17$) *M* (*SD*)**	***t***	**Secure ($N = 33$) *M* (*SD*)**	**Insecure ($N = 17$) *M* (*SD*)**	***t***
Q3: Adj. for mother	.67 (.44)	.61 (.30)	.49	.020 (.07)	.010 (.05)	.74
Q4: Adj. for father	.67 (.40)	.74 (.50)	- .50	.000 (.01)	.00 (.01)	- .71
Q6: Upset	.79 (.53)	.72 (.46)	.46	- .001 (.01)	.000 (.01)	- .69
Q7: Separated	.59 (.51)	.61 (0.49)	- .11	.002 (.01)	.003 (.01)	- .21
Q8: Rejected	.40 (.29)	.39 (0.33)	.14	- .004 (.16)	-.004 (.02)	.01
Q9: Threatened	.68 (.96)	.54 (0.36)	- .57	.001 (.01)	0.00 (.01)	.08
Q13: Loss	.95 (.94)	.61 (0.42)	1.42	.002 (.01)	- .003 (.01)	1.53
Q14: Trauma	.71 (.64)	.29 (0.29)	1.75	.023 (.14)	- .023 (.04)	.87

	HR					
	Spread (RMSE)			**Slope (β)**		
AAI Question	**Secure ($N = 33$) *M* (*SD*)**	**Insecure ($N = 17$) *M* (*SD*)**	***t***	**Secure ($N = 33$) *M* (*SD*)**	**Insecure ($N = 17$) *M* (*SD*)**	***t***
Q3: Adj. for mother	5.55 (1.81)	5.08 (1.53)	.92	.006 (.01)	- .011 (.02)	**2.98****
Q4: Adj. for father	5.29(1.49)	5.32 (1.47)	- .06	.007 (.016)	- .015 (.043)	**2.60***
Q6: Upset	5.05 (1.72)	5.21 (1.68)	.58	- .006 (.016)	.009 (.057)	-1.38
Q7: Separated	4.69 (1.44)	4.73 (1.34)	- .11	.003 (.012)	.003 (.014)	1.48
Q8: Rejected	4.59 (1.36)	4.56 (2.14)	.04	.044 (.16)	.038 (.09)	.15
Q9: Threatened	4.87 (1.44)	4.87 (1.56)	- .01	.048 (.08)	.055 (.08)	-.28
Q13: Loss	5.23 (2.06)	4.38 (1.10)	1.58	.003 (.08)	-.007 (.09)	.38
Q14: Trauma	4.44 (4.55)	4.37 (1.39)	-.40	.19 (.91)	.02 (.19)	.50

* $p<.05$; ** $p<.01$

2.2.2 Attachment patterns and nonlinear analysis of Electrodermal and cardiac activity regarding AAI critical questions

A one way between groups analysis of variance was conducted to explore the impact of attachment styles (secure, preoccupied and dismissing) on physiological data during the answers to the critical AAI questions. Table 13 presents SCL and HR slope and spread mean values for the attachment patterns regarding the AAI critical questions, as well as *F* values for the *ANOVA* test. There was a statistically significant difference at the $p < .05$ level in the HR slope values regarding the answer to the adjectives for mother question. The effect size, calculated using eta squared, was .20. Post-hoc comparisons using the Bonferroni test indicated that the secure group ($M = .006$; $SD = .016$) differ significantly from the preoccupied group ($M = -.017$; $SD = .035$). The dismissing group ($M = -.007$; $SD = .017$) did not differ significantly from either secure or preoccupied group.

Table 13. Mean spread and slope values of SCL and HR in AAI critical question for each attachment pattern

	SCL							
	Spread (RMSE)				**Slope (β)**			
AAI Question	**Secure (*N*=33) *M* (*SD*)**	**Preocuppied (*N*=6) *M* (*SD*)**	**Dismissing (*N*=11) *M* (*SD*)**	**F**	**Secure (*N*=33) *M* (*SD*)**	**Preocuppied (*N*=6) *M* (*SD*)**	**Dismissing (*N*=11) *M* (*SD*)**	**F**
Q3: Adj. for mother	.67 (.44)	.61 (.35)	.62 (.29)	.117	.002 (.007)	- .0002 (.004)	.0017 (.0062)	.438
Q4: Adj. for father	.67 (.40)	.64 (.61)	.80 (.44)	.387	-.0004 (.005)	- .0002 (.002)	.0011 (.006)	.320
Q6: Upset	.79 (0.52)	.76 (.67)	.69 (0.32)	.140	- .001 (.006)	- .001 (.004)	.0003 (.006)	.320
Q7: Separated	.59 (.51)	.49 (.24)	.67 (.59)	.259	.003 (.012)	.003 (.005)	.004 (.017)	.031
Q8: Rejected	.40 (.29)	.51 (.40)	.32 (.28)	.757	-.004 (.016)	.002 (.013)	-.008 (.019)	.668
Q9: Threatened	.68 (.96)	.60 (.55)	.51 (.25)	.180	.001 (.013)	- .003 (.018)	.002 (.014)	.182
Q13: Loss	.95 (.94)	(.58) (.50)	.62 (.50)	1.005	.002 (.014)	.001 (.004)	- .006 (.013)	1.677
Q14: Trauma	.71 (.63)	.19 (.24)	.40 (.33)	1.620	.023 (.14)	- 0.003 (.002)	-.042 (.06)	.458

	HR							
	Spread (RMSE)				Slope (β)			
AAI Question	**Secure (*N*=33) *M* (*SD*)**	**Preocuppied (*N*=6) *M* (*SD*)**	**Dismissing (*N*=11) *M* (*SD*)**	**F**	**Secure (*N*=33) *M* (*SD*)**	**Preocuppied (*N*=33) *M* (*SD*)**	**Dismissing (*N*=33) *M* (*SD*)**	**F**
Q3: Adj. for mother	5.55 (1.81)	4.77 (.64)	5.24 (1.86)	.570	.006 (.016)	- .017 (.035)	- .007 (.017)	**5.077***
Q4: Adj. for father	5.29 (1.49)	5.41 (1.04)	5.27 (1.70)	.018	.07 (.017)	- .019 (.031)	- .013 (.050)	**3.401***
Q6: Upset	5.50 (1.72)	5.13 (1.18)	5.25 (1.95)	.176	- .006 (.016)	- .004 (.015)	.016 (.07)	1.606
Q7: Separated	4.69 (1.45)	4.95 (1.94)	4.62 (.98)	.111	.013 (.034)	- .008 (.026)	.002 (.033)	1.266
Q8: Rejected	4.59 (1.36)	4.57 (.35)	4.56 (2.70)	.001	.044 (0.16)	.041 (.06)	.036 (.11)	.014
Q9: Threatened	4.87 (1.44)	4.79 (1.78)	4.92 (1.53)	.013	.05 (.08)	011 (.09)	.025 (.06)	2.357
Q13: Loss	5.23 (2.06)	4.44 (.68)	4.35 (1.31)	1.229	.03 (.12)	.091 (.08)	- .0005 (.09)	.600
Q14: Trauma	4.44 (4.56)	3.89 (.90)	4.85 (1.76)	.056	.19 (.91)	.06 (.06)	- .019 (.27)	.134

* $p < .05$; ** $p < .01$

Similarly, the answer concerning adjectives for father revealed significant differences regarding the HR slope values. The effect size was large (eta squared = .14). Although post-hoc comparisons with the Bonferroni evidenced no differences between the three groups, namely secure (*M* = .007; *SD* = .017), preoccupied (*M* = -.019; *SD* = .031), and dismissing (*M* = -.013; *SD* = .050). No further slope or residual variance differences both for HR or EDA regarding the key AAI questions were found (see Table 13).

2.3 Attachment and nonlinear analysis of Psychophysiological activity shifts in AAI critical questions

2.3.1 Secure vs. Insecure attachment and nonlinear analysis of Electrodermal and Cardiac significant activity shifts regarding AAI critical questions

Table 14 presents the mean values of SCL and HR activity shifts of secure and insecure attachment groups for the AAI critical questions, as well as the *t* values for the *t*-test.

Table 14. Mean shift values of SCL and HR activity for secure and insecure attachment during the AAI critical questions.

	SCL								
	SCL increase			**SCL maintain**			**SCL decrease**		
AAI Question	**Secure**	**Insecure**	***T***	**Secure**	**Insecure**	***t***	**Secure**	**Insecure**	***t***
	(*N*=33)	**(*N*=17)**		**(*N*=33)**	**(*N*=17)**		**(*N*=33)**	**(*N*=17)**	
	***M* (*SD*)**	***M* (*SD*)**		***M* (*SD*)**	***M* (*SD*)**		***M* (*SD*)**	***M* (*SD*)**	
Q3: Adj. mother	.19(.10)	.19 (.09)	.28	.58(.25)	.63(.22)	-.67	.22(.16)	.17(.14)	.96
Q4: Adj. father	.19(.09)	.20(.12)	-.42	.55(.26)	.54(.28)	.06	.25(.16)	.24(.18)	.24
Q6: Upset	.18(.10)	.17(.10)	.11	.57(.27)	.61(.25)	-.46	.23(.18)	.19(.16)	.71
Q7: Separated	.17(.11)	.15(.12)	.59	.59(.27)	.63(.28)	-.49	.20(.16)	.17(.17)	.62
Q8: Rejected	.15(.11)	.14(.11)	.56	.59(.27)	.62(.26)	-.28	.19(.18)	.18(.17)	.21
Q9: Threatened	.19(.12)	.18(.09)	.54	.55(.29)	.56(.25)	-1.16	.21(.18)	.21(19)	.08
Q13: Loss	.18(.12)	.15(.12)	1.02	.56(.29)	.58(.27)	-.23	.22(.16)	.23(.17)	-.28
Q14: Trauma	.14(.16)	.02(.06)	3.74**	.29(.33)	.23(.35)	.53	.17(.22)	.10(.21)	1.15
	HR								
	HR increase			**HR maintain**			**HR decrease**		
Item	**Secure**	**Insecure**	***T***	**Secure**	**Insecure**	***t***	**Secure**	**Insecure**	***t***
	(*N*=33)	**(*N*=17)**		**(*N*=33)**	**(*N*=17)**		**(*N*=33)**	**(*N*=17)**	
	***M* (*SD*)**	***M* (*SD*)**		***M* (*SD*)**	***M* (*SD*)**		***M* (*SD*)**	***M* (*SD*)**	
Q3: Adj. mother	.34(.05)	.33(.04)	.99	.31(.08)	.33(.09)	-1.01	.33(.05)	.32(.06)	.97
Q4: Adj. father	.35(.06)	.34(.07)	.74	.29(.09)	.31(.11)	-.50	.33(.05)	.33(.06)	.26
Q6: Upset	.37(.05)	.35(.08)	.74	.27(.08)	.32(.10)	-2.00*	.35(.05)	.31(.03)	3.29**
Q7: Separated	.36(.06)	.33(.08)	1.72	.25(.09)	.30(.14)	-1.58	.35(.06)	.32(.08)	1.44
Q8: Rejected	.34(.09)	.31(.13)	.99	.29(.14)	.33(.19)	-.59	.30(.09)	.29(.13)	.21
Q9: Threatened	.38(.07)	.36(.09)	.57	.27(.09)	.31(.12)	-1.32	.31(.09)	.27(.05)	1.60
Q13: Loss	.36(.05)	.29(.06)	4.33**	.27(.10)	.37(.13)	-2.99**	.32(.04)	.29(.08)	1.54
Q14: Trauma	.24(.22)	.15(.19)	1.70	.18(.19)	.10(.17)	1.34	.19(.18)	.11(.14)	1.42

* $p < .05$; ** $p < .01$

Based on the nonlinear EDA and HR analysis of significant shifts during the AAI (cf. Table 14), we verified for question 6 (upset) that the insecure group had a

significantly higher HR maintaining mean scores [*M* = .32, *SD* = .010; *t*(48) = -2.004, *p* <.05] than those of the secure group (*M* = .27, *SD* = .08). The verified effect-size of this difference was moderate (eta-squared = .07). In addition, a significant difference [*t* (48) = 3.289, *p* <.05] of HR decreasing scores, between secure and insecure, was also found in this question. This difference was expressed as the secure participants (*M* = .35, *SD* = .05) had higher HR decreasing scores than the insecure participants (*M* = .31, *SD* = .03). The effect-size was large (eta-squared = .18).

In question 13 (losses) two significant differences were verified between secure and insecure group. Regarding the HR increasing scores, secure participants (*M* = .36, *SD* = .05) had higher mean values than the insecure ones [*M* = .29, *SD* = .06; *t* (48) = 4.332, *p* < .05) during the question about losses. The effect-size was large (eta-squared = .28). About HR maintaining scores, the insecure group [*M* = .37, *SD* = .13; *t* (48) = -2.991, *p* <.05] had higher mean scores than the secure group (*M* = .27, *SD* = .10) when talking about losses. The effect-size was .16 and therefore large.

When participants were asked about traumatic experiences (question 14), a significant difference between participants with secure and insecure attachment were found [*t* (48) = 2.918, *p* <.05) regarding EDA mean increasing scores. Indeed, the secure group had higher mean EDA increasing scores (*M* = .14, *SD* = .16) than the insecure group (*M* = .02, *SD* = .06). The effect-size that characterized this difference was large (eta-squared = .15).

Beside these verified differences, some correlations were found between physiological activity shifts and attachment dimensions (security/insecurity and deactivation/hyperactivation) and/or alexithymia dimensions. Thus, on question 3 (adjectives for mothers) a moderate positive correlation (*r* = .379; *p* <.05) was found between HR decreasing scores and security/insecurity. Regarding the question about adjectives for fathers (question 4) a moderate positive correlation (*r* = .294, *p* <.05) linked deactivation with EDA increasing scores. Questions 6 (upset) and 9 (threatened) exhibited a positive moderate correlation between security and HR decreasing (*r* = .460, *p* <.05, and *r* = -.295, *p* <.05, respectively), and between security and HR maintaining scores (*r* = .359, *p* <.05, and *r* = -.296, *p* <.05, respectively). About the experience of loss (question 13) two significant correlations were found with security: one that linked security with HR increase (*r* = .516, *p* < .05) and; the other one that negatively linked security with HR maintain (*r* = -.387, *p* <.05). Question 14 (traumatic experience)

showed also a twofold relation between psychophysiological activity and security: HR decreasing scores were negatively correlated with security (r = -.286, p <.05), and EDA increasing scores were positively associated with security (r = .421, p <.05).

Moreover, alexithymia were found to be associated with psychophysiological sudden shifts. Especially HR decrease showed a moderate negative correlation with difficulty in Identifying Feelings (TAS factor 1), both in question 6 (upset) (r = -.310, p <.05) and 8 (rejected) (r = -.359, p <.05) respectively.

2.3.2 Attachment patterns and nonlinear analysis of Electrodermal and Cardiac significant activity shifts regarding AAI critical questions

Table 15 presents the mean values of SCL and HR activity shifts of the attachment patterns for the AAI critical questions, as well as the F values for the *ANOVA* test. Relying on the nonlinear EDA and HR analysis of significant shifts during the AAI (cf. Table 15), we observed that attachment patterns differ in terms of mean HR decreasing scores [F(2, 47) = 3.551, p <.05; eta squared = .13] as regards to question 3 (adjectives mother). The effect size was moderate. A post-hoc comparison revealed that only secure participants (M = .33, SD = .05) differ from the preoccupied participants (M = .28, SD = .06), as the dismissing group did not differ from either (M = .34, SD = .06). In terms of AAI question father adjectives, no significant mean differences were found regarding EDA and HR non-linear shifts. In question 6 (upset) a significant mean difference [F (2, 47) = 5.427, p <.05] for HR decreasing score was obtained, in which the secure individuals (M = .35, SD = .05) had higher scores than the dismissing ones (M = .30, SD = .04). The preoccupied participants (M = .31, SD = .03) did not differ from both secure and dismissing participants. The effect size, computed using eta squared, was .18 and therefore high. For question 7 (separated), 8 (rejected) and 9 (threatened) neither significant mean difference between attachment patterns nor significant correlations were confirmed. Concerning to the question about losses (question 13), two significant mean differences were found, one regarding the HR increasing score [F (2, 47) = 9.197, p <.05] and the other one for HR maintenance [F (2, 47) = 4.393, p <.05]. Regarding HR increasing score, the secure individuals (M = .36, SD = .05) had higher mean values and differ both from preoccupied (M = .29, SD = .06)

and dismissing (*M* = .29, *SD* = .07) participants. The effect size of this difference was high (eta squared =.28). About the HR maintenance score, it were the dismissing group (*M* = .37, *SD* = .13) which had the highest score differing from the secure group (*M* = .27, *SD* = .10). The preoccupied participants (*M* = .37, *SD* = .12) did not significantly differ from either the secure or the dismissing participants. The obtained effect size was .16 and thus high. Finally, when asked about traumatic experience (question 14) a mean difference [*F* (2, 47) = 4.182, *p* <.05] between attachment patterns were found for EDA increasing. Thus, the secure group (*M* = .14, *SD* = .16) had higher mean scores than the dismissing (*M* =.02, *SD* = .06), as the preoccupied (*M* = .03, *SD* = .07) exhibited no difference from both secure or dismissing. The effect size was high (eta squared= .15).

Table 15. Mean shift values of SCL and HR activity regarding attachment organization during the AAI critical questions.

					SCL							
	SCL increase				**SCL mantain**				**SCL decrease**			
AAI	**S**	**P**	**D**	***F***	**S**	**P**	**D**	**F**	**S**	**P**	**D**	***F***
Question	**(*N*=33)**	**(*N*=6)**	**(*N*=11)**		**(*N*=33)**	**(*N*=6)**	**(*N*=11)**		**(*N*=33)**	**(*N*=6)**	**(*N*=11)**	
	***M* (*SD*)**	***M* (*SD*)**	***M* (*SD*)**		***M* (*SD*)**	***M* (*SD*)**	***M* (*SD*)**		***M* (*SD*)**	***M* (*SD*)**	***M* (*SD*)**	
Q3.	.19(.10)	.18(.10)	.19(.09)	.07	.58(.25)	.65(.26)	.61(.20)	.28	.22(.16)	.15(.16)	.18(.13)	.54
Q4.	.19(.09)	.15(.14)	.23(.09)	1.44	.55(.26)	.64(.36)	.49(.23)	.66	.25(.16)	.19(.23)	.26(.15)	.29
Q6.	.18(.10)	.13(.12)	.19(.09)	.83	.57(.27)	.68(.33)	.57(.21)	.39	.23(.18)	.18(.21)	.21(.14)	.30
Q7.	.17(.11)	.12(.11)	.17(.13)	.47	.59(.27)	.65(.29)	.62(.28)	.15	.20(.16)	.19(.19)	.16(.17)	.25
Q8.	.15(.11)	.16(.12)	.12(.11)	.32	.59(.27)	.64(.27)	.61(.27)	.07	.19(.18)	.17(.17)	.18(.18)	.05
Q9.	.19(.12)	.19(.09)	.17(.09)	.21	.55(.29)	.54(.29)	.57(.24)	.04	.21(.19)	.21(.23)	.21(.17)	.004
Q13.	.18(.12)	.13(.13)	.16(.12)	.57	.56(.29)	.66(.31)	.54(.25)	.35	.22(.16)	.18(.19)	.26(.16)	.59
Q14.	.14(.16)	.03(.07)	.02(.06)	4.18*	.29(.33)	.39(.43)	.15(.29)	1.11	.17(.22)	.03(.06)	.14(.25)	1.11
					HR							
	HR increase				**HR mantain**				**HR decrease**			
AAI	**S**	**P**	**D**	***F***	**S**	**P**	**D**	**F**	**S**	**P**	**D**	***F***
Question	**(*N*=33)**	**(*N*=6)**	**(*N*=11)**		**(*N*=33)**	**(*N*=6)**	**(*N*=11)**		**(*N*=33)**	**(*N*=6)**	**(*N*=11)**	
	***M* (*SD*)**	***M* (*SD*)**	***M* (*SD*)**		***M* (*SD*)**	***M* (*SD*)**	***M* (*SD*)**		***M* (*SD*)**	***M* (*SD*)**	***M* (*SD*)**	
Q3.	.34(.05)	.33(.05)	.33(.03)	.56	.31(.08)	.38(.09)	.31(.08)	1.93	.33(.05)	.28(.06)	.34(.06)	3.55*
Q4.	.35(.06)	.33(.08)	.34(.06)	.35	.29(.09)	.33(.14)	.31(.09)	.22	.33(.05)	.32(.07)	.33(.05)	.05
Q6.	.37(.05)	.36(.05)	.35(.09)	.38	.27(.08)	.31(.07)	.33(.12)	2.03	.35(.05)	.31(.03)	.30(.04)	5.43**
Q7.	.36(.06)	.35(.09)	.32(.07)	1.94	.25(.09)	.32(.18)	.29(.11)	1.27	.35(.06)	.30(.11)	.34(.06)	1.44
Q8.	.34(.09)	.34(.06)	.29(.15)	.91	.29(.14)	.31(.11)	.34(.22)	.23	.30(.09)	.31(.09)	.28(.15)	.19
Q9.	.38(.07)	.36(.09)	.37(.09)	.19	.27(.09)	.32(.11)	.30(.13)	.90	.31(.09)	.26(.04)	.28(.06)	1.36
Q13.	.36(.05)	.29(.06)	.29(.07)	9.19**	.27(.10)	.37(.12)	.37(.13)	4.39*	.32(.04)	.29(.08)	.29(.09)	1.16
Q14.	.24(.22)	.15(.17)	.15(.21)	.99	.18(.19)	.17(.19)	.07(.15)	1.39	.19(.18)	.14(.15)	.09(.14)	1.57

* $p < .05$; ** $p < .01$

S. – Secure; P. –Preoccupied; D. – Dismissing; Q3. - Adj. for mother; Q4. - Adj for father; Q6. – Upset; Q7. – Separated; Q8. – Rejected; Q9. – Threatened; Q13. – Loss; Q14. – Trauma.

2.4. Attachment and Heart rate variability

2.4.1. Secure and Insecure attachment and Heart rate variability during the critical AAI questions.

Table 16 presents the mean LF/HF ratio values for secure and insecure attachment in each of the AAI critical questions, as well as the *t* value for the *t*-test. As exposed, no significant mean difference was found.

Table 16. Mean LF/HF ratio values for secure and insecure attachment in each AAI critical questions.

AAI Question	Secure (*N* = 33) *M* (*SD*)	Insecure (*N* = 33) *M* (*SD*)	*t*
Q3: Adj. for mother	8.28 (9.48)	9.28 (14.26)	- .30
Q4: Adj. for father	6.37 (4.97)	7.89 (9.15)	- .77
Q6: Upset	8.75 (5.96)	8.64 (6.22)	.06
Q7: Separated	5.68 (4.39)	4.46 (1.40)	1.11
Q8: Rejected	4.64 (1.40)	4.44 (0.90)	.36
Q9: Threatened	5.09 (3.64)	4.01 (1.16)	1.19
Q13: Loss	6.91 (5.57)	7.30 (7.71)	- .21
Q14: Trauma	4.23 (2.59)	5.24 (6.99)	- .66

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

2.4.2. Attachment patterns and Heart rate variability during the critical AAI questions.

Table 17 presents the mean LF/HF ratio values for the attachment patterns in each of the AAI critical questions, as well as the *F* value for the *ANOVA* test. Similarly, as for the above exposed results, no significant LF/HF ratio mean differences was found for attachment patterns regarding AAI critical questions (see Table 17).

By correlating the LF/HF ratios with the alexithymia (TAS-20), a moderate negative correlation ($r = -.317$; $p < .05$) was found between the LF/HF ratio of the question three (adjectives for mother) and the TAS subscale difficulties in identifiying feelings

Table 17. Mean LF/HF ratio values for attachment patterns in each AAI critical questions.

AAI Question	**Secure** (***n*** **= 33**) ***M*** **(*SD*)**	**Preocuppied** (***n*** **=6**) ***M*** **(*SD*)**	**Dismissing** (***n*** **= 11**) ***M*** **(*SD*)**	**F**
Q3: Adj. for mother	8.28 (9.48)	12.37 (22.86)	7.59 (7.42)	.389
Q4: Adj. for father	6.37 (4.97)	9.00 (14.06)	7.29 (5.82)	.416
Q6: Upset	8.75 (5.96)	9.18 (9.14)	8.34 (4.45)	.039
Q7: Separated	5.68 (4.39)	4.35 (1.32)	4.52 (1.50)	.605
Q8: Rejected	4.64 (2.16)	4.45 (0.60)	4.43 (1.08)	.064
Q9: Threatened	5.09 (3.64)	3.87 (0.24)	4.08 (1.45)	0.708
Q13 Loss	6.91 (5.57)	11.00 (12.25)	5.29 (2.73)	1.661
Q14: Trauma	4.23 (2.59)	8.30 (11.12)	3.33 (1.47)	2.296

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

3. OTHER ANALYSIS: ATTACHMENT, PSYCHOPATHOLOGY AND ALEXITHYMIA

3.1. Relations between AAI and Psychopathology

With the aim of determining possible differences and associations between attachment and the psychopathological symptoms of the SCL-90-R, the developmental psychopathological markers of the PAMaDeP, and alexithymia as measured by the TAS-20 *t* test and One-Way ANOVA with Bonferroni Post-hoc comparisons test were used for comparing groups (secure vs. insecure, and secure vs. preoccupied vs. dismissing) and Pearson's correlation coefficient for determining possible associations between the Mega-items, the DH, the security-insecurity strategy and each of SCL-90-R, PAMaDeP, and TAS total scores and sub-scale.

3.1.1. AAI and General Psychopathology

The obtained results in SCL-90-R scale and respective subscales showed no significant differences ($p \geq 05$) between secure and insecure attachment. Although, using a one-way between-groups analysis of variance to explore the impact of the AAI attachment classification on the SCL-90-R scores, a significant difference was found for the Phobic Anxiety subscale [$F(2, 47) = 3.702$, $p < .05$]. The actual difference in mean scores between groups was a large effect (eta squared = .14). Based on Bonferroni post-hoc test, these differences were mainly between the dismissing ($M = .54$, $SD = .43$) and the preoccupied group ($M = .07$, $SD = .12$), as the secure group ($M = .29$, $SD = .36$) did not differ significantly from those above.

Table 18 presents the correlation matrix between the SCL-90_R and the AAI Mega-items. As can be seen, no statistically significant correlation was found between the SCL-90-R and the Mega-items.

Further, a significant positive correlation ($r = .331$, $p < .05$) was found between Phobic Anxiety and the DH attachment dimension.

Table 18. Correlation Matrix of the SCL 90-R with the Mega-items.

	MB	MA	FA	HF	FD	P	D	C	MD	FE	PR
Somatization	.056	.099	-226	.041	.121	.216	.041	-.073	-.130	.200	.065
Obsessive-Compulsive	-.050	-.037	.007	-.072	.033	-.022	.008	.060	.044	.061	- .009
Interpersonal Sensitivity	-.058	-.028	-.084	.026	-.044	-.041	-.096	-.035	.146	-.014	.058
Depression	-.082	-.009	.060	-.157	.019	.023	-.006	.012	.032	.015	- .047
Anxiety	-.003	-.030	-.123	.026	.032	.068	.038	- .110	.004	.043	.142
Hostility	.209	.151	-.213	.186	.075	.134	.100	- .093	- .161	- .013	.072
Phobic Anxiety	-.058	-.101	.121	-.120	.068	.093	.203	- .218	.040	- .013	.188
Paranoid Ideation	-.145	.035	-.039	-.002	.165	.056	-.034	- .013	.111	.113	- .034
Psychoticism	-.049	.010	.006	-.024	.060	- .123	.095	.040	.061	- .082	.021
Global Severity Index	-.018	.029	-.083	-.024	.077	.050	.044	- .039	.017	.051	.044

*p<.05 ** p<.01

MB- Mother Base; MA- Mother Availability; FA- Father Availability, FD- Family disruption; P- Preoccupied; D- Dismissing; C- Coherence; MD- Mother demand; FE- Family enmeshment; PR- Parental rejection.

3.1.2. AAI and developmental markers of psychopathology

In terms of the PAMaDeP scores, only for the Dependence subscale we found differences [t (48) = -2.60, $p < .05$) between secure vs insecure attachment organization. So, the participants with secure attachment organization had lower mean dependence scores (M = 13.97, SD = 3.16) than the participants with insecure attachment organization (M = 16.41, SD = 3.12). The effect size of that difference was medium (eta squared = .12). Additionally, a *One-Way ANOVA* analysis revealed also that the three considered attachment classification groups differed only in terms of the dependence scale of the PAMaDeP [F(2, 47) = 3.944, $p < .05$, eta squared = .14]. The calculated effect size was large. Although, this difference was only between the secure group (M = 13.97, SD = 3.16) and the preoccupied group (M = 17.50, SD = 3.51), as the dismissing group (M = 15.81, SD = 2.89) exhibited no differences when compared to the other two.

Table 19 presents the correlation matrix between the PAMaDeP and the AAI Mega-items. Thus, we verified that low to high correlation values were found between the dimensions of the PAMaDeP and the AAI Mega-items.

Table 19. Correlational Matrix linking the PAMaDeP dimensions with the Mega-items.

	MR	MO	ME	FR	FO	FE	A/R	D	OF
Mother base	**-.581****	**- .296***	.058	- .240	-.141	-.219	**-.514****	-.242	**-.368****
Mother availability	**-.614****	-.147	**.325***	-.135	.084	-.070	**-.455****	-.035	-.113
Father availability	-.119	-.188	-.027	**-.700****	**-.317***	.210	**-.360***	-.085	-.095
Harsh father	.146	.179	-.033	**.695****	.257	-.241	**.323***	.004	.022
Family disruption	**.447****	.214	-.133	**.455***	.143	.170	**.476****	.211	.150
Preoccupied	.138	.176	.062	**.283***	.149	.229	**.285***	**.388****	.121
Dismissing	.047	-.031	-.092	.133	.123	.136	.060	.213	-.095
Coherence	.027	-.056	-.040	-.092	-.099	-.193	-.073	**-.337***	-.004
Mother demand	**.589****	**.292***	**-.320***	.028	-.058	.058	**.398****	.070	.162
Family enmeshment	.268	.277	.045	**.410****	.269	.120	**.386****	**.322***	.254
Parental rejection	.153	.061	-.095	.264	.144	.053	.222	.233	.010

*p<.05 ** p<.01

MR-Mother rejection, MO-Mother overprotection, ME-Mother enmeshment, FR-Father rejection, FO-Father overprotection, FE-Father enmeshment, A/R-Abandoned/Rejected, D-Dependence, OF-Over-concerned with the family.

The AAI Mother base mega-item was negatively related with PAMaDeP's Mother Rejection (r = -.581, p < .01), with Mother Overprotection (r = -.296, p < .05), with Abandoned/Rejected (r = -.514, p < .01) and with Over-concern with the family (r = -.368, p < .01). As Mother Availability mega-item denoted both a negative correlation with Mother Rejection (r = -.614, p < .01) and the Abandoned/Rejected factor (r = -.455, p < .01), it was positively correlated with Mother Enmeshment (r =.325, p < .05**).** Father availability was negatively linked with Father Rejection (r = -.700, p < .01) and Father Overprotection (r = -.317, p < .05), and also with PAMaDeP's Abandoned/Rejected factor (r = -.360, p < .05). On the other hand, harsh Father was positively correlated with both Father rejection (r = .695, p < .01) and Abandoned/Rejected (r = .323, p< .05) PAMaDeP subscales. Family disruption was found to positively correlate with three factors of the PAMaDeP, namely Mother rejection (r = .447, p < .01), Father Rejection (r = .455, p < .01), and Abandoned/Rejection (r = .476, p < .01). The AAI preoccupied Mega-item revealed to correlate with Father Rejection (r = .283, p < .05), so as with Abandoned/Rejection (r = .285, p < .05) and with Dependence (r = .388, p < .01). Coherence was found to negatively correlate with Dependence (r = -.337, p < .05). Mother demand was the AAI Mega-item that correlated with most of the PAMaDeP factors, a total of four. Thus,

Mother demand were positively associated with PAMaDeP's Mother rejection (r = .589, p < .01), with Mother Over-protection (r = .292, p < .05) and with Abandoned/Rejection (r = .389, p < .01); and negatively correlated with Mother Enmeshment (r = -.320, p < .05). Family enmeshment was found to correlate positively with Father Rejection (r = .410, p < .01), with Abandoned/Rejected (r = .386, p < .01) and with Dependence (r = .322, p < .05). For the Dismissing and Parental Rejection, AAI Mega-items no significant correlation were found with the PAMaDeP subscales.

No significant correlations were also found between the PAMaDeP and the AAI DH dimension and/or security-insecurity dimension.

3.2. AAI and Alexithymia

Considering the results of the TAS-20, we verified that participants with secure attachment organization had significant lower values [M = 14.48, SD = 5.36; t (48) = -2.852; p < .05] in the Difficulties in Identifying Feelings subscale than those with insecure attachment (M = 19.06, SD = 5.39). The effect size, calculated using eta squared, was .14. Performing an *ANOVA* (AAI attachment classification x TAS-20 total and subscales) also revealed a significant difference for the Difficulties in Identifying Feelings subscale [F (2, 47) = 3.997, p < .05]. The verified difference in mean scores between the three groups was a large effect (eta squared = .015). Post hoc comparisons using Bonferroni test indicated that the mean score for secure participants (M = 14.48; SD = 5.36) was significantly different from dismissing (M = 19.18; SD = 5.17). The preoccupied group (M = 18.83, SD = 6.27) did not significantly differ from either secure or dismissing group.

Observing the correlation matrix of TAS with its subscales and the Mega-items as presented in Table 20, we substantiate that low to moderate correlation values were found. Especially factor 1 – difficulties in identifying feelings – was the factor of the TAS with most significant correlations. Thus, the difficulty in identifying feelings seems to be positively linked with family disruption (r = .388, p < .01), preoccupation (r = .378, p < .01), dismissing (r = .356, p < .05), father rejection (r = .311, p < .05) and family enmeshment (r = .279, p < .05), and negatively linked with coherence (r = -.341, p < .01). Externally oriented thinking was negatively correlated with the coherence AAI

Mega-item (r = -.279, p < .05). Lastly, the TAS total score were positively associated with the dismissing (r = .367, p < .01) and the father rejection (r = .287, p < .05) mega-items, and negatively associated with coherence (r = -.335, p < .05).

Table 20. Correlation matrix of TAS with the AAI Mega-items.

	F1	F2	F3	TAS total
Mother Base	-.111	.071	- .015	- .030
Mother availability	-.016	.066	.059	.038
Father availability	-.275	- .107	- .017	- .177
Harsh father	.227	.026	- .093	.084
Family disruption	**.388****	- .028	.118	.214
Preoccupied	**.378****	.066	.209	.278
Dismissing	**.356***	.268	.272	**.367****
Coherence	**- .341***	- .192	**- .286***	**- .335***
Mother demand	- .051	- .060	- .096	- .081
Family Enmeshment	**.279***	-.005	.124	.174
Father rejection	**.311***	.180	.201	**.287***

** p < .01* p < .05

F1 - Difficulties in identifying feelings; F2 - Difficulties in describing feelings; F3 - Externally oriented thinking

Moreover, the TAS total score evidenced to be moderately and positively associated with the DH (r = .337, p < .05), and moderately negative with security (r = -.365; p < .01). Regarding the subscales, the F1 (difficulties in identifying feelings) and F2 (difficulties in describing feelings) evidenced low positive correlation values with the DH, r = .297 (p < .05) and r = .298 (p < .05) respectively. Further, security was negatively associated with the difficulties in identifying feelings TAS subscale (r = -.373; p < .01) and with the externally oriented thinking subscale (r= -.287; p < .05).

CHAPTER V: DISCUSSION AND CONCLUSION

1. Discussion

The discussion section is organized as followed: first, the autonomic activity and their relations with attachment organization are presented; there, linear and non-linear analysis will be discussed and reflected about their contributions for differentiation of attachment organization. Second, results about connection between autonomic activity and alexithymia are highlighted; following, some evidences that link attachment with alexithymia are reported; and finally, some results about attachment and developmental markers are approached and examined. Once discussed the results of the empirical study, some limitations of the present study are suggested and recommendations for future research are presented.

1.1. Attachment and autonomic activity

Our first psychophysiological data analysis model aimed to replicate the findings of previous studies (Dozier & Kobak, 1992; Roisman et al., 2004; Roisman, 2007). The results evidenced that secure attached participants had higher skin conductance levels than insecure in all twenty AAI questions. Considering the attachment patterns, secure participants showed higher electrodermal activity than the dismissing group in several questions ("background", "describe relationships", "adjectives for mother", "adjectives for father", and "upset"), as preoccupied attached participant did not differ from either groups, in those questions. But, preoccupied participants differed from secure participants, having lower SCL values than the secure ones in the questions about "changes in the relationship" and "current relationship with parents". Moreover, no significant differences regarding heart rate were found between secure vs. insecure and between the three attachment patterns (secure, preoccupied and dismissing). Also, no significant association was found between attachment strategies (deactivation-hyperactivation and security-insecurity) and physiological measures (SCL and HR) in

any of the AAI questions. These results trace some parallelism with previous findings, but also state some contradictions. Congruent with previous state of the art (Roisman et al., 2004; Roisman, 2007) was the fact that attachment patterns did not differ in terms of cardiovascular activity, and that deactivation was not associated with heart rate. Although, otherwise than in previous reports (Dozier & Kobak, 1992; Roisman et al., 2004; Roisman, 2007), a secure attachment pattern exhibits higher electrodermal activity than preoccupied and dismissing patterns. This result find support along the literature, especially because it has been found that low electrodermal activity implies low autonomic reactivity (Iacono et al., 1983, 1984; Moya-Albiol et al., 2003), and in clinical settings, participants with depressed symptomatology had also lower SCL than those without such symptoms (Bonnet & Naveteur, 2004). Additionally, our results contradict Fowles (1980) three-arousal model, on which previous findings were based (Dozier & Kobak, 1992; Roisman et al., 2004; Roisman, 2007), because instead, as predicted by the model, in showing a positive association between electrodermal activity and the Behavioural Inhibition System - passive responding and behavioural inhibition - a negative association went out. Such a finding is congruent with Keltikangas-Järvinen and colleagues (1999) or Ravaja (2004), which also could not found support for Fowles (1980) model, denying the argument of a direct link between behavioural inhibition and a rise of electrodermal activity, as a consequence of a growing anxiety. At this point, it might be stated that the valence of the arousing stimuli (joyful/aversive or friendly/threatful) play a crucial role, and therefore, an increase in electrodermal activity might not be exclusively linked with anxiety, but may imply a rise in the activation of cognitive and emotional strategies to respond to the stimuli (Ravaja, 2004).

The second psychophysiological data analysis model aimed to explore hidden cardiac and electrodermal activity that would not be explained by a linear approach based on the direct assessment of mean values. With this scope, we tried to verify if cardiac activity is really a bad measure to differentiate attachment patterns, as have been argued (Dozier & Kobak, 1992; Roisman et al., 2004; Roisman, 2007). The analysis of the spreads (RMSE) and slopes (β) revealed no differences between SCL among the attachment patterns, but in terms of the HR's slopes there were some differences. In both question of the AAI, where the participants were invited to characterize their relationship in childhood with the mother and the father (adjectives for mother and for

father), it was possible to differentiate secure from insecure classified participants, namely secure evidenced a positive HR slope and insecure a negative. Although, only for description of the relationship with the mother it was possible to distinguish between the three attachment patterns; secure with a positive slope, dismissing with a negative slope, and preoccupied with the most negative slope. Thus, it seems that the secure attached participants HR exhibits an "up-flow" (slight increasing trend) as the insecure attached HR "down-flow" (decreasing trend) under circumstances of discussing and characterising their relationship with the parents. Although, it should be noted that this increasing and decreasing in HR activity are very slightly, and not an abrupt change; otherwise it would be noted in linear trend analysis, as the results of the first psychophysiological data showed.

The differences found between the two psychophysiological data analysis models may be explained based on their neurological basis, namely the electrodermal system is a direct and unadulterated measure of the sympathetic activity; on the other hand, cardiovascular activity is controlled by the joint (and independent) activation of the sympathetical and parasympathetic nervous system. Therefore, increases in the electrodermal activity signals the preparation of the individual for a certain action, as an increase in cardiovascular activity may mean an action taking or an decreased restoration event, because sympathetic and parasympathetic nervous branches are active at the same time and (may) function together or independently of each other (Dawson et al., 2000, Porges, 2007). Thus, it might well be that this non-linear data analysis strategy models the dynamical and interactive process between both autonomic nervous system branches. And consequently, electrodermal activity changes, given its direct sympathetic effect, are prone to be detected through a mean based analysis, as cardiac activity, given need to uncover the sympathetic and parasympathetic effects, need to be described through more sophisticated statistical analysis, that are sensible to the dynamical interplay of both nervous system branches. However more studies and detailed analysis are needed to confirm this assumption.

Based on the non-linear analysis of electrodermal and cardiac significant activity shifts along the AAI critical question, it was possible to identify both differences between secure and insecure attachment, and differentiations between the attachment patterns (secure, preoccupied and dismissing). In terms of electrodermal activity, secure participants had more increasing shifts than insecure during the question about trauma.

In detail, secure attached were the group that had more SCL increasing shifts, differing significantly from the dismissing group, which has the lowest increasing shifts. This result might be interpreted in the way that secure participants feel more confident to discuss their traumatic experiences, during the AAI, expressing their traumatic content that affected them, engaging emotionally and cognitively, and therefore, they tend to activate more and exhibit higher autonomic reactivity than the dismissing ones. Those later tend to avoid talking about such themes, even if activated, and concentrate their efforts to inhibit their cognitions and emotions. Some studies have found evidence that negative emotions implicate slow recovery or prolonged activation if they caused stress (Angrilli et al., 1999; Williams et al., 2005). Under this scope, it might be hypothesized that insecure attachment, especially the dismissing pattern, down-regulates emotional and cognitive drives during the AAI, and when they are activated they last longer with a certain stability, exhibiting as a result less autonomic changes.

Regarding the HR significant shifts, when talking about upset experiences in childhood, the secure group showed lower HR mantaince values and higher HR decrease values than the insecure group. Similarly, the question about losses of significant ones revealed that secure evidence more HR increasing shifts and less HR mantaince shifts than insecure participants. Considering the attachment patterns, the analysis allowed to trace some differences through the AAI questions in terms of the HR shifts; namely, concerning the question about adjectives for mothers, where the preoccupied participants evidenced lower HR decreases than secure and dismissing participants. Additionally, when talking about childhood upset experiences, the secure attached showed higher HR decreases than the dismissing attachment pattern. And, finally, the question about losses evoked higher HR increases and lower HR mantaince in the secure attached pattern than in the dismissing attached group. Positive and negative emotions have comparable levels of HR (Jacob et al., 1999). The duration of the responses after a negative stimulus may be more prolonged than after a positive stimulus. Brosschot and Thayer (2003) equated that a reason for such emotional valence differences might be that negative affect implies the continuation of unresolved problems or an uncontrollable threatening situation, leading to prolonged rumination. Thus, a high level of HR shifts (increasing and decreasing) is a sign of a high heart rate variability, and therefore, it might be stated, based on our results and the outlined literature, that secure attached participants are more proficient in dealing with positive

and negative situations than negative; especially, because they might have had a bunch more of positive life experiences and memories with their caregivers. High heart variability (as an index of psychophysiological reactivity, for a revision see Fox, 1989) has been linked with constructive coping responses and with less avoidant or aggressive coping responses under potential stress situations (Fabes et al., 1994; Fabes & Eisenberg, 1997). It might well be the presence of such coping strategies, product of and fostered by secure attachment experiences, that contribute for an physiological differentiation between secure and insecure attachment, in AAI questions about difficult and critical situations, as upset, losses and/or trauma. This argumentation is in line with the 'engagement' hypothesis (Jacob et al., 1999), that posted that cardiovascular activity under emotional situations reflects rather the extent of engagement of the individual than the emotional valence of that specific situation; and consequently, secure attached participants are those which engage more into the AAI situational challenges that are asked to them.

Furthermore, the question about characterizing the relationship with the mother in childhood showed that attachment security dimension was associated with HR decreasing shifts, and DH (Deactivation-Hyperactivation) was linked with SCL increasing shifts. Attachment security dimension showed to be associated with HR decreasing and mantaince shifts regarding the questions about upset and threat experiences. In the question about losses, security was associated with HR increasing shifts and negatively linked with HR mantaince shifts. And, referring to traumatic experiences, security was found related with SCL increasing shifts and negatively connected with HR decreasing shifts. Again, these results stay in direct connection with the precious ones, and emphasize the relation between HR (increasing and decreasing) shifts and security, as HR mantaince seems to be a sign of insecure attachment. Beside that, DH (Deactivation-Hyperactivation) was found to be associated with SCL increasing shifts, at the question for characterising the relationship with the mother, a result that is congruent with previous studies (Dozier & Kobak, 1992; Roisman, et al., 2004; Roisman, 2007).

Moreover, the results of this significant shift analysis suggest that the notion of generalized stress reactivity has no appliance in favour, because it overlooks several different patterns of “up-regulation” and “down-regulation” in the sympathetic and parasympathetic branches of the autonomous nervous system (Berntson, Cacioppo, &

Quickly, 1991). The differences found between secure and insecure attachment, and also those contributing for an attachment pattern differentiation, evidenced medium to high effect sizes, what shows that those differences were not obtained by chance. Despite these, at some instance, robust findings, it is clearly to early, given the complexity of psychophysiological measures, to take them for granted without pursuing several replications and extensions of these results and the non-linear data analysis strategy.

The results regarding the heart rate variability, measured through the LF/HF ratio, showed neither differences in terms of attachment patterns (secure, preoccupied and dismissing), nor between secure and insecure attachment. Further, there were also no significant correlations between the LF/HF ratio and the two attachment strategies (security vs. insecurity and hyperactivation vs. deactivation). These results could not confirm previous data of Dias (2007), where a sympathetic activation (high LF/HF ratio, given by high LF values, due a shift to sympathetic nervous system dominance), during some of the critical questions of the AAI was associated with a secure attachment pattern. Even if the study of Dias (2007) evidenced some limitations related to the sample's clinical heterogeneity, it showed also the importance of heart rate variability as a variable to identify (possible) physiologically-expressed differences in attachment organization. In fact, the general literature about sympathovagal balance highlights that a predominant parasympathetical activity is at the core of a human physical health state (Eckberg, 1997; Fabes & Eisenberg, 1997); moreover, sympathovagal balance plays a central role on emotional regulation and responding (Appelhans & Luecken, 2006; Bornstein & Suess, 2000), on self-regulation behaviour (Segerstrom & Solberg Nes, 2007), and is used as a marker of autonomic modulation of the heart (Borell et al., 2007; Ramaekers et al, 1998). For instance, McCraty and colleagues (1995) showed, by comparing the difference in sympatovagal balance and degree of autonomic activation between a baseline period and an emotional expression period in an adult health sample, that emotional expression of either positive or negative emotions were associated with an increase of the LF/HF ratio regarding to baseline. Later, Capitovic-Vesilica et al. (1999) discussed the interaction between emotions (fear and aggression) and HRV that were also not evident in HR responses. An increase in the LF/HF ratio has also been reported in acute laboratory psychological stressors (e.g. Delaney & Brodie, 2000; Jain et al., 2001), real-life acute stressors (Lin et al., 2001;

Sloan et al, 1994). Under this scope, there is some substantial support of the usage of heart rate variability as a measure to tap psychological differences in distinct contexts, even if our study showed no differences reagridng attachment oragnization with this measure.

1.2. Autonomic activity and alexithymia

The present study revealed a negative association between alexithymia's dimension difficulty in identifying feelings and HR decrease in two AAI questions: upset and rejected experiences. Additionally, a negative association between alexthymia's dimension difficulties in identifying feelings and the LF/HF ratio of the question about characterizing the relationship with the mother was found. This result is, to some extent, in line with the Fukunishi and colleagues (1999) study, where during a stress situation; the increase of LF/HF ratio was higher for students with low scores on alexithymia than those with high scores. It seems that an insecure maternal attachment is associated with the development of alexithymic features and also with the sympathetic activity; therefore, it might be stated that our findings support the idea of; when the person is submitted to a (potentially) stress situation, as it is the AAI, those which have had negative relationship experiences with their mothers, seem to disengage and act defensively, experiencing possible internal conflict regarding feelings identification, when asked about that relationship. On the other hand, those which have a secure and warmful relationship with their mothers seem to activate sympathetically, expressing their emotional arousal, and do not experience any difficulties in finding the words and identifying the feelings, during those circumstances. This assertion finds some substance under the evidence that increased levels of alexithymia is connected to an attenuated autonomic reactivity to anger situations (Neuman, et al., 2004). However, there are some aspects to overcome, and therefore, these interpretations might be previewed as hypothetical statements. The results were obtained with simple correlational analysis, no conclusive features can be drawn, except the existence of a link between alexithymia and sympathovagal balance. More examinations across different samples will be required.

1.3. Alexithymia and Attachment

Moreover, a positive association between alexithymia and DH (Deactivation-Hyperactivation), and a negative link between alexithymia and security was found. DH (Deactivation-Hyperactivation) showed to be correlated with difficulties in identifying feelings and with the difficulties in describing feelings; as security evidenced a negative association regarding the ability to describe feelings and with externally oriented thinking. In addition, participants classified as secure had significant lower alexithymia scores than those classified as insecure. These findings are consistent with previous reports, for instance, of Kramer and Loader (1999) and of Hexel (2003), where low alexithymia was associated with secure attachment style, and insecure attachment was held as the cradle for the development of alexithymic components. It may be that secure attached participants exhibit lower scores of alexithymia than insecure because of an internal locus of control, which allows experiencing fewer difficulties in identifying and describing feelings, and striving less to an externally oriented thinking. Further, under this scope, it can be assumed that secure participants perceive a higher control over life events, facing them with much more confidence, and demonstrate less need for approval and less preoccupation with personal relationships (Scheidt et al., 1999; Wood & Wessley, 1999). This standpoint is consistent with Feeney and colleagues (1994) view, that "need for approval" reflects the person's need for others acceptance and confirmation, and the "preoccupation with relationships" entangles an anxious acting mode regarding others for fulfil dependency needs.

Moving deeper into the relationship between alexithymia and attachment, the present study provides some supporting findings of the ingredients that set the lines between this two constructs. Thus, family disruption, preoccupation, dismissing behaviour, low coherence, family enmeshment and father rejection were the attachment related components (mega-items) that were found significant concerning the alexithymia's dimension difficulty in identifying feelings. The externally oriented thinking dimension was only connected with a decreased coherence. These results are consistent with the preposition that alexithymia develops in response to interactions with primary caregivers, which also are at the hub of infant and adult attachment. Lumley and colleagues (1996) found evidence that familiy emotional disfunction was linked with young adults'difficulty in identifying feelings; beside that, a lack of family

guidelines for members'behaviour was in connection with an increased predilection for externally oriented thinking. Another author, have pointed out some dimensions of family environment as expressiveness, conflict, disengagement, enmeshment, parenting style, as factors contributing to alexithymic tendencies (Fukunishi et al., 1999; Kench & Irwin, 2000). Honkalampi and colleagues (2000) have especially emphasized the role of adverse childhood experiences such as harsh discipline and unhappiness of the childhood home as contributors for long-lasting alexithymic features. Therefore, individuals who are raised in environments where they feel physically and emotionally threatened and insecure, and where emotional expression is held down, would not be expected to become skilled at coping with their emotions, and as a consequence they will feel bumpy experiencing emotions. Actually, normal affective development is impossible to occur if the parents are incapable to interpret the emotional cues of the infant, and, in addition, fail to function as external regulators and mediators of the infant's emotional states. Because the lacking awareness of their own emotional states and experiences, alexithymic individuals are unqualified to assume the other persons viewpoint, and consequently, are unempathic, short in self confidence, and ineffective in modulating properly emotional states to others (Goleman, 1995; Kench & Irwin, 2000). Apart of these assumptions, the present study advantaged previous cited studies, which analysed the link attachment-alexithymia, in the way that used the AAI and not a self-report measure to determine attachment pattern; even so, the results are of correlational nature, meaning that no causal role can be drawn about attachment organization and alexithymia.

1.4. Attachment and developmental and psychopathological markers

We also found that dismissing and preoccupied attached participants differ in terms of phobic anxiety symptomatology, namely, dismissing evidenced higher social phobia symptoms than preoccupied. Additionally, phobic anxiety showed a positive correlation with DH (Deactivation-Hyperactivation). Beside the fact, that this sample is non-clinical and that none of the participants scored above the clinical range, this result supports those behavioural and cognitive-emotional features assessed with the symptom scale stand in direct connection with those that characterize each of the mentioned

attachment patterns. The dismissing participants tend to stay away from others, do not trust others, feel stressed with their presence, and are likely to avoid emotional expression; the preoccupied ones search constantly for others, are deeply dependent on there presence, feeling secure with the presence of others. Moreover, the results with the PAMaDeP scale revealed that the three attachment patterns differed regarding the dependency dimension, where differences between secure, less dependent, and preoccupied, highly dependent, were found. Further, several significant correlations were found between the PAMaDeP and the AAI Mega-items, and where negative correlations were found between mega-items associated with security and a group of markers linked with psychopathology. Such results underpin and are consistent with several recent longitudinal and transversal research about human development and psychopathology (e.g.Grossmann et al., 2002; Grossmann & Grossmann, 2005; Grossmann et al. 2005, Hamilton, 2000; Hesse, 1999; Sroufe et al., 2005; Strauss, 2000; Waters et al., 2000).

Taken together, our results indicate that at first sight it seems that attachment oragnization is only differenced by electrodermal activity and not by cardiac activity; and where an increased electrodermal activity during the AAI characterised secure attachment. Although, based on a non-linear physiological data analysis, HR seem to be differentiating factor between attachment organization, namely, when participants were invited to reflect and characterize their relationship with their mother and father, secure attached participants showed a slight predisposition for HR increase and insecure attachment for a decrease; a tendency that able to differentiate secure, with a bent to increase HR, from dismissing, with a bent to decrease HR. Such results may indicate a different susceptibility of physiological changes to be tapped by data analysis models. The EDA innervated only by the sympathetic nervous system seems eager to fit into a linear analysis model; as the HR innervated simultaneously by two branches of the autonomic nervous system (parasympathetic and sympathetic) seems to be more accurately reflected by non-linear analysis. Considering the significant shifts of EDA, it turned out that secure attached individual had more increasing shifts than insecure ones, as a response to the question about traumatic experiences Further, secure attached participants evidenced more HR shifts (decreasing and/or increasing) when reflecting and talking about questions such as upset experiences or losses, as insecure evidence

more mantaince shifts. Likewise, DH (Deactivation-Hyperactivation), was linked with EDA increasing, and security were mostly linked with either HR decreasing and HR increasing. Heart rate variability (LF/HF) was not found to be able to distinguish between attachment patterns. Even so, heart rate variability was linked negatively with alexithymia. Furthermore, a positive relation between alexithymia and DH (Deactivation-Hyperactivation), and a negative link between alexithymia and security was found. Finally, several congruent relationships with attachment theory, linking attachment and attachment-related variables with alexithymia, were found.

Although, when we consider such findings, we should be aware of a certain kind of psychophysiological heterogeneity in responding to the experimental situations, and therefore, more studies are needed to uncover a psychophysiological differentiation between attachment patterns.

1.5. Some limitations and future directions

By starting to address the limitations of this empirical study, it is important to highlight a certain limited character of the conclusion to draw out of this project. The reason for this, is intimately related with the participants distribution among the attachment classification, namely, our sample comprised 66% (n=33) of secure attached, 12% (n=6) of preoccupied and 22% (n=12) of dismissing participants. This means that insecure attachment is slightly under-represented in the sample, and such a fact is quite expressive among the preoccupied attachment group with only six participants. Despite this fact, the attachment classification were congruent with the distribution among non-clinical samples (van IJzendoorn et al., 1992; van IJzendoorn & Bakermans-Kranenburg,1996), and the sample size were within the range of previous studies (Dozier & Kobak, 1992; Roisman et al., 2004; Roisman, 2007), which analysed the association between attachment organization and autonomic activity (skin conductance and heart rate). Even so, there is need to cautiously view this data and their results, especially the non-linear analysis, as an exploratory intend to uncover the link between autonomic reactivity and the discursive and narrative organization of the adult attachment.

Second, the sample was not screened for the occurrence of any special life events. Several authors have emphasised the importance of life events for the attachment organization and their change over time (e.g. Hamilton, 2000; Waters et al., 2000; Weinfeld et al., 2000). Therefore, in a future studies, questionnaires and interviews assessing life events may be of advantage, so as, a deeper analysis, beyond the Q-sort and mega-items, of the content produced through the AAI narratives.

Third, our sample was composed exclusively by females, and thus, a generalizability of the results for men cannot be extrapolated. Along the literature, there are some evidence for differences of attachment-related variables between men and women that could also account for some psychophysiological differences (e.g., Brennan, Shaver & Tobey, 1991; Brody, 1985; Gross & Hansen, 2000).

Fourth, even if the usage of the HRV, in comparison to previous studies (Dozier & Kobak, 1992; Roisman et al., 2004; Roisman, 2007), constitutes a methodological advance, the results should be taken into account with some reserves of methodological nature. In fact, the LF/HF is a ratio, reflecting the separate effects of the two branches of the autonomic nervous system, that do not function in ways of simple addition or subtraction of the relative components (Hainsworth, 1995); indeed, the branches do not function as a perfect continuum, where an increase in one branch implies a decrease in other. Instead, they have the ability to either function in a synchronised way or independently of each other, a fact that opens the door for multiple patterns of activation. This means that the ratio's values must be seen both in terms of an increase or decrease in LF and HF, which might explain the consequent changes in the ratio. In the present study, we did not assess respiratory activity, which would allow determining the respiratory modulation of HR - respiratory sinus arrhythmia - and as such, to have a selective marker of cardiac vagal activity (Kotani et al., 2000). Thus, the respiratory sinus arrhythmia is a phenomena entirely linked with the parasympathetic activity; and consequently, the additional usage of this measure would help in the interpretation of the LF/HF ratio (Appelhans & Luecken, 2006) by tracing a much more clearer differentiation of the role between sympathetic and parasympathetic (co-)activation or (co-)inhibition, and especially, because of the parasympatethic activation and inhibition could be easilier identified. Extending this idea, and following the recommendations of some authors (Kovalenko & Kudii, 2006; Pentila et al, 2001; Song & Lehrer, 2003), the usage of a pneumogramm to control the interaction between heart and lungs, and the

parasympathetic and sympathetic nervous brunches, has been recommended because variations in respiratory patterns can affect the rates of wave processes associated with the cardiac.

Beside these limitations, the link between attachment and autonomic activity, explored in a non-clinical group throughout this study, could be expanded with the inclusion and comparisons with clinical groups. Some of the potentialities of exploring psychophysiological correlates of attachment patterns have been shown by Dias (2007); albeit much work is to accomplish in these area of study. Moreover, standardized laboratory paradigms reflecting attachment situations, based on emotional induction and memory retrieving could be designed, and serve as additional orienting lines to interpret the more naturalistic data collected with the BioDReAMS during the AAI. Such an approach, could possibly contribute for the detection of specific emotional and cognitive configurations displayed along these standardized situations. Consequently, the obtained emotional and cognitive situations could then be used to for pattern identification throughout the different themes approached in the AAI. And, finally, as and extension of the analysis of the present study, other non-linear analysis could be developed in order to determine and describe more accurately the temporal tendencies of physiological "ups" and "downs" activity during AAI.

In sum, this study started with the aim of replicating previous findings, but in pursuing that, it came up with an exploratory aim of analysing the complex connection between attachment and autonomic activity with non-linear analysis. The results, more than offering definitive answers, configure a starting point for new and future research questions.

2. Conclusion

Over the decades, attachment theory (Bowlby, 1969/1982) has raised to an evermore crucial place inside developmental psychology. Attachment theory has been stated to be '*one of the broadest, most profound, and most creative lines of research in 20th century psychology'* (Cassidy & Shaver, 1999). The growing interest in attachment theory is not surprising because it is a life-span theory that offers explanations for human behaviour *'from the cradle to the grave'* (Bowlby, 1969/82, p.208). Further, it

has progressively emerged as one of the most important frameworks for the study of parent-child relationships and their role in shaping adaptation over the life course. Conceptual and theoretical frameworks, as exposed in these thesis, have been wide spreading used an applied to the explain the importance of early experiences for later social and emotional development, to uncover how security patterns are maintained and carried through life and transmitted to next generations. But more than that, as Cassidy and Shaver (1999) noted, the theory interested and challenged researchers of all psychological science. It is under this umbrella, that the present project and its results, studying the psychophysiological correlates of attachment patterns and attachment strategies (security-insecurity and deactivation-hyperactivation), can be flagged.

The central aim of our study was to determine till which extent individual differences in adult attachment organization represent qualitatively different emotional and cognitive configurations of past experiences. Secure attachment was found to have distinct psychological configurations throughout the AAI, and regarding some critical AAI questions differences between attachment patterns and psychophysiogical measures could also be found. Consistent with these findings, the present study points evidence for distinctive physiological signatures of secure, preoccupied and dismissing adults, and also that the attachment strategies (secure-insecurity and deactivation-hyperactivation) coins specific physiological associations, during the AAI. At this base, this thesis, suggests that adults'representation of early and later childhood experiences may play a crucial role in differentially building up sets of physiological responses in adults, in ways consistent as predicted with attachment theory.

Another, important issue, shown up with this study, consist on the immense challenge that attachment research, especially using the AAI, post to traditional psychophysiological measurements and techniques. In fact, there are at least three critical aspects when we make psychphysiological inferences about psychological changes. First, behaviour and physiological measure should be simultaneously recorded and synchronized, in order to allow a "perfect match" for segmentation, coding and extraction of data. These requisites are offered by the BioDReAMS 2.0, where a user friendly platform allows easily sorting, marking and readjusting several events along the AAI, synchronizing them for audio-visual and autonomic nervous system measures (SCL and HR).

Second, behaviour (seen as a broad concept) should be the central tenet, in the way that inferences about psychophysiological state are based on the convergence of both measurement systems rather than on the physiological response alone. Apparently this aspect is one of the most challenging when we move to a more complexer level of human behaviour, as it is afforded by the study of adult attachment through the AAI. Even so, Q-sort ratings of the AAI acknowledged as with several congruent findings with attachment theory (e.g., Bowlby, 1969/82; Main & Hesse, 1990), namely, participants with secure attachment exhibit a coherent discourse and collaborative attitude. Preoccupied participants are incoherent and concerned, angry, passive and confused about most past experience, as dismissing individuals adopt a normalizing attitude with unsupported and contradicted memories, arguing that the past did not affect them in any special way. It was aspects as those that guided our interpretation of the psychophysiological evidences during the AAI. As we have seen, our results show congruent and incongruent data when compared with previous studies (Dozier & Kobak, 1992; Roisman et al., 2004; Roisman, 2007); a fact, that might indicate the necessity to improve the number of studies and to sharpen our viewpoint about the attachment behaviour along the AAI, considering the idiosyncrasies of the attachment patterns and there repercussions on autonomic regulation. In the pursue of these intentions, a multilevel research of adult attachment (self-report, behavioural ratings, physiological measures) might of use in strenghten the accurancy of differences between secure and insecure attachment patterns; and simultaneously cosntitute additional information to help along with a psychological interpretation of attachment-related physiological activity.

Third, many of the physiological responses are sudden and have fast response times, therefore, a multiple trial procedure should be more adequate, to able a more precise averaging across the epochs allowing to obtain a more stable estimate of the physiological response. This argument is part of general jargon inside the psychophysiological field, which states "more measures, more replication, more accuracy of what is measured". Even if this might be true, we never should forget external validity in detriment of internal validity, and especially, not if our interest goes to study attachment by a interview procedure, in which the attachment system is activated through the elicitation of several memories and reflections about attachment-critical questions. Our psychophysiological measures were collected using a sample

ratio of 100 Hz, what means that we achieve a resolution of 100 data points per second, which is well above the normal physiological changing rates of both cardiac and electrodermal activity. Such a high sample ratio assures that no changes in autonomic measures are lost. Regarding the attachment measures, It is true that we could perform the AAI twice or also three times, but it would needed several month of interval between each of the retests. It might well be that, if this time would not be respected, that the insecure groups had the chance to perform the AAI with even less interest, showed increases in coherence, or even reported "untrue stories". Thus, attachment research states complex methodological and validity challenges for psychophysiological research. In fact, it is impossible to use classical stress or emotion paradigms; the time has come where new paradigms need to be developed and new methods of assessing and controlling validity need to be tested.

At another level, there are several advantages among the use of psychophysiological assessment for adult attachment research. First, psychophysiological events might score subtle and otherwise difficult detectable changes in cognitive and emotional arousal throughout the AAI. Independently of our analysis models, our data revealed some psychophysiological differences between the attachment patterns along the various AAI'questions, differences that might be very difficult and maybe impossible to detect with non-physiological techniques.

Second, these physiological events might reveal and uncover conflict-themes and their inter-connections, before their occurrence in verbal exchange. In fact, along some of the critical AAI questions (e.g., relationship with the mother and father, upset, separation, losses, etc.), psychophysiological results evidenced discrepancies between physiological activation (increases, decreases or mantaince) and the narrative produced in response to a critical attachment theme. And, these differences were most visible between secure and dismissing organized attachment patterns, where the dismissing tend to model a somewhat similar discourse to the secure (normalizing tendency), but otherwise than secure attached, the discourse fail to give genuine and deep reflected memories about attachment situations; our data detected some of these incongruences and were able to distinguish them, fostering therefore, the attachment classification based on the ratings of the AAI.

Finally, physiological events might provide an objective means of evaluating attachment patterns, and also changes that purportedly occur across time in attachment

organization. But, until this is possible, some consistent physiological data need to characterize differences in attachment patterns. The actual state of the art, allows only to say, there is evidence for attachment differences, but what do they mean is another question. Further, past models of physiological data are to simplistic, contradict each other if the complexity rises, and seem to be unreliable to explain attachment organization. A much more dynamic vision of the autonomic nervous system and its psychological significance need to be entailed (Porges, 2007). Fundamental theoretical, methodological, and statistical problems need to be resolved before physiological assessment could truly contribute for a deeper attachment description.

As an end word, the usage of psychophysiological measures in adult attachment research is at the beginning, otherwise than with infants where several studies have been accomplished with the SS (see Fox & Card, 1999, for a review). We hope that our results, may have contributed for the physiological understanding of adult attachment, as it is manifested through the AAI, and that our findings constitute new starting points for future research.

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