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“Never meant to break your heart”

Adult attachment and cardiovascular regulatory capacity

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Thanks

As a psychotherapist and researcher, I am surprised just how much personal therapy and finishing a dissertation project have in common. Both confront oneself with important questions about personal development, and both bear the potential of gaining knowledge, maybe even insight, into oneself. For both it is very different to hear or read about it than to actually be involved. And for both the seemingly contradictory statement may be valid, that - at the end of the day - you don't really change that much, but still the experience changes you. Anyway: Dissertations, as well as personal therapies, are not possible without the guidance, help, and context of others, and of course I would like to thank some of them.

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Introduction

Have you ever wondered how the rock diva Tina Turner, the progressive-rock band Yes, and the electropop duo Pet Shop Boys are related to cardiovascular stress physiology? From the perspective of this research project, the answer is straightforward: The Pet Shop Boys describe a basic interrelatedness of attachment relationships and cardiovascular reaction ("every time I see you / my heart starts missing a beat"; Heart/Pet Shop Boys). The other two artists depict two distinct forms of attachment-related regulatory function. While Tina Turner portrays hyperactivation of attachment-oriented thoughts, emotions, and stress-physiology ("I spend my time / thinking about you / and it's almost driving me mad / and there's a heart that's breaking / down this long distance line tonight"; Missing You/Tina Turner), the band Yes sings about attachment deactivation and shutting down of attachment-related memory content ("owner of a lonely heart / much better than a / owner of a broken heart"; Owner of a Lonely Heart/Yes). Which strategy is better? Tina Turner may finally make herself heard, but will her heart survive the drama? How long will Yes stay lonely, and are their stress-systems equipped to adapt when they can't avoid heartache?

The driving question behind this dissertation project is to examine the set-points and boundaries of attachment-related regulatory defensive function in adults with regard to cardiovascular stress physiology. Assessing stress regulation, and especially cardiovascular stress physiology, is an important tool for studying attachment, in a twofold way: On the one hand, it adds indirect information about psychological states not captured by self-report or interview approaches. On the other hand, it bears direct implications for health psychology and clinical interventions (McWilliams & Bailey, 2010).

Our world is full of relationships. We spend most of our time in families, dyads, groups, organizations, and development and learning experiences occur within these contexts. Most of our sorrow, but also most of our joy, stems from relationship experiences. We may even live longer when socially integrated (Holt-Lunstad, Smith, & Layton, 2010). One of the most prominent developmental theories in relationship research was conceptualized by John Bowlby (1907-1990), a British psychoanalyst and pediatrician. Motivated by his experiences with maladapted children as well as his work on maternal care for the World Health Organization (WHO), he started to question contemporary theories on mother-child development. At the search for better models for his work, he was inspired by different fields such as ethology, cognitive science, systems theory, and evolutionary biology (Cassidy,

2008). Together with Mary Ainsworth (1913-1999), an empirical developmental psychologist, he developed and refined what was to become attachment theory.

Over the last decades, attachment theory as a truly bio-psycho-social approach to personality and relationship has received widespread attention in several fields of psychology. One area of interest assesses longitudinal development and predictive value of early attachment formation in healthy as well as risk samples (see Grossmann, Grossmann, & Waters, 2005). Social psychology of interpersonal adult relationships has drawn from and developed concepts and paradigms under the umbrella of attachment research (Mikulincer & Shaver, 2003). And last, but not least, scholars from health psychology and psychosomatic medicine started to apply attachment theory as a framework for understanding human stress regulation and disease development (Maunder & Hunter, 2001).

Although theoretically and clinically important, this line of research is just beginning to unfold, and methods and results differ substantially (Diamond & Fagundes, 2010). A central shortcoming of previous research concerns attachment theory itself: There are several pathways on when and how the attachment system may influence stress physiology, and these interactions have been largely neglected in earlier studies. One area of particular significance is the conceptualization of insecure attachment strategies as defensive processes with the overall aim of homeostasis regulation: The impact of attachment on stress physiology may be moderated by other factors, which specifically switch attachment-related regulatory processes on or off. The following studies provide one possible approach to these issues.

As many of the existing studies use self-report data for the assessment of attachment, we were interested in a recent questionnaire for our own research that facilitates international comparability. Therefore the *first study* validates a German translation of a questionnaire on adult attachment in two large samples, which is then used throughout all subsequent projects. The *second study* describes the rationale and validation of a newly developed, attachment-related short-term stressor, the separation recall (SR) task. The SR is compared to an achievement-oriented stressor, and correlated with attachment style. The *third study* deals with factors leading to the activation of attachment-related defensive processes. It probes whether there is a lower threshold of personal significance of attachment-related memory content which triggers attachment-related defensive functioning as measured by psychophysiological response. The *fourth study* concentrates on whether psychological distress in general and life-stress more specifically are able to distract and change the impact of attachment defensive function on psychophysiological stress reaction; in other words, it explores the upper boundaries and vulnerability of insecure attachment strategies.

1. Attachment theory

The attachment system is a regulatory psychological structure which develops in the context of early, repeated interactions with the primary caregivers. From a perspective of middle-level evolutionary theories, the need to attach is a primary, inborn tendency of the human being to increase chances of survival in childhood, but also to facilitate mating and reproduction, and to provide mutual support in long-term relationships in adolescence and adulthood (Simpson & Belsky, 2008). From a psychological perspective, the main goal of the activation of the attachment system in childhood is the (re-) establishment of proximity, contact maintenance, and a state of felt security. Depending on the co-regulatory quality and contingency of interactions, internal working models (IWM) of the self and others start to develop and to differentiate (for an overview see Beebe et al., 2010). IWM are considered representational structures which integrate and shape the interpretation of successive relationship experiences with attachment figures, organize attachment behavior with regard to attachment strategies, and influence attachment related motivation, cognitions, and emotions within a broader attachment behavioral system (Dykas & Cassidy, 2011).

In children as well as in adults, three organized attachment styles can be reliably observed: secure, anxious, and avoidant. Prototypically secure individuals have a deeply rooted trust that others will be available in times of distress. They are flexible and at ease with the use of attachment behaviors and proximity to significant others. Prototypically avoidant persons are usually uncomfortable relying on and getting close to others in times of need. They deny interpersonal needs for the price of ultimately staying lonely. Anxious individuals, on the contrary, view themselves as insufficient with respect to self-regulatory competence, for the price of separation anxiety and overdependence. They desperately try to obtain the attention and proximity of others, often accompanied by emotional hyperarousal, and clinging or controlling behaviors. A separate category refers to disorganized strategies, often related to unresolved attachment trauma and loss. As the studies of this dissertation do not directly assess attachment disorganization, we will not comment on this aspect any further and refer for example to Bernier and Meins (2008). In healthy adult populations and using interview data (see chapter 2), about 58 % of the participants are classified as secure-autonomous, about 23-28 % as insecure-dismissing (which would be labeled as ‘avoidant’ in broader terms), and 15-19 % as insecure-preoccupied (‘anxious’). Including the ‘unresolved trauma’ category, about 51-56 % can be seen as secure-autonomous, 16-24 % as insecure-dismissing, 9-11 % as insecure-preoccupied, and 15-18 % as unresolved with regard to trauma and loss. There is also robust evidence for transgenerational transmission of attachment styles (Bakermans-

Kranenburg & van Ijzendoorn, 2009). It is important to note that insecure attachment strategies increases chances of individual survival by allowing a child to maintain at least some kind of proximity even with neglecting or intrusive/abusive primary caregivers. Some authors even argue that a diverse distribution of attachment styles may incorporate advantages in recognition and collective handling of threat and danger at a group level (Ein-Dor, Mikulincer, Doron, & Shaver, 2010).

Another central aspect of IWM is the conceptualization of organized insecure attachment strategies as defensive regulatory processes. In line with Mikulincer, Shaver, Cassidy, and Berant (2009, p. 294), defensive processes can be seen as "mental mechanisms aimed at adaptation and self-regulation". Attachment-related defenses are usually activated to regulate distress resulting from rejection, loneliness, fear, and further consequences of unaccomplished relational needs. External or internal cues switch defensive processes concerning attachment on and off, and the adaptive value of regulatory defensive functioning may be impaired or disturbed under certain conditions (see chapter 5).

There is direct evidence for considerable stability of attachment patterns over time from simulation studies and meta-analytic data (Fraley, 2002), as well as indirect evidence for their predictive value in longitudinal studies. For example, Simpson, Collins, Tran, and Haydon (2007) were able to show that attachment security at 12 months predicts more positive relationship experiences as well as more adaptive conflict resolution abilities in the early twenties, mediated by higher social competence in elementary school and better friendships in adolescence. Other results on longitudinal stability are summarized by Grossmann et al. (2005). Although IWM can change over time, and new attachment relationships and life events may leave their traces, the integration of novel experiences seem to occur within a hierarchical, relatively stable prototype model of preceding attachment relationships (Fraley, Vicary, Brumbaugh, and Roisman, in press). Or, as Overall, Fletcher and Friesen (2003, p. 1490) conclude from their research, "specific relationship models are nested under relationship domain representations that are, in turn, nested under an overarching global working model".

Attachment relationships are usually characterized by the maintenance of proximity, separation distress, a function of 'safe haven' to return to in times of internal or external threat, and of a 'secure base', from which to explore the environment. However, while attachment relationships in childhood are asymmetric concerning the secure base function, in adult romantic relationships both partners may provide support and co-regulation for the other (e.g., Diamond, Hicks, & Otter-Henderson, 2008).

Mikulincer, Shaver, and Pereg (2003) developed an integrative model for the operation of the attachment system in adulthood. Although the authors originally framed their thoughts within the context of affect regulation, their ideas were applied to additional aspects of attachment functioning. Mikulincer and colleagues propose the attachment system to comprise three core components, each with a distinct role, yet connected by inhibitory and excitatory feedback loops: The *first module* monitors and evaluates potentially threatening events. It activates the behavior-oriented part of the attachment system with regard to proximity seeking as a primary attachment strategy. The *second module* probes whether an external or internalized attachment figure is available. If so, attachment based co-regulatory strategies result in the relief of distress and the ability to continue with other activities. Repeated positive interactive experiences within the circuit of the second module are the basis of broaden-and-built cycles of attachment security and attachment formation (Diamond, 2001). If there is no attachment figure available, a *third module* tries to evaluate the feasibility of proximity-seeking as a means of coping with increasing distress by eliciting either deactivating or hyperactivating secondary attachment strategies. Deactivation leads to inhibition, distancing and down-regulation of trigger- and attachment-related cues and needs, to avoid further arousal or frustration. In the long run, this is the basis as well as the primary regulatory strategy of attachment avoidance. Hyperactivation, on the other hand, is characterized by hypervigilance, approach-oriented behavior, and increased monitoring of threat-related cues and availability of potential attachment figures. It is the primary regulatory strategy of attachment anxiety (Mikulincer et al., 2003). One of the strengths of this model is its solid base in attachment theory as well as empirical research. It allows the prediction and testing of dynamic aspects of attachment formation and its regulatory function. This is of special relevance when examining the impact and consequences of insecure attachment strategies.

1.1 Insecure attachment as a bio-psycho-social risk factor

While attachment insecurity has to be considered a normal facet of development (Bakermans-Kranenburg et al., 2009), theoretical as well as empirical evidence suggests that insecure attachment may narrow regulatory strategies and therefore serve as a risk factor. Maunder & Hunter (2001) provided the first comprehensive review on how attachment insecurity may influence disease processes and coping strategies. In their seminal paper, they outline several possible pathways: *First*, attachment insecurity may alter physiological stress

responses by increased perceived stress, impaired biological stress physiology, and reduced abilities for an adequate social modulation of stress. A *second* pathway describes an increased use of external, maladaptive factors for affect regulation, such as substance abuse, problematic eating tendencies, or higher risk-taking regarding sexual behavior. All of these factors increase the general risk for disease development. A *third* pathway comprises a more general impaired use of protective factors, such as seeking professional help, using social support, differences in attending to ones symptoms, or problems in treatment adherence and compliance. A *last* aspect of the model comprises differences in symptom reporting and healthcare utilization in more insecure individuals.

The paper stimulated a large body of research and was updated and refined (Maunder & Hunter, 2008). For example, avoidant attachment negatively influenced adaptive processes, treatment adherence, and physician-patient-relationship in individuals with diabetes (Ciechanowski, Katon, Russo, Von Korff, Ludman, Lin, et al., 2004), and moderated the relationship between disease severity and comorbid depressive symptoms in ulcerative colitis (Maunder, Lancee, Hunter, & Greenberg, 2005). Ciechanowski, Walker, Katon, and Russo (2002) report interactions between different aspects of attachment anxiety, symptom reporting, and increased health care utilization. Finally, insecure patients are also perceived as 'more complicated' by medical personnel (Maunder, Panzer, Viljoen, Owen, Human, & Hunter, 2006). A recent cross-sectional study by McWilliams and Bailey (2010) found attachment avoidance to be associated with pain-related health conditions, while attachment anxiety was predictive for a wider range of diseases, including pain, cardiovascular problems, and ulcers. When controlling for lifetime depression, anxiety, and substance abuse, the effects for avoidant attachment failed to reach a conventional significance level, while anxiety was still related to pain and cardiovascular diseases. Although the study was limited in several ways, such as a simple questionnaire for the assessment of attachment, and the cross-sectional nature of the data, it raises at least one important question: What are the differences in regulatory strategies between anxious and avoidant attachment? And, more specifically, is the disappearance of interrelations between attachment avoidance and health-related conditions just a statistical problem caused by correlations between psychological symptom load and attachment questionnaire data, or is it an indicator of how formally adaptive, regulatory functioning of avoidant strategies can be disturbed? To approach these questions, it may be helpful to review two biological models of stress regulation as a framework for predicting and conceptualizing the influence of insecure attachment on stress physiology.

1.1.1 Regulatory models of human stress physiology

A fundamental component of stress research concerns the adaptiveness of human regulatory biology. Most models are based around the ideas of homeostasis, allostasis, and allostatic load. Traditionally, homeostasis refers to the maintenance of a system's or organism's stable internal state, often within the range of normal values. However, this view underemphasizes inter-individual differences as well as dynamics of changing environmental conditions.

Expanding on classical concepts of homeostasis regulation, one of the most influential contributions to the understanding of stress and disease stems from the model of allostasis and allostatic load. Allostasis, also defined as 'stability through change', refers to adaptive processes of the body and the brain to changing internal or external demands. The main purpose of these processes is protection, which implies that remaining in a state of psychophysiological equilibrium may not always be the best solution for maintaining health, but rather optimal responsiveness. Allostasis involves a wide array of biological systems, such as cardiovascular, metabolic, immune, and brain functions (McEwen, 1998). Adaptive responses are usually characterized by the ability to quickly mobilize for example energy, but also down-regulate effectively in the absence of demands. However, through dynamic changes of internal milieus, allostasis can also place a burden on an individual's regulatory biological systems. The conditions under which the 'wear and tear' of adaptation may lead into pathogenic states are described in the model of allostatic load (Juster, McEwen, & Lupien, 2010). Constant activation of biological response systems through sustained stress, insufficient down-regulation in the absence of a stressor, and inadequate responding of allostatic systems with possibly detrimental effects on counter-regulatory systems lead to allostatic states. These may develop into subclinical, prodromal stages of physiological dysregulation, and even result in long-term shifts in psychophysiological response patterns, explaining at least some of the inter-individual differences in autonomic control described in the literature (e.g., Berntson, Cacioppo, Quigley, & Fabro, 1994). Disease processes follow phases of allostatic overload, which are characterized by continuous and accumulated dysregulative patterns. The model of allostasis and allostatic load is important for psychophysiological research as it offers a framework for the understanding of sometimes diverse findings, and also facilitates the estimation of possible impacts on health psychology.

Drawing on evolutionary psychology and life history theory, the Adaptive Calibration Model (ACM) incorporates and expands the concept of allostatic load (Del Giudice, Ellis, & Shirtcliff, 2011). According to the ACM, the human stress response system, including the

sympathetic (SNS), parasympathetic nervous system (PNS), and the hypothalamic-pituitary-adrenal axis (HPA), has three main functions. *First*, it coordinates the biological aspects of allostasis. *Secondly*, it organizes an individual's openness for environmental information. Activation of the stress response system itself provides information for the organism, what the authors describe as a "statistical summary of key dimensions of the environment" (Del Giudece et al., 2011). This relates directly to an individual's responsivity, as it either amplifies or filters environmental information. A *third* function lies in the regulation and integration of individual differences in psychophysiological and behavioral patterns across the life-span. The ACM allows us to predict four 'phenotype' patterns of stress response to different external or internal demands: sensitive, buffered, vigilant, and unemotional.

To summarize briefly, the *sensitive pattern* is characterized by high baseline and high responsivity of the PNS, moderate SNS and HPA baseline activity, and a mixture of moderate (SNS, HPA) to high (possibly SNS) reactivity. The psychophysiological feedback loops are associated with and allow for a high amount of openness towards the environment, self-awareness, cooperation, and mentalization. This pattern is thought to emerge in either a low-arousal, or protected environment, with adequate co-regulative experiences. The *buffered pattern* develops in a context of early, modest activation of the stress response system. PNS, SNS, and HPA baseline as well as reactivity scores are usually moderate, probably with a general parasympathetic dominance. The developmental context of the *vigilant pattern* is characterized by a dangerous and unpredictable environment, with repeated early activation of stress response systems. SNS and HPA baseline and reactivity are high, with low PNS during rest and also low to moderate PNS reactivity. Vigilant patterns complicate learning and cooperation because of constant monitoring and hyperarousal, including either agonistic or withdrawal tendencies, which the authors attribute in part to sex differences. The *unemotional pattern* develops alongside severe early traumatization, and results in low baseline stress levels and blunted reactivity in non-agonistic challenges. On a behavioral level, this pattern is accompanied by low empathy, low cooperation, and antisocial personality features. To sum up, key features of the ACM are the focus on the integration of allostasis, life history, and long-term, regulatory feedback loops, and the description of a non-linear relationship between biological stress response systems, psychophysiological responsivity, and life history. Highlighting the variability of psychophysiological response systems, it demands for caution in the interpretation of the results of present studies on biological responses to psychological stress.

1.1.2 Attachment-related stress regulation and psychophysiological response in adults

Although stress regulation is a central function of attachment theory, related systematic research on psychophysiological responses in adults started to unfold just over the last decade. The following section first describes central ideas on the topic in general. In a second step, results of a literature review on attachment and cardiovascular function in adults are presented.

In an influential paper, Diamond (2001) summarized the existing empirical literature, and described emerging topics concerning interrelatedness of psychological processes with ANS, HPA axis, and neuromodulatory substances. Another focus of the paper concerns normative processes in attachment formation on the one, and psychophysiology as a marker as well as a re-enforcer of co-regulative processes in dyads on the other hand. In other words, psychophysiological states may serve as 'hidden regulators' in the development of attachment bonds and internalization of attachment-related experiences. For example, higher security and the presence of attachment figures have the potential of improving psychophysiological regulatory abilities, which in turn strengthen the connection with the significant other. Additionally, repeated positive co-regulative experiences may even 'retune' formerly dysregulated biological processes and allostatic states over time, although the latter could be a rather rare phenomenon given that anxious or avoidant defensive processes tend to reproduce and facilitate insecure interactive experiences (Dykas & Cassidy, 2011). However, the notion of the interconnectedness of inter-individual psychophysiological response-patterns and life experiences or personality variables by long-term feedback-loops and conditioning processes is intriguing, and fits well with contemporary biological models as discussed in chapter 1.2.1.

Other important aspects of attachment-related stress-reaction are discussed by Sbarra and Hazan (2008) with regard to separation and loss experiences. They argue that co-regulation of psychophysiological arousal as a "property of the relationship itself" is a necessary element of an attachment-relationship, as opposed to overall stress-buffering effects of mere social support. Separation and loss experiences would remove this regulator and result in increased biological dysregulation. Sbarra and Hazan conceptualize this as a continuum, starting from mild irritation, via non-specific, disorganized psychophysiological arousal, to an organized, 'full-blown' stress-response involving HPA and SNS activation, which demand for successful self- or co-regulation to decrease levels of allostatic load and restore a sense of felt security. A central thought for the current project is the assumption of a

continuum concerning intensity and structure of the stress response depending on the significance of a given (or imagined) event.

The studies presented in this dissertation project exclusively rely on stress indices of cardiovascular physiology, for several reasons: Its methods are field-tested, and directly relevant for health psychology and psychosomatic medicine, linking psychological processes to possible risk-factors as described in chapter 1.2 (e.g., Ehrenthal, Herrmann-Lingen, Fey, & Schauenburg, 2010). Cardiovascular stress physiology also provides a middle level of responsivity to internal processes, being less sensible than for example electrodermal activity, but still more easy and timely to arouse than a full response of the HPA axis as measured by cortisol (e.g., Hubert & de Jong-Meyer, 1991). The following passage therefore exclusively reviews scientific work on cardiovascular stress response. For other biological markers we refer to the paper by Diamond and Fagundes (2010), or recent studies such as Dewitte, De Houwer, Goubert, and Buysse (2010). Please also note that studies with children and adolescents were also excluded, as none of these populations is studied in our research. Therefore the work by Gallo and Matthews (2006), who found augmented blood pressure responses to interactions with friends to be related to higher attachment anxiety, but augmented blood pressure reactions during conflicts to be associated with attachment avoidance in an ambulatory monitoring study, is also omitted from the review. Before combining the presented ideas and evidence into a model, main findings of associations between adult attachment and cardiovascular stress physiology will be briefly summarized.

Expanding the work by Diamond (2001) and Diamond and Fagundes (2010), we conducted a literature review on relevant papers concerning attachment and stress physiology. Only published studies on cardiovascular reaction and attachment in adults were included, which are summarized in Table 1. When examining the results, a wide variety of research methods concerning stress induction and assessment of attachment can be observed, as well as inconsistencies regarding psychophysiological outcome. At least two patterns seem worth mentioning. Studies that find results concerning attachment and cardiovascular parameters more often apply paradigms specifically designed for use in cardiovascular stress physiology, while more naturalistic procedures like the Adult Attachment Interview (AAI, see chapter 2) are more often associated with electrodermal activity as measured by skin conductance level (SCL).

However, the picture is more complex, and the contradictory findings are difficult to explain using conventional approaches of directly relating attachment styles to biological processes as main effects.

Table 1. *Studies on attachment and cardiovascular stress reaction in adults*

Authors	Sample	Measurement of attachment	Attachment-specific stress induction?	Key results
Carpenter & Kirkpatrick (1996)	N = 34 female students	Self-report (categorical: Hazan-Shaver; continuous: Simpson)	No (anticipation of stressful experience, but specific in terms of presence vs. absence of a partner)	- in more avoidant women cardiovascular reactivity (mostly HR, SBP) is higher when their partner is present - similar pattern in more anxious women
Feeney & Kirkpatrick (1996)	N = 35 female students	Self-report (AAQ)	No (mental arithmetic task, but specific in terms of presence vs. absence of a partner)	- in more anxious (vs. non-anxious) women the absence of the partner is associated with higher HR and DBP, and continued elevated HR and DBP - a similar pattern is found in more avoidant (vs. non-avoidant) women, but only on a trend level
Mikulincer (1998)	N = 30 students	Self-report (Hazan-Shaver, categorical)	No (anger eliciting scenario imagination)	- anxious-ambivalent and avoidant individuals have higher HR increase - avoidant individuals present a decoupled, incongruent pattern of increased hostility attribution, increased HR, but low reported anger
Diamond & Hicks (2005)	N = 75 young men	Self-report (ECR)	No (anger and anxiety induction by mental arithmetic + "harassment"; anger recall)	- current emotional relationship security is positively associated with resting vagal tone (RSA) - attachment anxiety is negatively associated with resting vagal tone (RSA), if current emotional security is not controlled for
Maunder, Lancee, Nolan, Hunter, & Tannenbaum (2006)	N = 67 healthy, middle-aged participants	Self-report (ECR-R)	No (stressful event recall, PASAT)	- attachment anxiety is positively related to perceived chronic stress - attachment avoidance is negatively related to HF-HRV at baseline
Kim (2006)	N = 33 healthy, young heterosexual couples	Self-report (RQ-2 analyzed dimensionally: anxiety, avoidance)	Yes (movie clips dealing with relationship problems and relationship scenario discussion)	- interactions between perceived situational stress and attachment on cardiovascular reactivity: under conditions of higher levels of stress … o … attachment avoidance is associated with lower RPP o … attachment anxiety is associated with higher DBP & RPP
Lawler-Row, Younger, Piferi, & Jones (2006)	N = 108 undergraduate students	Self-report (RQ: categorical, secure vs. insecure)	Yes (betrayal recall; parent/non-parent)	- secure individuals have generally lower SBP - secure men display better recovery after the betrayal recalls than insecure men

				- the secure group has better recovery in DBP - the secure group has lower MAP after the parent betrayal recall, and lower MAP during and after the non-parent betrayal recall
Smeets (2010)	N = 68 undergratuates	Self-report (ECR)	No (Trier Social Stress Test, TSST)	- no effects of attachment on HR, HF-HRV, alpha amylase, or cortisol
Lee, Sbarra, Mason, & Law (2011)	N = 119 recently separated adults	Self-report (ECR-R)	Yes (divorce-specific mental activation task, DMAT)	- individuals high in anxiety who also talked about their separation experiences in a personally engaged way have higher SBP and DBP at the beginning of the DMAT - mixed results concerning SBP and DBP reactivity
Roisman, Tsai, & Chiang (2004)	N = 60 young adults	Interview (AAI: Kobak Q-Sort)	Yes (monitoring during AAI)	- higher AAI deactivation is associated with increase in SCL - no associations between security/insecurity and SCL or attachment and cardiovascular reactivity (e.g. IBI)
Roisman (2007)	N = 80 couples	Interview (AAI: Kobak Q-Sort)	Yes (relationship disagreement discussion)	- more dismissing attachment is associated with higher SCL reactivity - more preoccupied attachment is associated with higher HR reactivity
Groh & Roisman (2009)	N = 60 undergraduate students	Interview (Secure base script know-ledge: Attachment Script Assessment)	Possibly (listening to infant crying and laughter, probably related to caregiving)	- the lower the secure base script knowledge, the higher SCL reactivity in response to infant crying - no effects of secure base script knowledge on HR or HR reactivity
Holland & Roisman (2010)	N = 115 couples at T1, N = 47 couples at T2	Interview (AAI: Kobak Q-Sort)	Yes (relationship disagreement discussion)	- more AAI security is associated with lower SCL reactivity at T1 - no effect of AAI dimensions on SCL at T2 - no effects of AAI dimensions on HR and HF-HRV
Dias, Soares, Klein, Cunha, & Roisman (2011)	N = 47 young adult women with mixed eating disorders	Interview (AAI: Kobak Q-Sort)	Yes (AAI)	- higher insecurity is associated with smaller increase in SCL during several AAI questions - some evidence for an impact of security on sympathico-vagal balance - no effects for HR

Note. AAI = Adult Attachment Interview; AAQ = Adult Attachment Questionnaire; DBP = diastolic blood pressure; DMAT = divorce-specific mental activation task; ECR = Experiences in Close Relationships questionnaire; ECR-R = Experiences in Close Relationships – Revised questionnaire; HF-HRV = high-frequency heart rate variability; IBI = inter-beat interval; MAP = mean arterial pressure; PASAT = paced auditory serial addition test; RPP = rate-pressure product (heart rate x systolic blood pressure); RQ = relationship questionnaire; RSA = respiratory sinus arrhythmia; SCL = skin conductance level. Mostly results directly related to attachment and cardiovascular stress reaction are reported from the studies.

For example, the stressor in the study by Smeets (2010) is usually highly capable of eliciting strong responses of the PNS, SNS, and HPA axis, but still did not produce any associations between attachment and psychophysiology. One could argue that this specific stressor was not attachment-related, but Maunder and colleagues (2006) also used a non attachment-specific stressor. Further inconsistencies regard psychophysiological function during relationship discussions: Kim (2006) reports associations between attachment and cardiovascular stress, but Holland and Roisman (2010) do not. This divergence cannot solely be explained by the use of different assessment of attachment strategies (see chapter 2), as Holland and Roisman were unable to replicate earlier results with regard to heart rate by Roisman (2007), whose study was parallel concerning the use of the AAI and a relationship discussion procedure.

A different explanation for the discrepancies may be provided by attachment theory itself: Most of the cited authors propose a direct influence of attachment on stress regulation, with the exception of Carpenter and Kirkpatrick (1996), Feeney and Kirkpatrick (1996), and Kim (2006). However, when taking into account the defensive function of insecure adult attachment and biological models of regulation, it would be more relevant to test indirect pathways that moderate under what conditions this regulatory system is activated so that it influences cardiovascular stress response.

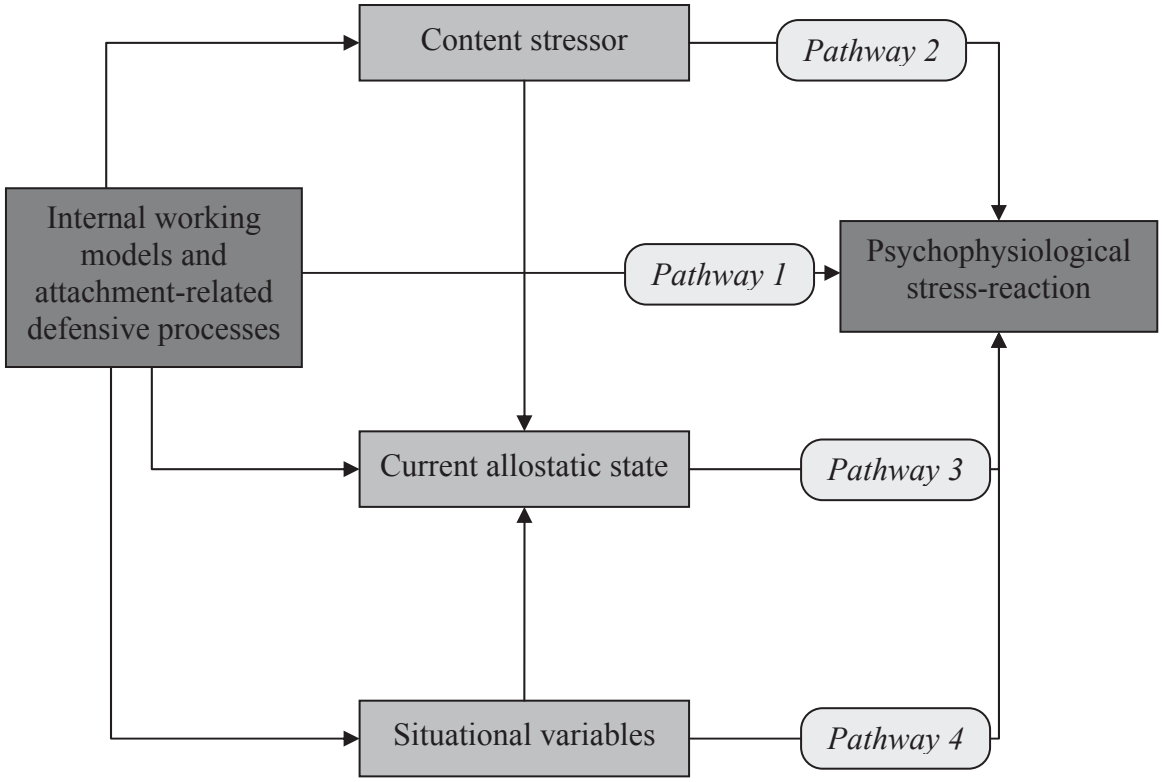
1.2 From attachment insecurity to human stress response – development of a model

Integrating ideas from attachment-related defensive functioning, psychosomatic medicine, regulatory biological states, and recent findings from direct studies of attachment and cardiovascular stress reaction, we propose a conceptual model for the systematic testing of moderational hypotheses. It comprises the key components IWM and related defensive processes, content of the stressor, current allostatic state, situational variables, and psychophysiological stress reaction (see Figure 1). Within this model, four testable, interacting pathways arise.

The *first pathway* describes a direct, biological influence of attachment on stress physiology, resulting either from very early shaping of the stress systems through epigenetic processes (Maunder & Hunter, 2001; Zhang & Meaney, 2010), long-term changes in stress physiology through sustained allostatic load (Juster et al., 2010), or both. This pathway is probably more related to early, non-conscious psychobiological states than to dynamic defensive processes. Most studies from Table 1 more or less implicitly test this first, direct

pathway (Diamond & Hicks, 2005; Dias et al., 2011; Groh & Roisman, 2009; Holland & Roisman, 2010; Lawler-Row et al., 2006; Maunder et al., 2006; Mikulincer, 1998; Roisman, 2007; Roisman et al., 2004; Smeets, 2010), with conflicting results.

Figure 1. *A basic moderational model for the influence of attachment on stress physiology*



The *second pathway* describes the interaction between attachment-related regulatory processes and the content of the stressor. We propose that some stressor-specific contents activate the need for defensive processes of the attachment system, and therefore psychophysiological up- or downregulation, while others remain undetected from the monitoring module of the attachment system as proposed by Mikulincer, Shaver, and Pereg (2003). In other words, attachment defensive function will only show its impact on stress physiology when internal or external threat or distress is high enough. We operationalize this pathway by manipulating the personal significance of the content of the stressor in study III (chapter 4). The *third pathway* emphasizes the influence of current allostatic states on the regulatory capacity of attachment defensive functioning with regard to psychophysiology. Attachment theory proposes that insecure strategies narrows regulatory capacities in the long run, and benefits of especially attachment avoidance may disappear when an individual experiences cognitive or emotional load (Dykas & Cassidy, 2011). This pathway is to some

extend addressed in the study by Kim (2006) who assessed moderational influence of a state of subjective distress evoked by relationship stressors. Not only related to allostasis, but also to an inner state of personal engagement is the paper by Lee et al. (2011). We operationalize this pathway in study IV (chapter 5) by testing the impact of psychological symptom load and current life stress as naturalistic moderators of the relationship between attachment insecurity and psychophysiological reactivity. The *fourth pathway* incorporates findings concerning situational variables from social support as well as inter-individual differences in feeling comfortable with opening up to another person (Carpenter & Kirkpatrick, 1996; Diamond, 2001; Feeney & Kirkpatrick, 1996; Mikulincer, Shaver, & Pereg, 2003). This pathway is not directly addressed in this dissertation project, but may play a role in the interpretation of some of the results. In addition, the model accounts for interrelations between the different pathways, which can be tested in multiple moderational or meditational analyses.

2. Study I: Assessment of adult attachment

The assessment of adult attachment draws on two traditions: the developmental-clinical perspective, and the social psychology perspective. While the former developed and refined mostly interview-based methods for the assessment of attachment-related states of minds, the latter designed questionnaires for assessing attachment styles, often towards romantic partners. Both sides tended to avoid incorporating or relating to the other tradition (Shaver & Mikulincer, 2002).

The most prominent method of interview-based assessment of adult attachment states of mind is the Adult Attachment Interview (AAI). It is particularly known for its predictive transgenerational value concerning children's attachment classification (see Bakermans-Kranenburg & van Ijzendoorn, 2009). The AAI is a semi-structured interview which comprises 18 questions, mostly concerning early interactive experiences with the primary caregivers. Interview verbatim transcripts are rated on several subscales with regard to what experience the given person might have had to his or her parents' loving behavior, role reversal, and other features, but more so on how the interviewee is behaving on a linguistic, discourse level. Ratings regarding for example coherence, idealization, lack of memory, dismissal of relationship experiences, or anger and vagueness of the narrative build the basis for the resulting AAI classification mentioned in chapter one (Hesse, 2008). Adding to the categorical method, there are also two commonly used ways of creating dimensional scoring. The approach by Waters, Treboux, Fyffe, Crowell, and Corcoran (2005) creates two

dimensions of security vs. insecurity, and dismissing vs. preoccupied attachment. A Q-Sort based system for the assessment of hyperactivation and deactivation on the basis of the AAI is provided by Kobak (1993). Recent research on the latent structure of the AAI indicates that the conceptualization of two dimensions of dismissive and preoccupied states of minds with regard to attachment may provide a better model-fit as well as a higher predictive value than the original security-insecurity distinction (Haydon, Roisman, Marks, & Fraley, 2011).

Questionnaires for the measurement of adult attachment have developed from single-item to complex, multi-item instruments of domain-specific assessment of attachment styles, and are widely used in a variety of research areas (Ravitz, Maunder, Hunter, Sthanikiya, & Lancee, 2010). However, questionnaires seem to measure different aspects of attachment than the AAI. For example, in a meta-analysis Roisman et al. (2007) found only small associations ($r = .09$) between AAI security and attachment self-report data, and $r = .15$ between AAI dismissing vs. preoccupied states of mind and avoidance as measured by questionnaire, respectively. Correlations for self-reported anxiety and AAI preoccupied states of mind were even lower ($r = .06$). Nevertheless, numerous studies have consistently linked attachment styles assessed by questionnaire to conscious as well as non-conscious aspects psychological and relationship functioning (Shaver & Mikulincer, 2002; Dykas & Cassidy, 2011). In other words, attachment questionnaires measure relevant, but distinct parts of the attachment system.

Early attachment classifications exclusively rely on categorical, prototype descriptions of attachment styles or states of mind. This may result from historical roots of a clinically informed approach towards personality, where prototype-formulations are a viable approach (e.g., Westen, Shedler, & Bradley, 2006). However, even the AAI can be refined by adding sub-classifications to existing categories (Hesse, 2008). There is increasing empirical evidence that the latent structure of attachment patterns of measures for children (as in the strange situation procedure; Fraley & Spieker, 2003) as well as adults (concerning the AAI; Haydon et al., 2011) is better represented by dimensional than categorical models. In an attempt to reappraise self-report measures of attachment, Fraley, Waller, and Brennan (2000) conducted analyses on 323 items of common questionnaires in a sample of more than 1085 undergraduates. Partitioning around medoids methods generated 30 empirical clusters, which were then examined using principal-axis factor analysis. This resulted in a two-factor solution of attachment related anxiety and avoidance. Ninety items that correlated high with the one, and low with the other factor were then subjected to item response theory (IRT) analysis using a graded response model procedure. On this basis 18 items were selected for each scale of

anxiety and avoidance, and the resulting questionnaire was named Experiences in Close Relationships – Revised (ECR-R). Using the same dataset, the authors were able to show superior test information function of the ECR-R compared to another well-known attachment questionnaire. The final questionnaire comprises 18 items on anxiety ("I'm afraid that I will lose my partner's love"), and 18 on avoidance ("I don't feel comfortable opening up to romantic partners") with regard to partner-related romantic attachment. Items are rated on a seven-point scale. Since its publication in the year 2000, the ECR-R has been widely used. Good test-retest reliability, factorial structure, as well as internal consistency are supported by independent analyses (Fairchild & Finney, 2006; Sibley, Fisher, & Liu, 2005; Sibley & Liu, 2004). To date, it remains the most thoroughly constructed questionnaire on partner-related attachment styles concerning psychometric as well as theoretical properties.

Main goal of the study by Ehrenthal, Dinger, Lamla, Funken, and Schauenburg (2009) was to translate and evaluate a German version of the ECR-R, the ECR-RD. Existing German attachment questionnaires at that time suffered from several disadvantages: They were either not up to date with regard to the two underlying dimensions of attachment anxiety and avoidance, burdened by psychometrical weaknesses, or constrained in terms of international comparability. With the authorization of R. Chris Fraley, Ehrenthal et al. (2009) performed a forward-backward translation on the original items, and evaluated the questionnaire in two German samples. The first, non-clinical group consisted of 1006 participants, the second of 225 individuals treated in inpatient psychotherapy clinics. Factor-analytical examinations supported the two-factorial structure of the ECR-RD. In both samples, Cronbach's α was high for anxiety and avoidance (.92/.91, and .92/.92, respectively). Concerning validity, the ECR-RD correlated substantially and in the expected direction with the subscales of another attachment questionnaire (RQ-2; Bartholomew & Horowitz, 1991), as well as partnership satisfaction, even when controlling for several covariates. The psychotherapy group exhibited higher values on both scales of the ECR-RD, with a medium effect size for avoidance, and a large effect for anxiety. This corresponds with earlier data (see Mikulincer & Shaver, 2007) as well as conceptual considerations (e.g., Morley & Moran, 2011). Another indicator for the validity of the ECR-RD was a substantial difference of its subscales related to general personality function: Both scales were significantly higher for patients with personality disorders (PD) than for patients without PD, again with medium effect sizes. This is of special relevance, as origins of PD are closely related to developmental processes influencing insecure and disorganized attachment formation (see Levy, 2005).

Summing up, the study by Ehrenthal et al. (2009) provided evidence for good reliability of the ECR-RD. Furthermore, interrelations between ECR-RD subscales and relationship dissatisfaction on the one, and ECR-RD and RQ-2 subscales on the other hand point towards adequate validity of the instrument. This is also supported by higher values in the clinical than the non-clinical group, as well as higher values for patients with PD. The ECR-RD is a viable questionnaire for the assessment of romantic attachment styles, and therefore used in all further studies of this dissertation project.

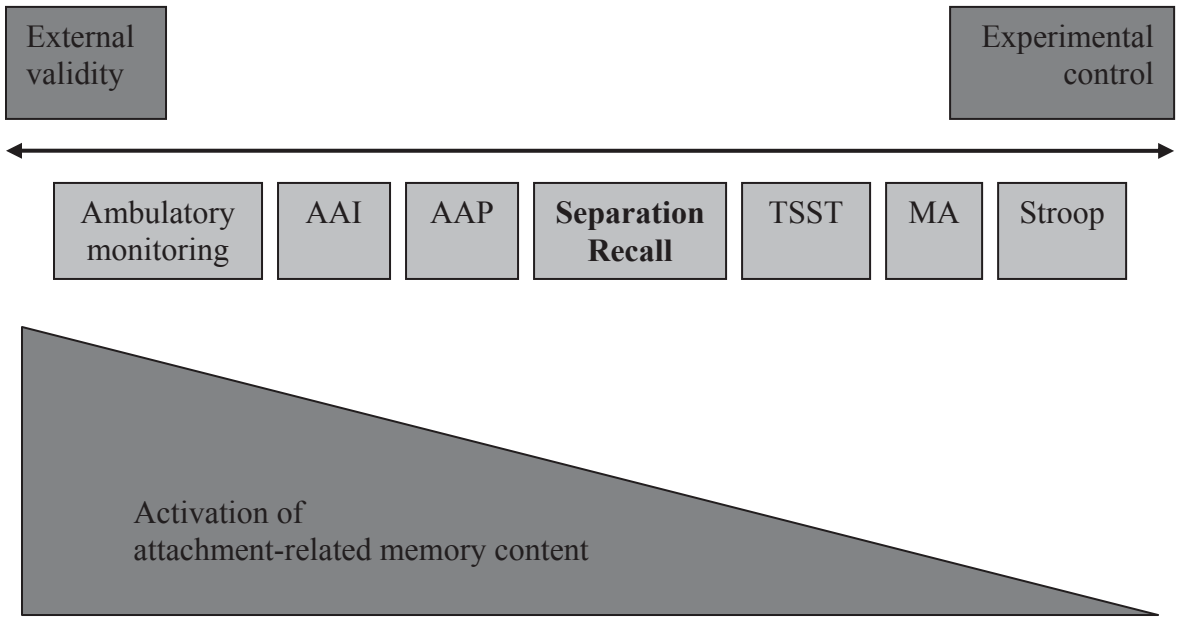
3. Study II: Development of an attachment-related short-term stressor

Existing studies on attachment and cardiovascular function in adults differ widely in their methods of stress induction (see chapter 2.1.1). However, when studying cardiovascular reactivity, methods actually matter. Using different tasks may result in dissimilar patterns of reactivity. Kamarck and Lovallo (2003) therefore recommend being specific with regard to the particular research question. This may include emotions involved, physical or psychological stimuli, and interpersonal challenges caused by a stressor. From an attachment perspective, the content of a task would also influence, which memories and related cognitions are activated or suppressed. Consequently, a simple mental arithmetic task could only test pathways 1 (direct influence of early experiences on any kind of physiological arousal) and 4 (relating attachment style to situational factors) from Figure 1. From another methodological point of view, length and controllability of a task are important as well. Measuring cardiovascular reactions during an attachment interview (for example 60 minutes, as in the AAI) results in a very complicated data structure. Although content and order of the questions of the AAI are always the same, the time it takes a participant to answer all questions can vary significantly. Longer measurement during a specific stressor may facilitate habituation effects, while measurements shorter than five minutes are not recommended for several physiological indices (Task Force, 1996).

Main goal of the study by Ehrenthal, Friedrich, and Schauenburg (2011) was to develop and test an attachment-related short-term stressor, the separation recall paradigm (SR). In line with Kamarck and Lovallo (2003), the SR is constructed to maximize variability in attachment-related responses rather than stress reaction in general. A second emphasis was to balance external validity, i.e. the activation of attachment-related memory content, with experimental control. The SR is therefore situated between established, unspecific stress

protocols, and procedures with high external validity concerning attachment activation, but probably limited internal validity (see Figure 2). From the interview procedures it takes the personalized approach of asking an open, but biographically relevant question, from the other side it borrows the standardization, especially regarding time. The SR is influenced by other commonly used recall tasks from psychosomatic medicine (e.g. anger recall interview, Prkachin, Mills, Zwaal, & Husted, 2001).

Figure 2. *Stressors in attachment research with regard to external validity and experimental control*



Note. AAI = Adult Attachment Interview; AAP = Adult Attachment Projective Picture System; TSST = Trier Social Stress Test; MA = Mental arithmetic task; Stroop = Stroop-Test.

The SR is introduced as a procedure which measures how the heart responds to certain memories and feelings. Usually preceded and followed by five-minute rest periods, the participants are invited to think about and report a situation from their lives, where they had felt lonely and abandoned, and wished that somebody would have been there for them. The experimenter then asks standardized questions on how they had felt in that moment, what kind of thoughts went through their heads, and what exactly they had whished at that moment, with the aim of keeping the attachment-related memory content processed and accessible for five minutes. Following completion of task, all participants are debriefed. The SR allows for systematic variations of content and personal significance of the reported situation. Because it

does not take long to accomplish, the SR is also suited for applied research such as the field of psychosomatic medicine.

In a sample of 50 healthy participants, Ehrenthal et al. (2011) compared psychophysiological and emotional response-patterns towards the SR with an established mental arithmetic subtraction task (MA). During the SR, attachment-related themes were presented, mostly related to conflict in close relationships, relationship break-up, relocation, and death or severe illness of a relative. Using an intra-individual design with counterbalanced tasks-order, both stressors produced emotional and cardiovascular responses. More specifically, both stressors elicited reactions concerning tension, anger, sadness, and happiness. While emotional arousal was generally higher for the MA, there was an additional significant task by arousal interaction. Participants showed more sadness and less happiness after the attachment-related SR, more tension, and a trend towards more anger after the MA. For cardiovascular data, both stressors produced reactions in heart rate (HR), systolic (SBP), and diastolic blood pressure (DBP). However, the pattern was again different for the two stressors: The MA was accompanied by higher HR during the stressor, the SR by higher DBP in the subsequent rest phase. Higher attachment avoidance as measured by the ECR-RD was related to impaired DBP recovery after the stressor, especially when taking into account the content of the reported situation. For participants talking about relationship conflict and breakup, which are more closely related to those aspects of attachment that are measured by the ECR-RD, avoidance was particularly correlated with impaired DBP recovery. No associations were found for attachment and psychophysiological recovery after the MA.

The study by Ehrenthal et al. (2011) provides first evidence that the SR task is a feasible paradigm for evoking cardiovascular and emotional reaction in general. It also indicates a certain degree of specificity with respect to attachment, as the patterns of reactivity and recovery differ between the task, and correlations between avoidance and blood pressure regulation were found for the SR only. The overall results are in line with research linking impaired blood pressure down-regulation to negative mood and prolonged internal representation of a stressor (Brosschot, Verkuil, & Thayer, 2010; Radstaak, Geurts, Brosschot, Cillessen, & Kompier, 2011). However, the results have to be evaluated with caution. We do not yet know exactly how attachment influences cardiovascular stress reaction (Figure 1), especially regarding the conditions of activation and deactivation of attachment-related defensive regulatory processes.

4. Study III: When is attachment-related defensive functioning starting to impact stress physiology?

A central component of the functioning of the adult attachment system concerns its regulatory nature. As the attachment system is just one of several regulatory structures (e.g. exploration, caregiving), it is not always fully activated. Activation of the attachment system is mainly initiated by threat appraisal processes. Drawing on a large body of research, Mikulincer and Shaver (2008) propose a two-stage approach to attachment activation. A first step concerns a preconscious activation of the attachment network, including related thoughts, emotions, behavioral tendencies, and memories or schemata of repeated interactions with significant others. For example, subliminal threat priming specifically facilitates accessibility of names of attachment figures and their mental representation (Mikulincer, Gillath, & Shaver, 2002). These representations influence subsequent automatic appraisal processes. In a second step, preconscious activation may transform into more conscious attachment-related thoughts, motives, and behavior.

Inter-individual differences in both the preconscious as well as the more conscious stage are intertwined with different attachment styles. For example, in more secure adults heightened accessibility of attachment-related memory content emerges in situations of threat only, and they more readily react to relationship themes with positive content than separation or loss (Mikulincer et al., 2002). Anxious individuals show a generally high accessibility to attachment-related names regardless of threat-level, and are more vulnerable to the accessibility of thoughts on rejection and loss. Avoidant reaction seems to mirror secure individuals' reaction, but change under conditions of cognitive load (see chapter 5).

The influence of IWM on the activation of preconscious and conscious parts of the attachment system may be guided by specific schemata or "scripts" for dealing with threatening situations (Ein-Dor, Mikulincer, & Shaver, 2011). A prototypical script for attachment anxiety would be to be vigilant, to react intensely to threat-related cues, to be relationship- and support-oriented, and to minimize distance from others when coping with the situation. When combining this script with a perspective of allostatic load, one can hypothesize that anxious attachment is especially related to a long-term change in counter-regulatory mechanism to deal with constant hyperarousal. From an attachment-perspective, it would also matter if another person is present or not. Although Carpenter and Kirkpatrick (1996) and Feeney and Kirkpatrick (1996) found contradictory results with regard to the presence or absence of a partner for cardiovascular function under stress, the stable tendency to minimize distance in attachment anxiety should make a difference. This is in line with

research on Relational Regulation Theory, that highlights the importance of co-regulatory processes in ordinary interactions for linking social support with health (Lakey & Orehek, 2011). A prototypical script for avoidance would be to downplay threatening cues as long as possible, engage in quick and more self-related protective actions, and to do this mostly by oneself. For cardiovascular stress physiology, one can speculate that a stressor would have to cross a threshold of importance or danger to affect avoidant regulatory function, but then the presence of another person would not make a difference in down-regulating arousal. These personality by situation or demand approaches are used in psychobiological capability approaches (see Coan, Allen, & McKnight, 2006). To sum up, the attachment system is not constantly activated, and intra-individual threat appraisal processes affect whether the attachment system is switched on or not.

To our knowledge, the study by Ehrenthal, Frank, Dinger, and Schauenburg (submitted) is the first attempt to systematically examine lower thresholds of attachment influence on cardiovascular regulatory function. Kim (2006) assessed perceived situational stress, but didn't experimentally manipulate it. In the study by Ehrenthal, Frank, et al. (submitted) including 49 healthy participants, heart rate (HR) and high-frequency heart rate variability (HF-HRV) were continuously measured during rest and the subsequent separation recall test. To approach the question of a threshold for the activation of attachment-related psychophysiological regulation, we manipulated the personal significance of the content of the SR, which corresponds to pathway 2 in Figure 1. Individuals were asked to briefly report two attachment-related situations, one with a high, and another with a lower level of personal significance. Participants were then randomized to report either the former or the latter situation during the SR. This approach has the advantage of creating an intra-individual difference in personal significance, so that general tendencies of what one is willing or able to remember or report are kept as constant as possible. In other words, inter-individual manipulation of significance of the content would be more vulnerable to a systematic influence of attachment-related information processing. Randomization was successful; the only difference in baseline variables concerned the a-priori rating of the personal significance of the situation. Multilevel repeated regression models revealed an interaction between attachment avoidance as measured by the ECR-RD and HR reactivity: In the condition of 'lower significance' of the SR content, higher avoidance was related to a larger increase in HR from rest to SR, while in the 'higher significance' condition this relationship was reversed. Increase in HR is usually related to increased allocation of energy to meet metabolic demands. On a psychological level, this may result from higher task difficulty, as avoidant

individuals usually try to suppress or refrain from talking about challenging attachment experiences, or from pre-set inner plans for related behavior, which is also known to increase HR (Sosnowski, Krzywosz-Rynkiewitz, & Roguska, 2004). The reversal of the pattern under conditions of higher significance of the memory content can be explained by a shutting-down of attachment related cognitions, emotions, and needs. This is in line with the model by Mikulincer et al. (2003). Contrary to the expectations, no effects were found for HF-HRV. This may be a mere statistical effect, as HF-HRV decreased, but not enough to reach a conventional significance level. However, it could also be related to other factors which we did not control for, such as situational variables (pathway 4 in figure 1), or sample effects with regard to dispositional dynamics (see pathway 1 in Figure 1, but also Del Giudice et al., 2011). The results partially parallel the paper by Kim (2006), where attachment was related to cardiovascular function especially in individuals who experienced heightened situational stress.

Importantly, there were no main effects for attachment as measured by questionnaire, which corresponds to several other studies mentioned in Table 1. This again stresses the importance of moderational factors when addressing attachment and stress regulation. Otherwise central dynamics of functioning of the attachment system are in danger to be systematically ignored. To sum up, the study by Ehrenthal, Frank, Dinger, and Schauenburg (submitted) provides first evidence that attachment avoidance starts to influence cardiovascular reactivity towards the presentation of an attachment-related memory only when a certain threshold of personal significance is crossed. Another relevant question is under which conditions these attachment-related regulatory processes function well, or whether they can be disturbed.

5. Study IV: Naturalistic disturbances of attachment-related defensive functioning

Insecure attachment is closely related to defensive regulatory processes (see chapter 1). However, when talking about defensive functioning, it is important to clarify what is being defended against. Attachment is conceptualized as a basic, inborn need, and attachment-related defensive functioning aims at regulating early as well as current frustrations of this need. In other words, attachment defensive functioning helps to survive in a world where social human beings are not always able to live in perfect close relationships. Defensive functioning is especially activated when an individual is confronted with a situation that is

similar to one which has led to suffering in the past (Dykas & Cassidy, 2011). Regulatory strategies of hyper- and deactivation as described by Mikulincer and colleagues (2003) are the result of empirical testing of Bowlby's conceptualization of two forms of defensive information exclusion, cognitive disconnection and deactivation (Bretherton & Munholland, 2008). Although defensive regulatory functioning is an ubiquitary phenomenon, often temporarily adaptive, and has to be considered part of normal development rather than a disorder, it may narrow regulatory flexibility under certain conditions. Most direct evidence for the fragility of insecure attachment strategies stems from experimental social and personality psychology (Dykas & Cassidy, 2011). Especially attachment avoidance is vulnerable to disturbances. In several experimental studies more avoidant individuals had an advantage in task performance, which would disappear once a component of cognitive or emotional load was added to the protocol (e.g., Gillath, Giesbrecht, & Shaver, 2009). However, these experimental studies indicated an influence of induced stress load on short-term performance. From a perspective of health psychology and psychosomatic medicine, however, it is even more important to discover long-term naturalistic stressors that mediate or moderate the influence of attachment on mental as well as physical health (Maunder & Hunter, 2001). In other words, it is vital to find out which psychological conditions influence an individual's internal milieu with regard to allostatic states strongly enough to disturb attachment-related defensive functioning (see pathway 3 in Figure 1).

The manuscript by Ehrenthal, Irgang, and Schauenburg (submitted) aims at examining the impact of two different forms of naturalistic stressors on the relationship between attachment and cardiovascular reactivity: current psychological symptom load, and perceived life stress. In two studies, these naturalistic stressors as well as attachment style were related to HF-HRV reactivity from baseline to separation recall (SR) as a measure of parasympathetic function. In a first study, influenced by theories on the intertwinement of stress and depression (Hammen, 2005), general symptom load was assessed by questionnaire in 49 healthy participants. Multilevel regression models revealed a main effect for symptom load in line with Ehrenthal et al. (2010), but just a trend for an interaction between attachment insecurity in general as measured by both subscales of the ECR-RD and symptom load on physiological reactivity. Under conditions of lower symptom burden, more attachment insecurity was related to a smaller decrease of HF-HRV, while the opposite was true for higher symptom burden. This was against the expectation that specifically avoidant defensive functioning would be influenced by our naturalistic internal stressor. However, in the sample both ECR-RD subscales were more highly correlated than expected, so we sought to replicate

and expand the results in a secondary analysis of data from 50 participants of the study by Ehrenthal et al. (2011; study II).

Using a similar design, in a first step we assessed main effects of symptom load as well as interactions with ECR-RD subscales on HF-HRV reactivity. Attachment avoidance was related to HF-HRV reactivity, but again on a trend level only. In a second step, we tested whether life stress would serve as a more potent moderator than symptom load. Not only is life stress a more conscious and less ambiguous factor than psychological symptoms, as for example depression can manifest itself in agitation as well as withdrawal. Also Fortuna and Roisman (2008) reported a moderational influence of life stress on the relationship between states of mind with regard to attachment as measured by the AAI and current burden of symptoms. In a second analysis of the study II dataset mentioned above, main effects and interactions of life stress with ECR-R subscales on HF-HRV reactivity were assessed while simultaneously controlling for symptom load and other covariates. The association between attachment avoidance, but not anxiety, and regulatory patterns was moderated by life stress. The decrease of HF-HRV from baseline to SR was generally larger when individuals scored both high on avoidance and life stress. This decrease can be seen as a withdrawal of vagal influence, indicating heightened psychological effort and physiological demand.

This again is to our knowledge the first attempt to transfer earlier results from experimentally induced short-term load to a more ecologically valid area and stress physiology. Both studies of the paper indicate that naturalistic long-term stressors such as symptom load, but even more life stress, can impair formerly adaptive defensive function of attachment insecurity on psychophysiological states. It also calls to attention assessing and controlling for this aspect in other experimental studies on attachment-related defensive processes, as it is possible that the impact of life stress is not limited to cardiovascular function, or symptom load as in Fortuna and Roisman (2008). On a seperate level, the results point towards the interrelatedness of defensive function and the concept of allostatic states (see chapter 1.2.1) for health outcome: Especially - or only - when attachment-related defensive processes start to influence allostatic biological states, an impact on mental as well as physical health is to be expected. On the other hand, a change in allostatic states related to internal or external demands may be a pre-condition of the break-down of the adaptiveness of defensive function. Although we cannot conclude from our data that these processes are related to attachment-specific stress induction only, by ensuring external validity as well as experimental control through the SR approach, we are able to be more specific in the testing

and interpretation of the results than other studies on psychophysiological stress reaction and attachment.

6. Conclusion

Attachment theory is a fascinating, vital, and still growing approach to relationship-oriented regulatory processes. Although research on cardiovascular function has considerably increased over the last decade, methods and results are inconsistent. Drawing on Bowlby's original concept of attachment-related defensive functioning, biological regulatory models, and previous publications, this dissertation project attempts to contribute to the topic by providing and testing an integrative model on different pathways from attachment to stress reaction. Special emphasis is placed on moderators of attachment activation and deactivation, and on conditions that impair regulatory function in more insecure individuals. A key message of our findings can be delineated as follows: When studying attachment and stress reaction, it is advisable to be precise with regard to the underlying theory.

After successfully translating and evaluating an internationally well-established attachment questionnaire as a basis for the subsequent research (study I), the second aim was to develop a research paradigm for studying attachment-related cardiovascular reaction. The separation recall (SR) proved good performance in a first study in comparison to a mental arithmetic subtraction task (study II) concerning stress induction as well as attachment-related specificity. Study III provides first evidence that the significance of the content of an attachment-related memory may serve as a set-point or indicator for when attachment-related, avoidant defensive processes are put into use in down-regulating cardiovascular reaction (pathway 2 in Figure 1). The fourth paper (study IV) shows that the impact of life stress on cardiovascular function parallels the influence of experimentally induced mental load on performance tasks in social and personality psychology. This is interpreted as an interplay between changed allostatic state, for example during job strain, examinations, and the like, current cognitive load, and the inflexibility of especially avoidant defensive functioning (pathway 3 in Figure 1). Two pathways of the model in Figure 1 have therefore received preliminary support from the data.

The psychophysiological studies in this dissertation project are by no means sufficient to draw strong or even final conclusions on the discussed matter, as they need replication in larger samples. However, they contribute in a substantial way to the literature, as they propose first evidence for a testable model of relevant and ecologically valid moderators. If it is true,

that the adaptivity of health-related, regulatory defensive parts of the attachment system depends on significance and valence of the content of what is experienced and remembered, as well as internal allostatic states, future research needs to be more careful in selecting situations and paradigms where these processes can be expected. Also earlier results should be re-evaluated, especially in cardiovascular physiology and health psychology (McWilliams & Bailey, 2010).

As the reported studies include mostly relatively secure participants, expanding the range of attachment insecurity may help to clarify whether relationships between regulatory function of attachment and stress physiology follow a linear or nonlinear pattern. In addition, it would be interesting to assess attachment representations by procedures as the AAI and simultaneously attachment style by questionnaire and compare the results. This could help to advance attachment theory as it has the potential of clarifying the influence of more conscious vs. more automatic aspects of IWM.

Future studies should also strive to maximize clarity by testing a single pathway of the model while keeping all others constant. Another important aspect is to assess and manipulate situational variables, such as the behavior of the experimenter during the SR, or security priming during the down-regulation from the stressor, to name a few. A third attempt could be to identify or clarify other moderating factors to expand the proposed model. Discovering attachment-related moderators of ecological validity may also improve the understanding of perceived social support, and the formation and disturbance of attachment relationships and attachment security (Cyranowski, Hofkens, Swartz, & Gianaros, 2011). Precise knowledge about psychophysiological responses in attachment-related situations could also play an important role in the understanding of hidden regulators and re-enforcers in co-regulative and self-regulation processes, which is considered one of the main topics of future attachment research (Sbarra & Hazan, 2008).

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Appendix: Original articles

Study I

Ehrenthal, J. C., Dinger, U., Lamla, A., Funken, B., & Schauenburg, H. (2009). Evaluation der deutschsprachigen Version des Bindungsfragebogens "Experiences in Close Relationships - Revised" (ECR-RD). *Psychotherapie, Psychosomatik, Medizinische Psychologie, 59*, 215-223.

Study II

Ehrenthal, J. C., Friederich, H.-C., & Schauenburg, H. (2011). Separation recall: Psychophysiological response-patterns in an attachment-related short-term stressor. *Stress and Health, 27*, 251-255.

Study III

Ehrenthal, J. C., Frank, S., Dinger, U., & Schauenburg, H. (submitted). Significance of memory content influences attachment-related stress reaction. *Journal of Research in Personality*

Study IV

Ehrenthal, J. C., Irgang, M., & Schauenburg, H. (submitted). Insecure attachment and the breakdown of regulatory defenses under high life stress: Psychophysiological evidence. *Journal of Social and Clinical Psychology*

Evaluation der deutschsprachigen Version des Bindungsfragebogens „Experiences in Close Relationships – Revised“ (ECR-RD)

Evaluation of the German Version of the Attachment Questionnaire „Experiences in Close Relationships – Revised“ (ECR-RD)

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Key words
- Attachment, Experiences in Close Relationships – Revised (ECR-R)
- psychopathology
- health psychology
- test validation

Zusammenfassung

Der „Experiences in Close Relationships – Revised“ (ECR-R) ist ein gut entwickelter und international verbreiteter Fragebogen zur Erfassung von Bindung. Die deutschsprachige Version (ECR-RD) wurde in einer großen nicht klinischen (n = 1006) und einer psychosomatisch-psychotherapeutischen Stichprobe (n = 225) evaluiert. Die guten psychometrischen Eigenschaften konnten bestätigt werden (Cronbach's α = 0,91/0,92), ebenso gab es Hinweise auf Konstruktvalidität. Die klinische und nicht klinische Stichprobe unterschieden sich im ECR-RD voneinander, ebenso wurde ein besonderer Einfluss von Persönlichkeitsstörungen festgestellt. Der ECR-RD ist damit ein international vergleichbares Instrument zur Erfassung von partnerschaftsbezogener Bindung, welches sich für den Einsatz gerade in psychosomatisch-psychotherapeutischen Stichproben bewährt hat.

Abstract

The „Experiences in Close Relationships – Revised“ (ECR-R) is a well developed instrument for assessing attachment in adults, which is used in different research areas around the world. In this paper the German version (ECR-RD) was evaluated in a large non-clinical (N = 1006) and a clinical sample (N = 225). Overall, the good psychometrical properties were confirmed (Cronbach's α = 0,91/0,92), we also found evidence for construct validity. There was a substantial difference between the two samples in the ECR-RD as well as a specific impact of comorbid personality disorders. The ECR-RD can be seen as a reliable, internationally comparable instrument for assessing romantic attachment representations that can be used in clinical samples.

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Einleitung

Ein halbes Jahrhundert nach ihrer Entstehung hat die Bindungstheorie im Feld der psychosomatisch-psychotherapeutischen Forschung einen bedeutsamen Platz eingenommen.
Sie bietet ein biopsychosoziales Modell zur Betrachtung grundlegender Tendenzen menschlichen Verhaltens und Erlebens in Bezug auf den Einsatz von zwischenmenschlicher Nähe und Distanz zur Stress- und Affektregulation in Situationen subjektiv erlebter Bedrohtheit [1,2]. Bindungsforschung stellt Fragen nach Ätiopathogenese, Schutz- und Risikofaktoren, aber auch nach Veränderungsmöglichkeiten relativ stabiler Persönlichkeitsmerkmale in einem theoretisch fundierten und empirisch überprüfbaren Kontext intra- wie interpersoneller Entwicklung über die Lebensspanne [3 – 8].

Bindungstheorie

Eine zentrale Annahme der Bindungstheorie ist die eines evolutionär verankerten Bedürfnisses nach zwischenmenschlicher Nähe, welches bereits bei Kleinkindern in Situationen von Unwohlsein oder subjektiver Bedrohtheit ein komplexes psychophysiologisches „Bindungssystem“ aktiviert. Ziel und primäre Funktion des Bindungssystems ist das Herstellen von gefühlter Sicherheit, häufig durch eine Nähe und Schutz gewährende Person [1]. In Abhängigkeit von der Qualität wiederholter Reaktionen relevanter Bezugspersonen auf solche Bindungsbedürfnisse bilden sich im Kind relativ stabile „Innere Arbeitsmodelle“ zur Vorhersage, Interpretation und Regulation bindungsbezogener Verhaltensweisen, Gefühle und Gedanken [9 – 11]. In diesen Modellen werden nach Annahme der Bindungs-

theorie sichere, hyperaktivierende und deaktivierende Strategien in unterschiedlicher Ausprägung als relativ stabile Tendenzen bezüglich Erlebens- und Handlungsbereitschaft in bindungsrelevanten Situationen abgespeichert [12].

Bindung im Erwachsenenalter

Eine wichtige Annahme der Bindungstheorie bezieht sich auf ihre relative Stabilität und Wirksamkeit über die Lebensspanne. Ergebnisse von Simulations- und Längsschnittstudien [13 – 15] deuten auf komplexe Wechselwirkungen von Stabilität und Variabilität hin. Das primäre Bindungsmuster kann sich erfahrungsbasiert verändern und ausdifferenzieren, außerdem äußern sich Bindungsbedürfnisse später anders als z. B. in vorsprachlichen Jahren [9,16]. Trotzdem kann von einer hohen Bedeutsamkeit von Bindung im Erwachsenenalter ausgegangen werden, z. B. im Rahmen von Partnerschaften [17,18]. Letztere sind, theoriekonform, ebenfalls auf das Aufrechterhalten von Nähe ausgerichtet, lösen bei (forcierter) Trennung Distress aus und fungieren als „sicherer Hafen" und „sichere Basis" [19].
Bindung im Erwachsenenalter wird zudem u. a. mit psychosomatischen Fragestellungen [7], Psychotherapie [5] und Persönlichkeitsstörungen in Verbindung gebracht.

Erfassung von Bindung

Während Bindungsstrategien bei Kindern vor allem über Verhaltensbeobachtung erfasst werden [20], hat sich die Bindungsdiagnostik des Erwachsenenalters in zwei bedeutsamen Traditionen entwickelt. Dies sind zum einen die aus Entwicklungspsychologie und Psychotherapie stammenden Interviewmethoden und projektiven Verfahren [21], zum anderen die in der Tradition der Persönlichkeits- und Sozialpsychologie entwickelten Fragebogenmethoden, die Bindung durch Selbstbeschreibung und Partnerschaftsrepräsentationen messen.
Es gibt eine lange Debatte über Vor- und Nachteile der verschiedenen Verfahren [10], die wahrscheinlich für die Praxis mit einem konsequenten „Sowohl-als-auch" beantwortet werden sollte. Beide Traditionen konnten, trotz der wiederholten Feststellung allenfalls moderater empirischer Zusammenhänge untereinander [22,23], zeigen, dass sich mit ihren Methoden bindungsrelevante Hypothesen sinnvoll überprüfen lassen [10]. Während sich Interviewsituationen wie z. B. Adult-Attachment-Interview (AAI) oder Erwachsenen-Bindungs-Prototypen-Rating (EBPR) und projektive Verfahren wie z. B. das AAP [24] gerade durch die Reichhaltigkeit der gewonnenen Informationen auszeichnen, spricht für Fragebögen insbesondere ihre ökonomische Anwendbarkeit.

Die amerikanische Originalversion des ECR-R

Fragebögen zur Erfassung von Bindung haben sich von einfachen Selbstzuordnungen mit einzelnen umschriebenen Bindungsstilen hin zu komplexen Instrumenten der Bindungsforschung entwickelt. Trotzdem beklagten Shaver und Mikulincer [25] noch vor wenigen Jahren Defizite in Bezug auf die theoretische Fundierung sowie empirische Weiterentwicklung von Bindungsfragebögen. Unter anderem vor diesem Hintergrund wurde der Fragebogen „Experiences in Close Relationships – Revised" (ECR-R) entwickelt [26].
Theoretische Grundlagen bildeten Ergebnisse der Arbeitsgruppe um Fraley [27,28], in denen gezeigt werden konnte, dass es aus inhaltlichen wie auch empirischen Gründen sinnvoll ist, Bindungsstrategien auf zwei grundlegenden Dimensionen, nämlich bindungsbezogener Angst (z. B. vor Verlassenwerden) und bindungsbezogener Vermeidung (z. B. von engen Beziehungen) abzubilden. Hohe Werte auf der erstgenannten Achse führen zu hyperaktivierenden Strategien in relevanten Situationen, hohe Werte auf der zweitgenannten zu deaktivierenden Strategien. In einer ersten Version, dem „Experiences in Close Relationships" (ECR) [29,30], wurden in einer großen Stichprobe aus mehreren 100 Items bestehender Bindungsinstrumente faktorenanalytisch zwei Skalen extrahiert, welche bindungsbezogene Angst und Vermeidung messen sollten.
In einer Re-Analyse der Daten nach Kriterien der Item-Response-Theorie (IRT) konnten Fraley, Waller u. Brennan [26] zeigen, dass herkömmliche Fragebögen, wie auch der ECR, eine relativ niedrige Messgenauigkeit aufweisen, insbesondere im Bereich der Bindungssicherheit. In einem zweiten Schritt wurden diejenigen 36 Items ermittelt, welche die beste dimensionale Modellpassung und die beste Diskriminationsfähigkeit bei gleichzeitig maximaler Abdeckung des gesamten angenommenen Trait-Kontinuums lieferten, und daraus eine überarbeitete Version des ECR, nämlich der ECR-R, erstellt. Der ECR-R übertraf alle anderen untersuchten Messinstrumente, inklusive dem ECR, in seiner Messgenauigkeit im Sinne der jeweils berechneten Testinformationsfunktion, was für eine höhere Differenzierungsfähigkeit des Instrumentes spricht. Dies stellt einen der wesentlichen und empirisch überprüften Vorteile der IRT gegenüber der klassischen Testtheorie (KTT) dar [31].
In ersten Validierungsstichproben des ECR-R [32,33] konnten unter anderem eine gute zeitliche Stabilität und die angenommene Faktorstruktur bestätigt, ebenso Belege für konvergente und diskriminante Validität angeführt werden. Die Autoren sehen besondere Stärken des Fragebogens im Erfassen kleiner Effekte und bei der Analyse von Longitudinaldaten. Fairchild und Finney [34] konnten die angenommene Faktorstruktur ebenfalls bestätigen und berichten außerdem eine sehr gute interne Konsistenz (Cronbach's $\alpha > 0{,}92$). Tsaragatis, Kafetsios und Stalikas [35] veröffentlichten vor Kurzem die Validierung einer griechischen Version. Der ECR-R wird mittlerweile von verschiedenen Arbeitsgruppen eingesetzt, z. B. in den Bereichen von Psychophysiologie [36], Colitis ulcerosa [37], Essstörungen [38], Sucht [39] und Sozial- und Persönlichkeitspsychologie (z. B. [40]).

Deutschsprachige Bindungsfragebögen – eine Auswahl

Bestehende deutschsprachige Fragebogeninstrumente leiden unter verschiedenen Schwierigkeiten. Entweder sind sie aufgrund allenfalls mäßig bis befriedigend einzuschätzender psychometrischer Eigenschaften nicht verlässlich zu interpretieren wie z. B. die Adult Attachment Scale [41,42] sowie der Relationship Scales Questionnaire [43,44] oder ihrer Konzeption und Operationalisierung wegen schwer mit anderen Instrumenten zu vergleichen, wie der konzeptuell sehr interessante Bielefelder Fragebogen zu Partnerschaftserwartungen [45]. Die Bindungsskalen von Grau [46] und die Beziehungsspezifischen Bindungsskalen für Erwachsene [47] messen zwar Bindung auf mit dem ECR-R vergleichbaren Dimensionen, sind jedoch vornehmlich auf den deutschsprachigen Raum beschränkt und somit international nicht vergleichbar.
Vor Kurzem ist eine Evaluation des im vorangestellten Abschnitt beschriebenen Vorläufers [29] des ECR-R in einer deutschsprachigen Stichprobe unter dem Namen Bochumer Bindungsbogen (BoBi) publiziert worden [30]. In einer nicht klinischen Stichprobe und bei Patienten einer psychosomatischen Ambulanz konnten die guten Ergebnisse der amerikanischen Version repliziert

werden. Allerdings ist diese Untersuchung eher auf Partnerschaft und Selbstkonzept ausgerichtet gewesen und es werden abgesehen von Diagnosen nur wenige Informationen über die klinische Stichprobe berichtet. Ebenso erscheint unklar, warum sich die beiden Stichproben in den Skalen zwar signifikant unterscheiden, jedoch in der Angstdimension von der Effektstärke her nur marginal. Dies widerspricht, gerade bei einem berichteten Anteil von 33% komorbider Persönlichkeitsstörungen in der Ambulanzstichprobe, bisherigen Untersuchungen [48], in denen bei diesen Stichproben aufgrund zumeist desorganisierter Bindungsmuster deutlich mehr bindungsbezogene Angst und Vermeidung zu erwarten wären.

Aufgrund der Tatsache, dass die Originalversion des ECR-R wahrscheinlich den Fragebogen mit den aktuell besten psychometrischen Eigenschaften in Bezug auf die Differenzierungsfähigkeit seiner Skalen darstellt, dass bestehende Verfahren entweder unter mittelmäßigen psychometrischen Eigenschaften leiden, nicht international eingesetzt werden können oder sich auf eine Vorgängerversion des ECR-R beziehen, wird in der vorliegenden Arbeit eine Evaluation der deutschsprachigen Version des Bindungsfragebogens „Experiences in Close Relationships – Revised" (ECR-RD) vorgestellt.

In einer ersten Studie werden in einer nicht klinischen Stichprobe Daten zur Faktorstruktur, Reliabilität und Validität berechnet. Dabei kommen in Bezug auf die oben genannten Forschungsergebnisse zusätzlich Instrumente zur Erfassung von Symptomschwere, Partnerschafts- und Lebenszufriedenheit zum Einsatz. In einer zweiten Studie sollen die Ergebnisse in einer klinisch-psychotherapeutischen Stichprobe repliziert werden. Des Weiteren wird der differenzielle Einfluss von Persönlichkeitsstörungen (s. o.) ermittelt, ebenso Unterschiede zu einer nach Alter und Geschlecht gematchten nicht klinischen Stichprobe.

Alle Berechnungen wurden mit SPSS für Windows, Version 15.0 durchgeführt.

Methoden

Studie 1 – Nicht klinische Stichprobe

Rekrutierung

Die nicht klinische Stichprobe setzt sich aus zwei Substichproben zusammen, einer Papier-und-Bleistift- und einer Online-Stichprobe. Für die Erhebung der Papier-und-Bleistift-Stichprobe wurden Probanden[1] beiderlei Geschlechts auf dem Universitätsgelände (Mensa und Campusgelände), jedoch auch in studentischen Wohnheimen, auf der Straße und unter den ehrenamtlichen Mitarbeitern einer Beratungsstelle rekrutiert. Die Teilnahme war freiwillig und ohne Aufwandsentschädigung. Aus auswertungsökonomischen Gründen wurde zusätzlich ein Web-Experiment programmiert, bei dem Teilnehmende im Internet ECR-R, KPD-38, RQ-2 (s. u.) und Fragen zu demografischen Daten ausfüllen. Für die netzbasierte Datenerhebung wurden die Empfehlungen von Reips [49] so weit wie nötig umgesetzt. Die Anwendung wurde in Python geschrieben, lief in einem Unix-basierten Content-Management-System (Zope) und war an eine MySQL-Datenbank angeschlossen. Es wurde bewusst ein schlichtes, kognitiv ergonomisches Layout auf der Basis von einfacher HTML und CSS gewählt, um Barrieren beim Betrachten und Ausfüllen der Fragebögen vorzubeugen. Die Sicherheit der Vorgehensweise konnte unter anderem durch die Verwendung eines besonders geschützten Universitätsservers und die Zusammenarbeit mit einem speziell in diesem Forschungsbereich erfahrenen Netzwerkadministrator (B.F.) gewährleistet werden. Verbreitung fand der Online-Fragebogen einerseits per Schneeballsystem über E-Mail-Anfragen, jedoch auch über diverse offene Panels und Usergroups. Der Online-Fragebogen ist im Internet unter folgender Adresse zu finden: http://www.psych.uni-goettingen.de/exp/hidden/ecrr/online.

Die beiden Substichproben unterschieden sich in Bezug auf Alter, Geschlecht, beide Subskalen des ECR-R und Items des RQ-2 nicht voneinander. In der Papier-und-Bleistift-Stichprobe waren etwa 10% mehr Studierende vertreten, in der Internet-Stichprobe dafür ca. 10% mehr Angestellte/Beamte, was wahrscheinlich mit der Verbreitung in der universitären Forschungs-Community zusammenhängt. Dementsprechend mehr Personen waren in dieser Stichprobe berufstätig. Beide Substichproben wurden zu einem Gesamtsample zusammengefasst. Eingeschlossen wurden Datensätze, wenn in der Selbstauskunft aktuell oder in der Vorgeschichte schon einmal eine Partnerschaft berichtet und der ECR-R vollständig ausgefüllt wurde. Bei einzelnen Berechnungen ergeben sich daher leichte Variationen in der Stichprobengröße in Bezug auf andere Variablen.

Instrumente

Deutschsprachige Version des Fragebogens *„Experiences in Close Relationships – Revised" (ECR-RD)*: Die englische Originalversion [26] wurde aus den Items bestehender Bindungsfragebögen nach den Prinzipien der Item-Response-Theorie entwickelt und zeigte in verschiedenen Überprüfungen deutlich bessere psychometrische Qualitäten und höhere Test-Informationsfunktion als andere, herkömmliche Bindungsfragebögen. Des Weiteren ist er so konstruiert, dass er theoriekonform Bindung über 36 Items auf zwei Skalen, nämlich bindungsbezogener Vermeidung und bindungsbezogener Angst, abbildet.

Mit Einverständnis von R. Chris Fraley wurde der Fragebogen von drei Personen mit guten Englischkenntnissen unabhängig voneinander ins Deutsche übersetzt. Zwei davon waren mit der Bindungstheorie sehr gut vertraut, die dritte Person war fachfremd. Es wurde danach eine Konsensform der einzelnen Items erstellt. Bei Bedeutungsunschärfen einzelner englischer Wörter wurde der Erstautor der amerikanischen Originalversion zurate gezogen. Die Konsensversion wurde durch einen native speaker ins Englische rückübersetzt. Diese Version wurde mit dem Original verglichen und eine endgültige Version erstellt.

Die Mittelwerte von jeweils 18 Items, die auf einer Skala von 1 (stimme gar nicht zu) bis 7 (stimme völlig zu) eingeschätzt werden sollen, bilden die beiden Skalen „Bindungsbezogene Angst" (BANG) und „Bindungsbezogene Vermeidung" (BVER). Ein Beispielitem der Skala BANG lautet: „Ich habe Angst, die Liebe meines Partners/meiner Partnerin zu verlieren.", ein Beispielitem der Skala BVER lautet: „Ich ziehe es vor, meinem Partner/meiner Partnerin nicht zu nahe zu sein." In der Instruktion wird dazu aufgefordert, sich weniger auf eine mögliche aktuelle Beziehung, sondern auf das allgemeine Partnerschaftserleben zu beziehen. 14 Items müssen invers ausgewertet werden. Items und Skalenzuordnungen können beim Erstautor angefordert werden.

Beim *Relationship Questionnaire (RQ-2)* handelt es sich um ein sehr einfaches Instrument, das eine gewichtete Selbstzuordnung auf je einer 7-stufigen Skala zu vier prototypischen allgemeinen Bindungsmustern („sicher", „abweisend", „anklammernd",

[1] Aus Gründen der besseren Lesbarkeit wird im Folgenden entweder eine geschlechtsneutrale oder die männliche Form benutzt, auch wenn Frauen und Männer gleichermaßen gemeint sind.

„ängstlich-vermeidend“) ermöglicht. Das Instrument wurde von Bartholomew und Horowitz [50] entwickelt und geprüft und wird auch international (z. B. [51]) in vielen Studien begleitend eingesetzt.

Das *Klinisch-Psychologische Diagnosesystem 38 (KPD-38)* wurde von Percevic et al. [52] entwickelt und in großen Stichproben überprüft und normiert. 38 Items, welche auf einer vierstufigen Skala beantwortet werden, bilden die sechs Fragebogenskalen „Körperbezogene Beeinträchtigung“, „Psychische Beeinträchtigung“, „Soziale Probleme“, „Handlungskompetenz“, „Allgemeine Lebenszufriedenheit“ und „Soziale Unterstützung“. Ebenso kann ein Gesamtwert als Ausdruck des allgemeinen Beschwerdedrucks berechnet werden. Die Skalenstruktur wurde mit wenigen Ausnahmen faktorenanalytisch bestätigt, die internen Konsistenzen der Skalen sind zufriedenstellend bis sehr gut. Insgesamt handelt es sich beim KPD-38 um ein gut entwickeltes und ökonomisches Instrument, welches für nichtkommerzielle Forschungszwecke zudem ohne Lizenzgebühren verwendbar ist.

Weitere Instrumente: Neben demografischen Daten zu Alter, Geschlecht, beruflicher Qualifikation und Dauer der bisher längsten Beziehung, wurden zusätzlich Lebenszufriedenheit und Zufriedenheit mit einer möglichen aktuellen Beziehung auf einer aufsteigenden Skala von 0 – 10 abgefragt („Wie zufrieden sind Sie im Moment insgesamt mit Ihrem Leben/dieser Partnerschaft?“).

Ergebnisse Studie 1 – Nicht klinische Stichprobe

Demografische Daten und Skalenwerte

Eingeschlossen wurde eine Gesamtstichprobe (s. o.) von insgesamt 1006 Probanden. Demografische Daten und Skalenkennwerte werden in ◉ **Tab. 1** berichtet, aus Gründen der Übersichtlichkeit wird nur der KPD-38-Gesamtwert als Maß des allgemeinen Beschwerdedrucks berichtet. Es gab keine Geschlechtsunterschiede in Bezug auf die beiden Skalen des ECR-RD (Daten nicht berichtet[2]).

Tab. 1 Demografische Daten und Skalenkennwerte der beiden Stichproben.

	nicht klinische Stichprobe	**klinische Stichprobe**
	M *(SD)* bzw. gültige Prozente	M *(SD)* bzw. gültige Prozente
Alter (Jahre)	28,92 (10,67)	39,17 (13,68)
Geschlecht		
männlich	32,1 %	24,4 %
weiblich	67,9 %	75,6 %
Beziehungsstatus		
aktuell in Partnerschaft	69,6 %	68,0 %
aktuell ohne Partnerschaft	30,4 %	32,0 %
Partnerschaftszufriedenheit (0 – 10)	7,58 (2,74)	4,50 (3,85)
Lebenszufriedenheit (0 – 10)	7,09 (2,00)	4,18 (2,43)
Längste bisherige Beziehung in Monaten	72,94 (96,14)	158,88 (146,68)
körperliche Erkrankung		
ja	7,6 %	18,7 %
nein	92,4 %	71,3 %
Berufstätigkeit		
(Fach-)Arbeiter	0,9 %	31,5 %
Einfacher bis höherer Angest./ Beamter	16,3 %	34,1 %
Selbstständig	3,0 %	4,5 %
In Ausbildung/Umschulung	1,1 %	7,5 %
Schüler/Student	70,1 %	7,5 %
Hausfrau/-mann	2,6 %	6,0 %
Rentner	1,3 %	16,1 %
ohne Beruf	0,6 %	5,5 %
sonstiges	4,1 %	5,0 %
Erwerbstätigkeit		
Vollzeit	18,0 %	33,3 %
Teilzeit	25,9 %	12,1 %
nicht erwerbstätig	55,1 %	32,9 %
arbeitslos	1,0 %	21,7 %
ECR-R Bindungsbezogene Angst (BANG)	2,77 (1,09)	3,71 (1,41)
ECR-R Bindungsbezogene Vermeidung (BVER)	2,36 (1,0)	3,08 (1,27)
RQ-2 „sicher“	5,09 (1,57)	3,77 (1,70)
RQ-2 „abweisend“	3,58 (1,78)	3,38 (1,90)
RQ-2 „anklammernd“	2,46 (1,55)	3,21 (1,91)
RQ-2 „ängstlich-vermeidend“	2,91 (1,94)	4,45 (2,09)
KPD-38 Gesamtwert	2,14 (0,46)	2,94 (0,48)

Überprüfung von Faktorstruktur, Trennschärfe und interner Konsistenz der nicht klinischen Stichprobe

Um die angenommene zweifaktorielle Struktur des ECR-R zu überprüfen, wurde in Anlehnung an Sibley, Fischer u. Liu [33] eine explorative Hauptkomponenten-Faktorenanalyse mit obliquer Rotation (oblimin direkt, delta = 0) durchgeführt. Alle relevanten Items wurden vorher invertiert. Das Scree-Kriterium legte eine zweifaktorielle Lösung nahe, welche insgesamt 44,0 % der Varianz aufklärte. Alle Items luden auf dem jeweils zugehörigen Faktor, kein Item über 0,32 auf dem jeweils anderen Faktor (◉ **Tab. 2**).

Trennschärfeindizes (abgebildet als part-whole-korrigierte Item-Skala-Korrelation r_{it}) lagen für die Skala „Bindungsbezogene Vermeidung“ mit Ausnahme des Items 30 zwischen 0,52 und 0,73, für die Skala „Bindungsbezogene Angst“ zwischen 0,42 und 0,75.

Cronbach's α als Maß der internen Konsistenz fällt mit 0,92 für die Skala „Bindungsbezogene Vermeidung“ und 0,91 für die Skala „Bindungsbezogene Angst“ hoch aus, ebenso für die separate Berechnung für zwei Testhälften (◉ **Tab. 2**).

Konstruktvalidität der nicht klinischen Stichprobe

Als Maß der konvergenten Validität wurden Korrelationen mit den Skalen des RQ-2 herangezogen. Es ergaben sich erwartungskonforme Zusammenhangsmuster zwischen den beiden Bindungsfragebögen. „Sicher“ im RQ-2 korrelierte deutlich negativ mit bindungsbezogener Angst ($r_s = -0{,}47$) und Vermeidung ($r_s = -0{,}52$) im ECR-RD, RQ-2 „abweisend“ positiv mit BVER ($r_s = 0{,}29$), RQ-2 „anklammernd“ positiv mit BANG ($r_s = 0{,}46$), und in geringem Maße mit BVER ($r_s = 0{,}15$), und „ängstlich-vermeidend“ deutlich positiv mit BANG ($r_s = 0{,}55$) und ebenfalls mit BVER ($r_s = 0{,}54$) (Spearman-Rho, zweiseitig; alle $p < 0{,}01$). Ähnlich der amerikanischen Originalversion wurde eine Skaleninterkorrelation von $r = 0{,}49$ (Pearson, zweiseitig; $p < 0{,}01$) zwischen den beiden Skalen des ECR-RD gefunden.

Kriteriumsvalidität der nicht klinischen Stichprobe

Zur Überprüfung der Kriteriumsvalidität wurden Korrelationen mit weiteren erhobenen Variablen berechnet. Aufgrund von systematischen, leicht negativen Zusammenhängen zwischen Alter und BANG und positiven Zusammenhängen zwischen Alter und Beziehungslänge wurde für weitere Berechnungen in Bezug auf

[2] Daten können beim Erstautor angefordert werden.

Tab. 2 Itemkennwerte und Faktorladungen des ECR-R in nicht klinischer und klinischer Stichprobe.

	nicht klinische Stichprobe (n = 1006)					klinische Stichprobe (n = 225)				
				Faktor 1 (BVER)	Faktor 2 (BANG)				Faktor 1 (BVER)	Faktor 2 (BANG)
Cronbach's α Gesamt				0,92	0,91				0,92	0,92
Cronbach's α 1. Testhälfte				0,86	0,89				0,86	0,91
Cronbach's α 2. Testhälfte				0,85	0,81				0,86	0,83
	M	SD	r_{it}	Faktor 1	Faktor 2	M	SD	r_{it}	Faktor 1	Faktor 2
BVER										
ecrrd02	2,42	1,55	0,62	0,65	0,06	3,47	1,96	0,61	0,62	0,03
ecrrd04	2,39	1,54	0,62	0,71	– 0,08	3,09	1,85	0,56	0,62	– 0,03
ecrrd06	2,36	1,62	0,52	0,41	0,38	3,13	2,10	0,48	0,27	0,60
ecrrd08	1,97	1,35	0,63	0,76	– 0,16	2,63	1,86	0,75	0,86	– 0,17
ecrrd10	2,40	1,61	0,66	0,67	0,12	3,00	1,84	0,63	0,57	0,20
ecrrd12	1,75	1,28	0,61	0,71	– 0,08	2,15	1,62	0,64	0,72	– 0,04
ecrrd14	2,01	1,47	0,63	0,69	– 0,04	2,80	2,01	0,66	0,70	0,03
ecrrd16	2,72	1,67	0,57	0,56	0,12	3,53	1,97	0,61	0,68	– 0,01
ecrrd18	2,35	1,54	0,62	0,56	0,20	3,18	2,07	0,63	0,62	0,12
ecrrd20	2,16	1,41	0,67	0,73	– 0,02	2,92	1,91	0,66	0,74	– 0,02
ecrrd22	2,12	1,52	0,55	0,61	– 0,00	2,80	1,91	0,70	0,73	– 0,02
ecrrd24	2,55	1,57	0,68	0,76	– 0,05	3,05	1,91	0,63	0,71	– 0,04
ecrrd26	2,10	1,38	0,73	0,79	– 0,03	2,78	1,79	0,68	0,76	– 0,05
ecrrd28	2,07	1,53	0,62	0,65	– 0,05	2,80	2,03	0,63	0,67	0,05
ecrrd30	3,29	2,12	0,26	0,31	– 0,01	3,78	2,18	0,42	0,42	– 0,01
ecrrd32	2,56	1,58	0,63	0,52	0,31	3,68	2,00	0,61	0,47	0,41
ecrrd34	2,22	1,53	0,54	0,61	– 0,02	2,87	1,96	0,40	0,46	0,00
ecrrd36	2,91	1,43	0,63	0,55	0,32	3,92	1,87	0,64	0,57	0,25
BANG										
ecrrd01	3,61	1,81	0,61	– 0,15	0,75	4,61	2,12	0,66	– 0,18	0,80
ecrrd03	2,79	1,63	0,73	– 0,05	0,82	4,03	2,22	0,76	– 0,04	0,84
ecrrd05	2,50	1,63	0,73	0,14	0,73	3,80	2,20	0,78	0,12	0,80
ecrrd07	2,98	1,68	0,71	0,11	0,72	4,12	2,22	0,76	0,10	0,77
ecrrd09	4,56	2,08	0,42	– 0,22	0,58	5,23	2,05	0,41	– 0,26	0,59
ecrrd11	2,46	1,67	0,75	0,14	0,74	3,65	2,25	0,79	0,08	0,80
ecrrd13	2,42	1,59	0,66	– 0,05	0,73	3,23	2,09	0,69	– 0,01	0,75
ecrrd15	2,48	1,59	0,68	0,27	0,62	3,42	2,12	0,75	0,21	0,70
ecrrd17	3,20	1,88	0,49	– 0,03	0,58	4,29	2,26	0,46	0,04	0,49
ecrrd19	2,32	1,59	0,50	0,26	0,43	3,04	2,13	0,51	0,33	0,42
ecrrd21	3,05	1,84	0,65	– 0,04	0,72	4,30	2,26	0,56	0,01	0,62
ecrrd23	2,46	1,69	0,53	0,05	0,57	3,01	2,10	0,60	– 0,05	0,66
ecrrd25	2,48	1,72	0,54	0,04	0,58	2,99	2,01	0,56	0,11	0,54
ecrrd27	2,34	1,64	0,44	– 0,15	0,55	2,83	1,99	0,51	– 0,09	0,59
ecrrd29	2,75	1,89	0,57	0,24	0,52	4,16	2,30	0,66	0,17	0,65
ecrrd31	2,63	1,77	0,51	0,16	0,49	3,47	2,17	0,57	0,18	0,54
ecrrd33	3,07	1,89	0,52	0,09	0,51	4,35	2,11	0,52	– 0,08	0,61
ecrrd35	1,67	1,18	0,43	0,25	0,36	2,35	1,75	0,41	0,28	0,31

BANG = bindungsbezogene Angst, BVER = bindungsbezogene Vermeidung; M = Mittelwert, SD = Standardabweichung, r_{it} = part-whole-korrigierte Item-Skala-Korrelation

diese Skala des ECR-RD der Einfluss des Alters auspartialisiert [53]. Es zeigten sich signifikante positive Zusammenhänge zwischen erhöhten Skalenwerten des ECR-RD und den Skalen der KPD-38, negative Korrelationen mit Lebensqualität und Partnerschaftszufriedenheit, ebenso ein marginaler, jedoch signifikanter negativer Zusammenhang zwischen BANG und der Dauer der längsten Beziehung (**Tab. 3**). Die negativen Korrelationen zwischen BANG/BVER und Partnerschaftszufriedenheit blieben selbst nach simultanem Auspartialisieren von Alter und KPD-38 Gesamtwert, um z. B. depressive Bewertungseinflüsse herauszurechnen, erhalten, ebenso in Bezug auf BVER und Lebenszufriedenheit. Der negative Zusammenhang zwischen BANG und Lebenszufriedenheit erreichte bei letztgenannter Vorgehensweise das festgelegte Signifikanzniveau nicht mehr.

Studie 2 – Klinische Stichprobe

Rekrutierung

Mit Unterstützung des AK Stationäre Gruppenpsychotherapie wurden in mehreren Universitäts-, Fach- und Rehabilitationskrankenhäusern Patienten in stationärer psychotherapeutischer Behandlung zu verschiedenen Zeitpunkten der Behandlung rekrutiert. Die Teilnahme war freiwillig, es gab keine Aufwandsentschädigung. Eingeschlossen wurden Datensätze, wenn in der Selbstauskunft aktuell oder in der Vorgeschichte schon einmal eine Partnerschaft berichtet und der ECR-RD vollständig ausgefüllt wurde. Bei einzelnen Berechnungen ergeben sich daher leichte Variationen in der Stichprobengröße in Bezug auf andere Variablen.

Tab. 3 Korrelationen in klinischer und nicht klinischer Stichprobe.

	bindungsbezogene Angst (BANG)	bindungsbezogene Vermeidung (BVER)
nicht klinische Stichprobe		
Alter	– 0,15**	0,04
Lebenszufriedenheit [a]	– 0,33**	– 0,31**
Partnerschaftszufriedenheit [a]	– 0,36**	– 0,41**
Längste Beziehung (in Monaten) [b]	– 0,09**	– 0,06
KPD-Gesamtwert[a]	0,52**	0,43**
klinische Stichprobe		
Alter	– 0,30**	0,20**
Lebenszufriedenheit[b]	– 0,26**	– 0,15*
Partnerschaftszufriedenheit [b]	– 0,41**	– 0,41**
Längste Beziehung (in Monaten) [b]	– 0,14*	0,09
KPD-Gesamtwert	0,42**	0,26**

Pearson, zweiseitig; ** $p < 0,01$; * $p < 0,05$; [a] alterskorrigiert für die Skala BANG; [b] alterskorrigiert für die Skalen BANG und BVER

Methoden

Instrumente

Die Patienten füllten die Fragebögen analog zur nicht klinischen Stichprobe aus. Weiterhin wurde der zeitliche Status der stationären Behandlung in Form einer Selbsteinschätzung (1., 2. oder letztes Drittel) erhoben. Auf einem Zusatzblatt wurden vom Behandlungsteam maximal drei ICD-10-Diagnosen, die (Verdachts-)Diagnose auf eine Persönlichkeitsstörung und mögliche somatische Begleiterkrankungen abgefragt. Um die Anonymität zu gewährleisten, notierten die Patienten ihren Namen auf einem Deckblatt, welches nach dem Ausfüllen der diagnostischen Informationen durch das Behandlungsteam entfernt wurde.

Ergebnisse Studie 2 – Klinische Stichprobe

Demografische Daten und Skalenwerte der klinischen Stichprobe

Eingeschlossen wurde eine Gesamtstichprobe (s. o.) von insgesamt 225 Patienten in stationärer psychosomatisch-psychotherapeutischer Behandlung. Demografische Daten und Skalenkennwerte werden in **Tab. 1** berichtet. Aus Gründen der Übersichtlichkeit wird nur der KPD-38-Gesamtwert als Maß des allgemeinen Beschwerdedrucks berichtet. Laut Selbstauskunft befanden sich 43,1 % der Patienten in der Anfangsphase ihrer stationären Behandlung, 32,9 % in der mittleren und 24 % in der Endphase. Männer unterschieden sich nicht von Frauen in Bezug auf BANG und BVER, zwischen Patienten in unterschiedlichen Behandlungsphasen ergab sich ebenfalls kein signifikanter Unterschied[2].

Diagnosen

Bei 40,9 % der Patienten wurden mindestens drei psychische Störungsdiagnosen gestellt, bei 84,4 % zwei (**Tab. 4**). Unter einer komorbiden Persönlichkeitsstörung bzw. einer entsprechenden Verdachtsdiagnose litten 45,8 % der klinischen Stichprobe. Insgesamt zeigte sich ein großer Anteil an depressiven Erkrankungen, ebenso an somatoformen, Angst-, Traumafolge- und Essstörungen. Abhängigkeitserkrankungen waren nur zu einem geringen Anteil vertreten, sonstige Störungen bezogen sich z. B. auf die Mitbeteiligung psychischer Einflussfaktoren bei anderen Erkrankungen, Stottern, ADHS oder Transsexualismus.

Tab. 4 Diagnosen der klinischen Stichprobe.

Diagnose 1 (100 %)		Diagnose 2 (84,4 %)		Diagnose 3 (40,9 %)	
ICD-10 F3	57,7 %	ICD-10 F4	52,6 %	ICD-10 F6	43,2 %
ICD-10 F4	26,8 %	ICD-10 F6	24,4 %	ICD-10 F4	24,2 %
ICD-10 F6	8,2 %	ICD-10 F3	10,0 %	ICD-10 F3	11,6 %
ICD-10 F5	3,6 %	ICD-10 F5	8,4 %	ICD-10 F5	11,6 %
ICD-10 F1	2,7 %	ICD-10 F1	3,2 %	ICD-10 F1	2,1 %
sonstige	0,9 %	sonstige	1,3 %	sonstige	7,4 %

Angegeben sind in der ersten Zeile der Anteil der komorbiden Störungen in der klinischen Stichprobe, in den Spalten jeweils die auf diese bezogenen gültigen Prozente

Überprüfung von Faktorstruktur, Trennschärfe und interner Konsistenz der klinischen Stichprobe

Analog zur nicht klinischen Stichprobe legte in einer explorativen Hauptkomponenten-Faktorenanalyse mit obliquer Rotation (oblimin direkt, delta = 0) das Scree-Kriterium eine zweifaktorielle Lösung nahe, welche insgesamt 46,5 % der Varianz aufklärt. Mit Ausnahme von Item 6 luden alle Items auf dem jeweils zugehörigen Faktor, Item 32 zudem zu über 0,4 auf dem anderen Faktor (s. **Tab. 2**). Trennschärfeindizes (abgebildet als part-whole-korrigierte Item-Skala-Korrelation r_{it}) lagen für die Skala „Bindungsbezogene Vermeidung“ zwischen 0,40 und 0,75, für die Skala „Bindungsbezogene Angst“ zwischen 0,41 und 0,79.
Cronbach's α als Maß der internen Konsistenz fällt mit 0,92 für die Skala „Bindungsbezogene Vermeidung“ und 0,92 für die Skala „Bindungsbezogene Angst“ hoch aus, ebenso für die beiden Testhälften (**Tab. 2**).

Konstruktvalidität der klinischen Stichprobe

Es zeigten sich erwartungsgemäße Zusammenhänge zwischen dem ECR-RD auf der einen und den Subskalen des RQ-2 auf der anderen Seite. Die Skala BANG korrelierte negativ mit RQ-2 „sicher“ ($r_s = – 0,42$), positiv mit RQ-2 „anklammernd“ ($r_s = 0,49$) und RQ-2 „ängstlich-vermeidend“ ($r_s = 0,42$). Die Skala BVER korrelierte ebenfalls negativ mit RQ-2 „sicher“ ($r_s = – 0,41$), positiv mit RQ-2 „abweisend“ ($r_s = 0,23$) und RQ-2 „ängstlich-vermeidend“ ($r_s = 0,54$) (Spearman-Rho, zweiseitig; alle $p < 0,01$). Ähnlich der nicht klinischen Stichprobe ergab sich eine Skaleninterkorrelation von $r = 0,50$ (Pearson, zweiseitig; $p < 0,01$).

Kriteriumsvalidität der klinischen Stichprobe

Analog zur nicht klinischen Stichprobe zeigten sich Zusammenhänge zwischen den Skalen des ECR-RD und anderen Variablen. BANG korrelierte negativ mit Alter, Partnerschafts- und Lebenszufriedenheit, Länge der bisher längsten Beziehung und positiv mit dem Gesamtwert der KPD-38, BVER positiv mit Alter und Gesamtwert der KPD-38, negativ mit Lebens- und Partnerschaftszufriedenheit (**Tab. 3**). Die negativen Korrelationen zwischen BANG/BVER und Partnerschaftszufriedenheit blieben selbst nach simultanem Auspartialisieren von Alter und KPD-38 Gesamtwert (zur Kontrolle des Einflusses von aktueller Psychopathologie) erhalten. Der negative Zusammenhang zwischen BANG/BVER und Lebenszufriedenheit wird dann nicht mehr signifikant.

Vergleich von klinischer und nicht klinischer Stichprobe

Zum Vergleich der beiden Stichproben wurde aus dem nicht klinischen Sample eine nach Alter und Geschlecht gematchte Vergleichsstichprobe gezogen. Erwartungsgemäß fanden sich in der klinischen Stichprobe signifikant höhere Werte in Bezug auf die

	klinisch M (sd) (n = 225)	nicht klinisch M (sd) (n = 250)	T(473)	p	Effektgröße d
BANG	3,71 (1,41)	2,61 (1,15)	– 9,23	< 0,001	0,85
BVER	3,08 (1,27)	2,46 (1,10)	– 5,71	< 0,001	0,52

Tab. 5 Vergleich von klinischer und nicht klinischer Stichprobe

	PST M (sd) (n = 103)	ohne PST M (sd) (n = 122)	T(223)	p	Effektgröße d
BANG	4,13 (1,35)	3,36 (1,37)	4,19	< 0,001	0,57
BVER	3,42 (1,27)	2,80 (1,20)	3,77	< 0,001	0,50
KPD gesamt	3,02 (0,45)	2,88 (0,50)	2,13	0,035	0,29

Tab. 6 Bindung und Persönlichkeitsstörungen in der klinischen Stichprobe

beiden Subskalen des ECR-RD, mit jeweils mittleren bis großen Effekten (**Tab. 5**).

Einfluss von Persönlichkeitsstörungen

Um mögliche Zusammenhänge zwischen Bindung und Persönlichkeitsstörungen zu untersuchen, wurde die klinische Stichprobe in zwei Gruppen unterteilt, eine mit klinischer (Verdachts-)Diagnose einer Persönlichkeitsstörung (PST), eine Gruppe ohne PST. Wie in **Tab. 6** abgebildet, gab es bedeutsame Unterschiede in Bezug auf die ECR-RD-Skalen BANG und BVER mit mittleren Effektgrößen, nach α-Fehler Korrektur nach Bonferroni mit neuer Irrtumswahrscheinlichkeit von $\alpha' = 0{,}016$ jedoch keinen Unterschied in Bezug auf den Gesamtbeschwerdedruck.

Diskussion

In der vorliegenden Arbeit wurde erstmalig eine deutschsprachige Version des partnerschaftsbezogenen Bindungsfragebogens „Experiences in Close Relationships – Revised“ (ECR-R) in einer nicht klinischen und einer klinischen Stichprobe von Patienten in stationärer psychosomatisch-psychotherapeutischer Behandlung untersucht. In beiden Samples konnte die angenommene zweifaktorielle Struktur insgesamt bestätigt werden, es wurden sehr gute Indizes für die interne Konsistenz der beiden Skalen „Bindungsbezogene Angst“ und „Bindungsbezogene Vermeidung“ gefunden, ebenso – mit wenigen Ausnahmen – gute bis sehr gute Kennwerte für die Trennschärfe der Items. Die beiden Skalen waren in einem theoriekonformen Muster und in ähnlicher Höhe wie in anderen Studien [35] mit den Subskalen des RQ-2 korreliert. Zusätzlich zeigten sich erwartungskonform Zusammenhänge zwischen höherer bindungsbezogener Angst und Vermeidung auf der einen und geringerer Partnerschafts- und Lebenszufriedenheit auf der anderen Seite. Im Hinblick auf Voruntersuchungen ist davon auszugehen, dass die Korrelationen kein Artefakt der Stichprobengröße darstellen (vgl. [17]).

Im Vergleich zur amerikanischen Originalversion und der griechischen Übersetzung fällt auf, dass die Mittelwerte der beiden Skalen des ECR-RD in unserer nicht klinischen Stichprobe niedriger liegen. Fraley [54] berichtet Mittelwerte für BANG = 3,64 und BVER = 2,93, Tsagaratis, Kafetsios und Stalikas [35] für BANG = 3,60 und BVER = 3,02. Allerdings zeigt sich beim Blick in andere Studien, dass es auch hier mehr oder weniger deutliche Abweichungen gibt. So reichen die berichteten Mittelwerte für BANG von 2,08 (gemittelt über drei Stichproben, siehe [33]), 2,50 [37], 3,17 [34] bis hin zu 3,32 [38]. Eine deutschsprachige Stichprobe von Kirchmann, Fenner und Strauß [22] kam auf einen Wert von BANG = 3,20. Für die Skala zur bindungsbezogenen Vermeidung gibt es ebenfalls eine große Variabilität in weiteren Stichproben. BVER reicht von 1,92 (gemittelt über drei Stichproben, siehe [33]) über 2,70 [37], 2,78 [34] bis hin zu 3,16 [38]. Kirchmann, Fenner und Strauß [22] berichten einen Wert von BVER = 2,68. Insofern liegen die in unserer heterogenen, nicht repräsentativen Stichprobe erhobenen Werte im Rahmen dessen, was in anderen internationalen Studien berichtet wird.

In Bezug auf die Skaleninterkorrelation verhält sich der ECR-RD ähnlich wie in anderen Untersuchungen. Die Korrelation von BANG und BVER liegt bei Fraley [54] bei r = 0,41, Tsagaratis, Kafetsios und Stalikas [35] berichten einem Zusammenhang von 0,35, ansonsten variiert sie von 0,48 (gemittelt über drei Stichproben, siehe [33]), über 0,53 [37] bis zu 0,59 [38]. Vor dem Hintergrund, dass einerseits in nicht klinischen Stichproben Bindungssicherheit bei ca. 60 % liegt [55] und andererseits Untersuchungen mit Selbstbeurteilungsinstrumenten häufiger einen größeren Anteil an Bindungssicherheit berichten als Studien mit Interviewverfahren, spricht einiges dafür, dass durch eine Häufung der Werte im „sicheren“ Quadranten mit niedriger Angst und niedriger Vermeidung einer Korrelation der beiden Skalen Vorschub geleistet wird. In anderen Worten: Bei einer bekannten Prädominanz sicherer Strategien, gerade in Fragebogenuntersuchungen, können bindungsbezogene Angst und Vermeidung eigentlich nicht unkorreliert sein.

Nach Kriterien der klassischen Testtheorie hat sich der Fragebogen insgesamt bewährt. Die interne Konsistenz liegt höher als bei allen veröffentlichten deutschsprachigen Bindungsfragebögen. Die Zuordnung der Items zu den jeweils angenommenen Faktoren wird insgesamt bestätigt. Ausnahmen stellen Item 6 und Item 32 dar, welche sich mit der Frage beschäftigen, ob es einer Person leicht fällt, sich auf den Partner/die Partnerin zu verlassen. Eine mögliche Erklärung wäre, dass trotz allgemein formulierter Aufgabenstellung die Studienteilnehmer hier zu sehr auf eine konkrete Partnerschaft fokussieren anstatt auf eine allgemeine innere Tendenz. Bei Item 19 geht es darum, inwiefern der Partner/die Partnerin einen dazu bringt, an sich selbst zu zweifeln. Dies hat möglicherweise im Deutschen eine andere Konnotation als z. B. in der amerikanischen Originalversion. Item 35 („Mein Partner/meine Partnerin scheint mich nur dann wahrzunehmen, wenn ich wütend bin“) lädt generell eher niedrig auf beiden Faktoren. In einer zukünftigen Version sollte darüber nachgedacht werden, diese Items ggf. zu ersetzen. Aus Gründen der internationalen Vergleichbarkeit schlagen wir jedoch vor, sie vorerst in der Gesamtversion des Fragebogens zu belassen.

Die klinische Stichprobe wies im Vergleich mit einer nach Alter und Geschlecht gematchten Vergleichsgruppe signifikant höhere Werte in beiden Skalen des ECR-RD auf. Dies steht z. B. im Ein-

klang mit den Ergebnissen von Dozier, Stovall und Albus [56], welche über verschiedene Studien hinweg nur eine geringe Ausprägung von Bindungssicherheit in klinischen Stichproben fanden. Im ECR-RD finden sich, im Gegensatz zu den von Neumann, Rohmann u. Bierhoff [30] berichteten Ergebnissen des BoBi, substanzielle Unterschiede mit mittleren bis großen Effekten zwischen klinischer und nicht klinischer Stichprobe. Selbst wenn beim ECR-RD alle Patienten mit (Verdachts-)Diagnose einer Persönlichkeitsstörung ausgeschlossen werden[2], bleibt der Unterschied zur nicht klinischen Stichprobe mit mittleren Effektgrößen bedeutsam. Der Befund, dass Patienten mit Persönlichkeitsstörungen höhere bindungsbezogene Angst und Vermeidung im ECR-RD aufweisen als Patienten ohne PST, und zwar bei nicht signifikant verschieden ausgeprägtem Gesamtbeschwerdedruck, kann als Ausdruck einer tief greifenden Dysregulation kognitiv-emotionaler Schemata, wie sie z. B. von Levy [57] für die Borderline-Persönlichkeitsstörung beschrieben wird, interpretiert werden.

Des Weiteren haben wir in die bestehende Untersuchung nur Probanden eingeschlossen, wenn diese schon einmal eine Beziehung erlebt haben. Trotzdem scheint der ECR-RD auch bei Personen geeignet, die bisher keine Erfahrung mit Partnerschaften hatten. Erwartungsgemäß haben diese[2] eine jeweils höhere bindungsbezogene Angst und Vermeidung, insbesondere in der klinischen Stichprobe. Mit dem RQ-2 ergibt sich ebenfalls ein sinnvolles Korrelationsmuster.

Einschränkungen der vorliegenden Untersuchung liegen u. a. in der Heterogenität der Stichproben. Die nicht klinische Stichprobe ist nicht bevölkerungsrepräsentativ, insofern sind auch die berichteten Mittelwerte als vorläufig zu betrachten. In der klinischen Stichprobe haben wir uns auf maximal drei klinische Diagnosen im Rating der behandelnden Therapeuten beschränkt. Es kann also sein, dass manche Patienten unter weiteren komorbiden seelischen Erkrankungen litten, die in dieser Untersuchung nicht abgebildet werden. Außerdem wäre es wünschenswert, in weiteren ggf. störungsspezifischen Untersuchungen die Diagnosestellung durch Verwendung standardisierter Interviews noch besser vergleichbar zu machen. Bei der Erfassung von Partnerschafts- und Lebenszufriedenheit haben wir aus Gründen der Durchführungsökonomie einfache Selbstauskünfte differenzierteren Instrumenten vorgezogen. Dies sollte in zukünftigen Untersuchungen verändert werden, um spezifische Einflüsse von bindungsbezogener Angst und Vermeidung besser abbilden zu können.

Zu guter Letzt soll noch einmal daran erinnert werden, dass der ECR-RD partnerschaftsbezogene, bewusstseinsnahe und erfahrungsbasierte Aspekte von Bindung abbildet. Dafür scheint er zum gegebenen Zeitpunkt der beste vorhandene, international verbreitete Fragebogen zu sein. Bei der Wahl der Instrumente zum Erfassen von Bindung sollte jedoch immer die eigene Fragestellung ausschlaggebend sein: „One size does not fit all."

Fazit für die Praxis

▼

Der ECR-RD stellt ein international vergleichbares Instrument zur Messung von partnerschaftsbezogenen Bindungsstrategien mit guten psychometrischen Eigenschaften dar. Der Fragebogen lässt sich sowohl in psychosomatisch-psychotherapeutischen Stichproben als auch in der Allgemeinbevölkerung einsetzen. Für nichtkommerzielle Zwecke ist er zudem kostenlos einsetzbar.

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SHORT COMMUNICATION

Separation Recall: Psychophysiological Response-patterns in an Attachment-related Short-term Stressor

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Abstract

Attachment theory is a conceptual framework for emotional-motivational behaviour and stress regulation in social relationships. However, few experimental studies have investigated attachment-related autonomic stress responses in adults. In a sample of 50 healthy subjects, we investigated autonomic cardiovascular reactions and subjective stress-load to a newly developed, attachment-related short-term stressor (separation recall, SR). The overall magnitude of the cardiovascular response to SR was comparable to the well established mental arithmetic (MA) stress test. However, the SR induced higher levels of sadness and impaired diastolic blood pressure recovery, whereas MA was associated with higher levels of anger and greater heart rate increase. Recovery scores to the attachment-stressor but not the mental arithmetic were related to attachment avoidance as measured by self-report, especially when taking into account the content of the reported episodes of the SR. In sum, our newly developed attachment-related short-term stressor has proven good performance in a first study. Copyright © 2010 John Wiley & Sons, Ltd.

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Keywords

attachment; stress; cardiovascular; blood pressure; heart rate

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Introduction

Within the field of social neurosciences, there is growing interest in attachment theory as a conceptual framework for emotional-motivational behaviour and stress regulation in social interactions (Cacioppo et al., 2007; Diamond, 2001). The attachment system can be conceptualized as a psycho-physiological motivational system which is activated in times of threat with the overall aim of reestablishment of 'felt security' by means of proximity-seeking and contact-maintaining behaviours (Berman & Sperling, 1994; Marvin & Britner, 1999). Patterns of secure, anxious and avoidant behaviour have been found to be relatively stable personality dispositions (Fraley, 2002; Mikulincer, Shaver, & Pereg, 2003). High avoidance leads to suppression or deactivation of attachment related thoughts, needs and emotions in times of distress. Highly anxious persons may try to get the attention of others by hyperactivation of attachment behaviour.

The attachment system plays a decisive role in coping with threat and anxiety-related arousal, highlighting its importance in stress regulation. Research relating attachment to physiological stress response in adults is just beginning to emerge (e.g. Diamond, 2001; Laurent & Powers, 2007). Previous studies on cardiovascular parameters either lack external validity by using mostly

unspecific stressors (Diamond & Hicks, 2005; Diamond, Hicks, & Otter-Henderson, 2006; Maunder, Lancee, Nolan, Hunter, & Tannenbaum, 2006) or experimental control (e.g. Roisman, 2007). Existing ecologically valid paradigms from fMRI studies (e.g. Buchheim et al., 2008) may not be suitable for cardiovascular stress research.

Given that activation of the attachment system is related to stress reaction, stress reactions can be economically measured by cardiovascular indices (Linden, Gerin, & Davidson, 2003), but that there are no reliable, attachment-related short-term stress paradigms, the main aim of the present study was to develop and evaluate an attachment-related short-term stressor: the separation recall (SR) interview . We hypothesized that an attachment-related stressor activates the autonomic cardiovascular system to a comparable level as a mental arithmetic (MA) subtraction task. Secondly, we were interested whether the patterns of emotional and autonomic cardiovascular responses differ between both stress tasks as well as effects of individual attachment orientation.

Method

Sample

Fifty healthy, unmedicated (except contraceptives) volunteers were recruited and provided written informed consent. They were requested to apply only if they were not suffering from any current mental or somatic disease. Food, caffeine containing beverages and smoking were stopped 3 h before the examination. Participants were 23.3 (SD 2.2) years old, 80% were female, 50% in a current relationship, and mostly college students or staff. Twelve % reported smoking. The study was approved by the local ethics committee.

Materials and procedure

Attachment orientation was assessed using the anxiety (M = 2.58, SD = 0.83) and avoidance (M = 2.14, SD = 0.76) subscales of the German version of the Experiences in Close Relationships—Revised (ECR-R; Ehrenthal, Dinger, Lamla, Funken, & Schauenburg, 2009). Symptom load as a possible confounding factor (Gorman & Sloan, 2000) was measured with the global severity index (GSI; Franke, 2000) of the Brief Symptom Inventory (M = 0.45, SD = 0.32).

Assessment of cardiovascular data followed a standardized procedure of baseline–MA – rest – SR – rest. The stress tests were carried out in a counterbalanced order. Each period lasted 5 min. At the beginning and end of each phase, the subjects were asked to rate their perceived level of tension, anger, sadness and happiness on a scale from 0 (not at all) to 10 (very much).

Indices of cardiovascular and autonomic functioning were recorded non-invasively and continuously using the FDA-certified TaskForce® Monitor (CNSystems, A; Fortin, Habenbacher, Gruellenberger, Wach, & Skabal, 1998; Fortin et al., 2006). We investigated phase-specific mean values of heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP).

Separation recall

The separation recall interview was developed in close accordance to the established protocol of an anger recall interview (Prkachin, Mills, Zwaal, & Husted, 2001). We instructed the participants to remember and talk about a situation from their life, when they felt lonely and abandoned, and had whished that somebody would have been at their side. A standardized set of questions on related thoughts, feelings and wishes (e.g. 'In that situation, what exactly were you thinking?') was used to further trigger the memories of the chosen situation and to keep the participants engaged. The SR approach seeks to combine several advantages for attachment-related cardiovascular stress testing as it addresses personally relevant memories, promotes an interpersonal component of self-disclosure and activates emotional-motivational aspects of attachment-related memories.

Results

None of the participants refused to engage in the tasks and all remembered and reported episodes of being lonely or abandoned during the SR. They reported conflict in close relationships, including family of origin (34%), break-up (30%), followed by relocation or staying abroad (22%) and death or life-threatening illness of a relative (14%).

Emotional reactions

To compare emotional reactivity between MA and SR, we used a dummy coding approach for creating two groups. There was no significant effect of order of the stressors or differences in any of the baseline-values

Table I. Emotional and cardiovascular reaction to mental arithmetic and separation recall

Source		Mental arithmetic	Separation recall	Main effect stress		Main effect stressor		Stress × stressor		
				F	*p*	*F*	*p*	*F*	*p*	*contrasts*
HR	pre	69.29 (10.66)	69.60 (10.56)	122.00	<0.001	0.59	0.446	3.66	0.028	pre vs stress*
(beats/min)	stress	85.35 (11.84)	80.81 (12.47)							rest vs stress *ns*
	rest	70.15 (10.58)	69.96 (10.80)							
SBP	pre	123.69 (9.17)	124.40 (9.99)	84.39	<0.001	0.92	0.339	0.33	0.722	pre vs stress *ns*
(mmHg)	stress	135.10 (10.88)	137.01 (11.40)							rest vs stress *ns*
	rest	125.10 (9.74)	127.32 (9.56)							
DBP	pre	79.62 (7.84)	79.49 (7.75)	127.16	<0.001	1.20	0.276	3.03	0.050	pre vs stress *ns*
(mmHg)	stress	90.28 (7.23)	90.95 (7.70)							rest vs stress**
	rest	78.86 (7.32)	82.32 (7.52)							
Tension	pre	2.53 (1.81)	2.58 (1.70)	182.72	<0.001	8.95	0.004	21.42	<0.001	
	post	6.48 (2.09)	4.52 (2.07)							
Anger	pre	1.12 (1.52)	1.36 (1.66)	27.98	<0.001	0.16	0.690	3.16	0.056	
	post	2.50 (2.27)	2.00 (1.99)							
Sadness	pre	1.54 (1.89)	0.96 (1.51)	19.78	<0.001	2.13	0.147	24.06	<0.001	
	post	1.44 (2.12)	3.00 (2.38)							
Happiness	pre	5.36 (2.16)	5.62 (2.18)	10.67	0.002	0.65	0.421	13.22	<0.001	
	post	5.42 (2.08)	4.50 (2.35)							

* $p < 0.1$; ** $p < 0.05$.
HR: heart rate; SBP: systolic blood pressure; DBP: diastolic blood pressure.

concerning emotional or cardiovascular variables between the two groups (data not reported). 2 × 2 repeated measures MANOVA [stress (pre-stressor versus post-stressor)] by stressor (MA versus SR) on the dependent variables tension, anger, sadness and happiness revealed a significant main effect for the factor stress, $F(4,95) = 44.79$, $p < 0.001$, a significant main effect for the factor stressor, $F(4,95) = 4.02$, $p = 0.005$ and a significant interaction effect stress by stressor, $F(4,95) = 22.07$, $p < 0.001$. Participants reported greater sadness and less happiness after the SR, more tension, and on a trend level, more anger after the MA (see Table I).

Cardiovascular reactions

Using a similar approach, 3 × 2 repeated measures MANOVA [stress (pre-stress versus stress versus subsequent rest)] by stressor (MA versus SR) on the dependent variables HR, SBP and DBP revealed a significant main effect for the factor stress, $F(6,93) = 133.94$, $p < 0.001$, no main effect for the factor stressor, $F(6,93) = 0.77$, $p = 0.515$, and a significant interaction effect stress by stressor, $F(6,93) = 3.39$, $p = 0.005$. For the interaction effect stress by stressor, especially when contrasting pre stress versus stress (reactivity) and stress versus subsequent rest (recovery), there were significant differences for HR (higher during MA) and DBP (higher during rest after SR, see Table I).

Attachment and cardiovascular recovery

To assess associations between self-reported attachment anxiety and avoidance and physiological reactions, we correlated ECR-R subscales and cardiovascular recovery scores. Cardiovascular recovery was assessed as inverse residualized change scores by predicting the rest mean from stress mean and therefore correcting for the preceding task value in a linear regression model. Positive inverse residual scores represent relatively larger decrease from stress to rest, negative inverse residual gain scores relatively small decrease, all in comparison to the overall sample. All correlations were partial correlations controlling for age, symptom load (GSI) and smoking (cigarettes/day).

Across all participants, there was a trend for a negative correlation between change scores in DBP and the ECR-R avoidance subscale ($r = -0.27$, $p = 0.067$) only. However, as attachment questionnaires seem to assess more conscious aspects of attachment behaviour (Roisman et al., 2007), and the ECR-R specifically deals with attachment experiences in close relationships, we also provide analysis for one group of participants who

talked about more conflictual relationship experiences (conflict in close relationships and break-up, $N = 33$) versus themes of farewell and loss (relocation or staying abroad and death or severe illness of a relative, $N = 17$). In the farewell/loss group there were no significant relations between ECR-R and psychophysiological recovery data. However, in the conflict/break-up group we found a significant negative correlation between ECR-R avoidance and residual change scores in DBP ($r = -0.50$, $p = 0.005$) for the SR, but not the MA condition.

Discussion

In accordance with our first hypothesis, the attachment-specific short term stressor activated the autonomic cardiovascular system to a similar level as a mental arithmetic task, but the cardiovascular profile differed between the two short term stressors: While the attachment-related SR was accompanied by sadness and delayed DBP-recovery, MA was associated with more tension and anger, and higher HR during performance. The difference may be related to heightened and prolonged attentive and emotional processing of the memories reported during SR (Brosschot, Pieper, & Thayer, 2005; Gianaros, May, Siegle, & Jennings, 2005).

We also found evidence for interrelations between attachment avoidance and delayed DBP-recovery for SR but not MA, especially in a subgroup of participants who recalled situations of interpersonal conflict or break-up. The influence of avoidance on physiological variables has been reported before (e.g. Diamond et al., 2006; Maunder et al., 2006) and might be explained by increased sympathetic and vascular reaction, possibly related to more negative emotion, for example, anger and dysfunctional cognitions after SR (Boelen & Reijntjes, 2009; Cacioppo, Berntson, Larsen, Poehlmann, & Ito, 2000; Gross et al., 2008).

Possible weaknesses of our pilot-study are related to sample selection, statistical power, and comparability of the tasks. By keeping the educational background constant using college students and staff, and therefore enhancing internal validity, comparability to low-educational samples, especially concerning the MA, may be limited. Also our sample size does not allow for testing differential effects of gender on performance and affectedness on MA and SR, although this may be relevant for future research (Wang et al., 2007). However, even though the 10 men in our sample had a better performance in the MA than female participants, this performance was neither related to emotional reactions or cardiovascular recovery scores (data not reported). Splitting up the sample post hoc with regards to the content of the SR results in small group sizes. As the results are relevant concerning attachment theory, we still feel they are valid to report, as they might stimulate more research. Finally, the MA task may be more related to attentional demands, while the SR depends on activation of memory processes. Although this would probably be relevant for neuroimaging data, we were targeting cardiovascular stress reaction, and therefore think it is valid to compare the SR to an established stress test as the MA.

In conclusion, this study provides first evidence that the presented separation recall task is a suitable tool to reliably induce attachment related stress responses in a clinical laboratory environment. Future studies should also include interview-based attachment measures (Fortuna & Roisman, 2008) and risk samples with more insecure attachment strategies. Furthermore, it is important to investigate differential and moderating effects of emotional valence, content of SR stories, and situational variables as possible mediators between attachment and psychophysiological stress response. For example, attachment avoidance may lead to reduced availability of related memory content and additional suppression of emotional reactions. Similar hypotheses are currently being researched in a series of controlled experiments, as the separation recall stressor has shown good performance in this first study.

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Significance of memory content influences attachment-related stress reaction

Johannes C. Ehrenthal, Sarah Frank, Ulrike Dinger, and Henning Schauenburg

Abstract

Attachment avoidance has a significant influence on stress regulation across the life span. However, it remains unclear under what conditions avoidant regulatory functioning is beginning to impact cardiovascular stress reaction. We tested whether the influence of attachment avoidance on psychophysiological stress differs depending on the significance of a reported separation experience. In a pilot study, 49 healthy subjects were randomized to recall and report a separation experience of either high or low personal significance. Multilevel regression models showed the influence of attachment avoidance on cardiovascular stress reaction to be moderated by the level of personal significance of a recalled separation experience, even when controlling for multiple covariates. This corresponds to a threshold and capability model of attachment activation and dynamics.

Keywords: attachment, psychophysiology, defenses, heart rate, cardiovascular

Highlights:

Insecure attachment differentially influences stress regulation. > We examined under what conditions attachment regulative function is activated. > The level of significance of an attachment-related memory influences the impact of attachment avoidance on heart rate reactivity.

1. Introduction

Attachment theory provides a framework for understanding and predicting inter-individual differences in stress regulation across the life span (Dykas & Cassidy, 2011). The attachment motivational system is activated in times of distress and aims at the re-establishment of felt security by means of proximity seeking and contact maintaining behaviour. Repeated relational experiences with primary caregivers shape relatively stable internal working models of secure, avoidant, and anxious attachment, which in turn influence the future prediction and interpretation of relational experiences (Mikulincer & Shaver, 2003).

Individuals with a high level of attachment security experience a deeply rooted trust that others will be there for them in times of need. Insecure attachment styles, on the other hand, may be temporarily adaptive in an evolutionary sense, but lead to inflexibility and a risk for adverse health outcome in the long term. This is mainly due to their primary regulatory strategies of coping with attachment-related arousal: hyperactivation as the predominant strategy of anxious attachment, and deactivation of attachment related emotions and cognitions as a main approach for attachment avoidance (Mikulincer, Shaver, & Pereg, 2003).

As one important function of adult attachment lies in the regulation of threat-related arousal initiated by internal or external demands (Maunder & Hunter, 2001), several researchers have attempted to relate insecure attachment styles to psychophysiological stress reaction. Most of the published studies report associations between attachment insecurity and heightened reactivity of the hypothalymic-pituitary-adrenocortical (HPA) axis and the autonomic nervous system (ANS). However, no clear conclusions can be drawn yet concerning specific effects of either anxiety or avoidance (Diamond & Fagundes, 2010). One possible explanation for the inconsistencies is the use of a wide range of measures as well as stressors, some more, some less attachment-specific. Another option would be to argue that the influence of attachment style on stress reaction may manifest itself under specific circumstances only, and is moderated by other external or internal variables.

If more complex interactions are relevant for the explanation of attachment-related stress reaction, one central question concerns the mechanisms that determine when and how the adaptiveness of attachment insecurity turns into dysregulation. Biological models of stress regulation point towards the importance of individual regulatory dynamics rather than norm values (McEwen & Wingfield, 2007). One more specific approach can be seen in a capability model, as it combines individual differences with certain external or internal demands to predict an individuals' reaction (Coan, Allen, & McKnight, 2006).

The activation of the attachment system mainly depends on the subjective and often automatic appraisal of a given internal or external threat under the top down control of excitatory or inhibitory feedback loops. For example, highly avoidant individuals will pre-consciously inhibit the accessibility of attachment related thoughts and emotions, therefore raise a threshold for the conscious experience of stress and interpersonal needs (Mikulincer & Shaver, 2003). Avoidance may be helpful in the down-regulation of for example painful thoughts, and even restrain the ability to encode attachment-related material, let alone retrieve the information from memory (for an overview, see Dykas & Casidy, 2011). Avoidant defensive function may even influence basic motor responses (Fraley & Marks, 2011). Other studies report evidence for a direct down-regulation of physiological arousal as measured by skin conductance level when avoidant individuals were instructed to suppress thoughts about loss. However, under conditions of experimentally induced stress and psychological load, defensive effects of avoidance disappear (Gillath, Giesbrecht, & Shaver, 2009).

Additional cognitive or emotional load may indicate one possible mechanism for the breakdown of regulatory defensive strategies by defining an upper bound threshold. It remains unclear, however, whether there is also a lower bound of significance that has to be reached for defensive strategies to impact physiological homeostasis regulation. For example, if an avoidant individual habitually suppresses possibly stressful memories, this could have an indirect effect, reducing observable psychophysiological reactivity. As there is a stable

tendency to suppress attachment-related, social, and often emotionally relevant information in avoidant individuals (Dykas & Cassidy, 2011), we sought to experimentally manipulate the significance of an attachment-related memory content to test whether the influence of attachment avoidance on psychophysiological stress reaction is different under conditions of low vs. high significance. More specifically, we expected psychophysiological reactivity to an attachment-related short term stressor to increase in individuals with higher avoidance under conditions of lower valence of the reported situation, as it is not threatening enough to bear the need interfere with normal stress reaction. On the contrary, if the significance of the reported situation is higher, avoidant regulatory function should start to become of use, resulting in a decreased cardiovascular reactivity towards the attachment-related stressor.

2. Methods

2.1 Participants

Students and university staff were recruited on campus for a small monetary reward. Exclusion criteria were a present physical or mental disorder, medication (except oral contraceptives), also participants should be fluent in German language. They were asked to stop the consumption of food, and drinks containing caffeine for at least 3 hours before examination, and stop smoking at least one hour before the appointment. Measurements were carried out in the afternoon. The study was approved by the local institutional review board, a total of 52 participants gave their written informed consent. Three Participants had to be excluded because of low ECG data quality, leaving a sample of N = 49 to be studied.

2.2 Psychological measures

Attachment anxiety and avoidance was assessed with the German version of the Experiences in Close Relationships – Revised (ECR-R) questionnaire (Ehrenthal, Dinger, Lamla, Funken, & Schauenburg, 2009). The ECR-R is a widely used, 36-item instrument,

which has been translated into several languages. Internal consistencies for the sample were .85 for anxiety and .93 for avoidance.

General symptom load as a potential covariate was assessed through the global severity index (GSI) of the Brief Symptom Inventory (BSI; Franke, 2000). Several other covariates were measured, including body mass index (BMI), self-reported level of physical activity on a scale from one to five (from none at all to professional competitive sports), smoking, age, and breathing frequency.

2.3 Laboratory testing procedures

Psychophysiological data was assessed with the Task Force® Monitor (CNSystems, Graz, Austria), a stable, non-invasive, computer-supported monitoring system. It provides a high resolution 3-channel-electrocardiogram (ECG) with a sampling rate of 1000Hz and offers not only calculation of heart rate (HR), but also indices of heart rate variability by automated analyses of autoregressive power spectral density in the beat-to-beat oscillations in RR intervals. The Task Force® Monitor is a monitoring system certified by the Food and Drug Administration (Fortin et al., 2006). For our current study we report data on HR, and high-frequency heart-rate variability (HF-HRV, 0.15-0.40 Hz) as a measure of cardiac parasympathetic control. All cardiovascular data were inspected for outliers and checked for normal distribution. As data on HF-HRV were skewed, log-transformed data were used for all further analyses.

2.4 Procedure

Psychophysiological stress reaction was continuously measured in a design of subsequent five minute recordings of rest – attachment-related separation recall task (SR) – rest. For the SR, participants were instructed to remember and report a situation from their life when they had felt lonely and abandoned, and had whished that somebody would have been there for them. The procedures are described in greater detail elsewhere [*name deleted to maintain the integrity of the review process*]. After the initial five minute baseline-period, the

participants were asked to remember two situations where they had felt lonely and abandoned, one with higher, another one with lower emotional valence. Self-rated emotional significance of each situation was assessed on a scale from 0-10. Participants were randomized to two conditions, where they were either asked to talk about the more, or the less important situation within the separation recall paradigm for five minutes. The results concern reactivity as increases from baseline to SR. All calculations were conducted with IBM SPSS 18.0.

3. Results

3.1 Sample characteristics

The group reporting the less significant separation-related memory content (N = 25) consisted of 60 % female participants. Mean age was 25.20 (3.55), BMI = 21.21 (2.21), physical activity = 2.48 (.77). Significance of the reported memory (on a scale from 0-10) was 5.36 (1.93), ECR-R anxiety 2.70 (.91), ECR-R avoidance = 2.15 (.78), GSI of the BSI = .50 (.48). Heart rate increased from baseline to SR from 75.22 (11.81) to 82.07 (12.26) beats/minute, so did breathing frequency from 18.88 (2.24) to 23.12 (1.80). Log-transformed HF-HRV decreased from 5.89 (1.19) to 5.61 (.80) ln ms^2. The other group reporting memories with higher personal significance (N = 24) consisted of 58.3 % female participants. Mean age was 23.79 (3.34), BMI = 21.89 (2.33), physical activity = 2.71 (.62). Significance of the reported memory (on a scale from 0-10) was 8.83 (.96), ECR-R anxiety = 2.80 (.82), ECR-R avoidance = 2.35 (.94), GSI of the BSI = .46 (.32). Heart rate increased from baseline to SR from 73.46 (12.70) to 80.23 (.14.31) beats/minute, so did breathing frequency from 19.42 (2.07) to 22.44 (1.79). Log-transformed HF-HRV decreased from 6.25 (1.48) to 5.94 (1.18) ln ms^2. Randomization was successful as there were no statistical differences in any of the psychological or psychophysiological baseline variables, except for the amount of reported significance ($F(1,47) = 62.50$, $p < .001$).

3.2 Main question

For targeting the main question, we used repeated multilevel regression models (two measurements nested within each participant) for both criterion variables (HR and HF-HRV). All baseline models showed that significant amounts of variance were at the participant level, indicating the necessity of further multilevel analyses[1] (Hox, 2002). The final models included reactivity (baseline to SR phase) as level 1 predictor and condition (high-vs.-low significance of reported situation), attachment variables (ECR-R anxiety and avoidance) as level-2 predictors, as well as the respective interaction terms. Both models were controlled for age, body mass index, smoking, physical exercise, breathing frequency and severity of current psychological symptoms. The results are displayed in table 1.

Table 1. Repeated multilevel regression models

	HR		HF-HRV	
	Coeff.	t	Coeff.	t
Level 1				
Reactivity	4.45	3.60 **	.04	.19
Level 2				
Significance (low vs. high)	3.06	.92	-.28	-.96
Anxiety	-.37	-.18	.14	.61
Avoidance	.81	.40	.01	.02
Reactivity x anxiety x valence low	-1.77	-1.46	.17	.78
Reactivity x anxiety x valence high	.61	.51	-.31	-1.46
Reactivity x avoidance x valence low	3.58	2.58*	-.15	-.61
Reactivity x avoidance x valence high	-2.60	-2.48*	.16	.83

Note. ‘ p < .10; * p < .05; ** p < .01. All analyses controlled for age, body mass index, smoking, symptom load (GSI), physical activity, and breathing frequency. HR = heart rate; HF-HRV = high-frequency heart rate variability.

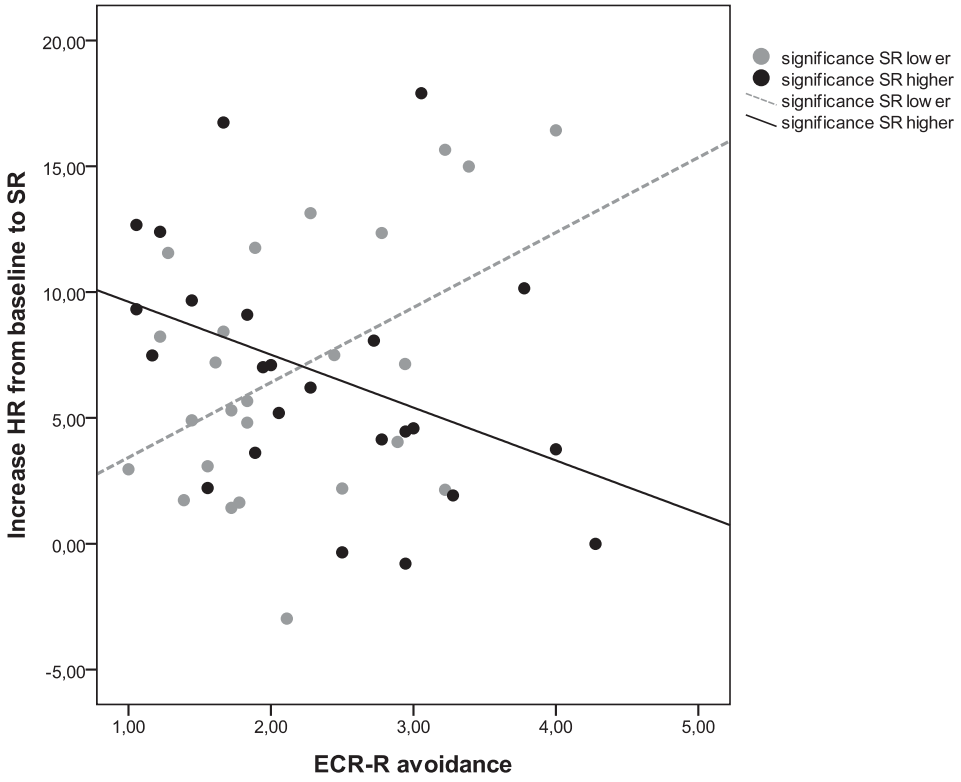
[1] Results can be obtained from the correspondent author.

Regarding HR, there was a main effect of reactivity, indicating that in general, heart rate increased from Baseline to SR. We observed no main effect of significance of the memory or attachment on general physiological arousal. We did find, however, an interaction between attachment avoidance and condition. When thinking about and reporting the attachment-related situation with lower significance, higher avoidance was associated with a larger increase in HR. This effect was reversed during the situation with high significance. Here, higher avoidance was associated with lower HR. Stated differently, highly avoidant individuals showed a greater increase in heart rate when they remembered a situation of lower emotional involvement, while the increase in heart rate was smaller when reporting about a highly meaningful situation. There were no significant influences of attachment, situational significance or their interactions on HF-HRV.

4. Discussion and conclusions

From a multidimensional perspective on attachment-related regulatory processes, we investigated effects of avoidance on cardiovascular and autonomic reactivity to an attachment-related short-term stressor, while experimentally manipulating the emotional significance of the reported situation. Randomization was successful, as the two groups differed only in the level of significance attributed to the reported situation. Under conditions of lower significance, we found a linear relationship between avoidance and amount of increase in HR from baseline to the task, while under conditions of higher significance, attachment avoidance was associated with a decrease in HR reactivity. The results were controlled for of covariates such as age, BMI, physical activity, smoking, symptom load, and breathing frequency. We did not find, however, a systematic relationship with regard to heart rate variability

Figure 1. Relationship between attachment avoidance and heart rate reactivity



Note. Scatterplot and regression lines for attachment avoidance and heart rate reactivity in high vs. low significance of a reported situation. Heart rate reactivity is calculated as a subtraction from separation recall phase minus baseline, so higher values indicate larger increase. SR = separation recall; ECR-R = Experiences in Close Relationships – Revised Questionnaire.

With regard to the a priori appraisal of the reported separation episodes, it must be noted that both groups reported relatively meaningful situations. However, as evaluative processes themselves are influenced by attachment style, for our study it was more important to create intra-individual differences in levels of significance, than maximizing between-group differences. The results concerning heart rate can be interpreted with regard to regulatory function of secondary attachment strategies within a threshold model. Avoidant attachment regulatory systems seem to be sensible with regard to at what level of significance they have to "interfere", possibly related to individual cut-off points. Under condition of lower significance, the associated larger increase in HR for more avoidant individuals can be explained by greater psychophysiological demands or task difficulty, as more avoidant

individuals usually experienced more stressful attachment experiences in general (Mikulincer & Shaver, 2003). An explanatory alternative relates to findings that HR acceleration is usually higher if there is an inner plan on how to deal with a task, as opposed to relatively high uncertainty (e.g., Sosnowski, Krzywosz-Rynkiewicz, & Roguska, 2004). In this case, there may be a set of avoidant responses to remembering a relatively controllable separation response, which increases HR reactivity. However, if the memory content is of higher significance, an inability to rely on pre-set response modes may be reached and more complex processing is needed, resulting in a smaller increase in HR in accordance with the model of Sosnowski et al. (2004).

It is important to note, that it is not arousal in general that is avoided, but arousal related to memories of higher attachment related significance. This may be understood in a broader context of circular, reinforcing processes of stability and change in attachment self- and co-regulation. Several researchers (Diamond, 2001; Sbarra & Hazan, 2008) proposed models of adult attachment formation in which physiological processes may play an important role as markers of attachment functioning and in strengthening certain attachment patterns. The habitual down-regulation of attachment avoidance usually dampens psychological and physiological arousal associated with stressful, attachment related information (Mikulincer & Shaver, 2003), allowing avoidant adults to function in a primarily social world despite their negative attachment experiences. At the same time, the association between smaller increase in HR and higher avoidance while remembering and talking about personally relevant separation experiences may psychophysiologically reinforce this regulatory strategy, as it helps to maintain homeostasis. This could also explain why for example McWilliams and Bailey (2010) didn't find an association between attachment avoidance and cardiovascular disease in a large, cross-sectional dataset: if stress-related, cardiovascular responses to attachment-related themes are successfully down-regulated, there is less "wear and tear" that

results from the constant activation of arousal-related physiology or counter-regulatory systems (McEwen & Wingfield, 2003).

It remains open why there was no association of attachment with HF-HRV as a direct marker of parasympathetic activity in the present study. A simple answer may be related to sample size and less reactivity in HF-HRV. However, it must be noted that quite a few studies on attachment and stress reaction did not find effects for HF-HRV, but rather skin conductance level (Diamond & Fagundes, 2010). On a different point, the separation recall task may not always elicit a full HPA response (for a more detailed discussion see Sbarra & Hazan, 2008, or Del Guidice, Ellis, & Shirtcliff, 2011). Also heightened cardiovascular demand through increased HR may be successfully regulated by changes in stroke volume or peripheral resistance, especially in healthy young adults.

This pilot study is limited in several ways. First, the number of participants is small and consists of students and university staff, limiting the generalizability of the findings. Secondly, our sample size does not allow testing for gender differences, although this has shown certain relevance in other studies on cardiovascular functioning. And last, but not least, as our participants described themselves as relatively secure with regard to attachment, a more diverse sample with regard to attachment characteristics would probably result in a more detailed picture of the impact of avoidant regulatory function. Nevertheless, to advance the understanding of attachment-related regulatory processes, we consider it mandatory to expand our knowledge of internal and external moderators of attachment activation. One area of special interest may be to expand findings from highly standardized laboratory testing into more ecologically valid stressors and procedures (e.g., Lee, Sbarra, Mason, & Law, 2011). This would also bear the potential of building bridges between personality and social psychology on the one, and health and clinical psychology on the other hand, which corresponds to how attachment theory was originally developed.

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Insecure attachment and the breakdown of regulatory defenses under high life stress: Psychophysiological evidence

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Abstract

Attachment plays an important role for stress regulation in an interpersonal context. Especially avoidant strategies can be conceptualized as formerly adaptive, defensive processes with the aim of maintaining homeostasis by deactivation of attachment-related cognitions, emotions and needs. However, as attachment insecurity is a risk-factor for maladaptive stress regulation in adults, it remains unclear under what conditions normative attachment strategies develop into maladaptive psychophysiological patterns. In two studies, we tested whether cardiovascular and autonomic reactivity is differentially influenced under conditions of low vs. higher psychological symptom load (study 1), and low vs. high life stress (study 2). Attachment, symptom, and stress load were assessed by self-report. Associations between the magnitudes of psychophysiological responses and attachment avoidance were moderated by life stress, and, to a lower extend, by symptom load. Insecure attachment, especially avoidance, may serve as an adaptive defensive process in psychophysiological stress reaction under low life stress only.

Keywords: attachment; stress; cardiovascular; heart rate variability; Experiences in Close Relationships – Revised; defenses

Introduction

Regulatory function of attachment has stimulated a large body of research. Originally conceptualized in a developmental context, the attachment system aims at the re-establishment of (felt) security in times of distress across the life span (Berman & Sperling, 1994; Marvin & Britner, 2008). Depending on the quality of recurring relational experiences with the primary caregivers, relatively stable "internal working models" (IWM) of the self and others in interaction develop. They are relevant for regulation, interpretation, and prediction of attachment related behaviors, emotions and cognitions, and form a distinct motivational-regulatory system. Inner working models are relatively stable across the life-span, although a) new experiences may affect the attachment system, and b) its content, verbal representation, and attachment figures differ from early relationships to adulthood (Fraley 2002; Simpson, Collins, Tran, & Haydon, 2007). Although sometimes labeled in other terms, individual differences can be reliably grouped into three organized styles of attachment-related security, avoidance, and anxiety, using a variety of measures (Bakermans-Kranenburg & van Ijzendoorn, 2009; Crowell, Fraley, & Shaver, 2008).

Regulatory defensive function of deactivating attachment strategies in adults

From the early stages of attachment theory, secondary/insecure attachment strategies were conceptualized as defensive processes, which can be regarded as 'mental mechanisms aimed at adaptation and self-regulation' (Mikulincer, Shaver, Cassidy, & Berant, 2009). Bowlby (1980) considered "unconscious defensive exclusion" as a temporarily adaptive mechanism in attachment-related information processing. It prevents painful thoughts, whishes, or observations from being consciously experienced, and therefore allows for example a child to function under adverse relationship experiences with their primary caregivers, but leads to

inflexibility in the long term. Bowlby grouped defensive processes resulting from systematic and repeated defensive exclusion into two categories of a) deactivation of behavioral systems, and b) cognitive disconnection. The former is associated with shutting down of attachment-related thoughts and feelings, emotional detachment, and replacement of attachment-related attentional processes with other activities. The latter results into a disconnection between an attachment-related event and an individual's response towards it by misattribution, redirection of negative affect away from it's cause, and becoming preoccupied with own psychological states instead of the possibly painful experience (Bretherton & Munholland, 2008). These defensive strategies are results of preceding attachment experiences, but also contribute to possible long-term developments in IWM.

Expanding on Bowlby's original ideas and incorporating a large amount of previous research, Mikulincer, Shaver and Pereg (2003) proposed an integrative model of attachment activation and processing. It comprises three modules with the overall aim of regulatory function. The first module deals with threat appraisal and preconscious, normative activation of the attachment system. If the attachment system is activated, a second module probes the feasibility of seeking proximity to an attachment figure for restoring felt security as a primary attachment strategy. If no attachment figure on a real or representational level is available or accessible, a third module evaluates the viability of using an attachment figure for coping with the resulting distress, leading to hyperactivating or deactivating strategies. Hyperactivation produces intense contact seeking behavior and hypervigilance concerning attachment and stress related cues, for the price of constant arousal and dependency in others. Deactivation brings along downplaying and suppression of attachment related needs and cues, for the price of ultimately staying lonely

(Mikulincer & Shaver, 2008). On a descriptive level, hyperactivating strategies are the predominant regulatory approach of anxious attachment, while deactivation of the attachment system habitually occurs in more avoidant subjects.

There is evidence that especially the influence of avoidant attachment is important for the regulation of attachment related information processing and response to challenges, generally supporting the assumption of secondary attachment strategies as defensive processes in adults. Fraley and Shaver (1997) found that attachment avoidance was associated with a better ability to suppress attachment related thoughts, and a lower physiological arousal as indicated by skin conductance under condition of normal functioning. Avoidance may even serve as a preemptive defensive process, as it is associated with less encoding of attachment-related information (Fraley, Garner, & Shaver, 2000).

Over the last years, several different authors reported data that highlight the fragility of avoidant defensive processes under experimental conditions of stress. In an extension to the study by Fraley & Shaver (1997), the general effect of high avoidance being correlated with the ability to suppress painful thoughts about a relationship breakup could be replicated. However, once a component of cognitive load was added to the experiment, the suppression effect disappeared (Mikulincer, Dolev, & Shaver, 2004). Another way of eliminating positive effects of avoidant defensive functioning was accomplished by thinking about a personal relationship experience with insecure content (Gillath, Giesbrecht, & Shaver, 2009). As secondary strategies for down-regulation of attachment needs require at least some kind of psychological effort, the reported effect can be seen as evidence for habitual cognitive-attentional defensive processes in attachment avoidance, which may be changed under external demand.

Although effects of short-term cognitive or emotional load may indicate one mechanism of breakdown of regulatory defensive strategies, it remains unclear whether this is also true under conditions of ecological validity, e.g. psychological symptom load or enduring life stress. This is of special relevance, as it would link the described mechanism to long-term effects of attachment-related adaptive processes, and health or well-being related outcome. Furthermore, it would propose a simple way of testing moderational hypotheses on functionality and limits of defensive insecure or avoidant strategies in diverse samples by adding measures of stress load. In conclusion, there is evidence for the fragility of avoidant defensive functioning under conditions of experimental cognitive or emotional load. However, it remains unclear whether this is also true with regard to everyday stress and strain.

Attachment and cardiovascular stress regulation

As one important function of adult attachment lies in different strategies of regulating threat-related arousal and internal or external demands (Maunder & Hunter, 2001), several researchers have attempted to relate attachment styles to psychophysiological stress reaction (Diamond, 2001). One way of assessing stress reaction is to measure psychophysiological cardiovascular reaction. This approach has several advantages: it provides insight into underlying biological mechanisms of regulatory processes (Brosschot & Thayer, 2005), is “field-tested” in multiple areas of research and practice, and highly predictive for long-term health outcome (Schwartz et al., 2003).

Existing studies differ with regard to measures of attachment and stressors being used (Diamond & Fagundes, 2010). Maunder and colleagues (2006) described a relationship between attachment anxiety and subjective measures of distress during a non-specific stress protocol, but a correlation between higher avoidance and reduced

high-frequency heart rate variability (HF-HRV) as a marker of parasympathetic modulation. Smeets (2010), however, reported no associations between attachment and, among other biological parameters, heart rate using the non-specific Trier Social Stress Test. Others found attachment insecurity to be partly related to heightened cardiovascular reaction depending on the presence or absence of a partner (Carpenter & Kirkpatrick, 1996; Feeney & Kirkpatrick, 1996), while Kim (2006) reported interactions between attachment insecurity and situational stress on cardiovascular indices. Another paper indicated changes in overall blood pressure and blood pressure recovery for insecurely attached individuals to a betrayal recall (Lawler-Row, Younger, Piferi & Jones, 2006). Recently divorced adults high in attachment anxiety exhibited higher blood pressure at the beginning of a divorce-specific mental activation task, while results concerning reactivity remained mixed (Lee, Sbarra, Mason, & Law, 2011). Emotional relationship security, and in part attachment anxiety was related to resting vagal tone in young men in a study by Diamond and Hicks (2005). Ehrenthal, Friederich and Schauenburg (2011) compared an attachment-related stressor with a mental arithmetic test and found similar overall cardiovascular and subjective stress reaction, but different patterns concerning the two tasks. Furthermore, blood pressure recovery after the attachment stressor but not the mental arithmetic was related to attachment avoidance, emphasizing an attachment-specific component of psychophysiological stress regulation.

Roisman, Tsai and Chiang (2004) found an association between attachment deactivation and increase in skin conductance during the Adult Attachment Interview (AAI), but not in cardiovascular parameters. Attachment insecurity was associated with smaller increase in skin conductance level during several AAI questions in a sample of women with eating disorders (Dias, Soares, Klein, Cunha, & Roisman,

2011). However, results concerning parameters concerning ANS functioning were mixed, and the authors did not find any associations concerning heart rate. In another study relating attachment representations to psychophysiological reaction during a marital conflict resolution task, Roisman (2007) showed again attachment deactivation to be associated with higher skin conductance, while attachment hyperactivation was related to an increase in heart rate. In a replication attempt by Holland and Roisman (2010), however, only the AAI security-insecurity dimension was related to skin conductance in a similar task, but not to cardiovascular indices. Summing up, existing studies on adult attachment and psychophysiology differ widely. From a methodological point of view, some work drew on unspecific short-term stressors with high external controllability, while others used more naturalistic procedures like the AAI with the focus on external validity. Also the studies diverge in the results, partly due to differences in stressors and samples.

Intraindividual differences in psychophysiological regulatory dynamics

Physiological stress reaction is a highly individual and complex process with a vast amount of psycho-biological systems, regulatory and counter-regulatory mechanisms involved (Chida & Hamer, 2008; Juster, McEwen, & Lupien, 2010). From a perspective of allostatic load, organisms maintain stability by changing and adapting to internal or external demands. Therefore, regulatory dynamics may be more important than functioning within a range of norm values. This also implies that every individual has its own dynamic homeostatic cut-off points that have to be taken into account when interpreting data. Last but not least, there is a general stress reaction towards different paradigms, and the amount of specificity related to psychological processes remains somewhat unclear (Brosschot, Pieper, & Thayer, 2005). Consequently, the interpretability of the results depends either on very large

sample sizes, but even more on the exact knowledge of the effects of the paradigms being used. In psychophysiological research on attachment and stress reaction, the influence of moderating factors has mostly been ignored. These moderating factors, however, may be crucial to the understanding of activation and deactivation of insecure and especially avoidant regulatory processes with regard to attachment theory.

Research question

For the current study we were interested in the impact of psychological stress and attachment insecurity on psychophysiological stress regulation. More specific, we wanted to test whether reactivity in cardiovascular and autonomic function is differentially influenced by attachment avoidance under conditions of higher or lower naturalistic stressors.

Study 1

In a first study, we wanted to assess if and how a naturalistic, internal stressor impacts the association between insecure attachment and psychophysiological stress reaction. As an internal stressor we chose individual psychological symptom load. Stress and psychological symptom load are closely intertwined, as each may predict the other over time (Hammen, 2005). Furthermore, psychological symptom load, even in the absence of a major depressive disorder, is a relevant phenomenon for our chosen college sample (Steptoe, Tsuda, Tanaka, & Wardle, 2007), and has proven to be a naturalistic internal stressor with implications for academic achievement (Hysenbegasi, Hass, & Rowland, 2005).

Methods study 1

Attachment was assessed with the German version of the Experiences in Close Realtionships – Revised questionnaire (ECR-R; Ehrenthal, Dinger, Lamla, Funken, & Schauenburg, 2009). The ECR-R consists of 36 items rated on a scale from one to seven. It measures experiences and expectations concerning close relationships on two scales of attachment related anxiety ("I often worry that my partner doesn't really love me") and avoidance ("I feel uncomfortable opening up to my partner"). The ECR-R is a widely used instrument, yields good psychometric properties and has been translated into several languages (Fraley, Waller, & Brennan, 2000).

General symptom load was measured by the global severity index (GSI) of the Brief Symptom Inventory (BSI; Franke, 2000). The BSI assesses different domains of symptom distress on several subscales, which are usually combined into a global score. Information on smoking, physical activity (self-reported weekly intensity on a scale from 1-5), body mass index (BMI), and age was collected to serve as potential covariates.

Psychophysiological data was assessed with the Task Force® Monitor (CNSystems, Graz, Austria). The Task Force® Monitor provides a stable, non-invasive, computer-supported monitoring system. The system also provides, among other indices, a high resolution 3-channel-electrocardiogram (ECG) with a sampling rate of 1000Hz. It offers among other indices the calculation of heart rate variability by automated analyses of autoregressive power spectral density in the beat-to-beat oscillations in RR intervals, and breathing frequency. The Task Force® Monitor is a monitoring system certified by the Food and Drug Administration and other regulatory authorities (Fortin et al. 1998; Fortin et al. 2006; Gratze et al. 1998). In our study we focus on high-frequency heart rate variability (HF-HRV, 0.17–0.40 Hz) as a

measure of cardiac parasympathetic control. All beat-to-beat data were visually inspected and corrected for outliers. As data on HF-HRV was skewed, log-transformed values were used for all further calculations.

Stress induction was performed with an attachment-related short term stressor, the separation recall (SR) paradigm. For the SR, participants were instructed to remember and report a situation from their life which included a partner or family member, where they had felt lonely and abandoned, and had whished that somebody would have been there for them. The procedures are described in greater detail elsewhere [*name deleted to maintain the integrity of the review process*].

Participants study 1

We recruited 55 university students. Exclusion criteria were a current mental or somatic disorder, and language problems. The study was approved by the local ethics committee, and all participants provided written informed consent. They were asked to refrain from consuming food, cigarettes, or caffeinated beverages two hours before the appointment. The first 30 minutes were reserved to fill out the questionnaires, which also served as a physiological adaptation phase. Physiological measurements took place in a quiet, well-temperatured room. It consisted of a baseline phase (5 minutes), then the attachment-related short term stressor (5 minutes). Afterwards another rest phase took place, which is not part of the question concerning reactivity, and therefore omitted from the analyses.

Four participants had to be excluded because of poor ECG signal quality, another one because of an eating disorder, and one because of hypertension, leaving a total number of 49 participants to be studied. Of these 65.3 % were female, 61.2 % currently in a relationship. Mean age was 23.86 (2.97), mean BMI = 22.01 (2.24), level of physical activity = 2.76 (.90) on a scale from one to five. Values of ECR-R

anxiety = 2.90 (.87), avoidance = 2.22 (.77) as well as symptom load GSI = .45 (.39) were what can be expected in student populations. In our sample 26.5 % took medication, which consisted, except one person with a proton pump inhibitor, of oral contraceptives. High-frequency heart rate variability decreased from 6.04 (1.16) to 5.64 (1.06) ln ms^2, while breathing frequency from increased from 19.85 (2.11) to 22.62 (1.34).

Table 1.

Study 1: Multilevel Regression Coefficients of Level 2 Predictors Attachment, Symptom Load, and their Interaction on HF-HRV Reactivity

	HF-HRV	
	Coeff.	t
Level 1		
Reactivity	-.08	-.46
Level 2		
Symptom load (GSI)	.04	.09
ECR-R Anxiety	-.12	-.54
ECR-R Avoidance	.20	.73
Reactivity x anxiety x symptom load	-.72	-1.94’
Reactivity x avoidance x symptom load	.75	1.83’

Note. ‘ $p < .10$; * $p < .05$; ** $p < .01$. All analyses controlled for age, body mass index, smoking, physical activity, and changes in breathing frequency. HF-HRV = log-transformed high-frequency heart rate variability; GSI = global severity index of the Brief Symptom Inventory; ECR-R = Experiences in Close Relationships – Revised questionnaire.

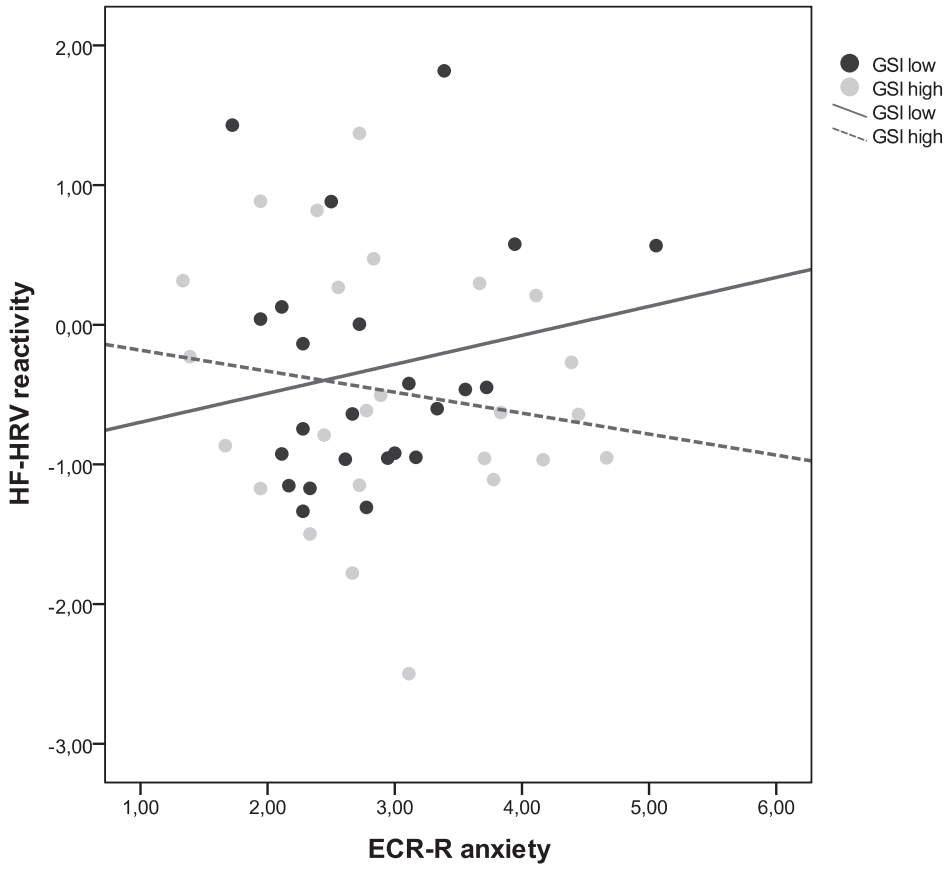
Results study 1

The subscales of the ECR-R were correlated ($r = .67$, $p < .01$), so were GSI and ECR-R anxiety and ($r = .41$, $p < .01$), and GSI and ECR-R avoidance ($r = .32$, $p < .05$). GSI was not significally associated with HF-HRV at baseline ($r = .02$, n.s.) or SR ($r = -.14$, n.s.). ECR-R anxiety did not significantly relate to HF-HRV at baseline ($r = .03$, n.s.) or SR ($r = .01$, n.s.). Higher ECR-R avoidance was marginally related to higher HF-HRV at baseline ($r = .27$, $p < .10$), but not during SR ($r = .10$, n.s.).

Because of the dependency of the data and the repeated measurements, we used repeated multilevel regression models (two measurements nested within each participant) from the IBM SPSS 18.0 liner mixed models procedure for targeting our main question. A baseline model demonstrated a significant amount of variance at the participant level, allowing for further multilevel analyses (Hox, 2002; results can be obtained from the corresponding author). The model included reactivity (baseline to SR) as level 1 predictor, and attachment (ECR-R), life-stress (GSI) and their respective interaction terms as level 2 predictors. The model was controlled for age, BMI, smoking, and level of physical exercise, and changes in breathing frequency. All level 2 predictors were entered as centered variables.

We did not find any main effects of ECR-R attachment scores or GSI symptom load on physiological reactivity scores. However, there was a marginal significant interaction for both ECR-R dimensions and GSI symptom load on reactivity of HF-HRV (see table 1). Figure 1 shows for higher anxiety a generally smaller decrease up to an increase in HF-HRV under conditions of low symptom load. Under higher psychological symptom load, there is a trend for a larger decrease in HF-HRV from baseline to SR with increasing attachment anxiety. This pattern is, to a smaller extend, also true for attachment avoidance (figure 2).

Figure 1. Study 1: Interactions between Attachment Anxiety and Symptom Load on HF-HRV Reactivity



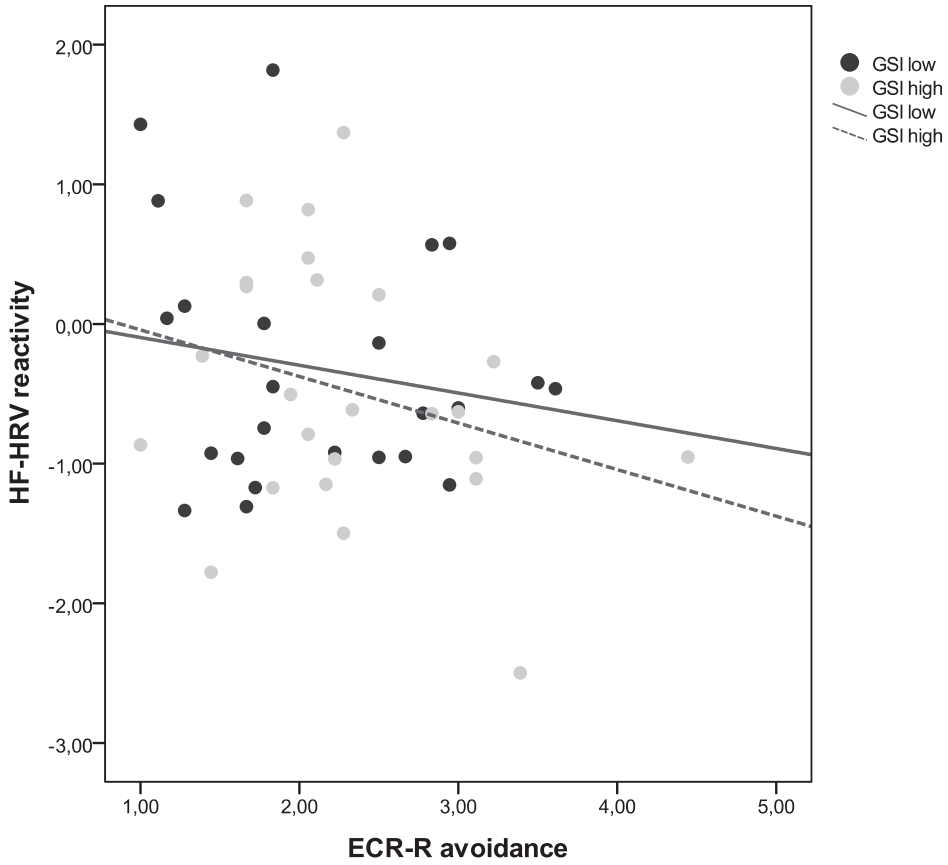
Note. HF-HRV = high-frequency heart rate variability; ECR-R = Experiences in Close Relationships – Revised; GSI = global severity index of the Brief Symptom Inventory; dots represent difference values (stress – baseline), lower values represent a larger decrease in HF-HRV from baseline to stress induction. Groups of high/low GSI are defined by median-split.

Discussion study 1

Our findings of a trend towards a moderational influence of psychological symptom load on the impact of attachment insecurity on reactivity of high-frequency heart rate variability can be discussed from different perspectives. Although our results failed to meet a conventional significance level, there was some evidence that attachment

insecurity was associated with a larger vagal withdrawal under conditions of higher concurrent symptom load.

Figure 2. Study 1: Interactions between Attachment Avoidance and Symptom Load on HF-HRV Reactivity



Note. HF-HRV = high-frequency heart rate variability; ECR-R = Experiences in Close Relationships – Revised; GSI = global severity index of the Brief Symptom Inventory; dots represent difference values (stress – baseline), lower values represent a larger decrease in HF-HRV from baseline to stress induction. Groups of high/low GSI are defined by median-split.

For lower symptom load, there was a trend for less vagal withdrawal associated with higher attachment anxiety, but not really for attachment avoidance. This was against our expectations that especially avoidant regulatory function is prone to disturbances from external or internal demands. However, as the correlation between

the ECR-R subscales in our sample was more substantial than expected, it is probably not possible to clearly distinguish between anxiety and avoidance with regard to psychophysiological functioning. Also we studied a relatively secure sample with regard to attachment, which might have reduced variability in ECR-R scores. Diminished reactivity in HF-HRV may have also reduced the amount of explainable variance. However, inter-individual differences in the functioning of the autonomic nervous system are to be expected in psychophysiological research (Berntson, Cacioppo, Quigley, & Fabro, 1994; Del Giudice, Ellis, & Shirtcliff, 2011). And last, but not least, increased symptom load may be less suited for inducing mental load to disturb attachment-related defensive processes.

Study 2

Because of the promising, but inconcise results of study 1 we sought to replicate our findings concerning the influence of symptom burden, but then test stress load in a more direct way via the assessment of current life stress. Life stress differs from psychological symptom load insofar as it refers more to the impact of consciously experienced worries concerning challenging events. It leaves room for differential coping strategies and may therefore be more suitable to test the impact of naturalistic stressors on possible associations between attachment insecurity and psychophysiological stress regulation (Hammen, 2005).

Methods study 2

All psychological and physiological assessment was similar to study 1 except for the operationalization of current stress load: life stress was assessed with the revised German version of the Perceived Stress Questionnaire (PSQ). The PSQ comprises four subscales of 5 items each about stress related worries, tensions,

demands, and joy over the last month, that can be combined into an overall stress score (Fliege, Rose, Arck, Walter, Kocalevent, Weber, & Klapp, 2005).

Participants study 2

The sample that provided the basis for this study has been described in another publication before [*name deleted to maintain the integrity of the review process*]. It consisted of 50 healthy volunteers recruited via advertisement at the university campus. Participants were mostly students or university staff, 23.3 (2.2) years old, 80 % female. Half of them were currently engaged in a romantic relationship, 12 % were smoking. Attachment scores on the ECR-R were 2.58 (.83) for the anxiety subscale, and 2.14 (.76) for the avoidance subscale, respectively. These values are in the range of what has been reported before in German samples (Ehrenthal et al., 2009). Cronbachs alpha was satisfactory with .86 for anxiety and .85 for avoidance. Mean value for the PSQ was 39.87 (16.15), with a Cronbachs alpha of .91. General symptom load was as expected (GSI of the BSI = .45 [.32]).

Psychophysiological stress reaction was measured in a counterbalanced design of subsequent five minute recordings of rest – mental arithmetic task (MA) – attachment-related separation recall task (SR) – rest. During the MA, subjects engaged in a continuous subtraction task. In the current study only psychophysiological data from the phase before the SR (baseline) and during the SR were used. Mean values and standard deviations for log-transformed HF-HRV were for baseline = 6.02 (.92), and for SR = 5.67 (.82).

Results study 2

Neither ECR-R anxiety nor avoidance itself was significantly associated with the HF-HRV variables. PSQ total score was moderately correlated with ECR-R anxiety and avoidance, and the ECR-R subscales were also moderately interrelated (see Table 2).

Table 2

Study 2: Correlations between Attachment Dimensions, Perceived Stress Level, and Difference Values in Psychophysiological Reaction

	ECR-R Anxiety	ECR-R Avoidance	PSQ total	HF-HRV baseline
ECR-R Avoidance	.54**	-		
PSQ total	.42**	.28*	-	
HF-HRV baseline	.01	.09	-.01	-
HF-HRV separation recall	-.05	-.02	-.03	.84**

Note. ECR-R = Experiences in Close Relationships – Revised; PSQ = Perceived Stress Questionnaire; HF-HRV = log-transformed high-frequency heart rate variability. **p < .01; *p < .05.

The analytical strategy was similar to study 1 using repeated multilevel regression models. Our first model used symptom load as the moderator variable, in an attempt to replicate findings from study 1. Our second model was identical, except for the use of life stress as measured by the PSQ as a level 2 predictor while simultaneously controlling for general psychological symptom load, and other predictors.

For our attempt to replicate previous findings, we again found a trend in the same direction as study 1, but only for the interaction of GSI and attachment avoidance (see Table 3), furthermore a main effect of symptom load. For our main question regarding life stress, we observed no main effects of anxiety, avoidance, or life stress on HF-HRV. However, the interaction effect of avoidance and life stress significantly predicted changes in HF-HRV. Under conditions of high life stress, higher avoidance was associated with a larger decrease in HF-HRV, indicating a

larger vagal withdrawal, while this could not be observed for lower life stress (see Table 4 and Figure 3).

Table 3

Study 2: Multilevel Regression Coefficients of Level 2 Predictors Attachment, Symptom Load, and their Interaction on HF-HRV Reactivity

	HF-HRV	
	Coeff.	t
Level 1		
Reactivity	-.31	-4.42**
Level 2		
ECR-R anxiety	.16	.81
ECR-R avoidance	-.01	-.01
Symptom load (GSI)	-1.05	-2.40*
Reactivity x anxiety x symptom load	-.05	.18
Reactivity x avoidance x symptom load	-.77	-1.86’

Note. ‘p < .10; *p < .05; **p < .01. All analyses controlled for age, smoking, physical activity, symptom load (GSI). HF-HRV = log-transformed high-frequency heart rate variability; GSI = global severity index of the Brief Symptom Inventory; ECR-R = Experiences in Close Relationships – Revised questionnaire.

Discussion study 2

In a sample of 50 healthy adults, we investigated changes in attachment-related regulatory capacity in relation to different levels of symptom load, and life stress. We were partly able to replicate the marginal influence of symptom load with respect to attachment insecurity, in this case avoidance. We also found a main effect of decreased HF-HRV associated with higher symptom load. This is in line with

findings on the topic of ANS function and for example depression (Ehrenthal, Fey, Herrmann-Lingen, & Schauenburg, 2010).

Table 4

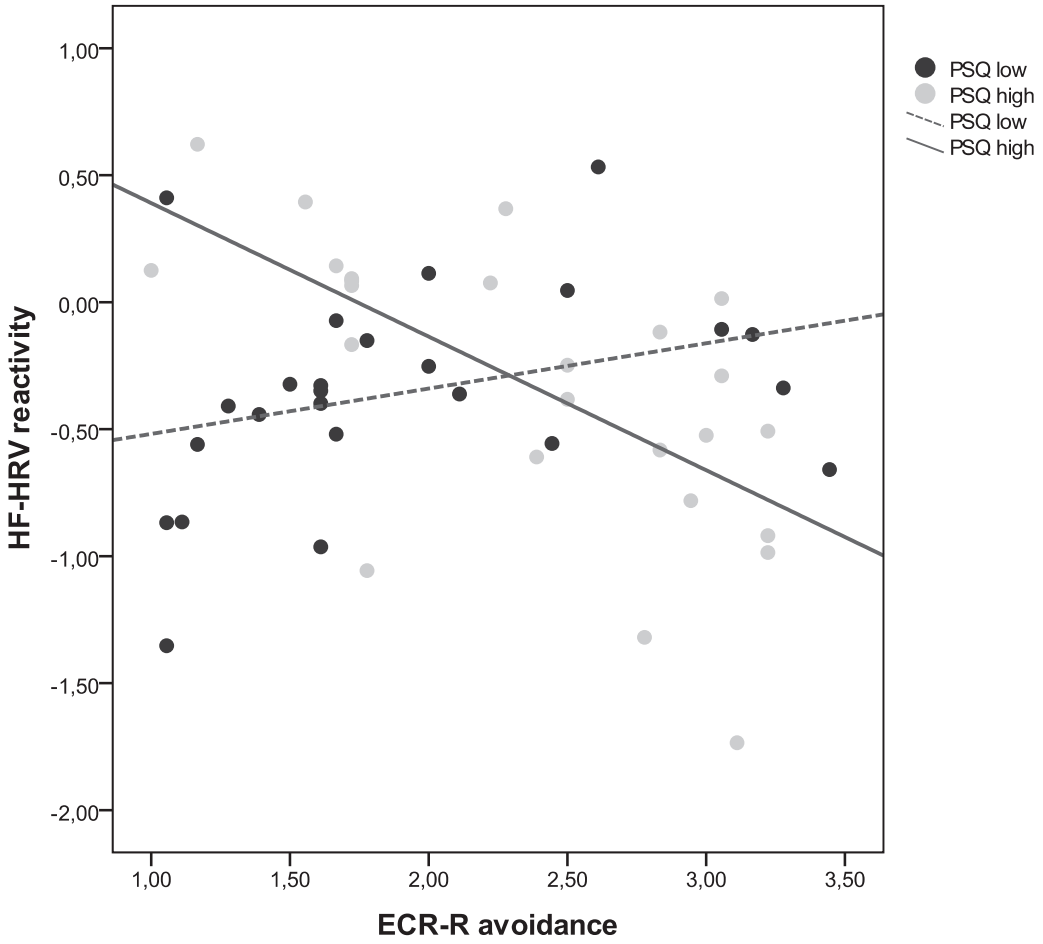
Study 2: Multilevel Regression Coefficients of Level 2 Predictors Attachment, Life Stress, and their Interaction on HF-HRV Reactivity

	HF-HRV	
	Coeff.	t
Level 1		
Reactivity	-.25	-3.67**
Level 2		
ECR-R anxiety	.04	.21
ECR-R avoidance	-.01	-.02
Life stress (PSQ)	.01	1.12
Reactivity x anxiety x life stress	-.01	-.53
Reactivity x avoidance x life stress	-.02	-3.94**

Note. *p < .05; **p < .01. All analyses controlled for age, smoking, physical activity, symptom load (GSI). HF-HRV = log-transformed high-frequency heart rate variability; ECR-R = Experiences in Close Relationships – Revised; PSQ = Perceived Stress Questionnaire.

Regarding our main question, the association between attachment avoidance and regulatory patterns was moderated by life stress. High-frequency heart rate variability decrease from baseline to task phase was generally larger when individuals scored both high on avoidance and life stress.

Figure 3. Study 2: Interactions between Attachment Avoidance and Life Stress on HF-HRV Reactivity



Note. HF-HRV = high-frequency heart rate variability; ECR-R = Experiences in Close Relationships – Revised; PSQ = perceived stress questionnaire; dots represent difference values (stress – baseline), lower values represent a larger decrease in HF-HRV from baseline to stress induction. Groups of high/low PSQ are defined by median-split.

No effects were found for attachment anxiety or anxiety by life stress interactions. The absence of any effects of attachment anxiety on cardiovascular reactions in study 2 is in line with most of the literature mentioned above. One explanation that comes to mind would be that anxious attached individuals are less challenged by a stressor as the separation recall, since talking about attachment issues is more close to the hyperactivating strategies generally used. Also the central fear of

losing a possible attachment object is not activated, as an interviewer is present during the task. And last, inhibition may not play such a central role in attachment anxiety, as opposed to avoidant functioning. As the ECR-R subscales were by far less related than in study 1, we consider it appropriate to interpret the results as more specific with regard to attachment anxiety and avoidance.

Several limitations have to be mentioned. First, sample size and selection are neither large nor representative. Although ECR-R mean values are comparable to other data from German university background, results could differ if people with more insecure attachment styles would have been included. Thus we might have only been able to find effects concerning relatively high functioning avoidant defensive processes. Also our sample does not allow for systematic investigations of possible gender effects, as only ten men were included. However, adding age, level of physical activity, smoking, and even psychological symptom load as covariates does not change the results. Also we did not control for breathing during the physiological monitoring. Although this is generally an important aspect of psychophysiological monitoring, some empirical investigations have shown no or marginal influence on HF-HRV (Beda, Jandre, Phillips, Giannella-Neto, & Simpson, 2007).

General discussion

In two studies we tested a moderational model of attachment-related stress regulation, as previous research has shown that the benefits of especially avoidant attachment can be reduced by inducing mental load. We sought to expand existing studies by using indices of cardiovascular autonomic function, and assess mental load in a more ecologically valid way. In both samples there was a trend towards an interaction between symptom load and attachment insecurity. However, in study 2

current life stress was found to substantially interact with attachment avoidance. The results indicate that life stress may serve as a naturalistic disturbance to avoidant defensive functioning with regard to psychophysiology.

On a physiological level, our data indicates vagal withdrawal, indicating a shift to relative sympathetic dominance during the attachment stressor for high avoidance and high life stress. Although we did not include a direct measure of the sympathetic branch of the autonomic nervous system (ANS), a reduction of HF-HRV as a measure of parasympathetic control can be accompanied by increased sympathetic influence (Task Force, 1996). There are at least two main approaches to the interpretation of reduced HF-HRV. One highlights its importance as a risk factor, linking for example depression with adverse cardiovascular conditions (Ehrenthal et al., 2010). However, it remains open whether insecure attachment is directly related to cardiovascular disease by changes in ANS functioning (McWilliams & Bailey, 2010), and data concerning possible pathways remain sparse (i.e influence of worry, as in Pieper, Brosschot, van der Leeden, & Thayer, 2010, or increase in dysfunctional attitudes following negative mood, as in Beevers, Ellis, & Reid, 2011). Adding to the complexity are studies that show specific cardiovascular effects of different types of social interaction with regard to attachment style (Gallo & Matthews, 2006), and associations between lower HRV, higher negative affect, and depression can also be buffered by positive influences of social interactions (Schwerdtfeger & Friedrich-Mai, 2009).

The other view stresses the function of HF-HRV as a marker for psychological processes and demands. Higher tonic vagal tone may be an indicator and/or a result of higher self-esteem and more adaptive self-regulation (Martens, Greenberg, & Allen, 2008), positive mood (Oveis et al., 2009), or self-regulatory or inhibitory strength

(Geisler & Kubiak, 2009). Thayer and Brosschot (2005) call attention to HRV as an indicator of prefrontal activity, being linked to attentional, motivational, and affective processes or demands. As we focus on intra-individual regulatory dynamics rather than health outcome, and do not use a high-risk group with regard to attachment or physical well-being, we consider this approach more appropriate for the interpretation of our results.

In the following section we will especially discuss the influences concerning attachment avoidance and life stress in the SR paradigm from study 2. Deactivating strategies could operate on different levels of the separation recall. More avoidant individuals may have less access to attachment related memory content; they may also choose not to talk about emotionally challenging episodes with a stranger, even if they would remember them. Both aspects have the potential of influencing stress reactions. For example, HF-HRV may be especially reduced in a combination of high defensive/repressive coping and tasks that involve direct personal feedback interactions (Pauls & Stemmler, 2003).

Under high life stress, the psychophysiological response pattern is shifting towards higher avoidance being accompanied by reduced vagal influence during the attachment recall task. Life stress may serve as a "naturalistic" demand or load, disturbing cognitive-emotional defensive processes, probably in a diathesis-stress-relationship. As the SR is still a highly controllable situation which can be managed by normal defensive functioning, additional life stress weakens this ability to deal with it: it could, along the lines of the experimental studies reported above, lead to the breakdown of the psychophysiologically dampening, but less flexible effects of avoidant defensive functioning, indicating more stress or demand. This can be

interpreted, especially in the case of HF-HRV, as an expression of increased mental effort to handle the attachment situation (Brosschot et al., 2005).

Our data might also highlight a perpetuative aspect of psychophysiological reinforcement of avoidant strategies in a context of attachment formation (Sbarra & Hazan, 2008). If the organisms of avoidant individuals experience the kind of shift in psychophysiological arousal proposed above, it might serve as a negative reinforcement to avoid attachment-related thoughts, emotions, and needs, and probably also uncontrollable situations of higher distress (Maunder & Hunter, 2001). Thus our design may provide a window not only into defensive function but also normative attachment formation.

One could argue that a similar psychophysiological pattern is seen under conditions of high avoidance and low life stress when interpreting the graphical associations in a quadratic rather than a linear fashion. This would imply that differences in regulatory function induced by life stress come into use mostly when avoidance is low. On the other hand, we don't consider our sample large enough to answer that question empirically. What needs to be discussed, however, is the finding from Figure 1 that vagal withdrawal seems to be high under conditions of high avoidance and high life stress, as well as low avoidance and low life stress, which could argue against the reinforcement thesis. This result could also be explained by a more open and flexible approach to the separation recall in more secure individuals without external strain, leading to higher engagement in the task, better access to emotionally relevant and possibly challenging memories, and less objection in self-disclosure towards a stranger. What might be an unpleasant experience that has to be avoided in the logic of deactivating defensive strategies could provide a mastery-experience in secure attachment, which would add to a broaden-and-build cycle of

attachment security over time (Sbarra & Hazan, 2008). In other words, subconscious or conscious appraisal of the mental effort and inner monitoring of resolvability may lead to more avoidance in avoidant individuals, while it could lead to more security in more secure individuals. This would fit well in a model of individualized allostatic, moment-by-moment regulation, which aims for optimal homeostasis adapted to internal or external demands (e.g. Del Giudice et al., 2011).

Finally, we do not know whether vagal withdrawal in a psychologically demanding situation should be considered a disadvantage. Schwerdtfeger and Derakshan (2010) conclude that although vagal withdrawal may also be an indicator of psychopathology and dysfunction, it may under certain aspects be situationally adaptive. In their study, individuals with higher avoidant coping engaged more rapidly in threat processing, but also disengaged more quickly. Stronger vagal withdrawal was associated with this disengagement process. They reason that higher engagement in combination with the ability to divert attention away as a cognitive coping skill could have lead to a higher readiness to engage in a task, leading then to stronger vagal withdrawal. This may also fit to our data, as more avoidant individuals may share some coping strategies with the sample mentioned above, until that ability was challenged or disturbed by life stress.

It has to remain open whether or not this might have had an influence on our results. Also we used self-reports for measuring attachment avoidance. As self-reports and AAI yield only small correlations, the results are not directly comparable to studies using interview measures. Especially more avoidant individuals may have a bias in self-perception with a possible overestimation of their own security. On the other hand, also questionnaire data has been used to show autonomic or unconscious processes. The only way to solve the problem of what part of the attachment system is

being activated and may have influenced our physiological results, would be by a parallel reporting of AAI and questionnaire measurement on physiological data (for an interesting study see Fortuna & Roisman, 2008), which has not been published to our knowledge with regard to psychophysiological data yet.

To conclude, our results provide evidence for psychophysiological effects of avoidant defensive processes, which may be adaptive under low life stress only, and become less flexible with increasing internal or external demands. Future studies should include possible moderating effects of life stress on attachment function. This may help to shed further light on the complex field of attachment and stress regulation. Additionally, influence of other moderating factors such as personal significance of the attachment-related memory content or situational variables should be addressed in future studies.

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Erklärung

Erklärung gemäß § 8 Abs. 1 Buchst. b) der Promotionsordnung der Universität Heidelberg für die Fakultät für Verhaltens- und Empirische Kulturwissenschaften

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