Self-System and Regulation of Negative Affect
[Selbstsystem und Regulation negativen Affekts]

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Content

Introduction

The present work is about the involvement of the self in the regulation of negative affect. In a nutshell, activation of extended cognitive-affective networks integrating self-referential information, such as personal needs, values, episodes, etc., is assumed to facilitate the removal of negative affect (Kuhl, 2000a, 2001). In contrast to the term *emotion*, the term *affect*, which will be used here, refers not only to explicit ("conscious") mental states but also covers implicit ("unconscious") mental states. Similarly, the term *affect regulation* (Koole & Jostmann, 2004; Kuhl, 2000a; Kuhl & Kazèn, 2001; Larsen & Prizmic, 2004; Parrott, 1993; Salovey, Hsee, & Mayer, 1993; Taylor, Wayment, & Collins, 1993) covers any kind of affect enhancement or reduction, no matter whether the regulatory process or the affect is experienced explicitly or not. Thus, it contrasts with the term *coping* (Lazarus, 1966; 1993), which is commonly reserved for *conscious strategies* of dealing with *emotions* or stressful events. In fact, the present work attaches significance to implicit rather than explicit processes. Backed up by myriad empirical data from neurobiology (LeDoux, 1995, 1996) and experimental cognitive psychology (Bargh & Chartrand, 1999; Nisbett & Wilson, 1977), there is broad consensus today that affective processes need not necessarily be accessible to human consciousness. Apart from differences in the conceptualization of the "unconscious", current theorizing is in accord with Sigmund Freud's opinion that conscious processes are but the tip of the iceberg judged by the entirety of mental processes (Kihlstrom, 1987; Kihlstrom, Mulvaney, Tobias, & Tobis, 2000).

The present work relies on different methodological approaches to examining the link between the self and affect regulation, overarching experimental cognitive and personality research as well as psychoendocrinology. With respect to the experimental approach (chapter 3), I attempted to activate the self-system by presenting self-referential information and made use of a novel paper-pencil technique to examine implicit affect (presented in chapter 2). With respect to the endocrinological approach (chapter 4), maturity of the self was assessed via questionnaires and, with respect to negative affect, concentration of the "stress hormone" cortisol was assessed by saliva-samples. Despite this methodological diversity, the empirical studies have in common a focus on the causal interplay of the self and negative affect.

The present work strongly relies on Personality Systems Interaction Theory (Kuhl, 2000a, 2001). This theory, briefly introduced in chapter 1, served as a wellspring from which the hypotheses of either study were drawn and provides the context for the studies to be interpreted and integrated.

Overview

Chapter 1: Self and regulation of negative affect: A Perspective from Personality Systems Interaction Theory

This chapter introduces the theory of Personality Systems Interactions (PSI; Kuhl, 2000a; 2000c; 2001) - a novel theory of personality functioning relying on the dynamic interplay of psychological systems. After having described the major systems, I explain how interactions between these systems can be modulated by changes in positive and negative affect and, conversely, how affect can be modulated by the activation of cognitive systems. After having elaborated on the general functioning of the entire system, I focus on a particular systems interaction, the interplay between the self-system and negative affect. Possible neurobiological underpinnings of the self-system and its participation in the regulation of negative affect are discussed.

Chapter 2: Introduction and evaluation of the Implicit Positive And Negative Affect Test (IPANAT)

Because affective processes often operate beyond human consciousness, particularly in the case of affect regulation provided by the self-system, the assessment of implicit affect is imperative. Instruments that validly assess implicit affect do not yet exist. Therefore, an implicit affect test developed by Kuhl and Kazén (2001) is evaluated and constitutes the basis for an experimental examination of implicit affect regulation processes in the ensuing chapter. The Implicit Positive And Negative Affect Test (IPANAT) measures positive and negative affect indirectly by judgments about the phonetic resemblance between mood words and artificial pseudo-words.

Chapter 3: Improvement of implicit affect through self-activation: An experimental study

This chapter includes a direct test of the self-relaxation assumption according to which activation of the self-system attenuates negative affect. To test this, an experiment is presented in which the influence of self-activation on implicit and explicit affective change was measured after negative affect was induced by a film clip. Self-activation was induced by the presentation of self-referential terms such as “my bed”, “my body”, as opposed to “the bed”, “the body”, etc. It is demonstrated how the self is involved in affect regulation and how self-activation functions differently for state-oriented individuals (“ruminators”) and action-oriented individuals (“non-ruminators”). In the theoretical part of the chapter, functional properties of the self that are thought to be intimately related to negative affect regulation are described. Finally, individual differences in the ability to access the self during negative affect are discussed.

Chapter 4: Self maturation and cortisol regulation

According to PSI theory, the operability of the self is directly linked to the neurobiological functioning of the hippocampus. The hippocampus is known to inhibit the Hypothalamus-Pituitary-Adrenocortical (HPA) system, which is activated during stress. The activation of the HPA system is assessed by the concentration of the glucocorticoid hormone cortisol, the "endproduct" of the HPA system. This correlational study examines the extent to which interindividual differences in self maturation (e.g., attachment security, self-determination, self-esteem) modulate the cortisol response to an acute stress-task and circadian awakening cortisol concentration. Additionally, because the awakening cortisol response has been associated with chronic stress, chronic stress was taken into consideration in this study.

Chapter 5: General discussion

This chapter discusses the major findings of the studies and places them in the context of a broader theoretical framework (PSI) from which the hypotheses were derived. This chapter disregards limitations and shortcomings of the studies, which were extensively discussed before. In contrast, it emphasizes results that were in accord with theoretical expectations. Finally, the topic as well as the findings of the present work are related to the overall theme of the local training research group "Integrative Competences and Well-Being" in which the present work was integrated.

A note to the reader

When reading the different chapters, the reader may come across repetition of content. These repetitions enable the reader to roughly understand the content of each chapter independently, without having read the others. This seems appropriate because the chapters partially focus on divergent issues and methods that may address varied audiences. For a similar reason, each empirical chapter is a coherent entity comprising an outline of the theoretical background, methods used, results, and discussion.

Chapter 1

Self-system and regulation of negative affect – A Perspective from Personality Systems Interaction Theory

Life gets simple, when you accept its complexity.

[Das Leben wird erst einfach, wenn man sich auf seine Komplexität einlässt]

Julius Kuhl (2001, p. 4)

Personality Systems Interactions (PSI) Theory (Kuhl, 2000a, 2000c, 2001) is a self-regulation theory that aims at explaining human behavior and experiencing. S*elf-regulation* theories commonly describe how behavior or affective states are adjusted by the individual to accomplish a specific goal (Baumeister & Vohs, 2004; Carver, 2004; Carver & Scheier, 1981). For this purpose, self-regulation theories draw on separate functions to describe the process of goal attainment (e.g., comparison of current and ideal state, instigation of action). PSI theory contrasts with most of these theories in that it subsumes specific patterns of such functions into distinct psychological systems that maintain permanent exchange of information among each other. Behavior and experiencing is thus explained by referring to interactions between systems. Moreover, individual differences in these interactions as well as in chronic activation thresholds of each system are considered to define personality.

In the most common sense with respect to self-regulation, the term *self* refers to the individual as a whole who regulates affect and behavior (Vohs & Baumeister, 2004). However, from a humanistic perspective (Deci & Ryan, 1983, 1985, 1991; Kuhl, 1996; Ryan, Kuhl, & Deci, 1997), "self" may also be used in a stricter sense, namely when referring to the total of interests and needs that are deeply wanted and not taken over by the individual ("intrinsic" aspects). In PSI theory, the term "self" is closely related to the latter meaning. More strictly, however, it is not only used as a collective name for singular self-aspects but to denote an entire system that comprises these aspects as well as a distinct pattern of specific functions. As such, the self, as referred to in this work, describes one of several systems constituting the psyche of an actor rather than the actor as a whole.

As an interesting, quasi-innovative idea following Aristotelian theorizing, PSI theory emphasizes connections between psychological systems rather than properties of single systems for the understanding of motivational and personality processes, and finally, behavior (Kuhl, 2000a).

Four cognitive macrosystems

According to PSI theory, at least four fundamental cognitive macrosystems need to be distinguished in order to be halfway able to understand human behavior and experiencing.[1]

[1] From a systems theoretical perspective (Bischof, 1995; Kriz, 1992, 1997), the degree of complexity of a system can be increased or reduced at will, depending on the object of explanation. More concretely, a system may be

Roughly speaking, there is one system that stores intentions, one that enacts intentions, one that perceives information that is discrepant with personal needs and expectations, and one that comprises these personal expectations and integrates respective discrepancies.

Intention memory (IM) is conceived of as a system operating consciously and sequentially. It sustains intentions until conditions are met that are convenient for the enactment of the respective intention. In a broader sense, thinking and planning are integrated functions of IM that are responsible for the elaboration of difficult intentions.

Intuitive behavior system (IBS) operates at an implicit-automatic level. It is engaged in the translation of intention codes into executable motor actions. However, this system does not process motor actions without respect to perception: It is postulated that IBS comprises integrated perceptive networks that are sensitive to orientation, movement, and context information. Because of its strong relevance for goal enactment, its attention is biased towards information that match an individual‘s expectancies (congruence-focus).

Object recognition system (ORS) is a perception system, predominantly operating at a conscious level. It amplifies signals that are discrepant to current expectations. Because of its high sensitivity to discrepant information, it facilitates arousal of negative affect. When the outcome of an action initiated by IBS was not successful, ORS gives feedback to the other systems, which leads to a correction of the action plan. Moreover, ORS amplifies the contrast between figure and ground, thus removing objects or details from their context. In contrast to IBS, which is highly sensitive to context and procedural information, the ORS is concerned with the identification of specific features of an object.

Extension memory (EM) or the *self-system* is considered a parallel working system processing extended semantics. It is thus able to detect holistic and configurational relationships between objects that may not be made completely explicit (as opposed to rule-based, logical propositions processed by the IM). As such, it is relevant to creative problem-solving (Beeman et al., 1994; Rotenberg, 1998). Because EM follows the rules of parallel distributed processing (Rumelhart, McClelland, & The PDP Research Group, 1986), it is able to quickly process a multitude of several aspects at once and to detect those aspects which match several criteria at the same time (“multiple constraint satisfaction”). In this respect, it is highly relevant for decision-making and motivation: Inasmuch as EM is activated, an overview of personal needs, goals, attitudes, and other self-aspects is provided which helps to find actions or solutions that are in accordance with several self-aspects at the same time (“decisions from the heart”). So, activation of this system can be seen as a prerequisite of intrinsic motivation (Bandura & Schunk, 1981; Deci, 1975; Deci & Ryan, 1985). This clearly illustrates a major difference to IM functionality: IM, which is based on a sequential and explicit operating mode, compares only one self-aspect with one opportunity for action at one time. However, the computational capacity of this system does not suffice to take into consideration all these comparisons at once in order to yield adequate decision-making. As a consequence, this may lead to almost infinite processes of decision-making (“prospective state-orientation”), increasing the risk of making decisions that neglect relevant self-aspects or needs. Indeed, because EM is highly engaged in the processing of self-relevant information, it is often used

separated into subsystems or, vice versa, several subsystems may be combined into one larger system, but not without taking into consideration specific transformation rules (Bischof, 1995). By definition, a *model* makes abstractions from a real prototype by sharing only a certain number of features with the prototype („partial homomorphism”). By contrast, features that are considered of minor importance with regard to the explanation of the target phenomenon are neglected (Tack, 1969). Consequently, all of the 4 cognitive systems hypothesized may be subdivided into subsystems if the goal is to explain microprocesses of psychological functioning. For explaining high level processes that underlie self-regulation and personality phenomena, this division may suffice (Kuhl, 2001).

interchangeably with the term *self-system* (Koole & Kuhl, 2003). The self-system, as conceived of in PSI theory, comprises networks of personal experiences, expectancies, needs, attitudes, autobiographical memories, and other self-relevant information (see below). Notably, the self-system is capable of integrating discrepant experiences perceived by the ORS with the consequence of becoming more and more differentiated ("accommodation").

Each of these cognitive macrosystems were brought into connection with the functioning of distinct neuroanatomical regions (Kuhl, 2001). For example, IM is supposed to be supported by the dorso-lateral prefrontal cortex (Fuster, 1995; Fuster, 1997; Goldman-Rakic, 1995). This area was found to be active in delayed response experiments where action-relevant information was needed to be sustained until an appropriate opportunity to enact the goal was given. There is some evidence that explicit representations of intended actions are preferentially processed by left- as opposed to right-hemispheric prefrontal areas (Knight & Grabowecky, 1995). Memories relevant to the maintenance of intended actions to some degree can be separated from working memory (Fuster, 1995). Working memory as opposed to IM is preferentially involved in storing sensory information that might function as cues that indicate suitable opportunities for the enactment of intentions.

The EM is thought to be preferentially supported by the right prefrontal cortex and the hippocampus. The right prefrontal cortex was found to be preferentially involved in the processing of remote associations (Beeman et al., 1994), self-referential information (Craik et al., 1999; Keenan, Nelson, O'Connor, & Pascual-Leone, 2001), and retrieval of self-related (episodic) memories (Tulving, Kapur, Craik, Moscovitch, & Houle, 1994; Wheeler, Stuss, & Tulving, 1997). On the other hand the hippocampus supports prefrontal areas in encoding and retrieval of episodic information (Tulving & Markowitsch, 1998). The IBS and the ORS share functional similarities with the ventral visual path in the posterior temporal region and the dorsal visual path in the posterior parietal region (Ungerleider & Haxby, 1994; Ungerleider & Mishkin, 1982). While neural networks of the ventral visual path are involved in identifying *what* an object is, neural networks of the dorsal path are involved in identifying *where* (or how) an object is. In contrast to the emphasis on the perceptive component in the dorsal path, PSI theory postulates a strong integration of perceptive and motor functions in the IBS.

Table 1 provides an overview of major characteristics of these systems. A detailed list and discussion of the systems' properties can be found in Kuhl (2001).

Table 1

Features of the 2 complex (on top) and the 2 elementary (below) cognitive macro-systems

Thinking / Intention memory (IM)	**Feeling / Extension memory (EM)**
• Translation of general goals from EM (e.g., to look after oneself) into general action concepts (e.g., to intent to follow health recommendations) • Conscious, sequential-analytical processing • Explicit propositional knowledge processing: plans, general intentions, etc. • Assisting system: analytical thinking (production of action plans, generation of rules and categories, explicit self-conceptions, etc.) • Either-or classifications and reductionism • Slow in application, fast learning • Decoupling from emotions (e.g., affect isolation, rationalization, suppression) • Vulnerable (no output in case of incomplete information) • Goal-focused attention • Intense cognitive-analytical utilization of feedback	• Unconscious parallel-holistic processing • Fast in application, slow learning • Robust (can produce an output despite incomplete information) • Processing of remote associations, creativity • Integrated self representations (integration of single, personal episodes into „landscapes of experiences“) • Implicit configurational knowledge: expectations, general goals, etc. • Integration of contradictions • Perception and regulation of affect • Primarily implicit (non-conscious) processing • Congruence-supporting, distributed attention (vigilance) > amplification of perceptions congruent with expectancies • Extensive cognitive-emotional feedback utilization: to what general goals or needs does an object or outcome fit? • Perception and non-suppressive, „democratic“ regulation of emotions
Object Recognition System (ORS)	**Intuitive Behavior System (IBS)**
• Differentiation of figure and ground (amplification of contrasts, removal of details from their context: objective perception instead of perception guided by expectancies, „allocentric“) • Separation of different senses • Categorization (either-or characteristic) • Oriented to the past (comparison with prevailing schemes, „recognition“) • Conscious processing • Attention oriented to discrepancies; orienting response • Feedback utilization only in the context of a defined goal: amplification of objects relevant to prespecified intentions („target detection“) • Explicit self representations/categories: „me“ as an object	• Intuitive/automatic programs, e.g., for stereotype social interactions • Context/field-dependent • Egocentric coordinate system: necessary to align body movements with objects • Connectionist multimodal integration • Oriented to the present (online control of movements) and the future (anticipation of action outcomes) • Unconscious-automatic • Translation of the intention code into concrete action routines • Spatial attention (orienting) • Direct feedback utilization: Amplification of signals that match an intended action

With respect to phylo- and ontogenetic development IBS and ORS can be conceived of as elementary systems, while IM and EM can be conceived of as high-level systems.

Personality as individual differences in system functioning: Activation thresholds

Although most individuals draw on a combination of systems for accomplishing a certain task and usually can shift between systems depending on the requirements of the respective task for optimal performance, they keep their preferences for specific systems or system combinations defining their "personal style". One may think of the different ways different people lead a conversation: People strongly relying on IM may pursue explicit goals and thus manipulate the conversation in a desired direction without paying attention to the other person's interests. Whereas people with a high operability of EM, may have a good overview of both the other person's and their own needs, which can be considered a prerequisite of mutual, symmetrical exchange of thoughts and feelings in a social interaction. Others who show high sensitivity towards discrepancies (ORS) may interpret behaviors of the other person as refusing or arrogant although they are not intended to be. This in turn may even lead to inhibited speaking. Finally, individuals strongly relying on the IBS are often very spontaneous in what they say and draw on well-learned, stereotypical idiomatic expressions. They may be excellent small talkers.

Personality, in this regard, may be described in terms of the average level of thresholds for activating the systems. Recently a questionnaire was developed for measuring these interindividual differences (Motive Enactment Test; Kuhl, 1999). More precisely, this instrument assesses the degree to which individuals differ in the functions supported by the macrosystems (cf. Table 1). To some degree, extraversion versus introversion and neuroticism versus emotional stability, the most prominent personality factors (e.g., Eysenck & Eysenck, 1985), may be brought into connection with individual differences in the functioning of the macrosystems: Extraversion versus introversion largely refers to chronic activation of IBS versus IM, whereas neuroticism versus emotional stability largely refers to chronic activation of ORS versus EM.[2] However, as pointed out by Kuhl (2001), these constructs confuse diverse psychological functions that need to be separated in order to analyse personality processes on a functional level.

Dynamic interplay of systems: Exchange of information

In each instance, one elementary and one high-level system work closely together to serve a major psychological purpose: The connection between the IM (goal-maintenance, planning) and the IBS is particularly relevant to the transformation of difficult intentions into actions and is therefore primarily related to *human behavior*. Compared to this, the connection between ORS and EM is particularly relevant to processing of personally relevant information and is therefore primarily related to *human experiencing*.

[2] To the extent that the activation of each system facilitates arousal of a specific affective state and vice versa (IM – inhibition of positive affect, IBS – activation of positive affect, ORS – activation of negative affect, EM – inhibition of negative affect), extraversion and neuroticism can also be mapped to sensitivity to corresponding affects just as well. Indeed, it is rather difficult to separate these functions by means of a questionnaire. This is especially true if the construction of a questionnaire is exclusively based on an aggregative (e.g., factor-analytical) rather than on a functional-theoretical approach.

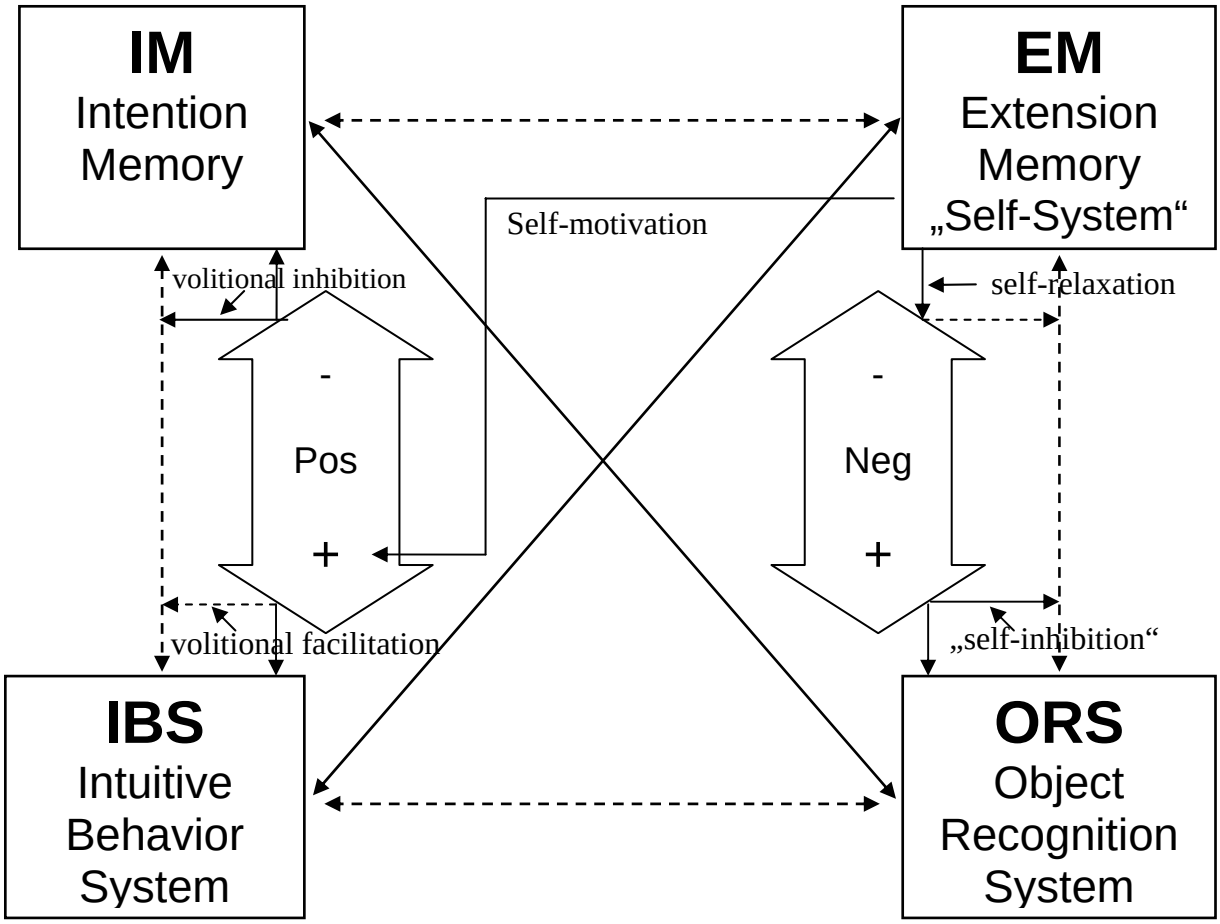

Figure 1

Schematic depiction of the relationships between the cognitive systems and the modulation by positive (reward system) and negative (punishment system) affect

Notes. ---- = inhibitory connection; ___ = facilitatory connection; Pos = positive affect/reward system; Neg = negative affect/ punishment system; -/+ = down/upregulation of positive or negative affect, respectively; to keep the illustration simple, only selected relationships are depicted.

It is assumed that each of the two system pairs IM/IBS and EM/ORS are mutually inhibited, such that effort is needed to remove this inhibition and consequently, facilitate the information exchange between the systems.[3] But how is it possible to overcome this inhibition in order to provide flow of information? In other words, how can the enactment of difficult intentions (IM/IBS) or the integration of discrepant information (ORS/EM) become facilitated? The core assumptions of PSI theory refer exactly to this question. Arguably, this is done by changes in either positive or negative affect.

[3] Referring to neurobiological underpinnings of this model, the two consciously operating systems, IM and OES, are assumed to be supported by left hemisphere structures, while the two unconsciously operating systems, EG and IBS are assumed to be supported by right hemisphere structures. As such, the inhibition between the psychological systems might be reflected in the contralateral inhibition of both hemispheres (e.g., Kinsbourne, 1970; Kosslyn, 1987).

Positive and negative affect

A large body of literature converges upon the assumption that specific affective states can be subsumed under two basic affective dimensions, labeled positive and negative affect (Cacioppo & Berntson, 1994; Cacioppo, Gardner, & Berntson, 1999; Watson, Clark, & Tellegen, 1988; Watson & Tellegen, 1985; Watson, Wiese, Vaidya, & Tellegen, 1999). Positive affect refers to appetitive behavior and is differentially supported by dopamine release from the ventral tegmental area (Hoebel, Herndandex, Mark, & Pothos, 1992). Positive (and negative) affect needs not necessarily be experienced at a conscious level (cf. chapter 2). If experienced, positive affect centers upon the emotion of pleasure. Conversely, inhibited positive affect may be best described by passivity, lethargy, or frustration. In contrast, negative affect is aroused in the presence of aversive stimuli and usually stimulates avoidance behavior. It is preferentially generated by amygdala activation (Aggleton, 1992). Negative affect can occur in the form of emotions like anxiety or sadness. A lack of negative affect might be best described by a state of serenity and calmness.

In PSI theory, each type of affect is thought to have a distinct modulatory effect on the link between the cognitive system pairs: While positive affect is thought to facilitate the information exchange between IM and IBS, negative affect is thought to facilitate information exchange between EM and ORS. Three out of a total of seven major modulation assumptions, which explain the systems' dynamic behavior as a reaction of specific activation changes of macrosystems and affect, are outlined in the next sections (see Kuhl, 2000a, 2001, for descriptions of all assumptions).

Volitional facilitation: Enactment of difficult intentions through upregulation of positive affect

One major assumption of PSI theory relates to the question of how enactment of intentions or the "will", respectively, can be supported. According to the *volitional facilitation* assumption, upregulation of positive affect removes the initial inhibition between IM and IBS (*volitional inhibition assumption)*, connecting both systems to each other. Transmission of intention codes from IM to IBS then becomes facilitated and IM obtains stronger influence on behavior.[4]

For example, a psychology student that is planning her master thesis loads IM with specific intentions, e.g., to recruit participants or to write the first lines of the thesis. If this task is difficult for the student, e.g., because she has social inhibitions, doesn't like writing or perceives piles of tasks, getting started is inhibited. However, when positive affect is upregulated, for example when one is praised by a professor, taking action is facilitated, provided this happens during the time the intention is still active. This gives a precise motivational explanation to the symptom of lethargy in depressive disorders. For example, Johnson, Petzel, Hartney, and Morgan (1983) were interested in the performance of depressive patients in recalling tasks that needed to be accomplished. They found that depressive as opposed to non-depressive individuals were superior in recalling uncompleted as compared to completed tasks (Johnson et al., 1983; Zeigarnik, 1927). This suggests that depressive individuals do not suffer from the inability to generate or sustain intentions, which is a function of IM, but are unable to enact the intentions due to an inability to upregulate

[4] This is not necessary for easy-to-be-carried-out intentions, i.e. those that are prespecified to a large degree. These intentions are processed almost exclusively by IBS, whereas IM, if at all, is only marginally required. Preprocessed intentions may not require dynamic upregulation of positive affect but may nevertheless benefit from (constant) high levels of activation and positive affect (cf. Kuhl, 2001).

positive affect (Kuhl 2000). Interestingly, Goschke & Kuhl (1993) replicated this finding for individuals high in trait hesitation ("state orientation", see below), which is considered a nonpathological component of depression (Kuhl & Helle, 1986).

Additionally, volitional facilitation was supported by experiments relying on the classic Stroop task (Kazén & Kuhl, in press; Kuhl & Kazén, 1999). In the classic Stroop task (Stroop, 1935), color words like green or red are printed in either the color they express (congruent) or in a different color (incongruent, for example the adjective *green* in red color). When instructed to name the color, individuals typically show slower reaction times in the incongruent than in the congruent condition ("Stroop Interference") because reading the color words is the dominant response. The volitional facilitation assumption would predict faster reaction times in the difficult (interference) condition if positive affect can be aroused and the IM is highly demanded (e.g., by second task immediately following the Stroop task). Indeed, the authors found that Stroop interference was removed exactly when the Stroop task was preceded by positive prime words and, at the same time, was followed by a second task.

Self-motivation: Generation of positive affect by the self-system

In fact, there are several ways by which positive affect can be upregulated. For example, there may be external cues (e.g., reinforcement by people, films, eating, sexual activity, etc.) that make us feel happy and motivate us to take action. Besides external triggers of positive affect, the individual can generate positive affect by himself, which is referred to as self-motivation.[5] More precisely, self-motivation refers to the capability of the *self-system* to instigate positive affect in a top-down manner, i.e. to stimulate elementary systems to generate positive affect (*self-motivation assumption*). If a task is perceived as demanding, the self-system starts up processes of search for any positive (reinforcing) aspect that may be associated with the accomplishment of the task. Finding such aspects, implicitly or explicitly, increases intrinsic motivation (Deci, 1975) and thus serves as an effective motor for starting with or maintaining the actions intended.

Self-relaxation: Downregulation of negative affect by the self-system

The self-relaxation assumption, which constitutes the centerpiece of the present work, refers to the antagonistic interplay between the self-system (EM) and ORS. More precisely, the *self-relaxation assumption* posits that activation of the self-system during or after negative experiences supports downregulation of negative affect and inhibits activation of ORS (see Table 1 for functions of ORS).[6] As a consequence, objects are processed in a holistic rather than analytical manner and can be compared to a large number of integrated experiences stored in the self-system. Moreover, congruences between aspects perceived and personal expectations or needs are amplified. On the other hand, local processing of unwanted or unpleasant (discrepant) information is suppressed (Friedman & Förster, 2005; Kuhl, 2000a).

Activation of the self-system gives simultaneous access to integrated representations of past and current experiences emotions, needs, etc.) and accordingly, a comprehensive overview of relevant aspects in a specific situation. Having access to this system, when confronted with

[5] Self-motivation explicitly refers to the case in which the individual is positively motivated by incentives. In contrast, a person might also force him-/herself to start with a task, which is accompanied by negative rather than positive affect. Therefore, this mechanism may better be labeled „self-instruction" or self-control (Kuhl, 1996; Kuhl & Fuhrmann, 1998).

[6] Conversely, elevation of negative affect increases activation of the ORS and consequently, facilitates processing of discrepant information and details (Easterbrook, 1959; Friedman & Förster, 2005). At the same time the self-system is inhibited ("self inhibition").

difficult or threatening situations, facilitates finding solutions and taking an optimistic view. The latter function directly draws on the self's attentional bias towards information that is congruent with prevailing expectations and wishes. Indeed, this function governs the creative search for actions that will change an unpleasant situation ("assimilation") or, if the situation is too difficult to change, the search for some positive aspects ("accommodation"). The latter aspect refers to reappraisal of or finding meaning in negative representations such as negative self-aspects, situations, objects, or experiences (Gross, 1999): To the extent that activation of the self-system provides an overview of many experiences, it becomes easier to find positive aspects that can be associated with acute negative experiences. Consequently, self-activation facilitates integration of schema-discrepant experiences into high-level, integrated networks of autobiographical memories. However, because the self-system is basically considered an implicit system, affect regulation relying on this system, is also implicit. (This does not exclude the possibility that this process may also be consciously perceived at times.) Reappraisal, as provided by the self-system, is therefore conceived of as an implicit rather than an explicit process. This is in contrast to generally accepted conceptualizations (Gross, 2002).

Creative search for opportunities for action or positive aspects is facilitated by the fast parallel processing mode of this system, which enables processing of remote associations (Beeman et al., 1994). Further, parallel distributed processing enables the consideration of several self-aspects at the same time ("multiple constraint satisfaction", cf. Rumelhart et al., 1986). As such, this system automatically computes an alternative out of an enormous number of possibilities that is in harmony with as much self-aspects as possible without drawing on explicit rules that explain why this alternative may be the best ("intuition"). Therefore, activating the self-system is considered to support attenuation of negative affect and to strengthen the influence of personal needs and creative ideas on decision-making and behavior.

However, there are alternative mechanisms that aim at downregulating negative affect but do not rely on the operation of the self-system. The most prominent mechanism is probably repression (Byrne, 1961; Freud, 1915). In contrast to self-relaxation, repression obstructs deeper confrontation with a negative experience. Accordingly, the process of searching for meaningful associations with preexisting experiences is impeded. As a consequence, integration of the current negative experience cannot take place, which in the end may engender unwanted mental rebounds of the experiences (Wegner, 1994) requiring permanent efforts to repress them again (Freud, 1926).

Therefore, self-relaxation can be considered to be more effective than repressive mechanisms, in the long run. For example, Showers and Kling (1996) found that individuals with low self-complexity, in terms of an inability to integrate negative self-aspects into the self-concept, ("repressive style") had problems to recover from a sad mood when forced to think about themselves after the sad mood induction. In contrast, these individuals were able to recover quickly when the opportunity was given to engage in a distracting task. In contrast, individuals with a tendency to integrate negative and positive self-aspects benefited from self-confrontation but showed impaired recovery when forced to engage in the distracting task. The results of this experiment suggest that, whenever experiences become too intense to be simply avoided, individuals drawing on self-relaxation are better able to cope with the respective experiences than those drawing on repressive affect regulation. This hypothesis was corroborated by studies relying on "self-complexity" as an indicator of high self-relaxation capabilities: Individuals with a high number of different self-aspects (self-complexity) show stronger resistance to depressive and psychosomatic symptoms particularly under high levels of stress (Linville, 1987a; Rothermund & Meiniger, 2004). These findings demonstrate the effectiveness of affect regulation processes capitalizing on the self-system.

Personality as individual differences in intersystemic connection strengths: Affect regulation

Affect modulation assumptions in PSI theory, such as those presented above, are conceived of as *general* mechanisms of psychological functioning. However, the seemingly paradoxical finding that depressives or individuals high in trait hesitation show impaired ability to enact their intentions suggests a description of individual differences in affect regulation in terms of the strength of interconnections between systems. As such, individuals may be more or less capable of regulating intensity of positive and negative affect which in turn modulates the connectivity of cognitive macro-systems and, in the end, behavior and experiencing.

Refering to the *volitional facilitation* assumption, interindividual differences in the ability to upregulate positive affect determines how easy it is for an individual to carry out difficult intentions. As mentioned before, this ability is impaired in individuals high in trait hesitation as expressed by the construct of decision-related action orientation (AOD; Kuhl, 1981; Kuhl & Beckmann, 1994b). A person high in AOD, for example, is able to quickly upregulate positive affect in order to make decisions and start with unpleasant but necessary tasks rather than to put them off. Individual differences in *self-motivation* thus rely on the specific ability to restore positive affect by accessing positive representations provided by the self-system (e.g., expectancies on positive rather than negative outcomes associated with the completion of the task).

Similarly, individual differences in *self-relaxation* can be expressed as the ability to access the self-system during a phase of negative affect without external help such as emotional support from friends or family members.[7] Most prominently, the construct of action versus state orientation after failure (AOF/SOF; Kuhl, 1981; Kuhl & Beckmann, 1994b) refers to individual differences in the ability to have access to the self-system in unpleasant situations. Indeed, several studies in which a day of a secretary was simulated corroborate this assumption: In this simulation individuals are asked to choose several tasks, which are putatively to be accomplished later out of a standardized list of tasks. After this, the instructor assigns additional tasks to the “secretary”. These studies repeatedly found that SOF as compared to AOF individuals who were stressed showed impaired ability to distinguish between tasks that were chosen by the individual itself, i.e. processed by the self-system, and tasks that were assigned by the instructor (Baumann & Kuhl, 2003; Kazén, Baumann, & Kuhl, 2003; Kuhl & Beckmann, 1994a; Kuhl & Kazen, 1994).

There are similar constructs that may also express the ability to downregulate negative affect or to access the self-system in negative affect, respectively. For example, self-determination (Deci & Ryan, 1980, 2002a, 2002b) refers to the ability to impose one’s goals or wishes particularly when they are threatened by feelings of obligation to social standards or expectancies of other individuals. Therefore, a major component of self-determination refers to the ability to access the self: Without self-access it is difficult to differentiate between goals that are intrinsically wanted and those that are introjected. To the extent that self-determined individuals have high self-access, they should be able to self-regulate negative affects.

Moreover, attachment security versus insecurity may also constitute an indicator of individual differences in self-relaxation (cf. chapter 4). Securely as opposed to insecurely attached individuals are able to experience close relationships as warm and supporting and can easily

[7] To the extent that the interaction partner is sensitive to the individual’s problems and needs and adequately reflects these aspects back to the individual, the person feels involved and his/her self is activated. If so, the self can be seen as a mediator between external emotional support and the attenuation of negative affect.

build up basic trust in new relationships because they draw on positive representations of early relationships with their caregiver. Inasmuch as they have integrated the affect-regulatory maternal functions, they possess the ability to self-regulate negative affect (Main, Kaplan, & Cassidy, 1985; Thompson, 1990). This is compatible with PSI theory, which also assumes early positive caregiving experiences to function as a basis for positive self development (Kuhl, 2000a, 2000c, 2001; Kuhl & Völker, 1998).

Emphasizing interconnectivity as a basis for affect regulation, it is argued that self-regulation of negative affect, except for severe developmental or neurological disorders, preferentially refers to an inability to access the self-system rather than to poor self-system functionality as such. Therefore, usage of this system should be fundamentally possible if a person basically has had the opportunity to develop a positive self once in his/her life (Bowlby, 1979; Bretherton, 1985; Kuhl, 2000a; Rogers, 1961). Normally, low affect regulation capabilities are thus considered to be associated with a blocked access to the self-system. Indeed, the aforementioned finding of impaired self-access in state-oriented individuals of the rumination type provides some evidence for this assumption: State-oriented as opposed to action-oriented individuals showed impairments in distinguishing between self-related and assigned tasks only if negative affect was aroused (Baumann & Kuhl, 2003; Kuhl & Baumann, 2000). This finding suggests that state-oriented individuals do have an intact self-system that, however, is difficult to be accessed in negative affective states. Moreover, some recent studies, capitalizing on the implicit association test for measuring implicit self-esteem (Greenwald & Farnham, 2000), provide some further evidence. For example, depressed patients showed reduced explicit self-esteem but did not differ from healthy controls in implicit self-esteem, which was positive in either group (Cai, 2003). If proven, this may have strong implications for therapy: It should be easier to strengthen the connections between systems (Hebb, 1949) than to rebuild the structure of a system. As such, teaching depressive patients to activate the self in daily stress situations may help to them cope effectively with negative affect. Finally, it is reasonable to assume that impaired self-access and poor self-structure are intertwined with each other to some degree: If a self-system is not intact, access to it is useless and as a consequence may become degenerated. Conversely, functionality of the self-system may degenerate as a function of low frequency of application (“use it or lose it”).

According to PSI theory, personality differences based on intersystemic connection strengths must contrasted with personality differences based on system activation thresholds (see above). Arguably, differences in activation thresholds refer to the degree to which a cognitive or affective system can be activated, whereas differences in connection strengths refer to the degree to which a system can be inhibited once it was activated. As such, individuals may be described by either function separately. For example, a person may integrate both functions high sensibility to discrepancies (ORS) or negative affect, respectively, and high ability to inhibit their functioning. Advantageously, this distinction allows a differential analysis and prediction of an individuals behavior and experiencing. According to PSI theory, the integration of the aforementioned functions are considered a prerequisite of the development of a mature, i.e. integrated and differentiated, self-system: Individuals who are not sensitive to emotional discrepancies are not able to integrate them into the self-system with the consequence that the self cannot become differentiated. Similarly, individuals who are sensitive to discrepancies but have impairments in downregulating negative affect cannot integrate these discrepancies into the self-system, i.e. associate them with preexisting structures of integrated, positive experiences. Consequently, both functions are needed to guarantee for self maturation.

How does the self-system in PSI theory fit with alternative conceptualizations of the self?

The meaning of the term "self-system" is by no means self-explanatory. There are numerous theories focusing on the so-called self and each of those defines the self in a different way. It is not intended to give an overview of how this dazzling and elastic term is used in these different theories. Rather, it will briefly be described how the self is conceptualized in PSI theory and how this relates to some influential classical and contemporary conceptualizations.

The self-system is considered a subsystem of EM that is differentially involved in the processing of self-referential information. Hence, the self-system in PSI theory is understood as an implicit system that comprises integrated networks of personal emotions, needs, attitudes, values, identity, episodic memories, and other self-aspects. As a subsystem, it additionally includes all properties of EM (cf. Table 1), e.g., implicit holistic-parallel processing, attentional focus directed to congruences, or the capability to downregulate negative affect. However, to the extent that this work rather focuses on the properties that the two systems have in common rather than on the differences, the two terms self-system and EM will be used interchangeably, as it has already been done in previous work relying on PSI theory (Koole & Kuhl, 2003).

To the extent that the self-system is primarily considered an implicit, holistic system, which means that the operations and contents of the self need not consciously be experienced or cannot be verbalized in its entirety, it sharply contrasts with the *self-concept* (Marsh, 1986; Marsh, Byrne, & Shavelson, 1988; Shavelson, Hubner, & Stanton, 1976). The self-concept can be defined as the perception one has of the own person. The self-concept can be subdivided into several explicit categories such as physical, academic, family or romantic self-concept, depending on the relevance of these aspects to the individual (Harter, 1999). In PSI theory, the construction of categories or classification of objects, respectively, is a function of ORS rather than the self-system. Despite these differences, the self-concept is not considered to be processed independently from the self-system: Although the operability of the self-system itself does not define specific contents of the self-concept, it functions as a basis for affective and organizational properties of the self-concept. As such, a well-developed self-system facilitates general explicit positive evaluation ("self-esteem"), high complexity of self-aspects (Linville, 1985, 1987b) or the integration of positive and negative self-aspects (Showers, 1992a, 1992b; Showers, 1995; cf. chapter 3).

In a similar but not the same vein, William James (1890) distinguished between I-Self and Me-Self. Accordingly, the *I-Self* refers to the subject or actor, whereas the *Me-Self* refers to the subject's knowledge about his/her person, thus serving as an object of reflection. However, the self-system cannot be equated with either of these conceptualizations. Rather, it may be something in between. On the one hand, in PSI theory, the actor (I-self) is described by the operating and interplay of several macrosystems, only one of those is called self-system (EM). On the other hand, it comprises implicit-experiential rather than explicit-semantic knowledge about the self.

Moreover, a clear-cut separation between agency and information stored leads to the homunculus problem and, therefore, does not seem tenable. In PSI theory, however, the self-system is conceptualized as a parallel distributed information processing network (Rumelhart et al., 1986). Parallel distributed modelling shows that central control is not required to explain agency of a system. Rather, behavior control is explained here by referring to the dynamic relationship between the operating units of such a system. In turn, the pattern of relationships between these units alters, in part, as a function of the experiences that are made by the system: Information storage thus relies on the adjustment of connection weights. As such, knowledge, self-referential or not, constitutes the actor in the end. Conceptualizations of

the self as a parallel distributed network were recently proposed by Mischel and Morf (2003) as well as Smith-Lovin (2002).

Neurobiological underpinnings of self-system and self-relaxation

As described earlier, the self-system in PSI theory is conceived of as the total of integrated networks processing self-referential knowledge such as personal needs, attitudes, bodily perceptions, emotions, or episodic memories. There is evidence from different neurobiological approaches supporting the assumption that the so-called self-system strongly relates to two distinct brain regions, the right prefrontal cortex and the hippocampus.

Right prefrontal cortex, self-system, and self-relaxation

The prefrontal cortex (PFC), the anterior portion of the frontal lobes, is known as a structure underlying working memory (dorsolateral PFC). As a higher-level structure, it is involved in top-down controlling (regulating) of either behavior and affect (Fuster, 1997; Goldman-Rakic, 1995).

Besides these and other functions, the PFC is involved in the processing of episodic memory (Tulving, 2002; Wheeler et al., 1997). Episodic memory, as described by Tulving (2002), constitutes “a neurocognitive system, uniquely different from other memory systems, that enables human beings to remember past experiences (p. 1)”. Indeed, as mentioned by Tulving a few lines below, episodic memory has also been “elaborated in terms of ideas such as self (p. 1)”. Specifically, the left PFC is differentially involved in encoding, whereas the right PFC is differentially involved in retrieving episodic memories (Habib, Nyberg, & Tulving, 2003; Nyberg, Cabeza, & Tulving, 1996; Tulving, Kapur, Craik, Moscovitch, Houle, 1994). In contrast to episodic memory retrieval, semantic memory retrieval has largely been localized in the left hemisphere (Buckner, 1996; Cabeza & Nyberg, 2000).

Similarly, there is huge evidence from neuroimaging research that the right PFC distinctly engages in the processing of different types of self-referential information. For example, the right PFC (particularly medial structures) has been identified to support recognition of one’s face (Craik et al., 1999; Keenan et al., 2001; Platek, Keenan, Gallup, & Mohamed, 2004) and processing of personal traits and self-related thinking (Fossati et al., 2003; Gusnard, Akbudak, Shulman, & Raichle, 2001; Johnson et al., 2002; Kelley et al., 2002; Schmitz, Kawahara-Baccus, & Johnson, 2004).

Additional support for the hypothesis that the self is supported by the PFC comes from lesion studies (Damasio, Graff-Radford, Eslinger, Damasio, & Kassell, 1985; Fischer, Alexander, D'Esposito, & Otto, 1995; Kopelman, 1987; Moscovitch & Melo, 1997). Patients with damages of the PFC often show disorientation in time and space (see below) and are frequently unable to hold coherent, integrated, and meaningful representations of the self. Moreover, their autobiographical memory is sometimes clouded and vague (Baddeley & Wilson, 1986).

As mentioned before, right hemisphere is advantageous in implicit, whereas left hemisphere is advantageous in explicit information processing (Springer & Deutsch, 1998). Therefore, this functional difference between left and right hemisphere may function as a neurobiological basis of explicit self-concept and implicit self-system, respectively. Indeed, Kircher (2002) found a selective involvement of the right hemisphere in incidental (implicit) processing of self-relevant trait adjectives and a selective involvement of the left hemisphere in deliberate (explicit) processing of self-relevant adjectives. Moreover, the right hemisphere is especially involved in the processing of somatosensory and emotional information (Tucker, 1981). For

example, Adolphs et al. (2000) found that right somatosensory fields are active when making judgments about emotional faces. This finding suggests that recognizing emotional states of interaction partners draws on the generation of representations of personal emotions, which is considered a function of the psychological self-system.

In sum, these findings lend support to the assumption that the implicit self-system is supported by the right PFC and, moreover, can be differentiated from explicit-verbal self-concept, which is preferentially supported by the left PFC (Kuhl, 2001).

It is interesting that right PFC has also been identified to support affect regulation. For example, Levesque et al. (2003) found that right PFC was active when participants engaged in self-regulation of sadness. Similarly, Eisenberger, Lieberman, and Williams (2003) found activity of the right (ventral) PFC to be negatively correlated with self-reported negative affect aroused by social rejection in a simulation of a ball-toss game. In a study from Ochsner, Bunge, Gross, and Gabrieli (2002), activity of the (dorso-)medial PFC (bilateral), which has been related to processing of personal information in other studies (e.g., Fossati et al., 2003), was associated with reappraisal of the content of unpleasant pictures.

Also, confabulations following right PFC lesions have recently been associated with a defensive motivation to maintain a stable and positive self-concept. Fotopoupou, Solms, and Conway (2004) argue that confabulations are an attempt to create an integrated and coherent self-representation, which is normally provided by the self-system supported by the medial PFC. According to recent findings, anosognosia can be brought into relation with motivated confabulation (Turnbull, Jones, & Reed-Screen, 2002). Anosognosia, resulting from right PFC lesions, refers to the inability to recognize severe bodily disorders of one's own (a paralysis, for example). As argued by Turnbull et al. (2002), lesions of the right prefrontal cortex may be responsible for the inability to accept the respective disorder or in other words, to integrate the negative experience into the self. To the extent that the self-system provides stable (implicit) self-esteem, which functions as a bolster against painful experiences, failure of this system or the right PFC, respectively, forces the individual to deny the painful experience.

Hippocampus, self-system, and self-relaxation

The Hippocampus (HC) may be another important neural structure underpinning the self-system. As hypothesized by Kuhl (2000a; 2001), functional properties of the psychological self-system to some degree resemble those of the hippocampus (HC), a multifunctional structure of the limbic system (for a detailed comparison of the properties, see Kuhl, 2001).

The HC is involved in a variety of cognitive and emotional functions, such as spatial orientation (O'Keefe & Nadel, 1978), encoding and retrieval of episodic memory (Tulving & Markowitsch, 1998), or conditioning of emotional and motor reactions to combined stimuli (Gluck & Myers, 2001; Schmajuk & DiCarlo, 1992). Moreover, the HC is intimately involved in regulating activity of the Hypothalamus-Pituitary-Adrenocortical (HPA) system, which is a major stress system in the human and mammal body (Sapolsky, 1992).

Here I focus on the HC's relevance to processing episodic information and HPA system inhibition because they may be particularly relevant to the issue of self-relaxation.

Encoding and retrieval: Integrated self and self-access

Apart from the PFC, the HC plays a dominant role in encoding and retrieval of episodic memory. The HC provides an overview of a large amount of information coming from

cortical and subcortical areas. There is evidence that encoding and retrieval is managed by different subareas of the HC: The rostral portions seem to be preferentially involved in encoding, whereas the caudal portions seem to be preferentially involved in retrieving episodic memories (Lepage, Habib, & Tulving, 1998). Moreover, there is some agreement that the HC is selectively engaged in processing episodic but not semantic memory (Aggleton & Brown, 1999; Cabeza & Nyberg, 2000; Mishkin, Suzuki, Gadian, & Vargha-Khadem, 1997; Tulving & Markowitsch, 1998).

Whenever an episode is stored or retrieved, many associations between aspects of this episode must be formed in an organized and structured way. For example, to retrieve an episode from a party, the HC composes information about the arrangement of people and objects in a room, information about when a person A told the subject the story of B, information about how the subject felt in this moment, information about what music was playing, and so forth. The HC thus arranges an instantaneous, complex configuration composed of a large number of aspects from diverse sensory modalities. Conversely, when the HC is damaged, the individual is unable, for example, to store new episodes ("anterograde amnesia") or to retrieve episodic information from distinct periods of his/her life ("retrograde amnesia"). Regarding the latter, there is agreement that this episodic information still exists in parts of the patient's brain (e.g., right posterior neocortex, right PFC) but cannot be accessed (Kopelman & Kapur, 2001).

However, the capability of the HC to form numerous associations serves not only the purpose of long-term encoding of episodes but, far and foremost, to find one's way around a current "episode", i.e. to be able to get one's bearing in the spatial and temporal environment. For example, rats with ectomized HC are unable to find their orientation in a water maze (Wilson & McNaughton, 1993). Similarly, the size of HC in birds that must find hidden grains increases faster than the HC of birds that were fed with grains not hidden (Clayton & Krebs, 1994). Kuhl (2000) speculates that this "coherence-producing function of the hippocampus relates not only to the representation of external, but also of internal environments. Integrated self-representations can be regarded as holistic representations of "inner environments" (emotions, needs, values etc.)" (p. 133). As mentioned before, access to self-related information in the form of a complex overview of instantaneously activated self-aspects can be considered a prerequisite of self-determination and of finding "creative" solutions to current problems. To the extent that this is accomplished by the HC, adequate functioning of this structure would contribute to high-level and top-down affect regulation in that it provides access to integrated self-structures. Indeed, results from a recent study by Kennedy and Shapiro (2004) bolster this hypothesis: The authors trained rats to approach nonspatial goal objects. Only rats with intact hippocampus used *internal* contextual information (e.g., hunger, thirst) to flexibly guide associative memory retrieval.

The capability of the HC to provide an integrated overview of stimulus features can be taken as a prerequisite of a further property that is relevant to affect regulation: The HC is involved in the process of conditioning emotional and motor reactions to complex stimuli and, also, in the modulation of these associations once they were formed (Schmajuk & DiCarlo, 1992). Negative patterning, for example, is a phenomenon that is suitable to illustrate such a modulation: Each of two neutral stimuli S1 and S2 is *separately* presented in combination with an unconditioned stimulus (e.g., a loud noise) for several times. In contrast, whenever both stimuli S1 and S2 are presented *in combination*, the unconditioned stimulus is left out. Usually, animals learn to differentiate the two situations from each other: They show conditioned emotional and motor reactions in response to separate presentation of either stimulus S1 and S2 but inhibit those reactions whenever both stimuli are presented in combination. By contrast, animals (and humans) with HC lesions are unable to learn to inhibit the emotional or motor reaction in the complex condition (S1 and S2). In a similar vein, the HC is involved in classical learning mechanisms such as extinction and renewal of

conditioned reactions (Gluck & Myers, 2001). According to Kuhl (2001), HC modulation of associations may constitute a basic mechanism underlying affect regulation: Within the first 2 or 3 years of life, when the HC is not fully developed, a child feels threatened by a tiger (stimulus 1) in the zoo although the tiger is locked up behind bars (stimulus 2). With increasing operability of the HC, the child becomes able to inhibit emotional reactions towards the tiger when it is behind bars (complex stimulus composed of tiger and bars). A well-developed and fully functioning HC can be considered to have the capability to inhibit stress reactions throughout an individuals' life: To the extent that the HC is able to provide an overview of previous positive experiences made in situations resembling a current one, stress reactions to a current unpleasant situation can be inhibited.

Taking a more general perspective, Gluck and Myers (1993; 2001) summarize the HC's role in information encoding as follows: The HC compresses information that is redundant, and, differentiates information that is relevant to predict future events. As such, distinctions that are important and meaningful to the person's self (in a broader sense) are emphasized and differentially stored. Conversely, distinctions that are less relevant to the person are deemphasized and condensed. The authors illustrate this representational distortion of relevant versus irrelevant information by referring to the following phenomenon: American students who had been asked to draw a map of the United States tended to draw their home region close to the center of the map. Moreover, they tended to draw their home region disproportionately large (Solso, 1991).

Hippocampus and stress inhibition

Besides its involvement in memory encoding and retrieval, there is another function of the HC closely related to self-relaxation: The HC inhibits activation of the Hypothalamus-Pituitary-Adrenocortical (HPA) system (Sapolsky, 1992). This system, along with the sympathetic nervous system, is a major stress system in the mammal body (Selye, 1936, 1956). When negative affect is aroused, for example by a stimulus classified as dangerous by the amygdala (Aggleton, 1992), neurotransmitters are released that lead to an increased excretion of cortisol by the adrenocortex. Cortisol itself stimulates the HC to inhibit HPA system activity (see chapter 4, for a more precise description of the processes). This may give a further neurobiological explanation of why the self-system is capable of regulating negative affect. However, if a critical threshold of cortisol is exceeded, HC functioning is inhibited (Pavlides, Watanabe, Magarinos, & McEwen, 1995). In the long run, this may even lead to HC damage (Sapolsky, Uno, Rebert, & Finch, 1990). To the extent that HC maturation has terminated not before the first 2 or 3 years of life, infants are highly sensitive to stress and therefore dependent on the soothing function of the caregiver. It is assumed that high stress levels and/or inadequate parental careand warmth during infancy deteriorates the development of the HC. Indeed, studies on rodents have demonstrated that a lack of parental carewithin the early periods of life entail impaired behavioral and cognitive functioning in the adult rat (Meaney, Aitken, van Berkel, Bhatnagar, & Sapolsky, 1988). Similarly, traumatic experiences in the early years of humans have been found to be associated with alterations of HPA system activity later in life (Heim, Ehlert, Hanker, & Hellhammer, 1998; Heim & Nemeroff, 1999).

There is large amount of evidence demonstrating that affect-regulatory and memory functions of the HC are not operating independently from each other. For example, retrieval of declarative memory (Kirschbaum, May, Wippich, & Hellhammer, 1996; Lupien, 1997; Sauro, Jorgensen, & Pedlow, 2003) and autobiographical memory (Wolf, Witt, & Hellhammer, 2004) has been found to be impaired under elevated cortisol concentration. Speculatively, the above-mentioned phenomenon of impaired self-access in state-oriented individuals may be attributed at least in part to impairments in HC functioning.

In a similar vein, integrated encoding of personal experiences is disturbed under high levels of negative affect. Posttraumatic stress disorder (PTSD) is a prime example of what can happen when stress exceeds the individual's affect regulation capabilities (van der Kolk, McFarlane, & Weisaeth, 1996): During a traumatic episode, formation of associations *among* aspects of the episode can fail, resulting in disorganized storage of these aspects (e.g., isolated encoding of episodic pieces). On the other hand, even if the HC maintained operative during this episode, *afterwards*, traumatized individuals are often not able to integrate the traumatic experience into their self, i. e. to combine it with preexisting structures of experiences. Indeed, there is large evidence that patients suffering from PTSD have a reduced HC volume (Bremner et al., 2000; Bremner, Randall, Vermetten, & Staib, 1997; Bremner & Vermetten, 2001). Moreover, in a recent fMRI experiment with healthy participants (Anderson et al., 2004), the attempt to suppress unwanted memories, which is a typical mechanism applied by PTSD patients, was associated with reduced activity of the hippocampus.

Chapter 2

Measuring affect via judgments about artificial words: The Implicit Positive And Negative Affect Test (IPANAT)

Within the last decade, implicit measures for assessing attitudes, stereotypes, self-concept, or self-esteem have been developed and a great amount of research has been done on or with these measures (e.g., Fazio & Olson, 2003; Greenwald et al., 2002). However, only little effort has been made to develop implicit measures for the assessment of affective states. This chapter introduces an indirect test for the assessment of positive and negative affect, the Implicit Positive and Negative Affect Test (IPANAT). This test draws on ratings on the extent to which artificial words express the meaning of mood adjectives jointly presented. A factor analysis of these judgments yielded two independent factors that can be interpreted as positive and negative affect. The corresponding scales show adequate internal consistency and test-retest reliability. With respect to construct validity, the IPANAT scales show moderate correlations with the respective scales of the Positive And Negative Affect Schedule (Watson et al., 1988) and associated personality variables. Experimental studies presented demonstrate good criterion-based validity, for example in terms of expected changes in state affect, which were not revealed by corresponding self-report mood scales. Finally, the IPANAT shows the potential to capture subtle, preconscious mood change.

Theoretical Background

Implicit measures

To obtain information about individuals' mental states, most of previous research has been drawing on explicit mood ratings, asking individuals about their mental states in a direct way. Although mood ratings usually show good reliability and validity, relying on subjective reports as a valid method for the assessment of internal representations or processes has been criticized for several reasons.

First, as a general phenomenon, affective processes often are beyond conscious experience and, therefore, are barely captured by self-report measures (LeDoux, 1996; Nisbett & Wilson, 1977). For example, the amygdala, which is today seen as a central brain region for the generation of negative affect (Amaral, Price, Pitkänen, & Carmichael, 1992; LeDoux, 1995) can be activated by subliminal negative stimuli, escaping the participant's notice (Morris et al., 1996). Moreover, referring to individual differences, people strongly differ in the extent to which they are capable of introspection (Fenigstein, Scheier, & Buss, 1975).

Although not reaching consciousness, there is ample evidence that non-conscious processes can have a strong impact on behavior (Asendorpf, Banse, & Mücke, 2002; John A. Bargh & Ferguson, 2000; Bargh, Gollwitzer, Lee-Chai, Barndollar, & Trötschel, 2001; Greenwald & Banaji, 1995; Kihlstrom, 1987; McClelland, Koestner, & Weinberger, 1989; Wilson, Lindsey, & Schooler, 2000). This has led researchers to assume the existence of two qualitatively different modes of information processing, explicit versus implicit, resulting in dual-system models of information processing (see Chaiken & Trope, 1999). Both processing systems can but do not need to exchange information among each other – an assumption that finds its expression in numerous findings showing weak or missing correlations between measures of explicit and implicit representations or processes (Asendorpf et al., 2002; Bornstein, 2002; Bosson, Swann, & Pannebaker, 2000; Greenwald, McGhee, & Schwartz, 1998; Hofmann, Gschwendner, & Schmitt, 2005). As such, information that is automatically processed does not need to be consciously experienced.

Second, explicit ratings are susceptible to self-esteem enhancement tendencies (Baumeister, Tice, & Hutton, 1989; Brown, Collins, & Schmidt, 1988; Tesser, 1988) that aim at disengaging from unwanted mental representations. For example, individuals avoid to be negatively evaluated (Rosenberg, 1969) or actively strive for positive evaluations (Brown, 1986). Both tendencies, commonly subsumed under the notion of social desirability tendencies (Edwards, 1957), can operate at either a deliberate or an unconscious level. The fact that people sometimes are not aware of their tendencies to blend out negative information about themselves refers to constructs like self-deception (Paulhus, 1984), repression (Byrne, 1961), or suppression (Gross & Levenson, 1993). For example, to some individuals, negative emotions (e.g., fear or anger) are hardly acceptable to themselves, and they are therefore, suppressed from awareness. Suppression of a particular thought (such as "a white bear") can result in a post-suppression rebound of the suppressed content (Wegner, 1994), or prolonged states of physiological arousal (Gross, 1998; Gross & Levenson, 1997), both contributing to chronic stress and, presumably, to the development of psychosomatic diseases. Similarly, referring to individual differences in introspective capabilities, impairments in perceiving one's own emotions are also associated with psychosomatic diseases (Lane, Sechrest, Riedel, Shapiro, & Kaszniak, 2000; Parker & Taylor, 1997). The fact that suppressed affect can have

adverse consequences, as illustrated here, but cannot be assessed via self-report, underscores the need for implicit affect measures.

In order to avoid the aforementioned shortcomings of explicit measures, over the last 50 years, researchers have been engaged in the development of procedures that aim at capturing mental representations by circumventing asking participants directly. As such, several methods were developed for measuring implicit motives (Kuhl, Scheffer, & Eichstaedt, 2003; D. C. McClelland, 1987; Murray, 1943), implicit attitudes (Fazio, Sanbonmatsu, Powell, & Kardes, 1986; Greenwald et al., 2002), or implicit self-esteem (Greenwald & Farnham, 2000; Koole, Dijksterhuis, & van Knippenberg, 2001).. However, indirect measures have often been criticized for having weak reliability or validity (Bosson et al., 2000; Greenwald et al., 1998; Rothermund & Wentura, 2004).

In contrast to implicit attitude, self-esteem, or motive tests, implicit affect tests are rather scarce.

Self-reported positive and negative affect

Previous lines of affect research have repeatedly found 2 independent factors of self-reported affectivity, labeled positive affect (PA) and negative affect (NA) (Diener, Larsen, Levine, & Emmons, 1985; Watson & Tellegen, 1985). One major product of this research approach is the Positive And Negative Affect Schedule or *PANAS* (Watson et al., 1988), which is one of the most frequently employed affect scales.

Positive and negative affect are considered to be high-order affective dimensions comprising specific affective states[8]. These states have been described as follows:

> *"High PA is a state of high energy, full concentration, and pleasurable engagement, whereas low PA is characterized by sadness and lethargy. In contrast, Negative Affect (NA) is a general dimension of subjective distress and unpleasurable engagement that subsumes a variety of aversive mood states, including anger, contempt, disgust, guilt, fear, and nervousness, with low NA being a state of calmness and serenity" (Watson et al., 1988). (p.1063)*

Although PA and NA were initially conceptualized as state dimensions, ongoing research has shown that they refer to stable interindividual differences as well (Watson & Clark, 1984; Watson & Tellegen, 1985). Considering this, the PANAS has been employed using different time frames, asking participants about their momentary feelings, feelings within the past few days, past few weeks, past year, and feelings in general (Watson et al., 1988). Chronic variations of PA and NA have been linked to constructs that represent chronic sensitivity towards reward or punishment signals, such as extraversion or neuroticism/anxiety, respectively (Tellegen, 1985; Watson & Clark, 1997).

However, the orthogonality of self-reported positive and negative affect has also been questioned. For example, Russell and Carroll (1999a) favor a unidimensional structure over a

[8] In contrast to higher-order descriptive affect models, other approaches postulate several basal emotions that are thought to differ in facial expression and specific experiencing (e.g., Ekman, 1982; Izard, 1991). Although the PANAS in itself cannot be divided into further subscales, conceptions have been elaborated that attempt to integrate the higher-order descriptive model and the account of specific emotions in a hierarchical model (e.g., Watson & Clark, 1992).

bidimensional structure of affect, arguing that affective states like happy and sad are subjectively perceived as opposites. However, subsequent discussions about uni- versus bidimensionality in self-reported affect paid little attention to theoretical concerns of the phenomenal status of affect. In contrast, they focused on methodical issues which refer to the question of what methodical factors may bias the factor structure into the direction of uni- versus bidimensionality, e.g., specification of the time frame, type of response format, or item selection (Russell & Carroll, 1999a, 1999b; Watson & Tellegen, 1999).

Cacioppo, Gartner, & Berntson (1999) try to integrate both points of view by relying on a theoretical model that distinguishes between a phenotypic "form" of affect and a genotypic "functionality" of affective systems (Cacioppo & Berntson, 1994; Cacioppo, Gardner, & Berntson, 1997). In line with several theorists (Cacioppo & Berntson, 1994; Cacioppo et al., 1997; Gilbert, 1993; Gray, 1994; Lang, Bradley, & Cuthbert, 1990; Watson et al., 1999), they argue that the bidimensionality of affect relies on the functioning of two separate but antagonistically interacting motivational brain systems that process information in parallel: The "aversive motivational system" is engaged in the processing of threat- or punishment-related (negative) information, whereas the "appetitive motivational system" is engaged in the processing of pleasure- and safety-related (positive) information. For example, there is huge neurobiological support that each of these systems is supported by different brain structures (see Cacioppo et al., 1999, for an overview). For example, whereas the generation of reward was found to be associated with the activation of the mesolimbic dopamine pathway including the ventral tegmental area and the nucleus accumbens (Hoebel et al., 1992; Wise, 1996), the generation of negative affect is stronger related to the activation of the amygdala (Adolphs, Tranel, Damasio, & Damasio, 1995; Davis, 1992a, 1992b; LeDoux, 1992).

Although relying on two distinct systems underlying the initial processing of positive and negative affect, Cacioppo et al. (1999) argue that "physical constraints generally restrict behavioral manifestations to bivalent actions (approach-avoidance)" and that "the bipolar (positive-negative) structure . . . represents a stable endpoint, however, not the states or processes that preceded this endpoint" (p. 841). As such, bipolarity might be interpreted as a conversion of multidimensional representations into one simple representation that is directly relevant to action in terms of approaching or avoiding an object.

This view might be illustrated by the antagonistic interplay of flexor and extensor muscles of our limbs: For example, moving the forearm up and down can be described at an unidimensional level. However, in order to perform this movement, we rely on two separate but antagonistically interacting muscles, the biceps and the triceps. When bending the arm (up-movement of the forearm), the biceps is tensed, whereas the triceps is relaxed. When stretching the arm (down-movement of the forearm), the triceps is tensed, whereas the biceps is relaxed. However, this antagonistic organization does not exclude a simultaneous activation of both muscles, as found in isometric contractions. If we would assess the course of tense of each muscle in a natural setting over a longer period of time, we would find high negative correlations between synchronous activations of biceps and triceps. However, this statistical finding would not rectify to assume that there is only one muscle. Transferred to the actual issue, finding high correlations between positive and negative self-reported affect, or even one general factor in factor-analysis for describing affective states, does not necessarily imply that there is not more than one dimension of affect. Moreover, analogous to the physiognomic example, antagonist interactions between appetitive and aversive systems do not exclude the possibility that both systems might be active at the same time, leading to a state of "mixed" emotions (Cacioppo & Berntson, 1994; Larsen, McGraw, & Cacioppo, 2001) or approach-avoidance conflicts (Lewin, 1936).

Implicit affect measurement

As outlined in the introduction, much of the problems of explicit measures can be circumvented via indirect assessment. Possibly, this might also be true for the dispute on bi- versus unidimensionality of affect. As argued here, implicit measures might be better able than explicit measures to tap into the functioning of the motivational systems postulated to process positive versus negative affect. As such, an orthogonal structure of both affects is assumed.

Taking up the idea of Cacioppo et al. (1999) of a conversion of multiple input representations to a single output value, one could apply this idea to information transfer between psychological systems, being based on different functional characteristics: According to dual-process models (Kuhl, 2000a, 2001; Strack & Deutsch, 2004), information can be processed in an explicit and an implicit way. Systems supporting implicit information processing, best described by connectionist modeling (Rumelhart et al., 1986; Smith, 1996), are considered to be associative and integrative. They are capable of processing multiple information sources in parallel ("multiple constraint satisfaction"). In contrast, explicit systems are considered to rely on categorization tendencies. Categorization reduces complex patterns of information to simpler patterns that are relevant to current *dominant* needs and goals of an individual ("single constraint satisfaction"). As such, complex information which is first processed by implicit systems serves as an input for explicit systems transferring this complex information in the manner of an either-or assignment to categories. As such, huge amounts of information become lost when transferred from the implicit to the explicit system.

Applied to the problem of affectivity, an object might be categorized by explicit systems according to the dimension of good versus bad, no matter in which other multiple aspects it may additionally differ. In contrast, implicit information processing is based on direct automatic associations, providing a differentiated picture of an object. As argued here, high correlations between self-reported PA and NA may strongly rely on classification tendencies of explicit systems, forcing the two-dimensional nature of affect into a bipolar valence format. In contrast, the assessment of implicit processing of affective information, which is to a large degree unaffected by explicit categorization, might result in an unbiased 2-dimensional structure, drawing on underlying biobehavioral systems processing reward versus punishment signals. If this is true, the confusion concerning uni- versus bidimensionality would particularly be due to characteristics of conscious processing.[9]

While methods for assessing broad affective dimensions have not been developed yet, some methods might be interpreted as measures of one specific variant of negative affect, which is anxiety. However, each of these indirect methods of measuring negative affect has significant

[9] Also, the idea of dual processes, with conscious processes relying on categorization, is compatible with Russell's (2003) distinction between *core affect* and *specific emotion* (see James, 1894), for a similar classification). According to this author's view, core affect refers to a "neurophysiological state that is consciously accessible as a simple, nonreflective feeling" (p. 147). In contrast, a specific emotion refers to the "categorization of one's state. The features on which the categorization is based are the other components of the episode (antecedent event, core affect, etc.) (p. 150)". As such, a currently prevailing core affect can (but need not) result in a conscious emotional episode through the way of psychological construction. Amongst others, this construction process includes the observation and categorization of external objects and internal states. However, Russell (2003) hypothesized that core affect may be unidimensional whereas the phenomenon of mixed emotions may derive from opposite valences of aspects of a complex object. Although relying on the same ideas concerning the construction process of self-reported emotion, this paper contrasts with Russell's view that positive and negative affect are two poles of the same dimension. Rather, and in accord with Cacioppo et al.'s (1999) view, it is argued that implicit positive and negative (core) affect are two different states relying on the operating of 2 distinct motivational systems.

limitations. For example, the *dot probe task* (MacLeod, Mathews, & Tata, 1986) and the *emotional Stroop task* (Williams, Mathews, & MacLeod, 1996) were criticized for suboptimal reliability (Egloff & Schmukle, 2002; Schmukle, in press). In contrast, the *Implicit Association Test for measuring the self-concept of anxiety* (Egloff & Schmukle, 2002) does show adequate reliability but revealed to be largely insensitive to change (Schmukle & Egloff, 2004). This might be attributed to the fact that this test is conceptually based on the notion of self-concept, i.e. it requires that representations of anxiety have become associated with the concept of the self, restricting the validity of the test to state anxiety.

A completely different approach to indirectly assessing affect can be seen in *psychophysiological measures*, such as electrodermal activity, heart rate, or blood pressure. Although these measures show advantages in terms of high sensitivity towards change and provision of continuous data about physiological processes, they only allow for the measurement of an unspecific arousal component of affects. As such, they are unable to identify specific affects or its valence in terms of pleasantness and unpleasantness (Andreassi, 2000). Even more expensive and time-consuming is the measurement via *facial expressions* (Ekman, Friesen, & Ancoli, 1980). Although this approach allows for a distinction between basic emotions, it cannot be assumed that implicit affect states (e.g., lethargy) are necessarily expressed in facial muscle activation.

Considering all of these problems, it might be worth striving for an indirect measure of positive and negative affect that shows adequate reliability, is sensitive to change, omits the detour via self-representation, and is easy in application.

Description of the Implicit Positive and Negative Affect Test

The Implicit Positive and Negative Affect Test (IPANAT) assesses implicit positive affect (IPA) and implicit negative affect (INA) by means of an inventory. To circumvent explicit judgments about one's personal affective states, the IPANAT relies on explicit judgments about artificial words.[10] More concretely, participants are asked to rate the extent to which artificial words, like FILNU or BELNI, express several kinds of mood states. A paper-pencil version of this test can be found in the appendix.

The diagnostic idea of this test is based on the principle of *mood congruency* (Bower, 1981; Bower & Forgas, 2000; Eich, 1995; Forgas, 1995; Forgas & Ciarrochi, 2000; Schwarz & Clore, 1983). According to this idea, positive (negative) affect facilitates attention to and retrieval of positive (negative) information. Accordingly, being in a positive or negative affective state may bias the perception of artificial words into the respective direction. In the specific case of the IPANAT, affective states are assumed to prime subjective judgments about the extent to which artificial words sound like emotional words.[11]

Instruction. To make sure that the person makes an indirect rather than a direct assessment of affect, the test is introduced with the following instruction:

[10] A similar method was already applied by Isen and colleages (Clark & Isen, 1982; Isen & Shalker, 1977; Abraham Tesser, Millar, & Moore, 1988) who asked individuals for pleasantness ratings of unfamiliar words using the two poles pleasant and unpleasant. However, in contrast to the test presented here, this method relies on a bipolar response format and, therefore, does not allow for a differentiation between positive and negative affect. Moreover, it has not been evaluated for reliability or validity.

[11] The IPANAT differs from traditional projective tests in that it draws on standardized ratings rather than free interpretations of a stimulus configuration.

> *The following words are from an artificial language. They are intended to express various moods. In all languages, there are words that already express their meanings in the way they sound (for example, the word „rattle" almost sounds like a rattle somehow). For each of the following words, please judge in how far it expresses different moods (e.g., ‚How much does the artificial word „FILNU" expresses the following moods: pleased, energetic, helpless, etc.?'). Try to let yourself be guided by your own feelings.*

With this instruction, the artificial words rather than the mood-related words are brought to the center of the individual's attention. Each item, composed of one mood adjective and one artificial word, is rated by checking out one out of 4 response alternatives, 0 = "doesn't fit at all", 1 = "fits somewhat", 2 = "fits quite well", and 3 = "fits very well".

Scales and Items. The construction of the IPANAT is based on items from the Explicit Affect and Arousal Scales (Kuhl & Kazén, in prep.), which is a German mood adjective checklist comprising 7 different affect scales. Of each scale, the item with the highest item-total correlation is included in the IPANAT. The adjectives are listed in Table 2. I found it important to include items from different affect scales in order to capture a broad variety of negative and positive affective states. Including only one item to assess a specific affect, the IPANAT (in this variant) combines economical assessment and extensiveness in that it addresses a variety of specific sub-affects by the help of its mood adjectives (for example, the negative affect scale comprises the items "*helpless"* or "*angry*," both functionally different types of negative affect).

Table 2

Mood adjectives and their origins from the explicit Affect and Arousal Scales

Adjective (translated)	Original adjective (German)	Scale
Pleased	fröhlich	Joy
Energetic	tatkräftig	Activation
Relaxed	entspannt	Calmness
Helpless	hilflos	Helplessness
Tense	angespannt	Arousal
Passive	träge	Lethargy
Aggressive	aggressiv	Anger

Artificial words. In a pilot study, 32 invented words (pseudowords), consisting of two syllables and 5 capital letters, were presented to 12 individuals who evaluated the words with respect to 4 criteria: *pleasantness*, *familiarity*, *meaning*, and *associative value*.[12] Subjective meaning was assessed by asking the judges about whether the word was meaningful to them. To assess the associative value of the word, judges were asked to write down as many

[12] Although a careful selection of the words was chosen, it is not clear whether doing so necessarily contributes to the validity of the test. For example, claiming for total neutrality of the words is not necessary because the stimuli are standardized in that they are constant between the subjects. Moreover, subjective associations are presumed to influence the judgments, contributing to the measurement error. At least in repeated-measurement designs, where intraindividual changes are of concern, features of the artificial words might not be important.

associations as they could produce within 30 seconds. At the end, 6 artificial words with ratings showing they were the most neutral, unfamiliar, and free of meaning were included in the test. These were SAFME, BELNI, VIKES, TUNBA, TALEP, and SUKOV.

Computation of Scale Scores. In a first-level aggregation, scores for single mood adjectives are computed using the average of all 6 artificial word judgments that refer to the respective mood adjective. For example, to compute a score for the scale "Joy" (mood item: "pleased"), the average of all ratings with the combinations of each artificial word with "pleased" is computed: SAFME – pleased, VIKES – pleased, up to SUKOV – pleased. In turn, scores for the aggregated "super-scales" *positive* and *negative implicit affect* are computed by averaging the adjective scores expressing positive or negative mood ratings, respectively.

Methodological considerations. The score obtained from a single item is theoretically expected to come from two different sources of variance. (a) To the extent that affective states systematically bias the ratings of the artificial words into a specific direction, there is variance from affective states determining the true measurement value. (b) Although the artificial words included in the test were largely neutral and meaningless (see below), some artificial words might still elicit subjective associations in some persons. In this respect, there is an additional source of variance stemming from the characteristics of the artificial words, adding to measurement error. However, aggregation across artificial words is expected to increase the variance coming from affective states at the expense of the variance coming from characteristics of the individual artificial words.

This differentiation helps to define the extent to which the IPANAT provides an implicit measure of affect[13]: In fact, considering the specific instructions given (cover story), the IPANAT provides explicit measures of judgments about the congruency between artificial words and mood adjectives. However, concerning the actual purpose of the test, the IPANAT provides implicit measures of affect because participants are kept unaware of the real purpose of this procedure (De Houwer, in press).[14]

[13] According to De Houwer (in press), the terms *indirect* vs. *direct* refer to the procedure, whereas the terms explicit vs. *implicit* refer to the output of this procedure.

[14] A similar distinction refers to the terms respondent versus operant (cf. McClelland, 1980). Operant tests are considered to assess spontaneous behavior or impressions, whereas respondent tests are considered to assess reactions to specific prompts given by the formulation of items presented on a questionnaire or inventory format. Therefore, in terms of the assessment of judgments about artificial words, the IPANAT can be interpreted as a respondent test. On the other hand, to the extent that the affective responses are conceived to be spontaneously generated, the IPANAT as a method for measuring affect can be considered to be an operant test. Therefore, although the measurement procedure is a respondent one, the affective responses to the test can be conceived of as resulting from an operant process.

Method

Sample and procedure

Ninety one female and thirty male sophomore psychology students (*mean age* = 25.7, *SD* = 6.2) at the University of Osnabrück participated in the study for course credit. Participants came to the Lab in small groups of at most 4 participants. Testing took place in individual cabins, and each participant answered a series of computerized questionnaires for about one hour. Before and afterwards, the IPANAT as well as two explicit mood rating scales were administered. Variables assessed by these questionnaires serve to investigate the construct validity of the IPANAT.

Results

After finishing answering the tests, the researcher approached each participant, asking questions about the practicability of the alleged "artificial word test" (IPANAT) and whether they would guess what the test was about. Only 2 individuals suspected that the test might assess affective states and were therefore excluded from data analysis. Thus, the final sample included 119 participants.

Descriptive statistics and reliability data

Mean values. Table 3 lists means and standard deviations separately for each IPANAT scale as well as for the mood adjective aggregates: *implicit positive affect* (IPA) and *implicit negative affect* (INA). Mean values of each scale are at the bottom of the scale, with mean values of positive affect scoring between 1.30 and 1.40 and mean values of negative affect scoring between .60 and .80. Remember that the range of possible mean values was from 0 ("*doesn't fit at all*") to 3 ("fits very well"). The positive affect scale and its adjective scores show higher mean values than the negative affect scale and its adjective scores. As such, in average participants judged artificial words as "going better" with positive than with negative mood adjectives, suggesting a bias towards positive mood, which can be expected in a population of normal college students.[15] Mean values of positive and negative affect at time 2 differ significantly from those at time 1. Paired t-tests revealed a significant increase in positive affect, $t\ (118) = -1.67$, $p < .05$, and a significant decrease in negative affect, $t\ (118) = 4.82$, $\underline{p} < .001$. Since responding to personality and mood questionnaires increase the accessibility to self-relevant knowledge, implicit affect might have been improved due to self-activation (cf. chapter 3).

[15] To the extent that the artificial words were rated as neutral in a pilot study, I interpret the effect as a mood rather than an evaluation bias. Even if the latter is the case, this would not affect validity of the scale but only shift the relative zero-point of the scale.

Table 3

Means and standard deviations for implicit positive and negative affect and its adjective scores (n = 119)

	Time 1		Time 2	
IPANAT Scale	Mean	SD	Mean	SD
Positive Affect	**1.35**	**0.40**	**1.41**	**0.43**
- pleased	1.54	0.48	1.65	0.52
- energetic	1.33	0.51	1.39	0.51
- relaxed	1.19	0.46	1.19	0.50
Negative Affect	**0.79**	**0.34**	**0.69**	**0.35**
- helpless	0.99	0.55	0.84	0.54
- tense	0.64	0.44	0.53	0.42
- passive	0.86	0.41	0.81	0.46
- aggressive	0.68	0.46	0.59	0.46

Note. Time 2 = about 2 hours after time 1. Ranges of Values: 0 ("*doesn't fit at all*") to 3 ("*fits very well*")

Reliability. For each affect scale, Table 4 depicts internal consistency estimates in terms of Cronbach's Alpha as well as test-retest reliabilities based on an interval of one hour and a half. Both, the positive and the negative affect scales show adequate internal consistency at each time of measurement, with internal consistencies at time 2 (.81 for each IPA and INA) being higher than at time 1 (.74 for IPA, .76 for INA). In contrast, internal consistencies of the single adjective aggregates are low to moderate. Considering internal consistency, the single adjective scores cannot be meaningfully interpreted as subscales of implicit positive or negative affect. Nevertheless, all internal consistency coefficients (and item-total correlations) are consistently positive, suggesting that affective states (true value) as compared to characteristics of the artificial words (error) contribute to internal consistency in a considerable way.

All alphas increase from time 1 to time 2, which presumably indicates an increase in response consistency and thus a decrease in error variance due to more familiarity in item handling.

Table 4

Internal consistency (coefficients alpha) and test-retest reliabilities (n = 119)

IPANAT Scale	Alpha at T1	Alpha at T2	Test-Retest 1.5 hours
Positive Affect	**.74**	**.81**	**.72**
- pleased	.42	.57	.62
- energetic	.54	.59	.57
- relaxed	.46	.63	.68
Negative Affect	**.76**	**.81**	**.79**
- helpless	.60	.68	.69
- tense	.54	.61	.67
- passive	.27	.52	.50
- aggressive	.58	.58	.71

Note. Test-Retest Correlation = Pearson Coefficients

Test-retest reliabilities were estimated through Pearson correlations between the first and second measurement. As can be seen in Table 4, the data produced relatively high test-retest correlations for the implicit positive (.72) and the implicit negative (.79) affect scales and moderate correlations for the adjective aggregates.

In sum, both internal consistency and test-retest reliability of the IPA and INA scales can be judged as adequate.

Internal validity

Factorial validity. Table 5 shows a Varimax-rotated solution of the adjective scores separately for times 1 and 2. All negative adjective scores load on one factor (explained variance of 31 % and 33 %, respectively) and all positive adjective scores load on a different factor (explained variance of 29 % and 30 %, respectively). At each time, all primary loadings are above .60 and all cross-loadings below .25. Thus, all adjective scores can be seen as adequate representatives of the corresponding scale.

Table 5

Varimax-rotated factor loadings of the Implicit Positive and Negative Affect subscales

	Time 1		Time 2	
Mood Adjective Score	INA	IPA	INA	IPA
Pleased	-.07	.85	.06	.86
Energetic	-.06	.84	.06	.85
Relaxed	-.03	.75	-.16	.82
Helpless	.81	.01	.83	.02
Tense	.76	.24	.79	-.06
Passive	.70	-.18	.72	-.01
aggressive	.62	.01	.64	.00

Note. Varimax-rotated solution of time-1 and time-2 adjective scores.

Scale Intercorrelations. In Table 6, affect-score intercorrelations at time 1 are depicted below the diagonal and at time 2 above. Negative affects at time 1 are strongly related to each other. An exception is the correlation between passive and aggressive (at each time), which is smaller than the others. This probably occurs because both emotions show very little commonalities in terms of behavior, physiology, and experiencing, with the exception of their common negative valence,. Regarding the intercorrelations between positive and negative emotions at time 1, arousal is somewhat positively correlated with activation.[16] However, these cross-valence correlations disappear at time 2. In contrast, at time 2, each positive (negative) affect score shows high correlations with each other positive (negative) affect score and negligible cross-valence correlations.[17]

[16] To the extent that both states share a physiological arousal component and therefore a common meaning in terms of content, if not in terms of valence, a positive correlation is not unsurprising.

[17] For comparison, intercorrelations between explicit positive and negative affects (PANAS) can be found in the appendix (Table 16).

Table 6

Affect scale intercorrelations (time 1 under diagonal, time 2 above diagonal; N = 119)

		I	II	III	IV	**V**	VI	VII	VIII	IX
I	**Positive**		.86**	.85**	.82**	-.03	-.06	.00	-.02	-.01
II	pleased	.84**		.61**	.55**	.03	.04	.03	.00	.02
III	energetic	.84**	.60**		.54**	.04	.00	.04	-.07	.16
IV	relaxed	.77**	.48**	.44**		-.15	-.19	-.06	.03	-.22
V	**Negative**	.04	-.03	.08	.04		.80**	.80**	.73**	.65**
VI	helpless	.02	-.01	.06	.01	.82**		.52**	.48**	.33**
VII	tense	.19	.08	.20*	.18	.75**	.45**		.50**	.43**
VIII	passive	-.11	-.14	-.16	.03	.66**	.47**	.37**		.22*
IX	aggressive	.00	-.02	.12	-.12	.65**	.37**	.37**	.15	

Notes. * p < .05; ** p < .01 (two-tailed)

Construct validity

Correlations with explicit mood ratings (state). To assess explicit affect states I applied the Positive-and-Negative-Affect-Schedule (Watson et al., 1988). However, because this instrument does not allow for a *functional* differentiation between several affective states, I additionally administered the explicit mood test which the IPANAT was derived from (Kuhl & Kazén, in prep.). This test comprises the affective scales joy, lethargy, helplessness, calmness, activation, arousal, lethargy, and anger.

Table 7 depicts correlations at time 2 between implicit and explicit scales. Corrrelations with corresponding explicit affects that indicate convergent validity are printed in bold. Implicit positive affect (IPA) is positively correlated with PANAS positive affect but not negative affect. Conversely, implicit negative affect (INA) is positively correlated with PANAS negative but not positive affect, suggesting both convergent and divergent validity of either scale. Even regarding the adjective scores, the majority of the scores are positively correlated with their corresponding explicit mood rating scale. Moreover, cross-correlations can be found between IPANAT adjective scores and explicit affects of the same valence but not with explicit affects corresponding to the "opposite" valence. For example, implicit anger does not only correlate with explicit anger but also with explicit arousal. However, this is unsurprising, because sensory arousal is assumed to accompany a state of anger, what has already been shown by Table 6.

Although convergent correlations at time 2 (not depicted) are somewhat lower than at time 1, both correlational patterns are very similar.

Table 7

Correlations between implicit and explicit affect scales (N = 119)

	Explicit states								
	PA	NA	P1	P2	P3	N1	N2	N3	N4
IPANAT – P	**.22***	.00	.25**	.14	.14	.09	-.04	-.01	-.04
IPANAT - N	-.07	**.30****	-.03	-.04	-.11	.26**	.27**	.20*	.17^{t}
- pleased (P1)	.26**	-.08	**.30****	.12	.19*	.02	-.17^{t}	.01	-.10
- energetic (P2)	.12	.10	.13	**.15^{t}**	.03	.19*	.12	-.07	.06
- relaxed (P3)	.18	-.02	.22*	.07	**.14**	.04	-.05	.02	-.07
- helpless (N1)	.02	.25**	.05	.02	-.03	**.23***	.19*	.20*	.14
- tense (N2)	-.07	.18*	-.04	-.02	-.11	.15^{t}	**.21***	.08	.11
- passive (N3)	-.07	.22*	.02	-.11	-.10	.19*	.17^{t}	**.27***	.06
- aggressive (N4)	-.11	.23*	-.14	-.02	-.10	.21*	.25**	.05	**.20***

Note. Letters in bold = correlations with corresponding explicit affect (convergent validity); IPANAT – P = implicit positive affect, IPANAT – N = implicit negative affect, PA = PANAS positive affect; NA = PANAS negative affect; P1-N4 (explicit) = explicit affect scales from BEF; ^{t} $p < .10$; * $p < .05$; ** $p < .01$ (two-tailed)

Correlations with measures of chronic affective experiencing, psychopathology, and personality. To extend construct validity of IPANAT, I examined its relationship to chronic variations of affectivity, psychopathology, and other related personality variables. To assess chronic positive versus negative affective experiencing, I applied the PANAS scales (Krohne, Egloff, Kohlmann, & Tausch, 1996; Watson et al., 1988), asking the individuals about how they feel in general. Extraversion and neuroticism were measured by means of the Neo Five-Factor Inventory (Borkenau & Ostendorf, 1993; Costa & McCrae, 1992).

Furthermore, I assessed optimistic/rhapsodic, reserved/schizoid, and negativistic/avoidant personality styles which are scales from the Personality Style and Disorder Inventory (Kuhl & Kazén, 1997). These scales measure styles in the normal range that correspond to the well-known personality disorders described in the axis II of DSM-IV. Optimistic individuals are those who predominantly show positive expectancies about the future. Reserved (schizoid) individuals usually avoid close contacts with other people and have a rational cognitive style. Reserved personality style has been functionally related to low sensitivity for reward (Kuhl, 2000b; Kuhl & Kazén, 1997). The negativistic/critical personality style is characterized by its negative attitude towards other people, focusing on the negative aspects of a particular action or situation (the personality disorder associated to this style was formerly labeled as “passive-aggressive” in the DSM-III-R).

Additionally, I applied two scales measuring affect regulation competencies, taken from the Action Control Scale (Kuhl, 1994a): *Action orientation after failure* (AOF) and *action*

orientation after decision and initiative (AOD), which relate to the extent to which negative affect can be down-regulated or positive affect self-generated. Individuals classified as action-oriented after failure, in contrast to state-oriented (i.e., ruminative), are able to focus their attention on a feasible action-plan after being confronted with failure or in conflictive situations. Decision-related action orientation, as compared to decision-related state orientation, refers to the degree to which people are fast in decision-making and are able to quickly initiate enactment of difficult or unpleasant tasks.

We also applied the Progression-Regression Inventory (Kuhl & Quirin, 2003) for assessing affect regulation styles. *Progressive coping style* is associated with high levels of top-down controlled affect regulation. Conversely, *regressive coping style* is associated with inhibited top-down control, thus facilitating impulsive coping (e.g., becoming aggressive). As a subscale of progressive coping, *reappraisal* measures the extent to which an individual tries to find positive aspects of recent negative experiences (Gross, 1999).

Activation control and *loss of concentration* are scales from the Volitional Components Inventory (Kuhl & Fuhrmann, 1998). Activation control assesses the degree to which a person is able to regulate his/her level of arousal by him/herself.

Whereas correlations of IPANAT scales with state measures would indicate validity of the test in terms of measuring state variance, correlations with trait measures would indicate validity in terms of measuring trait variance.

Table 8 lists Pearson-correlations between either IPANAT scale at each application time (time 1 and 2) and the aforementioned variables. Because some of the questionnaires were not applied to a subsample of participants, the sample sizes on Table 8 differ. The variables are clustered with respect to similarities in their correlation pattern. For comparison, correlations with corresponding explicit affects from the PANAS scales are listed in Table 16 of the appendix.

As can be observed, implicit positive (IPA) but not negative affect is significantly associated with general positive affectivity (PANAS), extraversion, optimism, and inversely with reserved/schizoid personality style. All of these variables are related to sensitivity towards positive affect (Tellegen, 1985).

Conversely, implicit negative (INA) but not positive affect is related to negativistic personality style (criticism) and anxiety (last 4 weeks) - variables that are related to sensitivity towards negative affect. Surprisingly, the correlation with general negative affect failed to be significant and the correlation with neuroticism, which is also commonly related to sensitivity towards negative affect (Tellegen, 1985), is close to zero at the second time of measurement.

Concerning the affect regulation variables, IPA is related to personality constructs that mirror high levels of volitional control, such as failure-related (AOF) and action orientation after decision (AOD), progressive coping, activation control, and reappraisal. Negative affect (INA), in contrast, is related to constructs associated with low levels of volitional control, such as regressive coping and loss of concentration.[18]

In sum, the IPANAT seems to be capable of measuring both state and trait variance of affectivity.

[18] For comparison, corresponding relationships of explicit affects are listed in the appendix (Table 17). Additionally, Table 18 (implicit affects) and Table 19 (explicit affects) inform about relationships with further personality variables.

Table 8

Pearson-correlations between implicit positive and negative affect measured at 2 times and diverse personality, affective, and self-regulation scales

	N	IPA - t1	IPA - t2	INA - t1	INA - t2
PANAS pos (chronic)	66	.31*	.22[t]	-.00	-.05
Extraversion (NEOFFI)	119	.27**	.22*	.02	-.01
Optimistic Style (PSDI)	119	.24**	.25**	.17	.06
Schizoid Style (PSDI)	119	-.27**	-.24**	.05	.01
Action orientation (AOF)	119	.25**	.25**	-.01	-.05
Action orientation (AOD)	119	.15	.26**	-.08	-.13
Activation control (VCI)	119	.36**	.41**	.06	.04
Reappraisal (PRI)	66	.32**	.33**	.01	-.07
Progressive coping (PRI)	66	.24*	.26*	.05	.06
PANAS neg (chronic)	66	-.03	-.01	.16	.17
Neuroticism (NEOFFI)	119	-.07	-.07	.14	.02
Depression (HADS)	66	-.12	-.09	-.03	-.02
Anxiety (HADS)	66	-.12	-.10	.22[t]	.28*
Negativistic Style (PSDI)	119	.03	.06	.20*	.28**
Regressive coping (PRI)	66	.14	.15	.31*	.31*
Loss of concentration (VCI)	119	-.02	-.09	.28**	.40**

Notes. * $p < .05$; ** $p < .01$ (two-tailed)

Criterion-based validity. The development of an implicit affect test is meaningful, if there is hope for an advantage over explicit affect tests, for example, in terms of predicting behavior, experiences, mental processes, or health symptoms. As such, to examine the ecological (predictive) validity of the IPANAT, experimental and clinical data are presented in the following sections.

(1) To the extent that IPANAT is thought to measure not only trait but also state affectivity, it should be sensitive to changes in affective states. To examine this notion, an experiment was conducted in which implicit positive and negative affect were measured before and after a negative mood manipulation. Thirty two participants were randomly assigned to either a treatment or a control group. Individuals in the treatment group were instructed to imagine an interaction with a *threatening* person, guided by a 4-minute tape of auditory instructions via headphones, whereas individuals in the control group were instructed to imagine an interaction with an affectively *neutral* person. The IPANAT was administered in a 4-adjective

variant, comprising the adjectives “energetic” and “pleased” expressing IPA, as well as “helpless” and “tense” expressing INA.[19] For comparability, the same adjectives were used for explicit mood ratings scoring from 1 (not at all) to 8 (absolutely). Both tests were administered in a counter-balanced order before and after the person-imagination manipulation. While there were no significant differences between treatment and control groups in explicit affective change (not depicted), both groups differed significantly in both implicit positive and negative affective change: Threat-imagination, as compared to neutral imagination, led to an increase in INA, $F(1, 30) = 5.71$, $p < .023$, and a decrease in IPA, $F(1, 30) = 9.06$, $p < .005$ (see Figure 2).

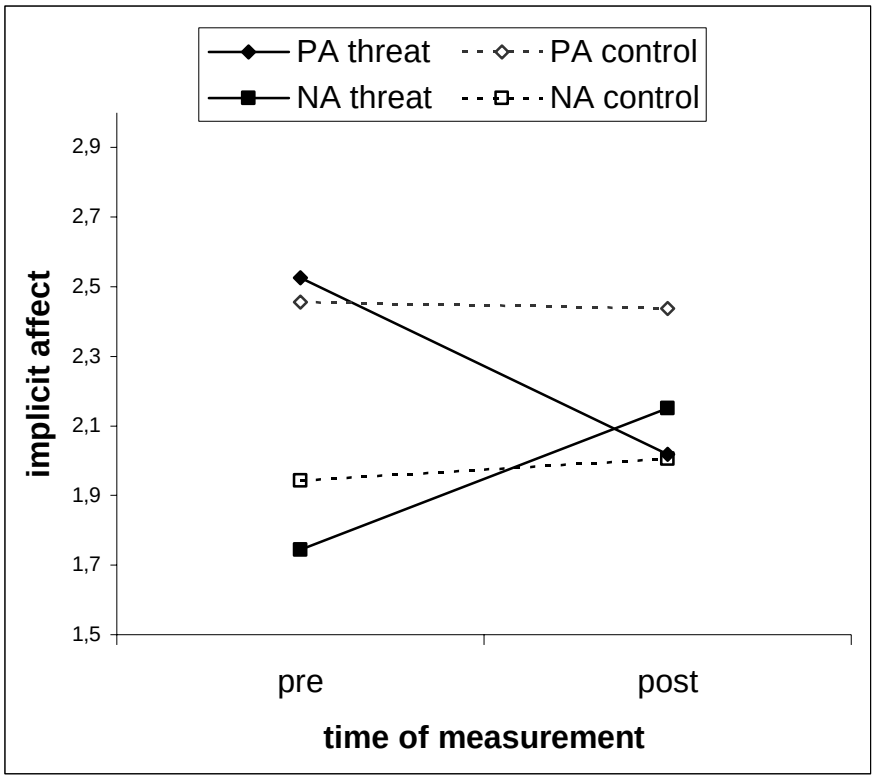

Figure 2

Course of implicit positive and negative affect separately for imagination group (threatening versus neutral social situation)

(2) In a study conducted with 70 voluntary school children (34 girls and 36 boys, from 10 to 12 years of age; $M = 10.4$, $SD = 0.58$; Fritsch, 2004), the IPANAT and corresponding explicit affect scales were assessed after having presented sad, activating, and funny music clips to *each* individual, presented in a counter-balanced order between subjects. As compared to the other clips, after the sad music clip both implicit and explicit positive affect were reduced. However, as an interaction effect, in the IPANAT scores, this difference was only significant in individuals scoring high on the “charming/histrionic” personality style of the PSDI, whereas in the explicit affect scores, this difference was only significant in individuals having high scores on the “careful/obsessive-compulsive” personality style of the PSDI. This corresponds with the idea that charming/histrionic individuals strongly regulate emotions by relying on implicit (intuitive) representations of affect whereas careful/obsessive-compulsive individuals regulate emotions by relying on explicit representations of affect.

[19] Because negative mood inductions show spontaneous recovery and affective processes are prone to be disturbed by the measurement itself, a shortened form of the IPANAT was applied.

(3) In another study, the IPANAT was used to test the assumption that self-activation after a negative experience leads to mood improvement (Kuhl, 2001). Indeed, as compared to a neutral control group, individuals primed with self-related information showed an increase in implicit (IPA) but not in explicit positive affect (Quirin & Kuhl, 2004a) see also chapter 3). This dissociation between implicit and explicit measures of affect is consistent with the assumption that emotional experience affects the implicit self (right hemisphere) more directly than the explicit self-concept (left-hemisphere) (cf. chapter 1).

(4) More validity data, referring to the trait-variance of the IPANAT, come from an examination of the relationships between impairments in self-perception of emotion ("alexithymia"), INA, and physical symptoms. According to the psychosomatic model, chronic forms of suppressed negative affect can lead to physical symptoms (Alexander, 1950). Alexithymia, defined as an impairment to perceive or communicate emotions, has often been observed in patients suffering from psychosomatic diseases. This phenomenon has therefore been discussed to be involved in the development of physical complaints (Taylor, 2000): Inasmuch as people cannot adequately cope with (negative) affect, negative affect becomes a chronic implicit state, which in turn, might lead to physical symptoms or complaints. This model was tested in a sample of N = 80 students. Impairments in the perception of emotion was operationalized by the subscale *emotion perception* of the Toronto-Alexithymia-Scale (Taylor, Bagby, & Parker, 1992). Physical complaints were assessed by the respective subscale from the Hopkins Symptom Checklist (Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974). Implicit negative affect was measured by the negative affect scale of the IPANAT. A mediator model was conducted relying on a combination of bivariate and hierarchical regression analyses (Baron & Kenny, 1986). As can be seen in Table 9, emotion perception, INA, and physical complaints were significantly and positively related to each other. However, when using both INA and emotion perception as predictors of physical symptoms in a multiple regression model, emotion perception failed to predict physical complaints significantly (model 3). This suggests that implicit negative affect (INA) functions as a partial mediator between alexithymia and physical complaints. In accord with a modified Sobel test for testing mediation (Sobel, 1982), this mediation was significant, $Z = 1.66$, $p < .05$ (one-tailed).

Table 9

Hierarchical regression of physical complaints on alexithymia (emotion perception impairments) and implicit negative affect (N = 80)

Predictor	Cumulative R^2	Increase in R^2	Standardized β	p (two-sided)
Model 1: Regression of INA on alexithymia				
Alexithymia	.158	.158	.40	< .01
Model 2: Regression of physical complaints on alexithymia				
Alexithymia	.086	.086	.29	< .05
Model 3: Regression of physical complaints on both alexithymia and INA				
Step 1: INA	.187	.187	.38	< .016
Step 2: alexithymia	.204	.017	.14	< .345

This mediation is depicted in form of a path diagram in Figure 3. The first path diagram illustrates the relationship between alexithymia and physical complaints, whereas the second path diagram illustrates the mediator model involving implicit negative affect (INA), as measured by the IPANAT.

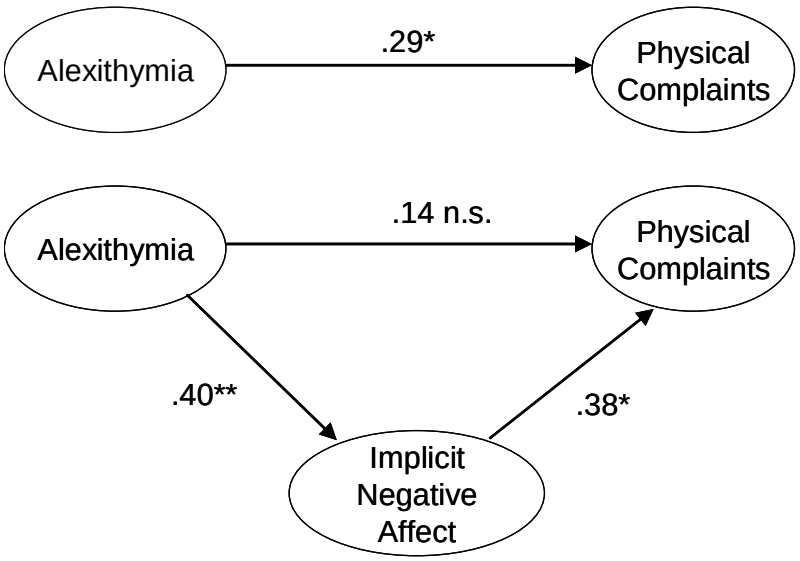

Figure 3

Path diagram for INA mediating the relationship between alexithymia and physical complaints

Notes. Coefficients are standardized betas; *p<0.05, **p<0.01,

Together, these studies provide evidence supporting the validity of the IPANAT as both a state and a trait measure.

Discussion

The aim of this chapter was to introduce and evaluate the implicit positive and negative affect test, an economical method for assessing implicit positive and negative affect based on personal judgments about the fit between meaningless artificial words and mood adjectives. Reliability and validity data were presented and the usefulness of this test was demonstrated with experimental and correlational data. Compared with other implicit measures, the IPANAT did not only show adequate reliability but also good internal and external validity. Suggesting good construct validity, the scales correlated with the explicit PANAS scales and related constructs like extraversion or anxiety. Moreover, in several experiments using affect inductions, the IPANAT proved to be sensitive to affective changes, sometimes even outperforming explicit mood ratings. Therefore, the IPANAT seems to be a suitable *supplement* to explicit mood ratings. It is especially indicated for studies in which mood changes are expected that are too subtle to be detected by the participant (e.g., if the valence of a stimulus or the stimulus itself cannot easily be identified). Furthermore, as an indirect test, the IPANAT avoids social desirability or self-presentation tendencies as well as demand characteristics.

The following sections provide a discussion about different aspects of the IPANAT, stressing both merits and shortcomings of this test.

Fakability. Indirect procedures can only be interpreted as implicit measures if individuals either do not know about which concept is assessed or know this but are not capable to bias their intuitive reactions (De Houwer, in press). Therefore, a shortcoming of this test can clearly be seen in its fakability. However, as reported above, to more than 97 % of the participants the cover story was credible. Therefore, if an appropriate cover-story is provided, it is rather unlikely that the IPANAT will be faked. Fakability, however, is not a specific problem of this test, but of almost all implicit measures.[20]

Internal validity. Although the vast majority of interrelationships between implicit positive and negative affect scores are consistent with the results of the factor analysis, there are some relationships that do not fit into this pattern. For example, although the adjective scores for anger and lethargy show high loadings on the factor “negative affect” both scores are only weakly correlated with each other. This is probably due to the fact that anger and lethargy represent affective states that strongly differ in terms of functional status and meaning and therefore do not coincide usually. That both affects are nevertheless positively associated might be attributable to common variance in valence rather than to the functional status between both types of affect. Common valence might indeed be the major reason for the clear-cut two-factor solution although differences in the functional status of variables partly are reflected by some correlations. However, high homogeneity among adjectives of the same valence was not the major criterion of test construction. I rather intended to provide an economical test that is capable of assessing different subtypes of positive and negative affect at the same time, which, however, can be modified for specific needs. However, using more items expressing subtypes of either positive or negative affect, might possibly result in a differentiated factor solution with different subscales of negative or positive affect (Watson & Clark, 1992).

[20] An exception is the IAT which is susceptible to faking only to a limited degree (Kim, 2003; Steffens, 2004).

Relationship to questionnaire data. Implicit measures of self-esteem have been criticized for a lack of interrelationships among each other, questioning validity of implicit measures in general (Bosson et al., 2000). Regarding implicit motive measures, for a similar reason, Bornstein (2002) claimed for at least modest interrelations between the implicit test scores and their explicit equivalents. Regardless of whether this is a justified claim or not, the finding that the IPANAT scales were positively correlated with corresponding explicit mood ratings serves as an indicator of the construct validity of the IPANAT.[21]

State versus trait. Explicit affect measures, although conceptualized as state measures, proved to be related to corresponding affective trait dimensions of positive and negative emotional reactivity (Tellegen, 1985; Watson & Clark, 1984). For example, positive and negative affective states from the PANAS are related to extraversion and neuroticism/anxiety, respectively (Tellegen, 1985; Watson & Clark, 1984). Analogously, similar patterns for the IPANAT scales were found. Interestingly, regarding the correlations between IPANAT scales and questionnaire variables, the IPANAT scales correlated somewhat higher with personality traits than with chronic affect states. Whereas this suggests that the IPANAT scales contain variance coming from personality traits, mood manipulations showed that the IPANAT is also highly sensitive to situational fluctuations. However, containing both state and trait variance is a typical feature of all tests measuring mental states.

Regarding trait variance of the IPANAT scales, there are limitations in measuring affective styles with this test: Although some constructs associated with high sensitivity towards punishment (e.g., an anxious or negativistic style) correlated with INA, core constructs like neuroticism and reported habitual negative affect did not (see Table 8). Along with the finding that repressive coping style and loss of concentration were even stronger related to INA than were neuroticism and explicit chronic NA, it might be speculated that the INA scale does not only reflects sensitivity towards negative affect but also affect regulation, that is the ability to disengage from negative affect. Because the IPA correlated somewhat higher with reappraisal and activation control than with extraversion and chronic PA, the same might be true for the IPA scale: It may be speculated that this test captures the ability to *actively* generate positive thoughts (affect regulation) rather than *passive* sensitivity to positive affect. Taken together, to the extent that the IPANAT captures affect regulation rather than sensitivity to affect, the absence of a correlation between INA and neuroticism or habitual negative affect might have a simpler interpretation: Although neurotic individuals are sensitive to negative affect, they could vary in their capability to downregulate negative affect once they have dropped into a negative state (Kuhl, 2001). However, at this point, this interpretation is rather speculative and further research is needed to fill this gap of evidence.

Interestingly, as mentioned above, lack of concentration is positively related to implicit negative affect (INA) but unrelated to positive affect (IPA). In contrast to Watson et al. (1988) who relate concentration to positive affect, our data suggest that lack of concentration is associated with negative affect. In light of the considerations from the previous section, concentration might thus result from an ability to disengage from negative (or incongruent) stimuli rather than from high sensitivity towards positive stimuli.

However, although a the IPANAT scales includes trait variance, several experiments measuring implicit affect as a dependent variable demonstrated that the IPANAT also includes state variance in that it is sensitive to changes in response to mood induction (Quirin & Kuhl, 2004a, 2004b; Fritsch, 2004). Even applying the IPANAT before and after a battery of questionnaires, as it was done in this study, it leads to an increase in IPA and a decrease in

[21] This statement, however, cannot be reversed: Most of the implicit measures of motives, self-esteem, or other constructs, were not related to their explicit analogs, and showed nevertheless validity, for example, in terms of predicting human behavior.

INA, interpreted as a self-activation effect. That this can barely be attributed to a systematic methodological artifact, is reflected by the fact that positive and negative affect changed into opposite directions instead of in the same direction.

IPA and INA revealed to be independent in terms of the overall factorial and correlational pattern. Moreover, most criterion variables were related only to one of these affect scales. This is in line with neurophysiological evidence suggesting two distinct psychophysiological systems associated with the processing of appetitive (positive) and aversive (negative) stimuli, respectively (Cacioppo & Berntson, 1994; Cacioppo et al., 1997; Gilbert, 1993; Gray, 1994; Lang et al., 1990; Watson et al., 1999).

As such, a distinctive correlational pattern for implicit positive versus negative affect might contribute to the debate on the structure of self-reported affect (Cacioppo et al., 1999; Russell & Carroll, 1999a, 1999b; Watson & Tellegen, 1985; Watson et al., 1999; Yik, Russell, & Barrett, 1999): Finding a more clear-cut dissociation between explicit and implicit measures suggests that bipolar factor structures of explicit measures might indeed reflect controlled verbal classification tendencies blurring the outcome of the basic motivational systems ("When I'm in a positive state, I cannot be in a negative state at the same time"). Briefly, the present findings not only underscore the validity of the test but provide support for the hypothesis that an implicit measure such as the IPANAT surpasses explicit measures in assessing more basic information processing in terms of separate motivational systems.

Repeated measurement. In general, repeated measures of equivalent tests are associated with carry-over effects. As such, it might be criticized that the validity of repeated application of the IPANAT might be reduced, for example, through memory of prior responses. Although memory effects cannot be excluded, the IPANAT still proved to be effective in revealing affective changes in several experiments. Therefore, for experiments focusing on change, we recommend repeated administration of the IPANAT, before and after the manipulation. In addition, because mood states can be short-lived, which depends on several factors such as stimulus intensity, coping abilities, etc., one can consider to adapt the size of the IPANAT to the expected duration of the mood state. If that is the case, to preserve test sensitivity it might be useful to give priority to adjectives addressing the specific affect that is expected to change rather than to heterogeneous adjectives representing global affective states like PA and NA. For example, if "calmness" is expected to change after an experimental manipulation, adjectives like calm, relaxed, or secure might be included whereas others might be dropped. If there are no hypotheses on changes about specific affects, application of homogeneous of PA and NA scales might be adequate.

Moreover, in the study presented, repeated administration of the IPANAT led to increased internal consistency in the second measurement. Presumably, the artificial words become more familiar over time, leading to more consistent responding at time 2. This phenomenon, sometimes referred to as "Socrates effect", has also been reported for explicit tests.

Implications for research and possible applications

Despite the limitations mentioned, the IPANAT can be a valuable instrument in emotion research. The IPANAT is easy to apply in that it doesn't rely on a computer and only takes about 3 to 5 minutes to be filled out. As a supplement to explicit mood rating scales, it can help to uncover affective processes at a preconscious level. Because of its sensitivity to subtle affective changes, it provides a useful tool whenever subtle affective changes are expected, that are barely experienced by the participants. So, in the area of experimental social psychology, uncontrolled automatic processes proved to influence human behavior and experience in a myriad studies on different topics (Bargh & Chartrand, 1999; Bargh, Chen, &

Burrows, 1996). For example, a great deal of experiments based on Terror-Management Theory (Pyszczynski, Greenberg, & Solomon, 1999; Pyszczynski, Solomon, & Greenberg, 2003a, 2003b) have shown that both direct and indirect induction of mortality salience leads to an enhancement of self-esteem or cultural worldviews of one's own, or even a devaluation of other cultures (Rosenblatt, Greenberg, Solomon, & Pyszczynski, 1989). Second, regarding research based on Self-Affirmation Theory (Steele, 1988; Steele & Liu, 1983a; Tesser, 1988), self-affirmation proved to be related to different kinds of positive behavioral outcomes (e.g., taking action instead of brooding on the negative Koole, Smeets, van Knippenberg, & Dijksterhuis, 1999). Third, affective changes due to Cognitive Dissonance (Festinger, 1957) are difficult to detect using only explicit measures (Harmon-Jones & Mills, 1999), leading to a greater interest in the use of implicit measures in this area of research (Gawronski, Strack, & Bodenhausen, in press). What all these theories have in common is that they assume that affective changes mediate between the situational frame and the resulting behavioral or experiential output. However, most studies trying to test this assumption with the help of explicit affect measures have failed. Possibly, the IPANAT provides a tool that has the potential to uncover some of the expected affective changes that operate outside people's awareness or escape people's notice.[22] Using the IPANAT in conjunction with explicit mood measures, it might become possible to examine under which circumstances or in which individuals implicit and explicit affective processes match or differ.

[22] However, in this regard, a problem should be pointed out: The associative network theory, which forms the theoretical basis of this test, predicts that perceptions or judgments are congruently affected by mood. However, research has shown that, especially if negative mood was induced, opposite moods can often be observed, which can be interpreted as an affect regulation process (Forgas & Ciarrochi, 2002; McFarland & Buehler, 1997; Rusting & DeHart, 2000; Sedikides, 1994; Smith & Petty, 1995). As such, if the IPANAT is administered during a phase where positive affect is emerging after a negative affect induction, the affect regulation process rather than the induced affect might be captured. Therefore, the time of application must seriously be taken into consideration when planning a study and interpreting the data.

Chapter 3

Improvement of implicit affect through self-activation: An experimental study

According to the self-relaxation assumption of *Personality Systems Interaction Theory* (PSI; Kuhl, 2000, 2001), activating the self-system in stressful situations attenuates negative affect as a result of implicit self-regulatory coping. Self-activation also facilitates positive affect which supports the pursuit of intended actions and shields intentions from distraction through ruminative thoughts. Results from a study are presented in which the self was activated by priming self-referential words after a fear-evoking film clip. Changes in implicit positive and negative affect were contrasted with changes in analogous explicit affects. Furthermore, the influence of a ruminative personality style on affect change was examined. As expected, implicit positive affect increased and implicit negative affect decreased through self-activation. For individuals high in rumination, self-activation led to stronger increases in implicit calmness which is interpreted as an indicator of successful downregulation of negative affect.

Theoretical background

The role of the self in negative affect regulation

Theories that take the relationship between the self and affect into consideration focus on how perceiving or recalling *specific* self-aspects influence affective states. As such, positive mood is likely to be elicited by activating or affirming a positive content (Steele, 1988), for example, the belief of being an intelligent person or the memory of an intimate self-disclosure with a close friend whereas becoming aware of concrete negative self-aspects (or self-discrepancies) is assumed to elicit negative affect (Carver & Scheier, 1981; Duval & Wicklund, 1972). Alternatively, the self can also be conceived of and experienced as an unspecific entity, well described as an "average tone of self-feeling which each one of us carries about" (James, 1890, p. 171). William James' (1890) distinction between the self as an experiencing subject being responsible for awareness and knowledge (*I-Self*) versus the self as an object of reflection comprising all beliefs about oneself (*Me-Self*) laid the groundwork for later theorists to adopt and separately study either the one or the other self variant. So, in contrast to theories which focus on specific and explicit self-concepts (e.g., Shavelson et al., 1976; Wylie, 1974), the present paper focuses on the intuitive-experiential form of the self. In recent years, intuitive conception of self have found their way into different research fields, such as child development (Harter, 1998, for an overview; Lewis & Brooks-Gunn, 1979; Neisser, 1991), social psychology (Epstein, 1994; Fazio & Olson, 2003; Greenwald & Banaji, 1995; Greenwald & Farnham, 2000; Koole et al., 2001), cognitive science (Kihlstrom, 1987; Matthews, Derryberry, & Siegle, 2000; McClelland, 1997; Smith-Lovin, 2002), and more recently, neuroscience (Kircher et al., 2002).

When I talk of the self (self-system) in the following, I refer to a high-level conception of an experiential self (e.g., Kuhl, 2000a)[23]. Following neural network modeling (Rumelhart et al., 1986), PSI theory considers this experiential self a holistic parallel-processing system of extended networks of implicit, integrated, and self-relevant representations comprising personal preferences, motives, values, emotional states, experiences, etc.[24]

According to Personality Systems Interaction Theory (Kuhl, 2000a, 2001) the implicit self-system is directly involved in the regulation of positive and negative affect. While activating the self-system in the face of difficult or burdening tasks is supposed to elevate positive affect for supporting the enactment of an intention of starting on a task (self-motivation), activating the self-system in the face of threats is supposed to down-regulate the elicited negative affect, thus leading to a state of relaxation or calmness (self-relaxation). In this paper I focus on the latter aspect, i.e. the self-relaxation assumption. More specifically, there are several inherent functional characteristics of the self-system intimately linked to each other, contributing to the

[23] The self-system in PSI theory is considered a subsystem of so-called extension memory (Kuhl, 2000a, 2001). Extension memory (or the self) is considered a high-level network with an orientation towards integration of new experiences by accommodation rather than simple assimilation. It differs from Epstein's (1994) experiential self which shows *negative* correlations with "constructive thinking" as a high-level, self-confrontational way of coping (Epstein, Pacini, Denes-Raj, & Heier, 1996). Epstein's low-level mode of coping has an orientation towards assimilation rather than accommodation and should be less efficient in differentiating and integrating conflicting experiences. For a more detailed discussion of the distinguishing characteristics, see Kuhl (2001).

[24] Implicit processes which are conceived of as constituting the basis of self-system functioning, proved to be more adequately reflected (Kihlstrom, 1987) in neural network models (Rumelhart & McClelland, 1986) than in traditional sequential models (e.g., Anderson, 1996).

capability of the self to down-regulate negative affect. The most relevant are (1) extended connectivity, (2) congruence focus, (3) positive resultant valence, and (4) integration of seemingly ambivalent affective information (cf. Kuhl, 2000a; see Kuhl, 2001, for an exhaustive listing and discussion of the characteristics). Although the present study does not aim at examining each of those basal mechanisms in detail, it is useful to shortly portray them in the following section in order to provide a theoretical basis for our predictions concerning self-relaxation. After this overview, the focus of the present study will be discussed. It concentrates on the macro-process of implicit versus explicit mood change as a consequence of self-activation.

The first functional characteristic of the implicit self, *extended connectivity*, refers to the dense and extended network of (even remote) interconnections among the components of the self-system such as personal experiences, opportunities for action, values, and other self-aspects (Baumann & Kuhl, 2002; Beeman et al., 1994; Bolte, Goschke, & Kuhl, 2003). The ability to activate remote associations facilitates creative problem solving (Isen, Daubman, & Nowicki, 1987; Isen, Johnson, Mertz, & Robinson, 1985). Consequently, sustaining creative processing in stress situations through activation of the self-system can help to retrieve or invent action strategies for solving one's problems or, in case of the impossibility of escaping the threat, to retrieve alternative self-aspects that are congruent with unexpected happenings or thwarted goals (Brandtstädter & Rothermund, 2002a, 2002b; Kuhl, 2001). For example, the deep sadness elicited by the loss of a loved person can be alleviated by accessing the self, which is based on an extended network of personal experience, no matter whether this network provides means to overcome the loss or ways to accept it in a meaningful way.

The second functional characteristic of the self is its *congruence focus*. This feature is based on a vigilant form of attention (cf. Posner & Rothbart, 1992) amplifying information that matches contents currently activated within the self-system, like preferences, attitudes, motives, or goals. For example, when the self is charged with some overall positive valence (i. e., *self-esteem* or *basic trust*), congruence-oriented attention (or vigilance) leads to an enhancement of the activation of positive associations, with the effect of negative affect being down-regulated.

As such, congruence-oriented attention is highly intertwined with a further well-documented characteristic of the self, *positivity-bias.* For example, implicit evaluations of the self, which seem to be associated with the functioning of the implicit-experiential self (Koole et al., 2001; Wilson et al., 2000), were positively colored in numerous studies (Greenwald & Farnham, 2000; Koole et al., 2001). Several studies using the implicit association test for measuring implicit self-esteem (Greenwald & Farnham, 2000) could even demonstrate a nonconscious positive self-bias in depressed patients (Cai, 2003), which is not reflected in their explicit attitudes towards themselves. Another example of self-positivity can be seen in the findings that positive self-referential information is generally more easily recalled from memory than negative self-referential information (Kuiper & Derry, 1982).

The fourth functional characteristic of the self relates to its capacity to integrate conflicting experiences. The enormous potential of the self for coping with unpleasant or even traumatic negative experiences can be explained on the basis of this integrative capacity. Through self-confrontation, negative experiences can make contact with positive ones (stored in the extended self) which puts painful experiences "in perspective", reminds the person of positive and more optimistic experiences, and provides possible routes for future action or for finding meaning in things that cannot be changed. This self-confrontational process is especially relevant when self-aspects are involved that cannot be easily dismissed by fast affect regulation mechanisms (e.g., attentional disengagement) because they are too strongly in conflict with existing expectancies and self-schemes. In this case, a painful experience can be integrated through self-activation by means of a slowly operating accommodative process

(Brandtstädter & Rothermund, 2002b). *Integration of conflicting information* can be supported by diverse forms of self-activation like self-disclosure (Pennebaker, Kiecolt-Glaser, & Glaser, 1988; Pennebaker & Susman, 1988), dreaming (Reynolds & Kupfer, 1988; Rotenberg, 2000), or active mastery orientated motivation (Dweck, 1986; Elliot & Church, 1997). As such, in the long run, self-activation in stress or even traumatic (Antonovsky, 1987) situations is assumed by PSI theory to support the development of an integrated self (Showers, 1992a, 1992b) and to provide a person with feelings of congruence (Rogers, 1951), coherence (Antonovsky, 1987), and meaning (Frankl, 1981; Klinger, 1977, 1998; Perls, 1973)[25].

Showers and Kling (1996) demonstrated that individuals with a tendency to integrate positive and negative self-aspects within a coherent self-representation recover quickly from an induced depressive mood, provided that the experimental procedure allowed them to engage in a self-reflective activity (i.e., writing a short essay "who am I"). On the other hand, individuals with a tendency to ignore negative self-aspects (positive "compartmentalizers" or repressors) have difficulties to recover through self-confrontation. Instead, they benefit from an ensuing distractive task (which impaired recovery in the former group). Similarly, in field studies, individuals with high self-complexity showed lesser depressive symptoms under high stress levels than individuals with low self-complexity (Linville, 1987a; Rothermund & Meiniger, in press). Because the self is considered a high-level associative structure comprising an integration of negative experiences within a network of predominantly positive experiences (positivity-bias), activation of negative representations should automatically spread (Anderson, 1983) to integrated positive representations with the result of positive effects on mood recovery (see Showers, 1995, for an individual differences view on self integration). The implicit nature of self-relaxation through self-confrontation (i. e. integration of negative affect in the extended experiential network of the self) was confirmed in an experimental study by Koole and Jostmann (2004). To test the hypothesis that self-regulation operates in an intuitive rather than deliberate way (see below), the authors used indirect measures of both self-activation and affect regulation. They could show that, after visualization of a demanding situation, the ability to detect a positive face among a crowd of angry faces (as an indicator for negative affect regulation), is mediated by self-access, as operationalized through the latency of self-descriptive judgments.

Several neurobiological studies provide additional support to the role of the self in negative affect regulation, demonstrating that the same or similar brain structures are active during down-regulation of negative affect (Levesque et al., 2003; Ochsner et al., 2002) and during the processing of self-referential information (e.g., Craik et al., 1999; Gusnard et al., 2001; Keenan et al., 2001), . For example, in a functional magnetic resonance imaging (fMRI) study from Ochnser et al. (2002), parts of the medial prefrontal cortex (known to be associated with self-recognition) were activated in subjects who had been instructed to reappraise the negative content of pictures. Similarly, in another fMRI study, right prefrontal cortex was involved in the suppression of sadness (Levesque et al., 2003).[26]

[25] For a similar view, see Epstein (e.g., 1994).

[26] More general support comes from animal studies, although the applicability to human functioning especially in terms of self-regulation is strongly limited. It was found that medial in contrast to lateral brain regions show stronger modulatory connections to limbic structures (e.g., amygdala, hypothalamus) that are involved in the generation of negative affect and corresponding autonomous reactions (Amaral et al., 1992; Morgan & LeDoux, 1995) reactions (e.g., LeDoux, 1996).

Implicit self-relaxation

PSI theory posits that the kind of affect regulation associated with the self-system functions at a preconscious rather than a conscious processing level (Koole & Jostmann, 2004; Kuhl, 2001). It is assumed that, when activating the self as a reaction to negative events, networks of positive self-aspects or experiences become activated. When positive self-aspects outnumber negative ones (i. e. with a self-positivity bias), negative representations of the current situation become overruled by the activation of positive representations, which in turn leads to a more positive (less negative) appraisal of the current situation and consequently to lower levels of negative affect. It goes without saying that positive self-contents that bear meaningful relations to the negative experience to be coped with should be more effective for coping than weakly or unrelated positive contents. Moreover, when the first automatic activation of relevant self-contents does not suffice for coping with a painful experience, a creative process may be initiated which *generates* rather than passively retrieves a sequence of increasingly effective coping attempts. In sum, - although preconscious - implicit self-relaxation is considered a high-level top-down process rather than a low-level automatic process. This can be inferred from findings showing that the self is associated with (right-)prefrontal cortex structures (e.g., Craik et al., 1999; Keenan et al., 2001; Wheeler et al., 1997), which are known for their involvement in top-down control processes (e.g., Stuss & Benson, 1987).

High-level coping involving self-access should be distinguished from other forms of affect regulation, like automatic or deliberate affect regulation. Despite its largely unconscious operation and its automatic speading-activation component, self-based coping is not automatic in the sense of an activation of preprogrammed routines that are not modulated by high-level executive processes. A full-blown and well-studied automatic regulatory mechanism is defensive repression, which aims at preventing fear-evoking information from further cognitive processing (Byrne, 1961; Egloff & Krohne, 1998; Freud, 1926; Hock, Krohne, & Kaiser, 1996). For example, former studies in the context of the 1950s New Look movement have demonstrated that threatening stimuli can indeed be unconsciously prevented from being further processed, already at an early stage of perception (Blum & Barbour, 1979, for a later study; Bruner & Postman, 1948; McGuiness, 1949). Moreover, repressors, in contrast to non-repressors, proved to be effective in inhibiting negative information in studies utilizing paradigms for the investigation of automatic attention processes (Bonanno, Davis, Singer, & Schwartz, 1991; Fox, 1994; Langens & Mörth, 2003; Myers & McKenna, 1996).

Despite the differences between automatic, low-level versus self-based, top-down forms of coping, an outstanding commonality between top-down intuitive self-relaxation and automatic affect regulation processes can be seen in the fact that the regulation process, and possibly the resulting change in affect too, escapes people's notice. Besides the above-mentioned work on perceptual defense and repression, there are other examples of unconscious affect regulation that gained strong attention in the area of social psychology. Terror Management Theory (e.g., Pyszczynski et al., 1999), for example, holds that death-related thoughts are coped with by an increased identification with values from one's own culture or by increasing one's self-esteem. Although this was corroborated by numerous experimental studies, changes in either self-reported or implicit affect as a possible mediator between mortality salience and value or self-esteem changes could not be detected yet.

Flexibility is a major feature distinguishing self-relaxation from more automatic forms of regulation. In accordance with the notion of the self as a high-level system comprising an integrated network of personal needs, interests, and goals, the self is capable of relatively flexibly deciding between confronting a negative aspect or inhibiting it when it appears to be

an issue of minor importance. In contrast, (automatic) repression of negative experiences is inflexible and therefore considered maladaptive in the long run (Kuhl, 2001).[27]

On the other side, both forms of intuitive affect regulation (i. e., self-based and automatic coping) must be distinguished from deliberative forms of affect regulation (Gross, 1999; Gross & John, 2002; Parrott, 1993; Salovey et al., 1993). For example, Gross and John (2002) distinguish between two well-studied forms of deliberate affect regulation, namely suppression and reappraisal. While suppression aims at preventing representations of unpleasant experiences from being consciously experienced (Wegner, 1994) or at least from being overtly expressed (Gross, 1998), reappraisal is understood as changing one's way of thinking about a situation.

However, to the extent that reappraisal processes can also be considered to operate at an unconscious level, our understanding of the underlying affect regulation process associated with the implicit self-system, shares some similarities with reappraisal in the way that positive representations are activated in reaction to negative experiences. Thus, deliberate reappraisal of negative experiences is apt to be prepared by preceding processes of intuitive self-based affect regulation, but it is not seen as a necessary consequence of intuitive regulation.

Similar causal relationships between the self and unconscious affect regulation have been postulated in the context of self-affirmation theory (Steele, 1988; Steele & Liu, 1983b). This theory posits that affirming positive and important aspects of the self as a reaction to the perception of self-regard threats helps people to maintain or restore both a positive image of the self and accompanying positive affect (Tesser & Cornell, 1991). However, the assumed causal relationship between self-affirmation and positive affect could not be detected by studies administering self-report measures of affect, leading to the qualified assumption that the resulting positive affect might not be consciously experienced (Tesser, Martin, & Cornell, 1996). This could be confirmed by Koole, Smeets, van Knippenberg, and Dijksterhuis (1999), investigating the influence of affirming a positive self-aspect on the disengagement from ruminative thoughts about a preceding failure in a putative intelligence test. They found that rumination was diminished when the subjects were allowed to affirm an important aspect of their self-concept that was unlinked to the self-concept of intelligence. Interestingly, they could prove the role of unconscious positive affect in mediating the relationship between self-affirmation and ruminative thoughts on the failure situation, supporting the assumption of implicit up-regulation of positive affect. According to PSI theory, self-based coping may work over and above self-relaxation through positive self-affirmation: A basal activation of the self-system comprising integrated networks of self-related knowledge may be sufficient for the instigation of self-relaxation, even when extracting clearly defined positive self-aspects cannot be accomplished. It is plausible to assume that the retrieval of affirmative self-aspects is as a possible way of getting access to more global and integrated networks of self-aspects or even the entire self-system. Stated differently, the more integrated the self-system of a person is, the less the person needs to rely on explicit identifications to instigate self-relaxation.

That self-activation is operating at an implicit rather than an explicit level does not necessarily imply that accompanying affects remain unrecognized, too. However, whenever affective processes are difficult to detect (Nisbett & Wilson, 1977) or statements on affective change are subject to social desirability or demand characteristics implicit measures are indicated

[27] I don't want to extend the problem of volitional versus automatic regulation (cf. Bargh et al., 2001) in this paper because the focus of the present study is on implicit in contrast to explicit affect change, no matter how the implicit process can be specified precisely. For the same reason, the distinction between automatic and self-mediated regulation is less important with respect to this empirical study, but important for understanding the theoretical framework on which our hypotheses are based.

(Fazio & Olson, 2003). For example, Polivy and Doyle (1980) demonstrated that self-report mood ratings reflect the operation of demand characteristics rather than true affective changes. Therefore, it can be assumed that, in the presence of stimuli explicitly perceived as positive or negative, explicit affect should surpass implicit affect in the amount of change, whereas in the absence of stimuli without definite valence, implicit affect should surpass explicit affect. The latter case is assumed in the case of self-activation.

Taken together, it seems conceivable that activation of the self-system in or after threatening situations results in positive affect and/or in an inhibition of negative affect (*self-relaxation assumption*). A vital role can here be assumed in unconsciously opposed to consciously perceived affective processes.

Individual differences in implicit self-relaxation

PSI theory holds that individual differences moderate the modulating influence of negative affect on the self-system (*self-relaxation assumption*): As already explained, the self-relaxation assumption postulates that negative affect inhibits the activation and accessibility of the self-system, leading to a reduced influence of the self-system on decisions or behavior. The duration of that "self-inhibition", however, depends on individual differences in affect-regulatory competence. A construct that reflects the ability to change a current affective state is action orientation (Kuhl, 1981, 1994a, 1994b; Kuhl & Beckmann, 1994b). People are called *action-oriented* if they are able to terminate unwanted ruminations quickly because their ability to stop paralyzing ruminations is especially helpful to prepare for action. In contrast, people are called *state-oriented* if they have problems in changing their affective state. State-oriented individuals often report having uncontrollable and perseverating ruminations (e.g., Martin & Tesser, 1989; Nolen-Hoeksema & Morrow, 1991) frequently following unpleasant or painful events. Rumination is typically considered a non-pathological component of depression as well as a risk factor for the development of depressive disorders (Kuhl & Baumann, 2000; Nolen-Hoeksema, 2000). In several electrophysiological experiments, after priming subjects with negative experiences, action-oriented individuals showed slow negative potential shifts that were related to facilitation of a subsequent memory task whereas state-oriented individuals showed positive shifts that were associated with debilitated performance (Haschke & Kuhl, 1994; Haschke, Tennigkeit, & Kuhl, 1994; Rosahl, Tennigkeit, Kuhl, & Haschke, 1993).

As long as the self is considered a system of extended networks of integrated representations of both positive and negative self-aspects, with positive aspects usually being predominant, activation of this system presumably leads to states of positive affectivity. On the other hand, if an individual is not able to activate his/her implicit self-system in aversive situations like those where he/she is departing from personal goals or needs, the self-system cannot provide the person with information about actual needs or self-relevant goals, thus making behavioral readjustments more difficult. Resulting feelings of alienation in turn have negative consequences for life-satisfaction and well-being (Deci et al., 2001; Gagne, Ryan, & Bargmann, 2003; Kasser & Ryan, 1999; Ryan & Deci, 2000).

Indeed, the idea that an inability to change a current negative state (state orientation) is associated with low self-access (Baumann & Kuhl, 2002, 2003; Kuhl, 2000a, 2001; Kuhl & Baumann, 2000) is supported by several studies. For example, it has repeatedly been shown in several studies that subjects high in *state orientation* sometimes confuse "introjected" social demands with their own preferences (Baumann & Kuhl, 2003; Kuhl & Baumann, 2000; Kuhl & Kazen, 1994). In these studies, people were asked to recall whether activities or goals were chosen by themselves or assigned by the instructor in a prior phase of the experiment. When negative affect (sadness or anxiety) was induced or spontaneously present, state-oriented

individuals showed significantly more false self-ascriptions than action-oriented individuals, i.e. they were less aware of the fact that some activities originally were not preferred by themselves, but were assigned by the instructor. This effect was attributed to impaired access to integrated self-representations which are necessary for identifying with personal strivings and rejecting alien thoughts and social demands. Additionally, a positive mood manipulation was found to diminish the number of false self-attributions (Baumann & Kuhl, 2003). As assumed by PSI theory, this is due to an improved access to the self-system that can be achieved by the up-regulation of positive mood. Similarly, state-oriented individuals who were instructed to perform a monotonous task (monitoring a control screen in an atomic power plant simulation), could be prevented from developing feelings of alienation in case they were given meaningful interpretations of this task (Kuhl & Beckmann, 1994a). Provided that meaningfulness is an important outcome of the self-system (Kuhl, 2001, 2003), meaningful interpretations might lead to an activation of the self-system and form a buffer against feelings of alienation.

Baumann and Kuhl (2002) examined the relationship between affective state and the performance in a task that is assumed to be facilitated by the self-system. In this task, subjects were asked to make intuitive judgments on word triples, which were only weakly associated, about whether they are coherent or not (see Bowers, Regehr, Balthazard, & Parker, 1990, for the method). State-oriented individuals who reported higher levels of negative affect showed reduced discrimination between coherent and incoherent triples, whereas relaxed state-oriented and action-oriented individuals did not. It can be concluded that state-oriented participants do not perform worse than action-oriented ones when negative affect is low.

This finding provides a clue as to what might help state-oriented individuals to avoid ruminations or impaired performance: Given that state-oriented individuals usually suffer from the inability to access their self-system autonomously under stress conditions, any effort towards supporting self-access externally should help them to down-regulate negative affect aroused by stressful events.

Indeed, there is evidence directly supporting this hypothesis. For example, Koole and Coenen (in preparation) examined creativity as a dependent variable that proved to be modulated by positive affect in prior studies (Baumann & Kuhl, 2002; Bolte et al., 2003; Isen et al., 1987; Isen et al., 1985). The authors found that state-oriented individuals being subliminally primed with self-related words remained creative during a boring task, while those primed with neutral words decreased in creativity (in contrast, action-oriented individuals remained creative independent from the conditions). Using a mood check list as a dependent variable, Koole & Jostmann (2004) showed that state-oriented individuals, but not action-oriented individuals showed decreases in depressive mood through visualizing a self-relevant warm person. In a similar vein, in a different experiment (Koole, in press), the same visualization task which primed a warm and accepting interaction partner helped state- but not action-oriented individuals to inhibit implicit negative self-evaluations as assessed by means of a reaction time measure described by Hetts, Sakuma, and Pelham (1999).

Moreover, additional support for state-oriented people benefiting from self-activation comes from studies on related personality traits. For example, people who integrate positive and negative self-aspects and who emphasize their negative aspects, emotionally benefit from self-confrontation after being exposed to a negative event (Showers & Kling, 1996). Conversely, people who tend to exclude negative self-aspects from their positive self-construals better recover from a sad mood when performing a distractor task. In a similar vein, people with a high level of neuroticism who simultaneously show high levels of self-determination are less prone to depressive symptoms than those with low levels of self-determination (Biebrich & Kuhl, 2002). Consequently, it can be hypothesized that activation of the self that is associated with self-congruent goal setting and inner feelings of integrity,

although not easily accessible, might be crucial for state-oriented individuals with seemingly beneficial effects.

In sum, a good deal of evidence supports the assumption that ruminators suffer from reduced self-access in aversive situations and might benefit from an opportunity to activate their self-system.

Goals of the study and hypotheses

The major goal of the study is to test the self-relaxation assumption, i.e. that activation of the self as a unitary system rather than specific self-concepts helps to repair one's mood. But how can one directly address the self-system in a more or less unspecific way? To serve this purpose, I chose to experimentally expose participants to self-referential information (e.g., Kircher et al., 2000; 2002). Because the focus of this study is on the regulation of negative affect, negative affect will be induced in all of the participants before experimental self-activation is manipulated. Negative affect is induced by showing a film clip depicting a threatening scene. Film clips proved to be highly effective as a mood induction method and even outperformed other methods like reading self-statements, visualization, or music (Gerrards-Hesse, Spies, & Hesse, 1994; Westermann, Spies, Stahl, & Hesse, 1996).

As argued before, it does not suffice to ask participants about their experienced emotions, because subjective responses can either escape the subject's notice or be confounded with several undesirable effects (e.g., social desirability tendencies, self-deception, demand characteristics, etc.) suspected to disguise the underlying affective process. Therefore, in addition to a mood rating scale I included an implicit affect measure which consists of subjective judgments on how well diverse mood states are expressed by a set of neutral artificial words (see methods). Administering a combination of both implicit and explicit measures thus allows us to uncover dissociations between affective processes between both levels of information processing, like the expected superiority of implicit affect changes due to implicit self-relaxation (Koole & Jostmann, 2004; Koole et al., 1999; Kuhl, 2001; Abraham Tesser et al., 1996).

To the extent that one of the major problems of ruminators results from a failure to access the self, the negative consequences of rumination such as persevering negative affect might turn into positive effects when self-access is externally supported. Therefore, this study aims at directly testing this assumption by examining affective changes through self-activation as a function of ruminative personality style (state orientation). Given that the affect most strongly associated with self-activation is postulated to be calmness (Kuhl, 2000a), state-oriented individuals should especially benefit from self-activation in terms of calmness.

In a nutshell, this study aims at testing the self-relaxation assumption of PSI theory. First, as long as the self-system contributes to relaxation, providing individuals with self-related information should support the mood recovery process in terms of an increase in positive affect particularly indexed by the key affect of calmness and/or a reduction of negative affect. Second, because affective processes associated with the implicit self-system are not necessarily translated into explicit affect, change in affect should especially be identified at an implicit level. In addition to the supportive effect of the self-system on mood-recovery, I expect a spontaneous process of mood recovery due to elementary homeostatic processes directed at restoring the original level of mental and bodily states (Forgas, 2000; Forgas & Ciarrochi, 2002). The third aspect refers to individual differences: To the extent that state orientation ("rumination") is associated with an inhibition of self-access under stress, state-oriented individuals should benefit more from external self-activation than action-oriented

individuals. The film clip is expected to arouse negative and – to a lesser degree – even positive affect on both an explicit and an implicit level.[28]

[28] As long as negative rather than positive affect is associated with aversive stimuli (Gray, 1987), changes in negative affect are expected first and foremost. However, to the extent that the mood induction procedure also affected arousal, a small increase in positive affect was expected as well.

Method

Sample

48 students (35 female, 13 male) studying behavioral sciences (N=31), economics (N=11) or law (N=6) at the University of Osnabrück participated at a small compensation of 10 Euros. Their mean age was 23.9 with a range from 19 to 39 years. Data from one person were not included in the analyses because the response pattern suggested implausible answering.

Procedure

After participants had filled in a booklet of questionnaires, they started with the experimental session (see Figure 4). 48 Participants were randomly assigned to a self-activation or a neutral control group and were seated in front of a PC in separate booths. At the beginning of the experiment, a film clip of about 4 minutes was presented to all subjects to induce negative affect (anxiety). The clip was taken from the end of the movie „The Silence of the Lambs“ which was recommended by Gross & Levinson (1995) for selectively eliciting the emotion of anxiety.[29] Afterwards half of the participants were subjected to self-activation (treatment), whereas the other participants were subjected to a neutral control condition. Both the self-activation and the control procedure were based on the same prime-target reaction task. After the presentation of a visual verbal prime of 4 s, a fixation cross of 250 ms appeared announcing the alleged target stimulus which was an asterisk. The task was to press “F” with the left index finger in case the asterisk appeared on the left or “J” with the right index finger in case the asterisk appeared on the right side of the computer screen. All subjects performed 48 randomly presented trials of 2 × 24 prime words. The entire procedure lasted about 4 min. Participants in the self-activation group were exposed to standardized prime words preceded by the pronoun “my” (e.g., my flat, my character, my goals, my bed) in order to create self-relevance. For controls, the pronoun was substituted by the neutral article “the” (the flat, the character, the goals, the bed, etc.). This procedure was chosen because of the following reasons. First, the stimuli are standardized for the individuals within either group and an adequate procedure controlling for self-activation is easily available by means of a simple substitution. Second, the stimuli as such are predominantly neutral in valence. This is relevant because the experimental manipulation was to examine the influence of self-activation on mood, which requires preventing trivial direct mood inductions. Third, the procedure applied doesn’t draw on active categorization or reflective processes (as it would be necessary for example for self-descriptions) which are suspected to inhibit the influence of the (spontaneous) self-system on behavior and experiencing (Koole et al., 2001; Kuhl, 2000a; Paulhus, Graf, & Van Selst, 1989; Paulhus & Levitt, 1987; Swann, Hixon, Stein-Seroussi, & Gilbert, 1990; Wilson et al., 2000). A further advantage of the induction procedure refers to the fact that participants’ focus of attention is drawn to performing well on an unrelated task (reaction to asterisks), favoring an incidental (spontaneous) rather than intentional (reflective) self-activation (Kircher et al., 2002) even more. To disguise the purpose of the self-relevant

[29] In this clip, a young female agent Clarence is interviewing a tailor at his home whom she suspects to be a cruel serial killer. As she convicted him, he disappears in the cellar where she looks for him. As she is fearfully entering the room, the light suddenly turns off and she is followed by the killer who is wearing a nightviewer, completely invisible to the victim. According to Hagemann et al. (1999) who tested the clip in a sample of German students, the degree of familiarity with the film had no effect on the reported emotion.

versus neutral prime words, participants were told that there is some evidence that faster reactions could be reached by presenting (self-referential) prime words beforehand. Additionally, as a cover story for the whole experiment, subjects were informed that the purpose of the study was to investigate the influence of watching emotionally intense movies on motor reaction speed in subsequent tasks (like classifying asterisks).

In order to record the time course of affective states, explicit and implicit affect were assessed by separate instruments before the clip (t1), between clip and self-manipulation (t2), and after self-manipulation (t3). At time 1 these instruments were applied in a random, at time 2 and 3 in a counterbalanced order.

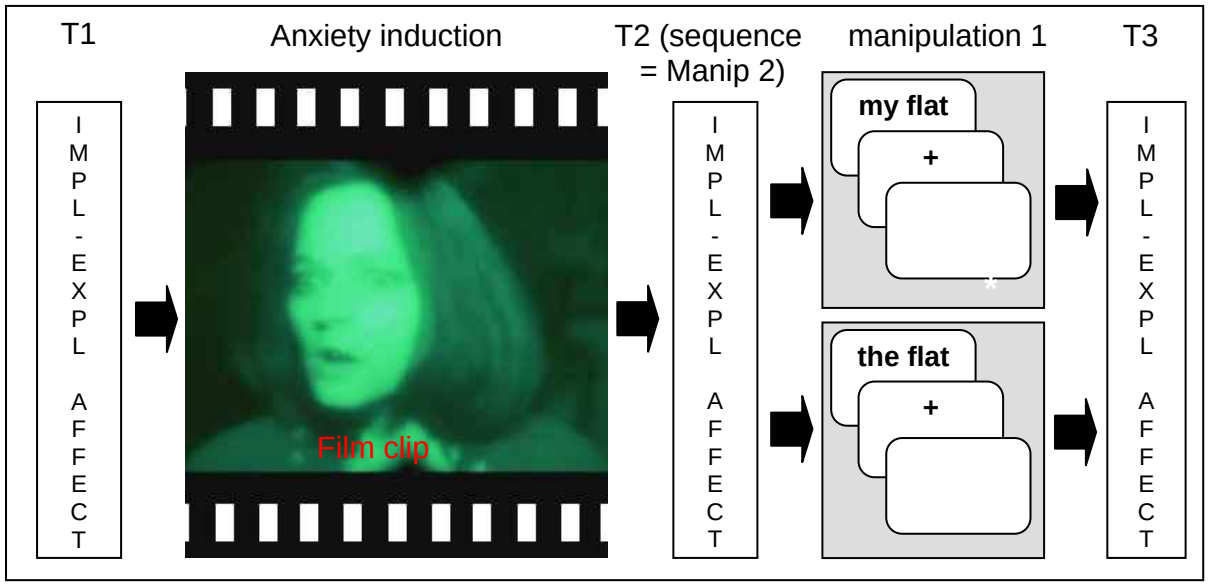

Figure 4: Experimental design

Assessment

Explicit affect

To measure explicit affect, a mood rating scale was applied which comprises an integration of several adjective checklists (e.g., the PANAS scales by Watson et al., 1988). At a first level, this measure distinguishes between the subscales positive affect (alphas at different measurement times = .78, .86, and .85) and negative affect (alphas = .81, .86, and .84, respectively). If required, positive affect (6 items) can in turn be subdivided into 3 components: joy (items “pleased” [gutgelaunt], “merry” [freudig]), activation (“active [aktiv]”, “energetic [tatkräftig]”) and calmness (“relaxed [entspannt]”, “secure” [sicher]”). In contrast, negative affect (4 items) is composed of the two components helplessness (“helpless” [hilflos]”, “insecure” [unsicher]”) and arousal (“tense” [angespannt]”, “strained” [verkrampft]”). To be able to assess subtle changes in affect, a 10-point rating scale ranging from “not at all” to “completely” was applied.

Implicit affect

Implicit affect was measured indirectly by means of the Implicit Positive And Negative Affect Test (cf. chapter 2). This scale assesses subjective judgments about how well each mood adjective goes with several artificial words[30] (e.g., ZAHEM, BELNI, see appendix). To disguise the actual purpose of this procedure, the test is introduced as being about onomatopoeia, that is an effort to assess in how far the artificial words sound like the mood words presented. Accordingly, participants are asked to judge to which extent a current artificial word might express the following mood (first order item value). This can be done by choosing between the 4 rating alternatives "doesn't fit at all", "fits somewhat", "fits quite well", and "fits very well". According to the idea of mood congruency (Bower, 1981; Bower & Forgas, 2000; Eich, 1995; Forgas, 1995; Forgas & Ciarrochi, 2000; Schwarz & Clore, 1983), implicit representations of emotional states automatically spread to representations of objects (or artificial words, like here), thus coloring judgments about the respective objects in the direction of the specific emotion (e.g., Forgas, 1995; Rusting, 1999). As such, being in a happy mood for example should lead to an inclination to interpret artificial words as expressing happiness, whereas being in an anxious mood should lead to a tendency to interpret them as expressing anxiety. In this version, each of the 6 adjectives are combined with 3 different artificial words, while 6 other adjectives are combined with 3 other mood words. A second order item value is composed by the mean of the values of the 3 word pairs. Using the same adjectives in both the implicit and the explicit procedure facilitates comparisons between the two measures. As in the explicit test, positive affect (alphas = .71, .73, .78) and negative affect (alphas = .70, .77, .77) can be distinguished. The subcomponents of either scale are identical with those of the explicit test.[31] A comprehensive description and discussion of this procedure can be found in chapter 2.

Moderator variables

To investigate individual differences in taking advantage of self-activation, the German version of the Action Control Scale (Kuhl, 1981) was used which has been extensively validated by Kuhl and his associates (Kuhl & Beckmann, 1994b). The subscale failure-related action orientation (AOF) was administered because it is most relevant to the problem in question. AOF measures the extent to which a person is able to overcome a negative affective state evoked by unpleasant events or thoughts, for example a failure. On the other hand, state orientation as the opposite pole describes a tendency to unwillingly ruminate on unpleasant events and to be unable to terminate negative states once aroused.

A further possible moderator that seemed worth being taken into consideration is self-esteem (e.g., Marsh, 1986; Rosenberg, 1979). To the extent that our procedure stimulates explicit self-conceptions (additionally to the expected implicit self), the valence of the self-concept or self-esteem might influence affective change during self-activation, with a positively evaluated self leading to higher positive mood levels and a negatively evaluated self leading to higher negative mood levels. Furthermore, self-esteem was lately suggested to be connected with affect regulation (Brown & Dutton, 1995; Dodgson & Wood, 1998; Greenberg, Solomon, Pyszczynski, & Rosenblatt, 1992; Smith & Petty, 1995). Therefore, I

[30] In a pretest, a large number of artificial words had been judged by students in terms of neutrality and other criteria. The most neutral words were selected for this study.

[31] There is a slight difference concerning the item composition: Because pilot studies revealed the implicit procedure to be less reliable than the explicit procedure to a certain degree, 2 items were added to the 4 items from the explicit negative affect scale in order to increase reliability for the measure of implicit *negative* affect ("sad" and "at a loss"). A subsequent reliability analysis resulted in an exclusion of the item "nervous", thus leaving 5 items. By contrast, the mood words from the implicit and explicit *positive* affect scale are identical.

additionally applied the Rosenberg-Self-Esteem Scale (Rosenberg, 1965), which is one of the most widely used instruments for measuring self-esteem.

Results

Negative affect induction check (changes from time 1 to time 2)

As expected, a one-way analysis of variance (ANOVA) with repeated measures (t1 and t2) on the different affect scales revealed a significant decrease in explicit positive affect, F (1, 46) = 5.56, $p < .05$ (one-tailed), as well as a significant increase in explicit negative affect, F (1, 46) = 6.77, $p < .01$ (one-tailed). Analysis of all components of positive affect revealed that changes in positive affect are confined to a significant decrease on the subscale calmness, F (1, 46) = 6.99, $p < .01$ (one-tailed). However, there were no significant changes on the implicit scales.[32]

Negative affect recovery phase (changes from time 2 to time 3)

One-way repeated measures (t2 and t3) ANOVAs revealed mood recovery in both explicit scales, namely an increase in positive affect, F (1, 46) = 4.86, $p < .05$, and a decrease in negative affect, F (1, 46) = 9.00, $p < .01$. Additionally, a strong increase in implicit positive affect was detected, F (1, 46) = 8.11, $p < .01$, which can be attributed predominantly to a change in the component joy, F (1, 46) = 16.02, $p < .001$, but also in calmness, F (1, 46) = 6.34, $p < .05$. There was no change in implicit negative affect (cf. Table 10).

[32] At the subscale level of the implicit test, there were only marginal changes in the expected direction in joy, F (1, 46) = 2.17, $p < .10$ (one-tailed), and in agitation, F (1, 46) = 1.78, $p < .10$ (one-tailed).

Table 10

Mean (SD) scores of implicit and explicit affects (time 2, time 3) for self-activation vs. controls and across both groups, and t2-to-t3 repeated measurement ANOVA significance tests (two-sided)

		self	neutral	total	self	neutral	total	F_{total}	$F_{self\text{-}neutr}$
			time 2			time 3			
Positive	i	2.25	2.26	2.25	2.50	2.28	2.39	8.65**	5.81*
Affect		(0.48)	(0.40)	(0.44)	(0.47)	(0.37)	(0.43)		
	e	5.33	4.44	4.90	5.70	4.61	5.17	4.75*	0.67
		(1.38)	(1.47)	(1.48)	(1.20)	(1.30)	(1.36)		
- joy	i	2.18	2.13	2.16	2.51	2.32	2.41	15.88***	1.14
		(0.57)	(0.56)	(0.56)	(0.58)	(0.55)	(0.57)		
	e	5.15	4.39	4.78	5.71	4.24	4.99	1.70	5.15*
		(1.78)	(1.79)	(1.81)	(1.48)	(1.76)	(1.77)		
- activation	i	2.33	2.41	2.37	2.49	2.27	2.38	1.85	0.30
		(0.58)	(0.46)	(0.52)	(0.56)	(0.34)	(0.47)		
	e	5.48	4.41	4.96	5.85	4.67	5.28	6.54*	4.05*
		(1.47)	(1.66)	(1.64)	(1.21)	(1.65)	(1.55)		
- calmness	i	2.24	2.22	2.23	2.49	2.25	2.37	0.01	4.83^{t}
		(0.55)	(0.48)	(0.51)	(0.49)	(0.49)	(0.50)		
	e	5.38	4.52	4.96	5.54	4.91	5.23	3.53^{t}	0.11
		(1.53)	(1.75)	(1.68)	(1.59)	(1.38)	(1.51)		
Negative	i	1.97	1.94	1.96	1.86	1.97	1.91	0.90	2.84^{t}
Affect		(0.43)	(0.48)	(0.45)	(0.40)	(0.49)	(0.44)		
	e	2.31	2.97	2.63	1.99	2.29	2.14	9.15**	1.14
		(1.19)	(1.63)	(1.45)	(0.92)	(1.26)	(1.10)		
- helplessness	i	2.03	1.90	1.96	2.01	1.99	2.00	0.33	0.59
		(0.52)	(0.59)	(0.55)	(0.61)	(0.56)	(0.58)		
	e	1.54	2.13	1.83	1.38	1.85	1.61	3.03^{t}	0.20
		(0.95)	(1.57)	(1.31)	(0.58)	(1.33)	(1.03)		
- arousal	i	2.05	2.15	2.10	1.88	2.01	1.94	5.83*	0.03
		(0.56)	(0.55)	(0.55)	(0.46)	(0.54)	(0.50)		
	e	2.94	3.48	3.20	2.44	2.80	2.62	6.05*	0.13
		(1.56)	(1.96)	(1.77)	(1.35)	(1.39)	(1.36)		
- lethargy	i	1.78	1.78	1.78	1.84	1.93	1.89	2.92	0.63
		(0.42)	(0.50)	(0.46)	(0.42)	(0.46)	(0.44)		
	e	1.96	3.02	2.48	1.96	3.28	2.61	0.79^{t}	0.79
		(1.06)	(1.82)	(1.56)	(1.15)	(2.25)	(1.88)		

Notes. i = implicit affect, e = explicit affect; total = main effect of time; self-neutr = affective change for self-activation vs. neutral group; *** $p < .001$, ** $p < .01$, * $p < .05$, ^{t} $p < .10$ (< .05 if one-sided)

To investigate the influence of *self-activation* on affect recovery (cf. Table 10), a 2 (self-manipulation: self vs. neutral) × 2 (repeated measurement: t2 vs. t3) ANOVA was conducted. As expected, self-activation raised implicit positive affect, F (1, 45) = 5.81, $p < .010$ (one-tailed), and reduced implicit negative affect, F (1, 45) = 2.84, $p < .05$ (one-tailed). However, there were no differences between the treatment and the control group in either explicit affect scale. The results for implicit positive and negative affect are illustrated by Figure 5.

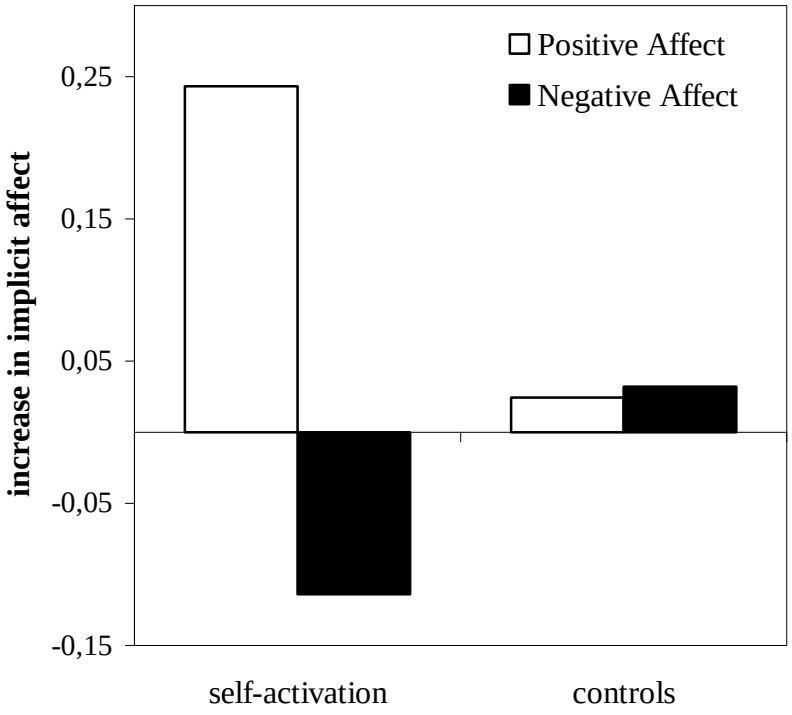

Figure 5

Increase in implicit positive and negative affect for self-activation vs. control group

To obtain a more differentiated picture of the implicit dynamic process, additional within-group analyses were conducted. Within the control group, a repeated measures ANOVA revealed an increase in joy, only, F (1, 22) = 5.54, $p < .028$. For self-activation, however, not only joy, F (1, 23) = 10.53, $p < .01$, but also calmness increased, F (1, 23) = 9.03, $p < .01$, thus supporting the close association between the self and the specific affective state of calmness, as postulated by the self-relaxation assumption.

In order to examine sequence effects from the affect measures applied in succession, t2 and t3 sequential order of both tests were taken as separate factors into the analysis. The resulting 2 (t2 order: AB vs. BA) × 2 (t3 order: AB vs. BA) ANOVA revealed no significant influence on either implicit or explicit affects.

Moderating effects of individual differences

The failure to find an overall change in implicit negative or positive affect might be attributed to the fact that some participants may produce implicit positive affect (or inhibit implicit negative affect) already during the film, whereas other participants may not. Hence, opposed changes in implicit affect due to individual differences in early implicit affect regulation might cancel each other out. Therefore, separate hierarchical regression analyses with affect at t1 (baseline) and action orientation as a predictor of affect at t2 (Cohen & Cohen, 1983) were carried out. Moreover, in order to check whether changes in affect during the recovery phase might be moderated by individual differences, analogous regression analyses predicting affect at t3 with affect at t2 and action orientation as a predictor were conducted. However, there was no relationship between action orientation and change of implicit affect. Moreover, no relationships with explicit affect scales were found.

In contrast to differential sensitivity to *spontaneous* recovery, action vs. state orientation was expected to be related to *self-determined* recovery. Therefore, to test the assumption that state-oriented individuals (low in AOF), which are assumed to have low self-access when being in negative affect, benefit more from external self-activation than action-oriented individuals, both implicit affects at t3 as well as its subcomponents were regressed on affect at t2, self-activation (vs. neutral), AOF, and the interaction of self-activation × AOF (Table 11) by means of regression analyses. Apart from the general self-activation effect (see above), as predicted, the interaction self-activation × AOF predicted implicit calmness significantly, β = .23, t (46) = 1.95, $p < .05$ (one-tailed). Calmness is the affect that is presumably most closely associated with the operation of the self (see Figure 6 for an illustration of the effect). No other affect component was significantly predicted by this interaction. Moreover, action orientation was not related to affect scores at time1, time 2, or time 3. Analogous analyses using self-esteem as a moderator variable, were far from any significant result.

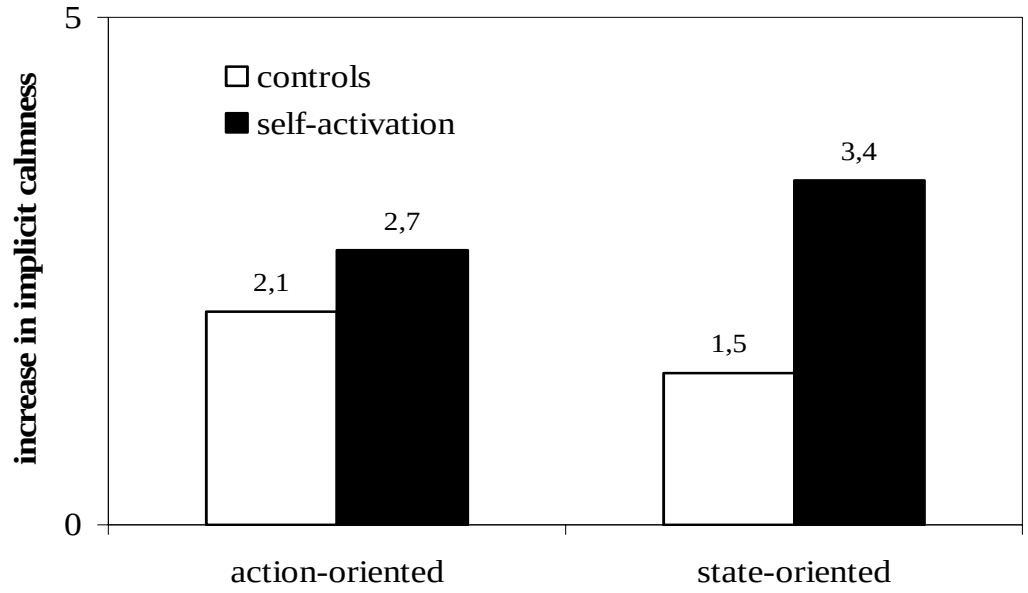

Figure 6

Implicit calmness scores (time 3 adjusted for time 2) as a function of experimentally induced self-activation and individual differences in action versus state orientation. Low and high

values on action versus state orientation correspond to one standard deviation below and above the mean, respectively.

Table 11

Hierarchical regression of time 3 implicit calmness on time 2 implicit calmness, state orientation, and self-neutral-manipulation (N=46)

Predictor	Cumulative R^2	Increase in R^2	Standardized β
Step 1: calmness t2[a]	.540	.540	.74***
Step 2: self (vs. neutral)	.581	.041	.23*
Step 3: SO	.594	.013	.12
Step 4: self × SO	.629	.034	.23*

Notes. *** $p < .001$, * $p < .05$ (all one-sided)

Discussion

The aim of the study was to examine the impact of the self in regulating negative affect. As explained in the introduction, the present work did not deal with specific *contents* of the self, in terms of multiple facets of self-representation (e.g., Epstein, 73; Greenwald & Pratkanis, 84; Markus & Wurf, 87). Instead, the present study focussed on a functional aspect of the experiential self-system, namely its general capability to increase positive or decrease negative emotions (self-regulation) when activated in a global manner. To a large extent, the results confirm the major hypotheses derived from the self-relaxation model of PSI theory. At an implicit level, self-activation compared with the control condition led to a stronger increase in positive affect, as well as a decrease in negative affect. Furthermore, a general mood restoration process could be observed in both the treatment and the control group, including an increase in both implicit and explicit positive affect as well as a decrease in explicit negative affect. However, a significant increase in the self-relevant affect *calmness* proved to be unique for self-activation. Considering individual differences in the affect regulation process, ruminators were found to benefit more from external self-activation than non-ruminators in terms of an increase in implicit calmness. According to the self-determination assumption, state orientation is characterized by an impaired ability to regulate affect through self-activation whereas effects of introversion on affective change are not necessarily confined to self-based change of affect. Self-based affective change can be distinguished from spontaneous (or "automatic") change on the basis of an interaction with external self-activation: Whereas external activation of the self should be irrelevant for individual differences related to automatic changes in affect (as expected for extra- vs. introversion), external self-activation should be relevant for individual differences related to self-dependent affective change (as assumed for action vs. state orientation). The pattern of results is consistent with the assumption that state-oriented individuals have specific problems when mood repair depends on self-activation (i.e. in the control condition). When self-activation is supported externally, state-oriented individuals show increased coping. Despite having confirmed the self-determination assumption, the study raises several questions that will be discussed in the following sections.

Implicit self-system activation or explicit self-reflections?

The first issue concerns the question whether the implicit self was activated globally as a system or, alternatively, whether the effects are attributable to explicit reflections about specific self-aspects. The latter alternative is not implausible: Presenting terms like "my body" or "my flat" may indeed make participants explicitly reflect about specific self-aspects or mental images. However, several arguments suggest that this potential effect of the procedure did not produce the effects observed. First, explicit recall of specific self-aspects or self-relevant episodes associated with a prime word can be accompanied by a co-activation of the experiential self (e.g., Wheeler et al., 1997), provided the self-relevant information is not too strongly processed in an analytical way (Quirin & Kuhl, 2004b; Watkins & Teasdale, 2001). Neurobiological findings from imaging studies show that exposure to explicit self-referential words and even an explicit instruction to control emotional responses to stimuli presented can activate the right hemisphere (Craik et al., 1999; Levesque et al., 2003) which does not support conscious verbal reflection (Springer & Deutsch, 1993). Moreover, priming effects that critically depend on the implicit status of the prime content (e. g., measures of

cultural world view defense after exposure to primes reminding of one's mortality) can be obtained after exposure to explicit primes, if measures are taken that increase the likelihood that the prime contents cease to be in focal conscious awareness, for example, passage of time, dual task load etc. (Pyszczynski, Greenberg & Solomon, 1999). In the experiment described here, an attempt was made to avoid elaborative analytical reflection by diverting participants' attention to a putative target task following each prime presentation.[33] In addition, affectively neutral primes were used to further reduce focal attention. If affective change is attributable to implicit self-activation rather than explicit reflection of specific self-facets individual differences in explicit self-esteem should not interact with the effects obtained. This prediction of the implicit self-determination hypothesis was confirmed (see later). Finally, the theoretically predicted influence of the self-primes on implicit affect, in some way, provides some face-validity for an activation of the experiential self.

Implicit versus explicit affect change

The observed changes in explicit positive and negative affect as a reaction to the film clip were in the predicted direction, replicating the findings by Gross and Levenson (1995; see also Hagemann et al., 1999). During the post-experimental phase (time 2 to 3), either affect category approaches baseline values again, which can be interpreted as a basic homeostatic recovery process. It should be noted, however, that changes in self-reported mood, especially in response to experimental mood inductions, are suspected to be partially due to demand characteristics, and therefore might not purely mirror actual mood changes (Parrott & Hertel, 1999; Polivy & Doyle, 1980).

Contrary to our hypothesis, implicit positive and negative affect did not seem to be influenced by the film at first glance. It would be premature, however, to conclude that the film did not have any effect on implicit affect. Individual differences in dealing with negative affect might conceal such effects. For example, some people might immediately activate positive affect in response to negative events (e.g., repressors), whereas others might even inhibit positive affect in the presence of a negative event (e. g., sensitizers).

During the recovery phase from t2 to t3, significant changes in implicit affect did show up. As expected, self-activation effected changes in unconscious but not conscious affect, supporting the assumption that self-relaxation is operating at an implicit rather than an explicit level. As such, self-mediated affect regulation does not only differ from deliberate regulation strategies in the sense that people do not need to be aware of the ongoing regulation process.

Changes in positive versus negative affect

Interestingly, the increase in positive affect exceeded the decrease in negative affect in the self-activation group compared to controls. Moreover, this positive-affect superiority effect (which was strongest for *joy*) can additionally be observed across both groups. A possible explanation can be taken from related self-regulation models emphasizing active retrieval of positive experiences from autobiographical memory as a reaction to negative life-events (Brandtstädter & Rothermund, 2002a, 2002b; Forgas, Johnson, & Ciarrochi, 1998; Isen, Daubman, & Nowicki, 1987; Isen, Johnson, Mertz, & Robinson, 1985; McFarland & Buehler, 1997; Rusting & DeHart, 2000) with the effect of increasing positive affect, perhaps as an antidote to negative affect. Indeed, in a field study, Rothermund and Meiniger (2004) found

[33] In a prior pilot study, I also tested shorter prime presentation times but without any effect on affect change. Therefore, I assume that the primes used here need some time to develop the desired effect of experiential self-activation (for a similar effect, see Kazén et al., 2003).

that self-reported positive rather than negative affect increased in individuals drawing on an efficiently functioning self-system (i.e. being equipped with high self-complexity). The authors suggest that so-called reinterpretation and reorientation processes do not always reflect intentional coping strategies, but are mediated through unrecognized micro-cognitive processes (Affleck & Tennen, 1996; Brandtstädter & Rothermund, 2002a, 2002b), that should be investigated in experimental studies focusing on those processes. An experimental study on memory for aversive information (pictures) conducted by Hock and Krohne (2004) again demonstrated the role of positive affect in coping for individuals with high scores in cognitive avoidance (down-regulation of negative affect): Higher levels of positive affect showed a negative influence on remembering negative pictures three days later. It thus can be concluded that self-relaxation, i.e. down-regulation of negative affect, is apt to be achieved by a process of retrieving positive self-aspects accompanied by positive affect, presumably operating at an implicit level of processing.

Nevertheless, the findings are in favor of the self-relaxation assumption, regardless of which component of positive affect stands out. To the extent that joy and calmness are mental states reinforcing each other, increases in either component can intensify the other.

In sum, although some issues remain open questions, the findings confirm the expected effects of the self-activation procedure as well as the validity and usefulness of the implicit affect measure.

Limitation: Vulnerability of the self

Although the self-relaxation assumption holds that the self-system attenuates negative affective states, this does not exclude enhanced sensitivity toward implicit negative affect in the initial phase of self-regulatory coping or when no threats are available that would require coping. For example, people with high levels of self-complexity (which may develop by confrontation with rather than repression of negative self-aspects), compared to people with low self-complexity, show a somewhat higher level of depressive symptoms in the absence of stress, but show reduced symptoms under high levels of stress (Linville, 1987a). Accordingly, self-based coping through confrontation with negative experiences should, by definition, be associated with an emergence of negative affect in the short run. Clinical confrontation procedures are based on this principle: Confrontation with an aversive situation is sought to obtain deeper and more sustainable long-term coping (Pennebaker, 1993, 1997; Pennebaker, Colder, & Sharp, 1990). This vulnerabilty component of self-based coping has also been found in several experimental studies where self-focus was experimentally increased by means of a mirror (Hass & Eisenstadt, 1991), self-related verbal material (Quirin, 2004; Quirin & Kuhl, 2004b), or a personal interview (Spalding & Hardin, 1999). For example, Quirin and Kuhl (2004b) found an increase in implicit negative affect in subjects engaged in sorting positive and negative trait words into personal self-domains in the absence of stress. Accordingly, it is possible that the self-system has complex effects on mood depending on the conditions under which it is activated[34]. Therefore, the question remains whether a spontaneous self-activation, compared to the activation in reaction to a negative experience, would show similar positive or rather contrary effects on mood change. To test this idea, a second study was planned, including a neutral film clip that serves as a baseline for estimating the effects of the negative clip.

[34] An alternative explanation for the divergent direction of mood change is that it depends on whether the cognitive or the experiential self is demanded. As such, reflective-analytical rather than intuitive-experiential processing of self-referential information might lead to negative rather than positive mood (cf. Watkins & Teasdale, 2001).

The role of rumination

A further goal of the study was to investigate the moderating influence of state orientation (rumination) on the relationship between external self-activation and affective change. Although no changes were found for the general scales positive and negative affect, self-activation led to a more pronounced increase in the subscale implicit calmness for state-oriented individuals. This is in line with the hypothesis that state-oriented individuals benefit from an external facilitation of self-access, particularly when being under stress. Given that rumination is commonly considered a non-pathological equivalent of depression and a risk factor for the development of depressive disorders (Nolen-Hoeksema, 2000), the present findings might contribute to the discourse about which factors prevent ruminators from becoming depressed or even turn rumination into a helpful mechanism. For example, to the extent that rumination can alternatively be interpreted as a special type of problem solving aiming at preparing for action (Martin & Tesser, 1989), rumination does not seem to be a disadvantageous mental process in itself: The attempt to solve problems rather than to repress or deny them is assumed to promote the development of a complex and integrated self structure in the end (Linville, 1987a; Showers, 1992b). In future problem situations, resembling the situation just coped with, a complex self has the potential to provide the agent with action-oriented knowledge. However, such a structure cannot serve its purpose as long as it is inhibited at the very moment it is most urgently needed, i.e. in stress situations. Instead of applying the knowledge they already have learned, ruminators start brooding again. If true, rumination would only turn out an adaptive mechanism when combined with the capability of activating the self-system under stress.

Implications for future research and application

At this point, we are far from understanding the entire complexity of affect regulation processes, particularly implicit affect regulation. To a high degree, this is attributable to a lack of valid methods tapping into implicit affect. As such, relying on the IPANAT, the present study can be seen as a first step into this direction, emphasizing the role of the self in regulating negative affect. To the extent that self-activation in a stress situation supports downregulation of negative affect, self-relaxation capabilities would have a crucial relevance to educational and clinical application: Teaching children or patients how to activate the self-system in stress situations, or to be self-determined, would not only help them to be more relaxed in stress situations but also to maintain mental health in the long run (Ryan & Deci, 2000a).

Chapter 4

Self maturation and cortisol regulation

Stress in personal relationships seems to be one of the most important factors modulating the functioning of the hypothalamus-pituitary-adrenocortical (HPA) system. In this chapter, a model of the relationship between self development and cortisol regulation is proposed that attempts an integration between the allostatic load model (McEwen, 1998b) and assumptions from attachment theory that relate to self maturation. The model presented is based on the hypothesis that early attachment stress (e.g., inadequate caregiving) can persistently effect both self development and physiological development in terms of HPA system alterations. On the one hand, early attachment stress can increase HPA responsiveness towards stress which results in an elevated cortisol response to acute stress (CRAS). On the other hand, early attachment stress can lead to a persistent reduction of the cortisol response to awakening (CRA) as a form of counteracting allostatic load. To the extent that early attachment stress has adverse effects on self development, impairments in self maturation (e.g., insecure attachment style) should be related to a reduced CRA. Moreover, the model assumes that - independent from these alterations taking place in earlier periods of life - everyday social stress stimulates HPA activation in terms of increased circadian cortisol release. As such, *opposite* effects of self maturation impairment (hypocortisolism) and social stress (hypercortisolism) on circadian cortisol organization are expected.[35] Drawing on cross-sectional data, implications of this model for static (as opposed to dynamic) relationships between self-maturity indicators in adulthood are tested. Data from 42 adult women are presented that corroborate the model. Cortisol response to a laboratory stress task, salivary cortisol sampled within the first hour after awakening, and questionnaires assessing self maturation (romantic attachment security, self-determination, self-esteem, avoidant personality style) and every day social stress were assessed. Romantic attachment anxiety (RAA) was uniquely and *positively* related to CRAS. On the other hand, RAA was *negatively* related to the CRA, an effect which uncovered spurious relationships between the other indicators of self-maturity and CRA in hierarchical regression analyses. CRAS was reversely related to CRA. Moreover, opposed to self maturation impairment, social stress was *positively* related to cortisol response to awakening only if attachment anxiety was controlled for. The data are discussed with respect to the model presented and to the superior role of attachment security in cortisol regulation.

[35] The prefixes „hypo“ versus „hyper“ typically refer to deviations from a norm („too little or too much of something“). In the present work, the term „hypocortisolism“ („hypercortisolism“) is used in a broader sense to express low (high), not necessarily too low (high), levels of cortisol. The term was kept here because it has broadly gained entry into the literature and because the present work is intimately related to this issue.

Theoretical background

Introduction

Since the seminal work of Hans Selye (1936), stress is known to activate the hypothalamus-pituitary-adrenocortical (HPA) system. Most notably, there is much evidence that HPA system activity is in turn associated with both psychopathological and bodily diseases (Gold, Goodwin, & Chrousos, 1988; Heim, Ehlert, & Hellhammer, 2000). HPA activity can easily be assessed through saliva samples containing the glucocorticoid hormone cortisol, which is the end product of the HPA axis in humans and is commonly increased under both acute and chronic stress[36]. Specifically, stress has been found to be related to cortisol secretion at two levels of cortisol organization. First, acute stress entails an immediate cortisol response. Second, prolonged periods of chronic stress were observed to influence circadian cortisol rhythm, for example the cortisol response to awakening (CRA; Prüssner et al., 1997) - an episodic secretion presumably serving as a synchronizer for the circadian rhythm of the HPA system (Van Cauter & Refetoff, 1985). Inasmuch as there are immense individual differences concerning subjective reactivity and ability to cope with stress, the amount of cortisol released as a reaction towards stress may be moderated by individual differences. However, evidence on a relationship between personality and cortisol secretion, be it CRA or CRAS, is very scarce (Schommer, Kudielka, Hellhammer, & Kirschbaum, 1999; Smyth et al., 1997).

However, most of the studies on personality and cortisol might have suffered from methodological shortcomings in terms of inadequate selection of personality variables, insufficient cortisol samples, inadequate monitoring of field cortisol assessment, low variability of methods for the induction of acute stress or insufficient use of multivariate data analyses. Therefore, it would be premature to dismiss the hypothesis concerning links between personality and cortisol.

In contrast, chronic stress in normal individuals (Prüssner, Hellhammer, & Kirschbaum, 1999; Schlotz, Hellhammer, Schulz, & Stone, 2004; Schulz, Kirschbaum, Prüssner, & Hellhammer, 1998; Wüst, Federenko, Hellhammer, & Kirschbaum, 2000) and psychopathology like depression (Bhagwagar, Hafizi, & Cowen, 2003; Yehuda, Teicher, Trestman, Levengood, & Siever, 1996) or posttraumatic stress disorder (Heim et al., 1998; Yehuda, 2002; Yehuda, Giller, Southwick, & Lowy, 1991; Yehuda et al., 1996) have repeatedly been found to be related to diurnal cortisol. In these studies, personality has not been a focus of interest.

In contrast to the common opinion concerning a positive relationship between stress and cortisol secretion, in patients with posttraumatic stress disorder (PTSD) as compared to controls, numerous studies have consistently found low in stead of high cortisol concentration. This phenomenon, typically referred to as *hypocortisolism* (Heim et al., 2000), challenged prevailing concepts of neuroendocrinology of stress. Later, hypocortisolism has also been observed in numerous groups of patients with distinct psychosomatic disorders

[36] Although the term *stress* also refers to bodily exertion or demands, in this chapter, it is largely used in the meaning of negative affect in terms of helplessness, anxiety, depressive mood, etc. Moreover, the term *stress reactivity* is used here in accord with the prevailing meaning in psychoendocrine stress research. As such, an individual has a high stress reactivity if the stress level is high in response to external stressors. Defined like this, it remains open whether stress reactivity emerges from a high sensitivity towards stressors, low affect regulation capabilities, or even both (cf. chapter 1).

(Heim et al., 2000) or even in healthy samples showing high levels of chronic stress (Prüssner et al., 1999).

The impact of the paradoxical status of hypocortisolism was underscored with Heim et al. (2000) stating that

> *". . . the association between stress and increased cortisol secretion has been consolidated over the past decades to such an extent that stress and increased cortisol secretion merely have become synonyms in the literature and, moreover, the presence of cortisol hypersecretion has been used to define states of stress (p. 2)."*

At this point in time, the processes underlying its etiology are still speculative (Heim et al., 2000). A plausible explanation is that hypocortisolism reflects a dysfunctional adaptation of the HPA system activity as a reaction to prolonged phases of high stress levels, for example in early childhood (Fries, Hesse, Hellhammer, & Hellhammer, 2005; Hellhammer & Wade, 1993; McEwen, 1998b; Yehuda, Southwick, Krystal, & Bremner, 1993).

Notably, hypocortisolism was also found in at least two of the few studies on normal personality and circadian cortisol organization. For example, Brandtstädter et al. (1991b) observed lower morning cortisol levels in individuals scoring high on personality scales that indicate low levels of self maturation. Similarly, Adam and Gunnar (2001) found a negative relationship between adult attachment insecurity and early morning cortisol secretion. Interpreting attachment insecurity as an indicator of low levels of self maturation, this result corresponds with the data from Brandtstädter et al. These findings are especially important in light of a lack of evidence concerning relationships between classical personality traits (e.g., extraversion, neuroticism) and cortisol regulation. Therefore, personality traits related to self maturation might be more promising candidates as possible correlates of cortisol response to stress than classical personality traits.

Indirect support for this hypothesis comes from studies that found the quality of early attachment bond to be associated with cortisol regulation in children (Gunnar & Vazquez, 2001, for a review). Attachment security revealed to be a determinant of self-development (Calkins, 2004). Insecurely attached children showed stronger cortisol responses (CRAS) as a reaction to the Strange Situation Test (see below; Ainsworth, Blehar, Waters, & Wall, 1978) than securely attached children (Hertsgaard, Gunnar, Erickson, & Nachmias, 1995; Nachmias, Gunnar, Mangelsdorf, & Parritz, 1996; Spangler & Grossmann, 1993; Spangler & Schieche, 1998). The CRA was found to be related to an absence of emotional parental relationships in children – a factor that is also deemed a constitutional component in the development of insecure attachment styles (Gunnar & Vazquez, 2001, for a review; Spangler, Schieche, Ilg, Maier, & Ackermann, 1994).

As can be concluded from this evidence, self maturation might be crucial in cortisol organization.

Brief overview

In this chapter, a study will be presented that examines the interrelationships between self maturation and cortisol regulation in terms of response to both awakening (CRA) and acute stress (CRAS), taking into consideration the level of everyday social stress. I start with a brief summary of the relationship between HPA system and stress. After this, self maturation is discussed against the background of attachment theory. Then, the connection between the self and stress regulation is outlined. I next present a dynamic model of the relationships between

self maturation, stress, and cortisol regulation building upon the model of allostatic load (McEwen, 1998b). In conjunction with attachment theoretical considerations about the development of the self, the model of allostatic load serves as the conceptual foundation for the present investigation.

Stress and the Hypothalamic-Pituitary-Adrenocortical (HPA) system

The causal network of the main physiological pathways from perceived stressors to cortisol secretion is well examined. After the amygdala, a central part of the limbic system, has evaluated a stimulus as harmful (LeDoux, 1995), the paraventricular nucleus of the hypothalamus is induced to release corticotropin-releasing hormone (CRH). This in turn leads to a secretion of adrenocorticotropin hormone (ACTH) from the anterior pituitary gland into the bloodstream. ACTH then stimulates the adrenal cortex to release cortisol that - amongst others - is involved in providing energy to the body in a current stress situation (McEwen & Sapolsky, 1995; Sapolsky, Romero, & Munck, 2000). On the other hand, cortisol also downregulates itself in a negative feedback loop by inhibiting both the hypothalamus and the pituitary gland (Keller-Wood & Dallman, 1984). Additionally, cortisol also excites the hippocampus (HC) to inhibit CRH secretion from the hypothalamus, ultimately leading to a reduction of cortisol (Jacobson & Sapolsky, 1991).

Hyperactivity of the HPA system is related to several negative outcomes for mental and physical health (Ehlert, Gaab, & Heinrichs, 2001). For example, increased HPA functioning was found in patients with anxiety and affective disorders (Heim & Nemeroff, 1999). Furthermore, heightened HPA activity disturbs the HC in its function of memory consolidation (Jacobs & Nadel, 1985) and triggers the suppression of immune system functions (Munck, Guyre, & Holbrook, 1984). Prolonged HPA activation can even lead to chronic diseases such as diabetes or hypertension (e.g., McEwen, 1998a). Moreover, prolonged phases of HPA activation were found to be related to neuronal cell death in HC (Sapolsky, Krey, & McEwen, 1985, 1986) and to decreases of HC volume, for example in patients suffering from posttraumatic stress disorder (Bremner, Randall, Scott, & Bronen, 1995; Bremner et al., 1997; Gurvits, Shenton, Hokama, & Ohta, 1996; Stein, Koverola, Hanna, & Torchia, 1997).

Self maturation from the perspective of attachment theory

Drawing on evolutionary considerations, attachment is conceived of as a basic need of being close to persons that give safety such as caregivers (Bowlby, 1979, 1980). The intensity of the attachment need is especially high in early childhood where the child strongly depends on external support. Typically, unpleasant feelings, aroused by hunger, pain or environmental threats elevate the acute need for attachment, starting up a behavioral program that aims at getting closer to the caregiver.[37] Consequently, inadequate responding by the caregiver results in elevated attachment stress. Therefore, an integral part of attachment theory refers to the quality of relationship between child and caregiver and its role for the emotional development of the child. More specifically, the caregiver's sensitivity and emotional responsiveness towards the infant's expressions of basic needs is a constitutional factor for the development of a secure attachment (Ainsworth et al., 1978; Belsky, Rovine, & Taylor, 1984; Goldsmith &

[37] Distinguishing between subsequent stages of attachment development, the term „attachment" in a narrow sense refers to the phase where the infant is able to actively approach the caregiver (Ainsworth et al., 1978). In this paper, attachment is more broadly used to express an intimate relationship. Consequently, attachment behavior refers to all kinds of behavior associated with the goal to be close to an intimate person (e.g., crying out for the mother).

Alansky, 1987; Grossmann, 1985). Secure attachment is expressed in the child's trust that the caregiver will return to the child when she is absent for a while, which is considered a major basis for positive self development (Main & Weston, 1981). Positive self-development comprises several functions, such as self-esteem, self-determination, or affect regulation competences. For example, a warm mother-caregiver relationship is deemed to favor the development of a positive image of the self in terms of being worthy of love (Bartholomew, 1990; Bowlby, 1979, 1980; Bretherton, 1985; Main et al., 1985; Sroufe, 1990) as well as the development of social-emotional competence (Keller & Harwood, submitted; Main et al., 1985; Matas, Arend, & Sroufe, 1978; Suess, Grossmann, & Sroufe, 1992).

Similarly, relying on Vygotsky's (1978) general idea that interpersonal processes become increasingly a matter of intrapersonal functioning, several attachment researchers have emphasized the important role of a positive early relationships for the development of affect regulation competences (Sroufe & Fleeson, 1986; Thompson, 1990)[38]: Generally, while the child's affects initially are regulated by the caregiver, they become increasingly self-regulated as a result of neurobiological maturation. However, the degree to which this internalization can take place is considered partially a function of the quality of caregiving. Indeed, it could be found that securely attached infants show a lower level of irritability than insecurely attached infants (Crockenberg, 1981; Egeland & Farber, 1984).

The most prominent method to assess attachment quality is the observation and classification of the child's behavior during a standardized test situation where the child is at first separated from the mother and later reunited (Strange Situation Test; Ainsworth et al., 1978). A secure attachment style is expressed in low worries during the absence of the mother and in an increased interest in the mother during reunification. Unlike secure attachment, insecure attachment has been divided into subtypes. An avoidant-insecure (dismissing) attachment style is expressed in a lack of worries about the mother's absence and a lack of interest in the mother when returning. Infants with ambivalent-insecure style are angry and upset about the mother's absence but show an approach-avoidance conflict during reunification. Infants with a disorganized (preoccupied) style (Main & Solomon, 1990) seem to lack a distinct behavioral program and show strange behaviors like pulling faces or freezing that cannot be assigned to one of the other classifications.

The quality of attachment is also assessed in adults, for example, via interview (George, Kaplan, & Main, 1996) or questionnaire (cf. Brennan, Clark, & Shaver, 1998). Most often, individuals are categorized according to their predominant attachment style, for example as secure, preoccupied, dismissing, or fearful-avoidant (Bartholomew & Horowitz, 1991). However, because individuals often comprise features of several attachment categories and therefore can barely be classified into a single category, dimensional descriptions were proposed (Bartholomew, 1990; Brennan et al., 1998, for an overview). Unlike the classificational approach, the dimensional approach does not reduce diagnostic information in advance, nevertheless enabling classification into predominant attachment styles by combining the scores of the underlying dimensions in retrospect.[39]

Based on an integration of several questionnaires, Brennan, Clark and Shaver (1998) describe both infant and adult romantic attachment representations by a combination of 2 dimensions,

[38] The idea of internalizing of external regulations can also be found in psychoanalytic theories (Meissner, 1981; Schafer, 1968).

[39] Individuals with low scores in both attachment anxiety and avoidance can be described as securely attached. A preoccupied style is described by high anxiety and low avoidance, a dismissing style by low anxiety and high avoidance, and a fearful-avoidant style by high anxiety and high avoidance. A very early and valuable approach to the dynamic interaction of both dimensions comes from Bischof (1976; 1993). In his cybernetic model of social distance regulation, differences between current and ideal states of each security and autonomy, which can vary intra- and interindividually, predict the child's behavior in an attachment relevant stress situation.

anxiety (about abandonment) and *avoidance* (of closeness and dependency). People high in attachment anxiety are often worried about being abandoned or not being loved, whereas people high in avoidance feel rather uncomfortable when being close to or dependent on others.

Although Bowlby (1977) theorized that early attachment experiences characterize human behavior in adulthood, he did not exclude the possibility of changes in attachment style and corresponding internal models of the self across the lifespan. Although some studies in deed found support for relatively high continuity over the lifespan (Belsky & Cassidy, 1994; Hazan & Shaver, 1987; Main & Cassidy, 1988; Rothbard & Shaver, 1994; Wartner, Grossmann, Fremmer-Bombik, & Suess, 1994), others indicate changes in attachment relationships depending on alternative experiences from other close relationships emerging over the lifespan (Cummings & Cicchetti, 1990; Egeland & Farber, 1984; Kobak, 1994; Oppenheim & Waters, 1995). Commonly, experiences gathered from parent-child, peer romantic, and adult attachment relationships are discussed as the main sources of the development of attachment representations and, therefore, the self (Crowell, Fraley, & Shaver, 1999).

While there is no doubt that a secure attachment is associated with a positive self development, it has been questioned whether all forms of insecure attachment are related to self development impairments to the same degree. For example, the avoidant attachment pattern has been considered a defensive coping strategy in terms of displacing oneself from the attachment relationship (Ainsworth et al., 1978). So, attachment avoidance may also constitute an alternative path to positive self development (Lamb, 1984), which even might be adaptive under certain conditions or in different cultural contexts (Hinde & Stevenson-Hinde, 1990). Similarly, Belsky and Rovine (1987) considered only the fearful pattern but not the avoidant pattern to be related to a high sensitivity towards distress.[40] Therefore, it remains an open question to which extent attachment avoidance is related to cortisol regulation.

Access to the self-system and stress regulation

As outlined in the first chapter, Personality System Interactions Theory (Kuhl, 2000a, 2000c, 2001) is a self-regulation theory explaining human behavior and experiencing on the basis of an interaction of psychological systems. One major system is called the self-system (or "extension memory") which is conceived of as the total of integrated networks of autobiographical memories comprising motives, personal preferences, attitudes, and other self-related information. According to PSI theory, the self-system is considered to play a major role in affect regulation: Accessing the self in stress situations attenuates negative affect and supports the production of efficient action plans helping to overcome the current stress situation. Functions that are deemed to be strongly related to the affect regulation capability of the self-system, that is to *self-access*, are self-determination and self-esteem. To the extent that access to the self-system is disrupted, these functions can hardly be provided.

Self-determination (Deci & Ryan, 1985, 1991) refers to both recognition of one's own needs or emotional states and motivation to instigate actions serving to adjust the situation to the direction of need fulfillment. Self-determination is particularly required in situations where it is difficult to access personal needs and goals, for example, when others try to undermine the

[40] However, the results are rather inconsistent. For example, in children with avoidant attachment style behavioral but not physiological arousal was reduced during the strange situation test (Spangler & Grossmann, 1993). According to this finding, high attachment avoidance doesn't seem to include effective coping strategies. To the extent that attachment avoidance may be interpreted as a repression of attachment needs, these findings fit in with the recent finding that, in repressors, self-reported emotional responses to acute stress is comparatively lower than their cortisol response (Rohrmann, Netter, Hennig, & Hodapp, 2003).

person's needs by trying to "introject" their own goals into the person's mind (Baumann & Kuhl, 2003; Kazén et al., 2003; Kuhl & Kazen, 1994). According to PSI-theory, self-activation widens the scope of need fulfillment opportunities, such that - in case of a thwarted goal - similar goals fulfilling the same need can easier be accessed. On the contrary, individuals who are low in self-determination suffer from negative affect (stress) arousing from the inability to diminish need dissatisfaction. Thus, impairments in self-determination are likely to reduce subjective well-being and life-satisfaction (Deci et al., 2001; Gagne et al., 2003; Kasser & Ryan, 1999; Ryan & Deci, 2000; Ryan & La Guardia, 2000; Sheldon et al., 2004).

Self-esteem is conceived of as the regard a person has for himself (Rosenberg, 1979). According to PSI theory, self-esteem results from an inherent characteristic of the self-system, the amplification of congruencies (cf. chapter 3). As such, establishing broad networks of self-related information, as supported by the HC (see below), is assumed to entail positive affect in general as well as positive self-esteem. On the contrary, low self-esteem often results from an impairment of access to the positive self. Then, a focus on incongruencies is prevailing, supporting self-critical thoughts.

According to PSI theory, the psychological self-system is supported by the right prefrontal cortex and the HC (Kuhl, 2000a, 2001). While the prefrontal cortex is considered to store self-relevant knowledge (Craik et al., 1999; Tulving, Kapur, Craik, Moscovitch, & Houle, 1994), the HC is strongly involved in providing online-access to this knowledge (Tulving & Markowitsch, 1998). Regarding the latter, similarities between self-system and HC functioning can be seen in the instantaneous formation of a large number of associations (Jacobs & Nadel, 1985; Sutherland & Rudy, 1989) and, thus, in a provision of an organized overview of multi-modal representations (McClelland, McNaughton, & O'Reilly, 1995; Squire, 1992). Furthermore, the HC shares functional similarities with the self-system. For example, it is involved in the encoding and retrieval of self-relevant (episodic) memories (Lepage et al., 1998; Tulving & Markowitsch, 1998), it has an inhibitory effect on stress (Sapolsky, 1992), it is functionally inhibited under high levels of stress (Pavlides et al., 1995), it differentiates self-relevant information (Gluck & Myers, 2001) and it develops as a function of the quality of parental care (Liu, Diorio, Day, Francis, & Meaney, 2000; Meaney et al., 1988). Corroborating the idea of a close relationship between the self-system and the HC, Prüssner et al. (in press) recently found self-esteem to be positively correlated with the size of the HC.[41]

Similar to attachment theoretical considerations, in PSI theory, the development of affect regulation competences relying on self-access is supposed to be facilitated by a warm and accepting caregiver-relationship. The *systems-conditioning model* (Kuhl, 2000a, 2001; Kuhl & Völker, 1998) of PSI theory provides a reinterpretation and functional specification of the internalization process of affect-regulative functions. In this model, classical conditioning is applied to the construction of pathways between psychological systems. Accordingly, maternal cues that have a pre-wired (unconditioned) effect on the child's affects follow the utterances of the child („conditioned stimulus") which can be interpreted as a preliminary form of self-activation. If these self-utterances are timely and adequately replied (Papousek & Papousek, 1987), the association between the child's self and its arousal becomes strengthened with the effect that activating the self-system later on suffices to instigate the affect regulation process. This model applies to the downregulation of negative (e.g., sadness,

[41] Similarly, psychopathological disorders that can be associated with inhibited access to the self-system also showed reduced HC volume, such as posttraumatic stress disorder (Bremner et al., 1995; Bremner et al., 1997) and major depression (Bremner et al., 2000).

anxiety, anger) as well as to the upregulation of positive affect (e.g., joy, interest, self-esteem).

Self maturation and cortisol response to acute stress

Adequate parental caregiving, particularly during the early years of life, is considered a basis for the development of effective stress regulation competences (Diamond & Aspinwall, 2003; Kuhl, 2000a; Sroufe & Fleeson, 1986; Thompson, 1990). So, if the caregiver has generally been responding adequately to the child's needs, the securely attached child will thus become able to regulate his emotions on his own. Consequently, it can be assumed that securely attached individuals, or those with a mature self, might show weaker CRAS while insecurely attached individuals, i.e. those with an immature self, show a stronger CRAS.

Since histories of prolonged phases of stress are connected to HPA system overactivity (Sapolsky, 1996; Sapolsky & Meaney, 1986) and insecurely attached individuals are supposed to be undergone higher levels of early childhood stress, particularly attachment stress, personality differences in terms of attachment security or other indicators of self development impairment should also be related to HPA overactivity. Specifically, attachment theory assumes that inadequate responding of the caregiver to the infant's needs constitutes one major stress factor in early life. Furthermore, the absence of adequate responding is thought to be a constitutive factor for a later impairment to self-regulate stress as associated with attachment insecurity.

Indeed, regarding the quality of caregiving, infants of insensitive as compared to infants of sensitive mothers showed elevated cortisol concentration when playing with the mother in a laboratory setting (Spangler et al., 1994). Similarly, regarding infants' attachment, attachment insecurity has repeatedly been found to be related to elevated cortisol concentrations in the Strange Situation Test (Gunnar, Brodersen, Nachmias, Buss, & Rigatuso, 1996; Hertsgaard et al., 1995; Nachmias et al., 1996; Spangler & Grossmann, 1993; van Bakel & Riksen-Walraven, 2004). However, since in some studies infants with an insecure-avoidant (dismissing) attachment style did not show increased cortisol levels in the Strange Situation (e.g., Hertsgaard et al., 1995), it remains an open question to which extent attachment avoidance as opposed to attachment anxiety might be related to HPA system hyperactivity as a reaction to acute stress.

That attachment quality is relevant to cortisol regulation might also be concluded from a study by Flinn and England (1995), examining the relationships between every day stressor types and cortisol responses in children. Accordingly, negative family events such as severe punishment or family fight led to a stronger cortisol reaction than stressors outside of the family, such as hard work or quarrel with peers. Conversely, body contact or the pure presence of familiar individuals dampens HPA system activation as has been found in animal studies (Jones & Merry, 1988; Levine, Wiener, Coe, & Bayart, 1987; Stanton, Wallstrom, & Levine, 1987; Von Holst, 1986). Similarly, Kirschbaum et al. (1995) observed a lower CRAS in male adult humans who obtained social support from their female partner before a social stress task.

Regarding adult attachment, in recent studies on attachment and stress response, Luecken (1998; 2000) found elevated cortisol responses in insecurely attached adults after exposure to a social stressor. In an induced-failure experiment (Prüssner, Hellhammer, & Clemens Kirschbaum, 1999), cortisol increase was negatively associated with self-esteem. Similarly, individuals who scored high on anxiety questionnaires showed higher cortisol responses than those who scored low (Granger, Weisz, & Kauneckis, 1994; Van Goozen et al., 1998).

Except for these studies, evidence on a relationship between personality and CRAS is rather scarce (Schommer et al., 1999). Prüssner et al. (1997), for example, revealed relationships between CRAS and personality variables only after aggregating cortisol responses to a social stress task applied on several consecutive days. In this study, the (negative) correlation of locus of control and social dominance with the CRAS was the stronger, the more cortisol responses had been aggregated.

The aforementioned findings support that self-maturity, i.e. in terms of attachment security or self-esteem, is related to the CRAS.

Self maturation and cortisol response to awakening

There is increasing evidence that personality variables are related to cortisol regulation, particularly to hypocortisolism. For example, alexithymia[42] (Henry, 1992) as well as low self-esteem, high external control, and introversion (Prüssner et al., 1999) were found to be negatively related to cortisol concentration in the morning.

In an early study, Brandtstädter, Baltes-Götz, Kirschbaum, and Hellhammer (1991b) found life satisfaction positively related to cortisol concentration at 8 am, whereas indicators for an impaired development of the self (e.g., heteronomous control over development, nervousness) were negatively related to early morning cortisol. No relationships between personality variables and cortisol levels later on the day were found. Similarly, in a recent study with adult women insecure attachment was found to be negatively related to morning cortisol concentration as assessed by one saliva sample from each of two mornings (Adam, 1999; Adam & Gunnar, 2001). In this study, insecure attachment was also related to a dampened diurnal cortisol slope. Both findings might be attributed to a stronger CRA, which, however, was not directly measured in terms of level change. Indeed, the authors took into consideration the possibility that this finding of hypocortisolism in insecurely attached individuals might be attributed to stable HPA system alteration. Similarly, neuroticism revealed to be related to diurnal hypocortisolism in a few studies (Gilbert, Stunkard, Jensen, Detwiler, & Martinko, 1996; Westrin, Engström, Ekman, & Träskman-Bendz, 1998). However, most of the studies administering neuroticism scales did not show a relationship to diurnal cortisol organization (Engstroem, Westrin, Ekman, & Traskman-Bendz, 1999; Miller, Cohen, Rabin, Skoner, & Doyle, 1999; Roy, 1996; Schommer et al., 1999). Conversely, Lindfors and Lundberg (2002) recently found low self-esteem and low autonomy related to elevated instead of reduced morning cortisol levels.

To the extent that alexithymia, insecure attachment, low self-esteem, and heteronomous control over development can be interpreted as indicators for impairments in self maturation, self maturation seems to be intimately associated with diurnal cortisol organization, or, specifically, with the CRA. Schieche and Spangler et al. (1994) found that children of less sensitive mothers had a lower CRA compared to those of sensitive mothers, suggesting that adverse parental care are likely to promote both insecure attachment and flattening of the cortisol rhythm.

[42] Alexithymia refers to impaired perception or communication of one's emotions (Taylor et al., 1992) and has also been brought into connection with the coping style of repression (Lane et al., 2000). Interestingly, repression itself has also been found to be related to hypocortisolism (Katz, Weiner, Gallagher, & Hellman, 1970; Wolff, Hofer, & Mason, 1964). In contrast to repression, a mature coping style comprises the perception and integration of negative events into the structure of personal experiences (Kuhl, 2001; Mary Main et al., 1985; Showers, 1992b).

Chronic stress and cortisol response to awakening

Most investigations on the relationship between cortisol concentration and psychological functioning centered on the role of chronic stress rather than personality. Chronic stress, commonly defined as frequent and/or prolonged acute stress, is frequently accompanied by high levels of diurnal or morning cortisol secretion (Prüssner, Hellhammer, Prüssner, & Lupien, 2003; Schulz et al., 1998; Steptoe, Cropley, Griffith, & Kirschbaum, 2000; Steptoe et al., 2003; Steptoe, Siegrist, Kirschbaum, & Marmot, 2004; Wuest et al., 2000). This fits with the traditional view that stress is associated with increased HPA activity (Selye, 1936, 1956).

However, researchers often fail to find such a relationship or even find a negative relationship, which resembles the situation in the context of personality reported above. For example, low instead of high CRA was observed in people living under ongoing stress conditions such as burnout or high workload (Caplan, Cobb, & French, 1979; Dutton, Smolensky, Leach, Lorimor, & Hsi, 1978; Prüssner et al., 1999; Schulz & Merck, 1997). In clinical studies, hypocortisolism has consistently been found in posttraumatic stress disorder (Yehuda, 2000, 2002), but also in distinct somatoform disorders (Heim et al., 2000) - disorders that are commonly associated with high levels of chronic stress.

Similarly, regarding childhood studies, a flat diurnal cortisol rhythm (low CRA) has often been observed in children living under high levels of stress (Gunnar & Vazquez, 2001). As such, neglected infants (Gilles, Berntson, Zipf, & Gunnar, 2000), orphanage-reared children (Carlson & Earls, 1997; Kroupina, Gunnar, & Johnson, 1997), children with psychosocial dwarfism (Vazquez, Watson, & Lopez, 2000), and school-aged maltreated children (Hart, Gunnar, & Cicchetti, 1996; Kaufman, 1991) showed a flat diurnal cortisol rhythm, predominantly resulting from a lower CRA. All the aforementioned groups of children suffer from adverse caregiving conditions, especially from neglect, thus lacking emotional warmth.

Allostatic load and hypocortisolism

The above-mentioned findings suggest that frequent activation or individual hyperactivity of the HPA system as a reaction to stress might lead to persistent HPA system alterations in terms of a downregulation of the CRA, presumably in a sensible phase during childhood (Heim et al., 2000; Hellhammer & Wade, 1993; McEwen, 1998b; Yehuda et al., 1991). This hypothesis is expressed in the model of *allostatic load* (McEwen, 1998b; McEwen & Wingfield, 2003). According to this model, stress system activation in acute stress situations provides the organism with energy and thus supports coping with the prevailing difficulty. However, overdoing of this reinforcing (or "allostatic") process might result in long-lasting dysfunctional changes of stress system characteristics, termed allostatic load. Referring to hypocortisolism, persistent as opposed to flexible short-term dampening of diurnal cortisol secretion might thus be interpreted as a dysfunctional adaptation of the HPA system in response to traumatic or prolonged periods of stress (McEwen, 1998b).[43]

There is increasing evidence from animal studies supporting this hypothesis (e.g., Mason, Brady, & Tolliver, 1968; Natelson et al., 1988). Indeed, several studies found that prolonged stress periods during infancy effect hypocortisolism in adulthood (Caldji et al., 1998; Coplan et al., 1996; Meaney et al., 1996). Although a direct proof of a long-lasting imprinting of the HPA system as a reaction to prolonged periods of stress is still due for humans, findings from clinical studies with PTSD patients are in favor of this model. As such, it could be found that alterations in HPA functioning varied as a function of the severity and nature of the traumatic event (e.g., Yehuda, Lowy, Southwick, Shaffer, & Giller, 1991).

[43] At the same time, it is plausible that frequent stress can lead to a sensitization of the HPA in terms of a cortisol hypersecretion to *acute* stressors.

Although the neurobiological mechanisms of hypocortisolism have not yet been revealed, several presumptions have been made. For example, hypocortisolism might be due to a decreased biosynthesis or depletion at different levels of the HPA axis, such as the hypothalamus (CRH), the pituitary (ACTH), or the adrenal cortex (cortisol). Additionally, other mechanisms may also be possible, such as adaptive down-regulation of pituitary CRF receptors, increased feedback sensitivity of the HPA system or morphological changes (for a detailed overview and discussion, see Heim et al., 2000).

In general, emphasizing here the influence of life experiences and personality on cortisol organization does not force back the impact of hereditary factors on the CRA (Bartels, de Geus, Kirschbaum, Sluyter, & Boomsma, 2003; Linkowski et al., 1993; Meikle, Stringham, Woodward, & Bishop, 1988; Wüst et al., 2000).

A model of opposed relationships of impaired self maturation and social stress with cortisol response to awakening

Summarizing the findings outlined above, individuals with lower levels of self maturation showed HPA hyperactivity in terms of an elevated CRAS in several studies. In studies on diurnal cortisol organization, such individuals as well as children under adverse rearing conditions (frequent HPA activation) surprisingly showed *low* instead of high levels of diurnal cortisol concentration or a low CRA, respectively. Moreover, chronic stress was found to be associated sometimes with hypercortisolism but other times with hypocortisolism.

It is plausible that the inconsistent relationship between chronic stress and diurnal cortisol is due to differences between populations or samples under study in terms of divergent parameters such as nature and duration of the stressor or systematic interindividual differences. As outlined in the beginning, indicators for self maturation often haven't been considered and thus were not controlled for in the relationship between chronic stress and cortisol. To the extent that HPA alteration has repeatedly been found to be effected by early life stress that at the same time has an adverse influence on self development, it is likely to assume that self-maturity constitutes a major factor confounding the relationship between diurnal cortisol concentration and chronic stress.

Arguably, findings of an association between current stress (as opposed to prior immense stress or stress during a sensitive time frame) and hypocortisolism might be attributed to an overrepresentation of individuals in the sample of chronically stressed individuals who suffer from an impaired self maturation or adverse early life conditions. In statistic analyses, this overrepresentation can cover an actual positive relationship between current sub-traumatic chronic stress and diurnal cortisol concentration or even can turn this relationship into a negative one (hypocortisolism).[44]

The fact that individuals with self development impairments are more prone to experiencing chronic stress or are unable to integrate traumatic stress makes it difficult to examine the relationships between each factor and diurnal cortisol separately.

[44] This model, which draws on the model of allostatic load, doesn't depend on whether previous periods of stress were present in childhood or later in life. In any case, it assumes that the stressor exceeded a certain threshold leading to a persistent imprinting of the HPA, for example, in terms of neural cell-death. However, to the extent that cortisol secretion varies with numerous biological and external factors, it can hardly be ascertained whether present cortisol concentrations are a function of altered HPA function due to traumatic stress. Regarding the normal population, however, it might be assumed that traumatic stress is more likely to appear in childhood than later in life. This hypothesis strongly relies on a definition of traumatic stress that refers to the current sensitivity of an organism to distinct stressor types, with stress being more traumatic the more sensitive the organism is. For example, a child is more dependent on the mother than an adult, and, consequently, the absence of the mother is more traumatic to a child than to an adult.

If true, the influence of personality variables and stress factors on diurnal cortisol must be tested in multivariate as opposed to bivariate models. Multivariate models (e.g., multiple regression models) allow for a mutual control of the influence of either predictor (personality and chronic stress) on the criterion (diurnal cortisol). As such, drawing on a multivariate approach, the model presented predicts a *negative* relationship between impaired self maturation and the CRA and at the same time a *positive* relationship between stress and the CRA.

Present research and hypotheses

The aim of this study is to test several assumptions about the relationships between attachment, social stress and cortisol regulation. Our hypotheses are based on theories about the functioning and development of the self (attachment theory, PSI theory) as well as the allostatic load model.

As outlined before, the self-system is considered to play an important role in coping with stress and is brought into connection with the functioning of the HC (Kuhl, 2000a), which itself is known to inhibit HPA system activity in stress situations (Sapolsky et al., 1990). As such, impairments in the development of the self-system, likely to be resulting in attachment insecurity, low self-determination, or self-esteem, can be assumed to be associated with strong HPA activation as a response to acute stress.[45] Therefore, indicators of an impaired self development are hypothesized to be positively related to CRAS (*hypothesis 1*). On the other hand, because both impairments in self maturation and hypocortisolism are associated with chronic early life stress, impairments in self-maturity are hypothesized to be related with a lower CRA, at least, if controlled for chronic stress (*hypothesis 2*). This hypothesis would further suggest that people with a high CRAS are likely to show a low CRA, resulting in a negative relationship between the two variables (*hypothesis 3*). Controlling for personality differences in the CRA, I assume a positive relationship between current chronic stress and the CRA (*hypothesis 4*). To the extent that individuals with a positive self development are commonly less susceptible to stress than those with a negative self development, a negative relationship between self development and stress is predicted (*hypothesis 5*).

[45] According to PSI theory, overactivation of the stress system in individuals with an underdeveloped self mainly derives from impairments to downregulate rather than from a low threshold to generate negative affect. However, separating the two mechanisms in the context of HPA system functioning are beyond the focus of the present study.

Method

General procedure

Participants were recruited via advertisements and invited to the laboratory for two meetings. The first meeting was divided into 2 parts. The first part was conceived of as an information meeting where the participants were given detailed information about the course, procedures, and intents of the study. Participants who decided to take part in the study continued to the second part, in which they filled in psychological questionnaires and were instructed about home saliva sampling. Within 2 weeks, the participants brought their samples to the laboratory where they performed a laboratory stress task. In the end, they received 30 Euros for expense allowance, were thanked and released.

Sample

The sample consisted of 45 employed women. To minimize the influence of disturbance factors, several variables were either controlled or kept constant. As such, drawing on findings on an association between HPA reactivity and age as well as gender (e.g., Bremner & Vermetten, 2001; Kudielka, Buske-Kirschbaum, Hellhammer, & Kirschbaum, 2004; Seeman, Singer, Wilkinson, & McEwen, 2001), only one gender was recruited, that is female. For the same reason, the age section was confined to a range of 25 to 50 years (mean age 34.5 ± 9.3 SD). Because social stress is a type of stress strongly related to HPA system activity (Dickerson & Kemeny, 2004; Kirschbaum, Pirke, & Hellhammer, 1993), I attached importance to recruit individuals predominantly from jobs demanding frequent social contacts (for example, half of the participants were nurses). None of the participants had a psychiatric disorder or took cortisone medication.

Psychological assessment

As outlined before, self maturation finds its expression in different variables, such as attachment security, self-determination, self-esteem or low self-criticism.

In this study, *attachment* is measured by a German translation of the Multi-Item Measure of Adult Romantic Attachment (Brennan et al., 1998). This instrument is a self-report measure comprising the scales *anxiety* (about abandonment; e.g., “I worry a fair amount about losing my partner”) and *avoidance* (of closeness; e.g., “I get uncomfortable when a romantic partner wants to be very close”). A weighted combination of the two scales, which is described in detail by the authors, results in four attachment patterns “secure” (low anxiety, low avoidance), “fearful” (high anxiety, high avoidance), “preoccupied” (high anxiety, low avoidance) and “dismissing” (low anxiety, high avoidance). Extensive empirical work by the authors proved this instrument to be a valid instrument for measuring romantic attachment orientations. Cronbach’s alpha of the German scales is .84 for anxiety and .81 for avoidance.

Self-determination is measured with a 4-item short version of the self-determination scale (Kuhl & Fuhrmann, 2001) taken from the Volitional Components Inventory (Kuhl & Fuhrmann, 1998). This scale measures the degree to which a person feels that the things he does are wanted by himself rather than by others (“self congruence”) or that he will manage a situation, even when it is difficult (“optimism”) (see appendix, Table 21, for the items).

Self-esteem is measured by the broadly applied Rosenberg Self-Esteem Scale (Rosenberg, 1965; German version from Ferring & Filipp, 1996). This scale ascertains the extent to which a person feels content with himself and likes his own person the way he is.

Self-criticism is measured by a 4-item short version of a scale from the Personality Style and Disorders Inventory (Kuhl & Kazén, 1997), a German self-report questionnaire for a dimensional assessment of non-clinical personality styles derived from commonly described personality disorders. The scale *self-critical personality style* taps the degree to which a person shows a low level of self-confidence, is timid and shy, and suffers from inferiority-complexes. A key problem of self-critical individuals is their high sensitivity towards negative evaluations.

Alternative personality and clinical variables that do not (directly) express aspects of the self were included to examine whether the expected relationship between self maturation and cortisol concentration is specific or attributable to more general personality traits, like neuroticism or extraversion, or even to transient states, like sub-clinical depression or anxiety.

Neuroticism and *extraversion* were measured by the respective scales from the NEO Five-Factor Inventory (Borkenau & Ostendorf, 1993, for the German version; Costa & McCrae, 1992).

Self-reported *anxiety* and *depression* symptoms during the last 2 weeks were assessed by the Hospital Anxiety and Depression Scale (Herrmann & Buss, 1994, for the German version; Zigmond & Snaith, 1983). This instrument provides a dimensional screening for anxiety and depression symptoms and proved to be especially suitable for an application in subclinical and psychosomatic populations.

To measure *chronic social stress*, I applied the Trier Inventory for the Assessment of Chronic Stress (Schulz & Schlotz, 1999). This inventory comprises several subscales assessing different variants of chronic stress via retrospection over the last year. The subscale social stress, which is the key variable here, refers to negative experiences with others, such as criticism, quarrels, or other kinds of conflict.

Diurnal saliva collection

Free plasma cortisol usually increases within the first 30 minutes as a reaction to awakening by 50-150% and continuously declines up to about noon (Prüssner et al., 1997). Salivary cortisol is easy to be sampled and revealed to be a highly reliable marker of free plasma cortisol (Kirschbaum & Hellhammer, 1989). Sampling was performed by the participants themselves (cf. Smyth et al., 1997) by using the Salivette (Sarstedt, Rommelsdorf, Germany). To obtain valuable data, sampling was monitored by an electronic drug exposure monitor (Aardex, Zug, Switzerland). Because measuring awakening cortisol within the first 30 to 60 minutes proved to be a reliable individual marker for circadian HPA activity (Prüssner et al., 1997), cortisol assessment was confined to this time frame. Thus, participants were instructed to sample saliva at the time of awakening (in bed), 30, 45 and 75 minutes thereafter for two consecutive days. The Salivettes, that is small rolls of wool, had to be chewed until they were completely soaked with saliva but at least for 30 seconds. Because all participants had regular working hours during the sampling days, the sampling period reached from 4:45 to 7:30 AM for all participants. Moreover, participants were asked not to take breakfast during the sampling period in order to avoid contamination of the saliva with food or drinks. Further, to avoid contamination with blood from microinjuries in the oral cavity, participants were asked not to brush their teeth during sampling. In case the daily routine did not thoroughly allow for these sampling instructions, participants were told to wait for the second sample before

breakfasting or teeth brushing. Participants were asked to store the samples in a refrigerator until returning them to the instructor.

Laboratory stress task

Participants were invited to the laboratory to perform a stress task in front of a computer situated in a cubicle. The stress task was based on an uncontrollable stress paradigm. Uncontrollability has been revealed a stress source strongly stimulating HPA system activity (Chrousos & Gold, 1998; Dickerson & Kemeny, 2004). Participants were exposed to a repeated uncontrollable aversive noise (auditory startle probe) of 500 ms duration via headphones while performing a visual classification task of about 8 minutes. This startle probe consisted of a sound recording of an electric shock presented pseudo-randomly 36 times over the course of the procedure (all 13 s, on average). The volume of the noise was adapted to the individual's noise sensitivity by adjusting the volume until it was just bearable to the participant. As a result, all values were within a narrow range of 100 to 103 decibel. As such, stress resulted from a continuing expectation of an aversive auditory stimulus and the uncertainty about the time of its appearance. Saliva samples were taken immediately before the stress task and 10 minutes afterwards.

Cortisol analysis and parameterization

Saliva samples were sent to the laboratory of the Center for Psychobiological and Psychosomatic Research at the University of Trier in Germany. Cortisol was analyzed by a time-resolved immunoassay with fluorescence detection (for an exhaustive description, see Dressendörfer, Kirschbaum, Rohde, Stahl, & Strasburger, 1992).

The CRA was parameterized through the individual increase from the awakening value (time 1) to the maximum cortisol value within the first 75 minutes after awakening, indicating the maximum increase in the morning (e.g., Prüssner et al., 1997).

The CRAS was operationalized through the increase from cortisol concentration before the stress procedure to cortisol concentration at 10 minutes afterwards.

Results

Because of incomplete cortisol samples, 3 participants were dropped from analyses. Thus, 42 participants remained in the sample.

Stability of the cortisol response to awakening

As expected, on each day, cortisol levels increased significantly within the first 30 minutes after awakening, F (1, 44) = 31.9, $p < .001$. As can be seen in Figure 7, at each morning, the course of cortisol concentration is similar, with a maximum at 30 minutes after awakening. Table 12 lists mean scores and standard deviations for each assessment.

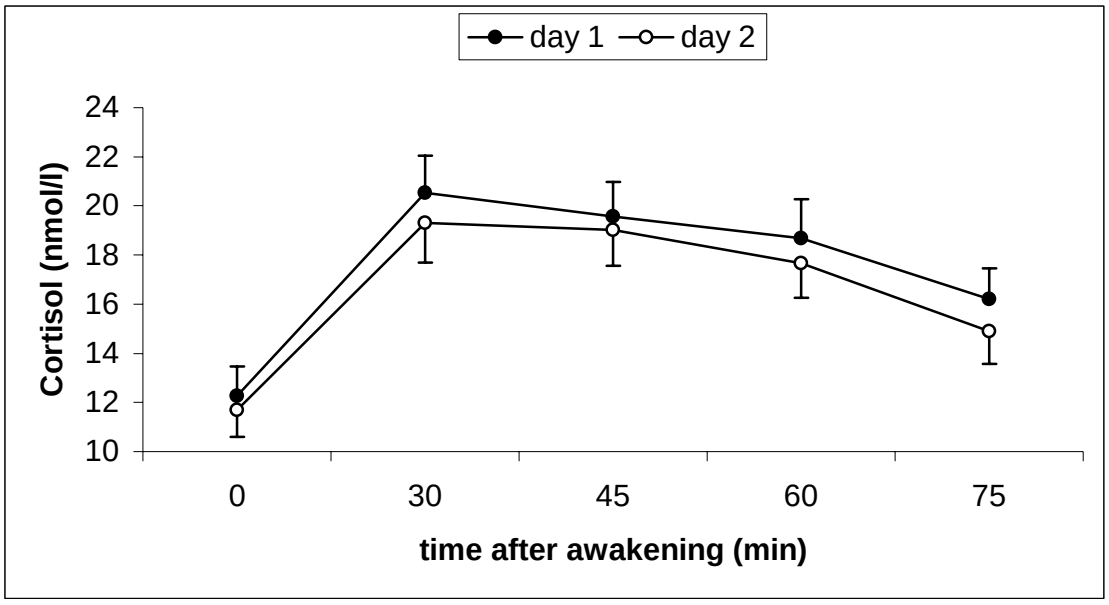

Figure 7

Mean salivary cortisol levels (± SE) on 2 days at 0, 30, 45, 60, and 75 minutes after awakening

Table 12

Mean salivary cortisol levels and standard deviations (SD) for each assessment time on day 1 and day 2

Time after awakening	Day 1		Day 2	
	mean	SD	mean	SD
0 min	12.26	8.13	11.71	7.58
30 min	20.53	10.17	19.30	11.00
45 min	19.56	9.45	19.01	9.96
60 min	18.69	10.49	17.66	9.52
75 min	16.20	8.18	14.89	9.11

Replicating the findings from Prüssner et al. (1997), the CRA showed relatively high intraindividual stability from one day to the next, $r = .64$, $p < .0001$. To increase the reliability of the CRA for further analyses, if not stated differently, average parameters for each baseline and maximum cortisol concentration were used based on the respective values from the two days.

Regressions of CRA and CRAS on personality and chronic stress

As a first step, bivariate regression analyses between psychological variables and CRA as well as CRAS were conducted. Because preliminary analyses revealed no relationships between psychological variables and baseline (t1) cortisol concentrations, difference scores for CRA and CRAS were computed. The results are visualized in Table 13.

Table 13

Regression of CRA and CRAS on personality variables (standardized coefficients, n = 42)

personality variables	CRA	ASCI
self-maturity indicators		
self-esteem	0.28*	-0.01
self-determination	0.33*	-0.17
self-criticism	-0.33*	0.13
romantic attachment anxiety	-0.40**	0.40**
(romantic attachment avoidance)	0.08	-0.04
general personality traits and clinical symptoms		
neuroticism	- .19	.19
extraversion	- .03	- .04
anxiety	- .01	.12
depression	.10	- .05
chronic social stress	.22	.17

Notes. ** $p < .01$; * $p < .05$ (both one-tailed); CRA = cortisol response to awakening (difference score); CRAS = acute stress cortisol response (difference score)

Confirming the hypothesis, self-maturity was positively related to the CRA in general, with individuals with high self maturation having a lower CRA. Specifically, self-esteem and self-determination proved to be positively related to the CRA, β's > .28, p's < .05 (one-tailed), whereas self-criticism and RAA were negatively related to the CRA, β's > .29, p's < .05 (one-tailed). Of all these variables, RAA showed the closest relationship with the CRA, $\beta = .40$, $p < .01$. Attachment avoidance, however, was not related to cortisol secretion. Neither was a *combination* of attachment anxiety and avoidance, composing distinct attachment styles (not depicted). No relationships to cortisol secretion were found for variables that are not directly linked to self maturation, such as neuroticism, extraversion, depression, and symptoms of anxiety.

Interestingly, of all variables, RAA was uniquely related to CRAS, with individuals high in RAA showing stronger increases as a reaction to the acute stress task, $\beta = .40$, $p < .01$.

Multiple regression analyses

RAA versus other self-maturity variables. The fact that cortisol regulation was most strongly related to RAA may give rise to the hypothesis that the relationships between the CRA and each of the other self-maturity variables only appear because RAA highly overlaps with these variables. Therefore, single hierarchical regression analyses were conducted. These analyses included the CRA as a criterion as well as RAA and either of the self-maturity indicators as predictors. The results are listed in Table 14. As can be seen, the simultaneous prediction of the CRA by each self-maturity variable and RAA removed the direct effect of the respective self-maturity variable on the CRA but not the effect of RAA. Instead, RAA remained significant at the level of one-sided testing.

Table 14

Hierarchical regression analyses for detecting spurious regressions of CRA by self-maturity variables (n = 42)

Predictors	Cumulative R^2	Increase in R^2	Standardized β	p (two-sided)
Model 1: awakening cortisol			.43	< .003
self-criticism	.27	.27	**-.32**	**< .024**
Model 2: awakening cortisol			.44	< .002
self-criticism			**-.19**	**< .216 n.s.**
RAA	.34	.07	-.31	< .044
Model 1: awakening cortisol			.46	< .002
self-determination	.24	.24	**.29**	**< .049**
Model 2: awakening cortisol			.44	< .003
self-determination			**.08**	**< .650 n.s.**
RAA	.32	.08	-.34	< .047
Model 1: awakening cortisol			.40	< .006
self-esteem	.16	.16	**.28**	**< .054**
Model 2: awakening cortisol			.43	< .003
self-esteem			**.09**	**< .557 n.s.**
RAA	.23	.08	-.34	< .039

Notes. Awakening cortisol as a baseline was partialized out in each model. For each self-maturity variable, Model 1 constitutes a regression model including only the self-maturity variable (and baseline cortisol) as a predictor of the morning peak value. Model 2 differs from Model 1 in that it additionally includes romantic attachment anxiety as a predictor.

Following the recommendations for testing mediator models (Baron & Kenny, 1986), the reduction of the effect from the regression of CRA on each self-maturity variable after inclusion of RAA was tested by a modified Sobel test (Sobel, 1982)[46]. As a result, the reduction of the effect was significant at a one-tailed level for self-esteem, $Z = 1.84$, $p < .05$, self-determination, $Z = 1.84$, $p < .05$, and self-criticism, $Z = -1.67$, $p < .05$. As an example, Figure 8 illustrates the result for self-determination in the form of a simple path model.[47]

[46] The Sobel test is a statistical test for the difference between the total effect of a predictor X on a criterion Y and the direct effect of X on Y after partializing out the indirect effect of X on Y through a mediating variable M. Usually, this test is used to test *mediation*. However, because this test doesn't distinguish between mediation and *spuriousness*, it can also be applied to test a spurious relationship between X and Y that is due to M causing both X and Y.

[47] In contrast to mediator models, the present model assumes a causal influence from one variable (RAA) to each of two other variables (self-determination, CRA), explaining the phenotype relationship between the latter variables. As such, reversing the arrow between RAA and self-determination does not have any effect on the parameters.

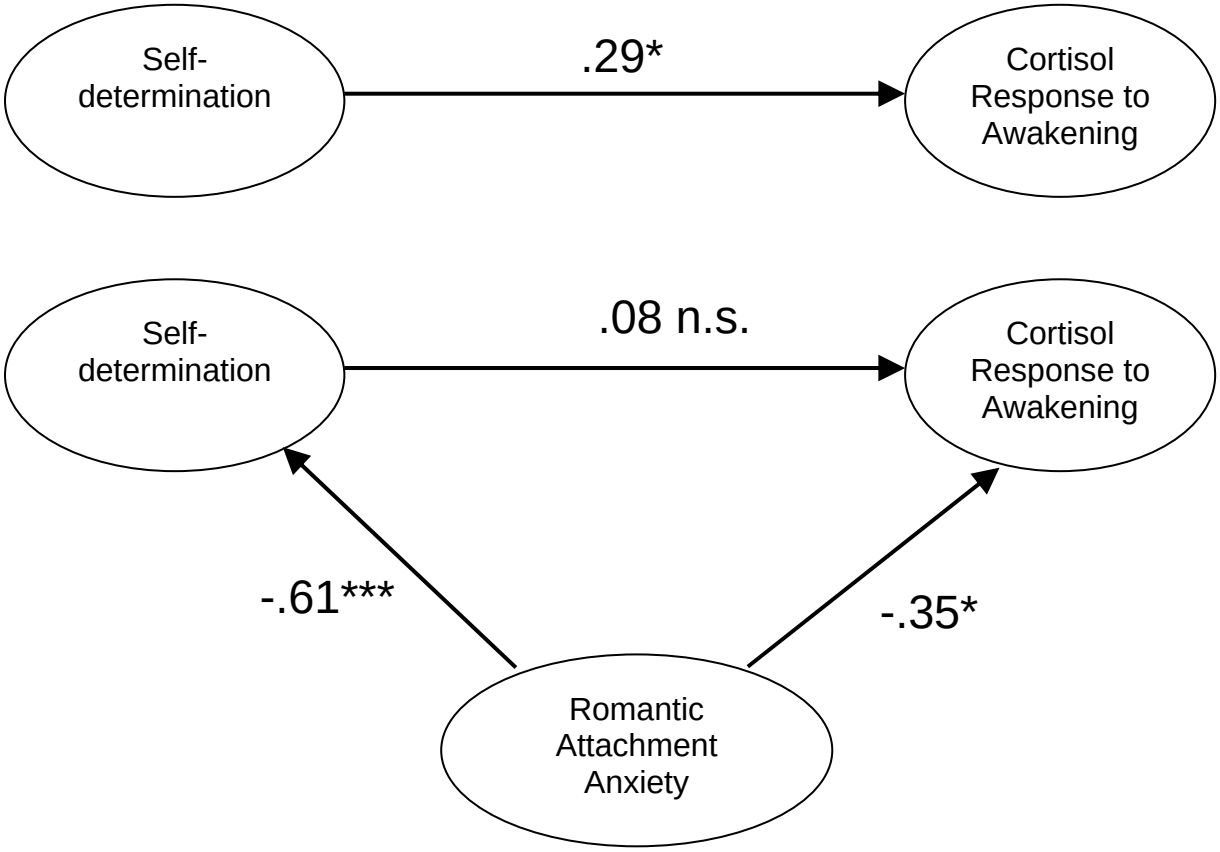

Figure 8

Spuriousness model for romantic attachment anxiety causing both cortisol response to awakening and self-determination (similar models for self-esteem and self-criticism, see text)

RAA, social stress, and cortisol. Because only RAA was *directly* related with cortisol and RAA was uniquely related to the CRAS, self-determination, self-esteem and self-criticism were excluded from further analyses. This section analyses the interrelationships between RAA, social stress, the CRA and the CRAS. To examine suppressor effects between variables, hierarchical regression analyses (Cohen & Cohen, 1983) were applied.

In each of the following models of CRA prediction, the cortisol maximum (aggregated across both days) was entered as a dependent variable (criterion). To control for baseline, cortisol level during awakening was entered as a predictor (cf. Cohen & Cohen, 1983). To predict the CRAS, in each model cortisol concentration at t1 (10 minutes after the end of the stress task) was used as a dependent variable, whereas cortisol concentration at t1 (immediately before the task) was taken as a baseline predictor. The results are listed by Table 15.

Drawing on hierarchical regressions, model 1 examines the relationship between RAA and the CRAS. RAA revealed to be unrelated to baseline cortisol concentration, β = -.14, p > .30. In contrast, after baseline control, RAA significantly predicted the CRAS, β = .21, p < .013 (cf. bivariate regressions).[48] Figure 9 illustrates cortisol changes for groups of anxiously versus securely attached individuals obtained by median-split. As a reaction to the stress task, cortisol increased in individuals high in RAA. By contrast, cortisol did not increase - or even decreased - in individuals low in RAA.

[48] Although the relationships between RAA and cortisol were already examined on the basis of difference scores, for completeness, they are additionally examined via multiple regressions in this section.

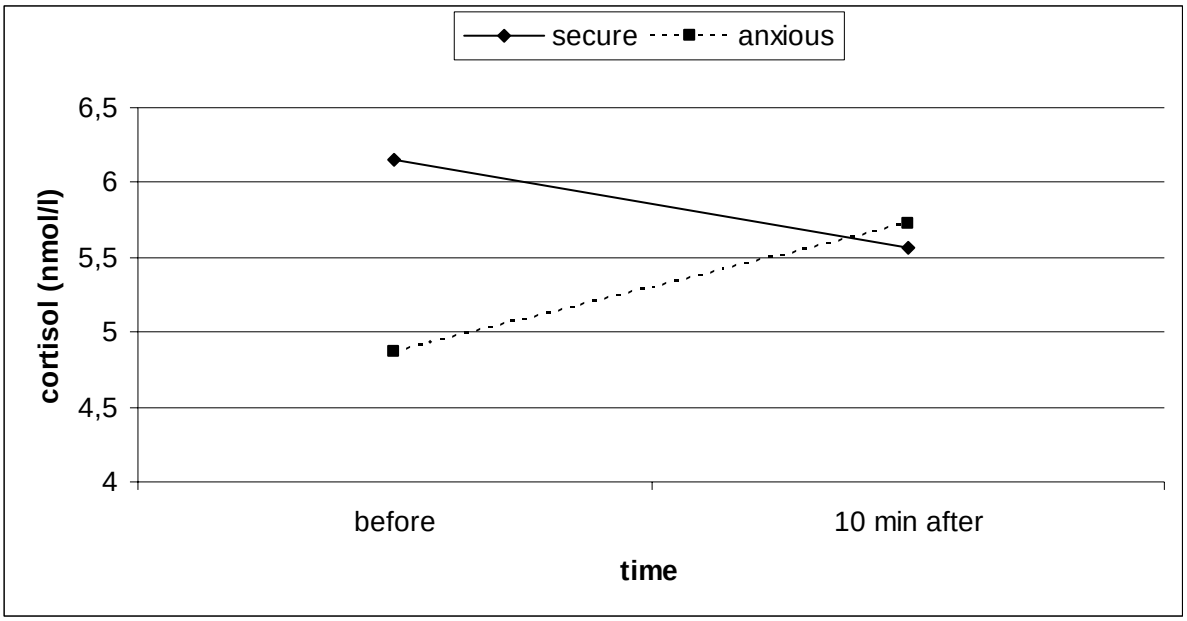

Figure 9

Saliva cortisol level immediately before and 10 minutes after the end of the 8-minutes stress task by groups of individuals with secure versus anxious attachment (median-splitted)

Model 2 deals with the relationship between RAA and the CRA (hypothesis 2). After having controlled for baseline cortisol (first assessment in the morning), RAA significantly predicted the (averaged) maximum cortisol level within the first hour after awakening, β = -.39, p < .008 (see also bivariate regressions). For illustration of the robustness of the findings, Figure 10 and 11 depict the CRA for each morning separately. Two groups of low versus high RAA were arranged by median split for better visualization of the data. On either morning, participants high in RAA show a flatter cortisol increase than participants low in RAA.

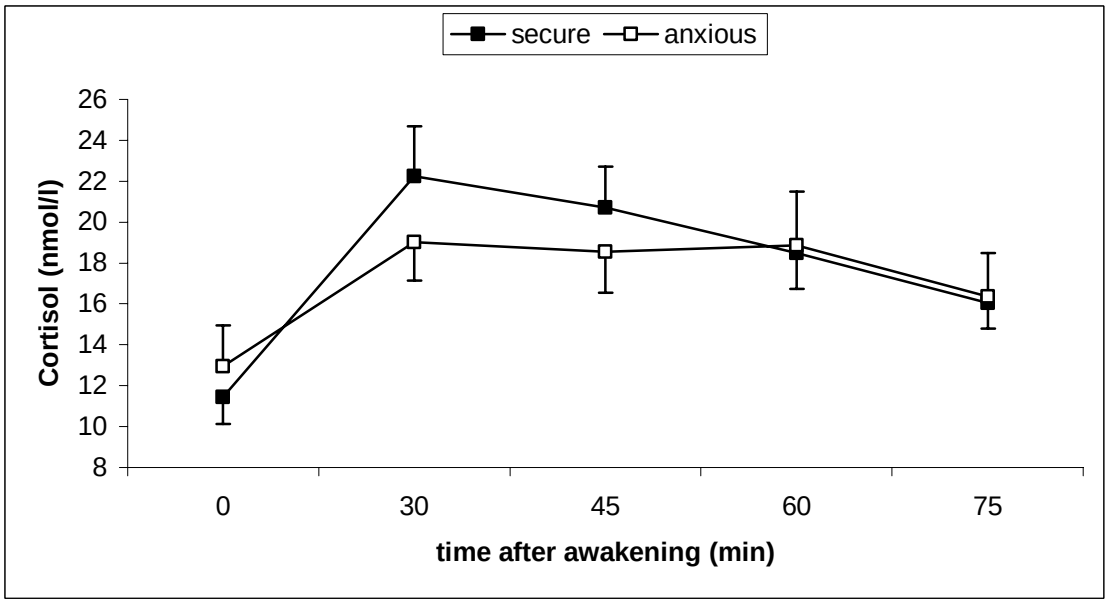

Figure 10

Morning cortisol levels at day 1 for two groups of participants with low versus high attachment anxiety based on median split

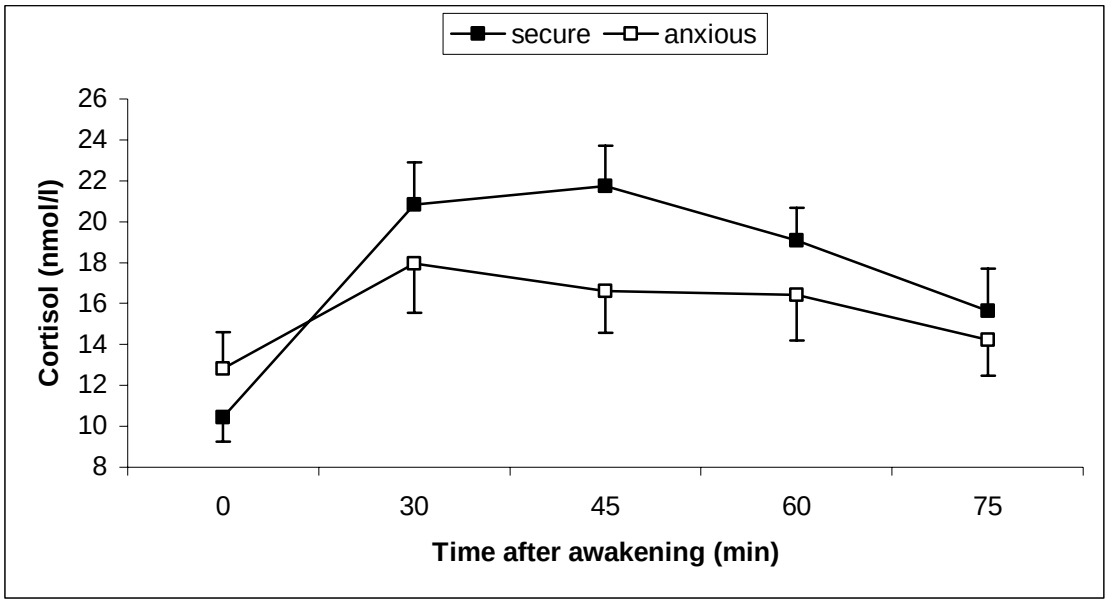

Figure 11

Morning cortisol levels at day 2 for two groups of participants with low versus high attachment anxiety based on median split

Although the curves seem to suggest a relationship between RAA and the cortisol level at time 1, regression analyses did not reveal a significant relationship, with all β's < .08, p > .60.

Now that RAA showed a positive relationship to the CRAS and a negative relationship to CRA, model 3 intents to directly test the relationship between the CRAS and the CRA. After having controlled for both the CRA and the CRAS baseline, the model revealed a significant negative relationship between post-stress cortisol concentration and maximum cortisol concentration in the morning, β < -.54, p < .042. This is in line with the hypothesis that the reactivity of the HPA system to acute stress leads to an adaptation (downregulation) of the CRA.

Having revealed significant regressions of the CRA on both RAA and the CRAS, the question rises of whether one of the two predictors (e.g., CRAS) might mediate the relationship between the other predictor (e.g., RAA) and the CRA. Therefore, in a second step, RAA was entered into model 3 as a further variable. As a result, RAA remained to predict the CRA significantly, β < -.30, p < .041, uncovering a direct relationship to CRA in addition to the indirect relationship via CRAS.[49]

The following models deal with relationships between social stress and CRA as well as RAA. First, it was posited that individuals high in attachment anxiety would be more susceptible to social stress than individuals low in attachment anxiety (hypothesis 5). As can be seen in Table 15, model 4 confirms this hypothesis, β < -.28, p < .05 (one-tailed). Second, I assumed a positive relationship between social stress and CRA. According to the overlap-model, self maturation impairment and stress mutually suppress the influence of either variable on CRA.

[49] On the other hand, the relationship between CRAS and CRA remained significant when social stress was additionally included in the model as a predictor (compare for the relationships in the structural equations model in the next section).

Consequently, the relationships with CRA should strengthen if both components are included as predictors into the same regression model. As such, regressing CRA on social stress revealed the expected positive effect when RAA was included (model 5b), $\beta < .32$, $p < .01$ (one-tailed), but not if it was not included, $\beta < .18$, n.s. (model 5a). Conversely, the relationship between RAA and CRA, which already revealed to be significant in model 2, increased after social stress was controlled for, $\beta < -.48$, $p < .001$. As hypothesized, the effects of either predictor on CRA were opposed: While RAA contributes negatively to the CRA, social stress contributes positively to the CRA.

Table 15

Hierarchical regression analyses for testing diverse relationships (n = 42)

Predictor	Cumulative R^2	Increase in R^2	Standardized β	p (two-sided)
Dependent Variable *Acute Stress Cortisol Response* (Model 1)				
Step 1: baseline lab cortisol	.710	.710	.84	< .001
Step 2: **RAA**	.753	.043	.21	< .013
Dependent Variable CRA (Model 2)				
Step 1: baseline aw cortisol	.161	.161	.40	< .008
Step 2: **RAA**	.313	.152	-.39	< .006
Dependent Variable CRA (Model 3)				
Step 1: baseline aw cortisol	.161	.161	.40	< .008
Step 2: baseline lab cortisol	.216	.055	.24	< .108 n.s.
Step 3: **time 2 lab cortisol**	.298	.082	-.54	< .042
Step 4: RAA (additionally)	.374	.076	-.30	< .041
Dependent Variable *Social Stress* (Model 4)				
Step 1: RAA	.077	.077	.28	< .075
Dependent Variable CRA (Model 5a)				
Step 1: baseline aw cortisol	.161	.161	.40	< .008
Step 2: **Social Stress**	.194	.033	.18	< .215 n.s.
Dependent Variable CRA (Model 5b, with RAA, all predictors at once)				
baseline cortisol			.47	< .001
RAA			-.48	< .001
Social Stress	.41	.41	.32	< .019

Note. Attention: Model 5b is not a hierarchical model. Baseline aw cortisol = average of first cortisol assessment after awakening on each day. Baseline (time 2) lab cortisol = Cortisol assessment before (after) the laboratory stress task.

Structural equations model

After having tested each relationship by *single* regression models, in this section, the entire structure of the relationships between RAA, social stress, CRAS, and CRA are tested. For this purpose, I used a structural equations model (SEM), proposing a network of causal relationships between the variables.

However, because the sample size is rather small, the present SEM might be understood as a descriptive summary of the results from the regression models rather than an exact statistical test. Nevertheless, to rule out a misfit of the overall model, statistical fit indices are presented. The SEM was computed by AMOS version 5.0 (Arbuckle, 2003), using the maximum likelihood algorithm.

The SEM is depicted in Figure 12. The target variable CRA functions as an exogenous latent-trait variable, indicated by the observed CRA's from each day. For parsimony and identifiability of the model, I went without testing the measurement model of the endogenous variables, treating either variable as an observed variable.

The model presented suggests that RAA has a positive effect on both the CRAS and perceived social stress but a negative effect on the CRA. Unlike RAA, social stress shows a positive relationship with morning cortisol increase. On the other hand, the negative effect of the CRAS on the CRA confirms the CRA adaptation assumption. As already suggested in regression model 3, a direct path from RAA to CRA is essential for obtaining an adequate model fit[50]. Notably, almost half of the variance of CRA (47 %) is explained by these 3 predictors.

The model revealed a remarkably high fit, with all fit-indexes lying at the top of desirability (Bentler, 1988; Hu & Bentler, 1999): GFI, AGFI, NFI, RFI and CFI are close to 1, whereas RMSEA is close to 0. The quality of all other fit-indexes (not depicted) was similarly good.

To the extent that the path from CRAS to CRA is imperative for an adequate data fit, the hypothesis that diurnal hypocortisolism results from hypersensitivity of the HPA system towards psychological stressors was supported by the data.[51]

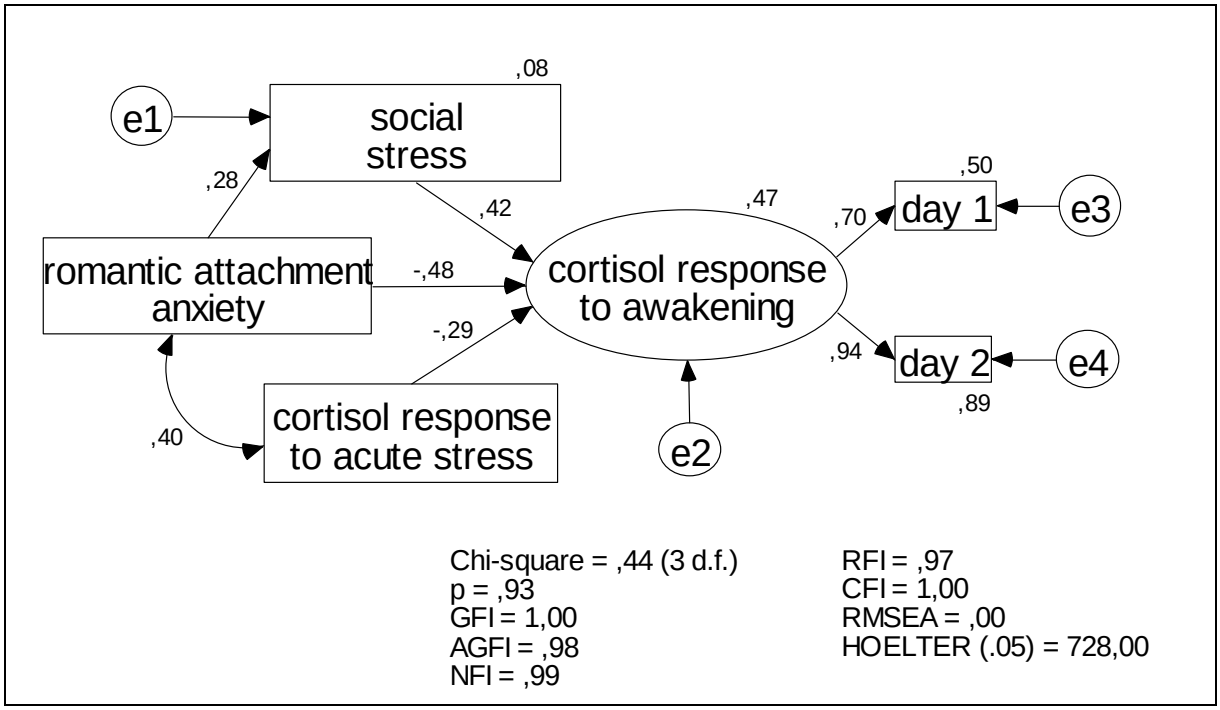

Figure 12

Structural equations model of the relationships between romantic attachment anxiety, social stress, cortisol response to acute stress and cortisol response to awakening (N =42).

Note. e1 to e5 indicate error terms. Coefficients next to path arrows index the strength of the direct path. Coefficients next to variables index the total of the explained variance of the variable.

[50] If I had had started with the SEM, I would have added this path post hoc.

[51] To exclude the reversed path, I exchanged the hierarchical position of CRA and CRAS. However, this model completely failed to fit the data.

Discussion

Brief summary

The primary goal of this study was to test the relationships between personality (self-maturity), social stress, and HPA activity in terms of both CRA and CRAS. The hypotheses predicting the nature of these relationships were derived from an integration of psychological models of self development (Ainsworth, 1989; Bowlby, 1979, 1980; Kuhl, 2000a, 2000c; Kuhl & Völker, 1998) and the allostatic load model of persistent alteration of the HPA system (McEwen, 1998b). According to attachment theoretical models (Ainsworth et al., 1978; Bowlby, 1980; Bretherton, 1985), the self develops as a function of the early infant-mother relationship. Appropriate responding of the caregiver to the infant's needs is conceived of as a prerequisite of the development of self-functions such as attachment security, self-esteem or self-determination. According to the model of allostatic load, prolonged periods of stress overload psychological or physiological stress regulation capabilities and - as a consequence - can lead to persistent alterations in HPA system functioning. Specifically, it was assumed that early negative attachment relationships lead to persistent HPA system alterations in terms of a sensitization of the HPA system to acute stress (CRAS) and a dampened CRA as a counteract. At the same time, negative attachment relationships impair the maturation of the self. Concludingly, self maturation was hypothesized to be related to a weaker CRA and a stronger CRAS. Moreover, current chronic stress was hypothesized to be positively related to the CRA, suppressing the prediction of the CRA by self maturation variables, and vice versa. These hypotheses were largely supported by the data of the present study: All self maturation indicators were positively related to the CRA. In contrast, personality variables which are not directly linked to self maturation were neither related to the CRA nor the CRAS. This is in line with prior studies with healthy participants stating the relevance of self maturation variables for HPA system activity (Adam, 1999; Brandtstädter, Baltes-Götz, Kirschbaum, & Hellhammer, 1991a). However, the relationships expected for self maturation variables like self-determination or self-esteem were qualified by attachment security/anxiety: First, while all self maturation variables were (positively) related to the CRA, only attachment security (vs. anxiety) was directly related to the CRA. Second, attachment anxiety was uniquely related to the CRAS and, third, was able to uncover a (positive) relationship between chronic social stress and the CRA. As a further result, the intensity of the CRAS revealed to be negatively related to the CRA. In other words, individuals with a strong cortisol response to acute stress showed a reduced cortisol response to awakening.

Notably, attachment anxiety, social stress, and the CRAS explained 47 % of the variance of the CRA, which is almost half of its total variance. Besides measurement errors, unexplained variance might rely on variability in current mental and bodily states (e.g., infections) or individual differences in physiological functioning which are unrelated to personality (e.g., differences in genetic dispositions). However, examination of these factors was beyond the focus of this study.

Attachment anxiety versus avoidance

In contrast to attachment anxiety, I did not share specific hypotheses for attachment avoidance and its relationships to the CRA and CRAS. In the present study, neither attachment avoidance nor the interaction with attachment anxiety was significantly related to either of the cortisol indices. Accordingly, our data are in line with Belsky and Rovine (1987) finding the avoidant pattern not to be associated with higher stress reactivity. However, our data concur with the results from studies reporting a strong cortisol response in infants with an avoidant attachment pattern. Because a direct comparison between infant and adult attachment styles is limited, further research on the link between adult attachment, child attachment and HPA activity is needed. Speculating about this inconsistency, early emotional disengagement from adverse attachment relationships might buffer against further attachment stress that may otherwise lead to a dysfunctional HPA adaptation. To the extent that attachment anxiety is commonly associated with a negative model of the self, disengagement might also facilitate the development of a positive model of the self (Bartholomew & Horowitz, 1991). Consequently, attachment avoidance might be considered an alternative path to higher levels of self-maturity (Hinde & Stevenson-Hinde, 1990; Lamb, 1984). However, to explore these possible relationships, longitudinal studies are needed.

Attachment and cortisol response to acute stress

RAA revealed to be positively related to the CRAS. This is in line with developmental studies observing higher cortisol increase in insecurely attached infants as a reaction to the Strange Situation Test (Ainsworth et al., 1978). Given that RAA but not self-esteem predicted the CRAS in the present study, it may be possible that prior findings of a relationship between self-esteem and the CRAS (e.g., Prüssner et al., 1999) may be due to overlapping variance of self-esteem with attachment security.

Although the results of a stronger CRAS in individuals high in attachment anxiety or related personality traits are in line with theoretical considerations, the underlying mechanisms are not yet clear. From a psychological perspective, 2 major processes should be distinguished, which, however, may not operate separately. On the one hand, attachment anxiety may be associated with high *initial sensitivity towards stress*, no matter whether genetically determined or mediated by adverse socialization factors. On a neuroendocrinological level, sensitivity towards stress is probably reflected in a high sensitivity of the HPA system. On the other hand, attachment anxiety may be associated with an *inability to down-regulate stress* once aroused. At a neuroendocrinological level, this might be reflected in strong *inhibition* of HPA system activity, e.g., by hippocampus or areas of the prefrontal cortex. According to the self-relaxation assumption (Kuhl, 2000a, 2001; cf. chapter 1 and 3), activating structures of integrated self-representations (right prefrontal cortex) in stress situations leads to an attenuation of negative affect. As such, the self-relaxation assumption would expect that attachment anxiety is associated with reduced inhibition of HPA system activation rather than a high sensitivity/reactivity of this system. However, it remains an open question to which degree a flattened CRA is due to an inability to inhibit HPA system activity or to an initial sensitization of the HPA system to acute stress. Answering this question would require neurobiological investigation focusing on interindividual differences not only in the structure of but also in the *connections* between the systems involved in the regulation of cortisol. Some ideas about possible neurobiological inhibitory connections are provided by the next section. The negative rather than absent cortisol increase in securely attached individuals probably reflects the normal circadian decrease.

Possible explanations for the unique role of attachment

Interestingly, attachment security versus anxiety revealed to be directly related to both the CRA and the CRAS, as compared to all other self-maturity indicators, which were only indirectly related, if at all. The following section provides some speculations about the dominant role of attachment security.

First, it might be questioned whether self-esteem and self-determination are adequately assessed by explicit ratings. For example, there is evidence from recent studies that high explicit self-esteem can function as a defense against low implicit self-esteem (Bosson, Brown, Zeigler-Hill, & Swann, 2003; Jordan, Spencer, Zanna, Hoshino-Browne, & Correll, 2003). As such, it might be possible that stable and secure self-esteem finds stronger expression in attachment ratings than in self-esteem ratings itself.

Second, secure attachment relationships are considered a prerequisite for the development of a mature self. Therefore, it constitutes a basis for the development of different adaptive personality functions, such as self-esteem, self-determination or self-confidence. In this respect, attachment security might be interpreted as a more basic variable in terms of ontogenetic development and, consequently, might be closer related to persistent HPA system imprinting, provided it takes place within the first years of life.

To the extent that insecurely attached individuals suffer from impaired internalization of caregiver functions, the HPA system is hyperactive in stress situations because it cannot be inhibited adequately. According to PSI theory, stress (or negative affect) can be inhibited by accessing the self-system that provides an overview of personal needs, positive self-representations, and coping strategies. Indeed, both relaxation and self-access can be connected with HC functioning: The HC has an inhibitory influence on cortisol excretion, and, provides access to self-relevant episodic memories that - according to PSI theory - are necessary for the maintenance of positive self-esteem, self-determination, and self-relaxation. If true, the HC constitutes a major link between self maturation and physiological responses. Indeed, first hints come from imaging studies revealing associations between self-esteem and HC volume (Prüssner et al., in press). However, although the HC is capable of establishing the conditions for immediate retrieval of self-relevant knowledge, the process of cortisol inhibition by the HC is rather slow. So, there is no empirical support for a fast downregulation of HPA system activity by the HC.

Extrapolations on developmental processes and causal direction

Although the present hypotheses are in line with theorizing on development processes, the present study only relied on cross-sectional data. Thus, I tested static in a sample of adult individuals as compared to dynamic relationships across the lifespan. Therefore, the data do not allow for a direct validation of the developmental processes that were here assumed to lead to a stabilization of the relationships found between personality, social stress, the CRAS, and the CRA. For example, to the extent that hereditary factors seem to influence the CRA (Bartels et al., 2003; Linkowski et al., 1993; Meikle et al., 1988; Wüst et al., 2000), early attachment stress is not the only explanation for a deviating functioning of the HPA system. In the same way, it cannot be excluded that attachment anxiety itself is influenced by hereditary factors.

However, that a strong CRAS predicts a low CRA is in line with the model of persistent HPA system adaptation: High HPA system activity in an early sensitive phase of HPA system and HC development, due to high levels of external stressors or hereditary factors, may account for circadian HPA system adaptation in terms of a reduced CRA. To my knowledge, this is the first finding of a direct relationship between CRAS and CRA.

Indirect support for the assumption of HPA system alteration due to early life stress in humans comes from studies on rodents providing a considerable body of evidence that adverse early rearing conditions or high levels of stress do have a negative effect on stress-related behavior, health, and mortality of the grown-up animal. For example, rat studies suggest early childhood to be crucial for the maturation of the HC, which is involved in the regulation of cortisol secretion (Sapolsky et al., 1990). Meaney et al. (1988), for example, found that refusing baby rats from parental care and stroking leads to subsequent deterioration of HC related functions such as spatial orientation.

However, it remains questionable whether the model of early HPA imprinting can be transfered to the development of human beings. In a similar vein, the extent to which attachment anxiety remains stable across the life-span is questionable. As such, longitudinal studies on the stability of the CRA, the CRAS, and attachment anxiety would be necessary in the end to determine the causal relationships between attachment, stress, and cortisol secretion.

Structural equations model

Inasmuch as the size of the sample under study is critical for *testing* a structural equations model, the SEM presented is conceived of as a graphic summary of the regression models rather than a conscientious attempt to fit the overall model. Furthermore, I found it appropriate to heuristically examine the entire structure of the relationships. As a result, the model fitted the data remarkably well. Nevertheless, the direction of the path between RAA and CRAS remains questionable. Specifically, turning the path from CRAS to RAA or vice versa leads to statistically equivalent models, what reflects the methodical problem of interpreting causality within cross-sectional data.

Hyper- or hypocortisolism in chronic stress?

Inconsistencies in findings from clinical studies are often due to sample or population differences in at least one variable that is critical for causing the inconsistency. As argued, this might also apply for studies examining the relationship between chronic stress and the CRA. As expected by the overlap-model, self maturation modulated circadian cortisol release in terms of the CRA. As such, degree and dispersion of self maturation, or more specifically attachment security/anxiety, within any population or sample under study may impact the relationship between stress and diurnal cortisol secretion in this study. Specifically, low cortisol levels or even hypocortisolism may show up in populations/samples with high average levels of attachment anxiety (or high stress levels during childhood), whereas high levels of cortisol may show up in populations with high average levels of attachment security (or low stress levels during childhood). Alternatively, no effects may be found if the levels of chronic stress and attachment balance each other out. Consequently, the finding of hypocortisolism in PTSD may be due to an overrepresentation of individuals with impairments in self maturation in this population, based on a selection bias: To the extent that a positive attachment relationship functions as a prerequisite for developing capabilities to integrate traumatic experiences into the self-system rather than to dissociate them from this system (Kuhl, 2001), anxiously attached individuals may be more prone to develop a PTSD compared to securely attached individuals. Supporting the plausibility of this argument, several studies indeed suggest that early life stress increases the vulnerability for developing a PTSD later in life (Bremner, Southwick, Johnson, & Yehuda, 1993; McCranie, Hyer, Boudewyns, & Woods, 1992; Zaidi & Foy, 1994). The fact that secure attachment can

function as a buffer even against acute *non-social* stress, as it often occurs in traumatic situations (e.g., earthquake), was demonstrated in this study.

The finding of *social* stress being related to the CRA corroborates previous findings on the role of social stress in modulating HPA system activation (Dickerson & Kemeny, 2004). However, in numerous studies alternative stress types such as high work load have also been found to be related to HPA system activation (Dickerson & Kemeny, 2004). Therefore, apart from a dominant role of social stress, alternative stress sources may influence the CRA depending on the personal relevance of the respective stress source to the individuals under study. With respect to the sample of the present study, social stress might have been particularly relevant because individuals were predominantly recruited from jobs with levels of social stress.

Generally, in future studies it might be useful not only to assess chronic stress with respect to its source (social, work, financial worries, etc.) but also with respect to functional qualities like uncontrollability or frequency of the stressor. For example, uncontrollability is a functional stress source that is strongly related to HPA system activity (Chrousos & Gold, 1998; Dickerson & Kemeny, 2004).

An alternative explanation for the cortisol response to awakening[52]

Speculatively, there may also be an alternative explanation for the reduced CRA in individuals low in self-maturity: In a recent study, Wolf, Fujiwara, Luwinski, Kirschbaum, and Markowitsch (2005) found that patients suffering from global amnesia due to different brain lesions did not show a CRA. However, brain lesions usually lead to increased rather than decreased cortisol levels (Tchiteya, Lecours, Elie, & Lupien, 2003). Consequently, as argued by Wolf et al. (2005), it may be possible that "the morning cortisol response requires an intact spatial and temporal orientation and that subjects with severe amnesia do not show the anticipatory and activating hormonal response at the beginning of the day" (p. 104). This suggests that the CRA may constitute a reaction to psychological rather than biological processes: Spatial and temporal orientation, which are functions provided by the HC (cf. chapter 1), are - far and foremost - psychological in nature. Considering these issues along with the present finding of a positive association between self maturation and CRA, it may be speculated that the CRA is a direct response to psychological self-system functioning. As such, one could say that the self-system needs to be "booted up" in the morning in order to be able to operate adequately and to cope with the demands of the upcoming day. In turn, this may be related to the paradoxical finding that individuals with a mature self show lower levels of well-being than those with an immature self when the stress level is low (Linville, 1987b): Inasmuch as normal HPA system activation may be interpreted as a physiological correlate of mild stress (or negative affect, respectively), individuals with a mature self may be more sensitive to stressors. Indeed, this has been found in an electroencephalographic study by Rosahl, Tennigkeit, Kuhl, and Haschke (1993) as well as in studies drawing on implicit motive measures (Kuhl, 1972, 1978). If this is true, the HC (or the self-system) integrates two seemingly opposed functions: inhibition of the HPA system (under acute distress) and excitation of HPA system in terms of the CRA ("eustress"). Since research has only very recently found direct connections between HC and CRA (Wolf et al., 2005), explanations for underlying neurobiological mechanims of this "paradoxical" functioning are still due. If future research gives further support to this idea, hypocortisolism may then be reinterpreted as a direct cause of an underdeveloped HC rather than a persistent counteracting of HPA system

[52] I added this section only a few days before the deadline of submission because I came across some more recent, partly unpublished, work on the role of the HC in the CRA. Indeed, this alternative explanation sheds a different light on the present relationships.

activation. Consequently, reduced CRA in insecurely attached individuals may then be interpreted as an insufficient HPA system „check“ that, if intact, provides a basis for effective coping with demands of the upcoming day. In fact, this reinterpretation would even more underscore the importance of the HC for the regulation of cortisol or even the importance of the self for the regulation of negative affect.

Success of this study

In the present study, expected relationships between several variables related to HPA system functioning such as the CRA, the CRAS, self-maturity, and social stress were confirmed by the data. Indeed, it is rather unusual that all of these relationships were uncovered within a single study. This positive outcome might be attributed to several methodological aspects that have not been considered entirely in earlier studies.

First, since Kudielka, Broderick, & Kirschbaum (2003) found that monitoring saliva sampling via microchips increased participants' compliance to keep the stipulated sampling times and thus improved validity of the data, we applied the same method in the present study. Second, to the extent that the CRA was revealed to be a reliable marker for individual differences in diurnal cortisol regulation (Prüssner et al., 1997), I attached special importance to the CRA by having participants sample their saliva densely within the first 75 minutes after awakening. To increase the reliability of the CRA as a trait measure, the CRA from more than one day was assessed (Prüssner et al., 1997). Third, I tried to increase the ecological validity of the present study by reducing the disturbances coming from other variables that are assumed to be associated with diurnal cortisol regulation. For example, gender and – to some extent - age were kept constant. Moreover, the participants were told not to sample during periods of acute illness or nightshifts. Furthermore, several exclusion criteria (e.g., cortisone medication, psychiatric disorder, contraceptives) guided participant recruitment. Fourth, I focused on personality variables related to the self-system, which has mostly been ignored in many studies. In contrast, previous studies explored the role of prominent descriptive and highly aggregated (e.g., neuroticism, extraversion) rather than functional personality traits like attachment anxiety or self-esteem (e.g., Schommer et al., 1999). Fifth, inasmuch as recent work placed emphasis on social as compared to other kinds of stressors as a modulator of HPA activity (Dickerson, Gruenewald, & Kemeny, 2004; Dickerson & Kemeny, 2004; Dickerson, Kemeny, Aziz, Kim, & Fahey, 2004), I assessed perceived social stress. To guarantee for potential social stressors in participants' real life, I predominantly recruited participants from jobs that are commonly associated with high levels of social stress.

Generalizability

Although the overlap model is considered a general model, it was only tested on the basis of a sample of middle-aged females. As such, the postulated relationships between self maturation, social stress, and cortisol excretion still need to be explored for males.[53] Moreover, to the extent that I relied on the CRA for testing the model, extrapolations to all-day cortisol secretion is limited.

Implications for psychopathology and physical diseases

As mentioned in the beginning, hypocortisolism has typically been found in several psychopathological disorders (e.g., PTSD, depression), stress-related bodily disorders, and other clinical populations (e.g., upper respiratory symptoms, patients with cancer, patients with metabolic syndrome and abdominal obesity; for an overview, see Heim et al., 2000). Notably, in patients suffering from breast cancer, those with a flat circadian cortisol rhythm died significantly earlier than those with a pronounced cortisol rhythm (Sephton et al., 2000). This evidence suggests that hypocortisolism facilitates physiological dysfunctioning and the development of several psychopathological and physical disorders. Indeed, diurnal hypocortisolism is discussed as a possible neurobiological mediator between stress and physical complaints (Ehlert et al., 2001; Heim et al., 2000). To the extent that attachment anxiety was found to be related to hypocortisolism in terms of the CRA, it might be speculated whether attachment anxiety may constitute a risk factor for the development of psychosomatic disorders, with early morning hypocortisolism as a mediating variable. Alternatively, both attachment anxiety and physical complaints might also be a consequence of altered HPA system functioning in terms of hypocortisolism.

With respect to the model of opposed effects, the relationships between subjective stress, diurnal cortisol rhythm and disease might also be interpreted as follows: To the extent that physical capacities (e.g., of the hippocampus) are limited to counteract cortisol in the long run, ongoing cortisol elevations as caused by subjective stress cannot further be down-regulated. Possibly, only if both resources for down-regulation are exhausted and a certain threshold of overall diurnal cortisol level is being exceeded for a longer time period, ongoing stress may have adverse effects on physical health. This fits with reported findings of physical symptoms being stronger related to the entire amount of diurnal cortisol secretion than to the CRA, which itself is stronger related to chronic stress (cf. Prüssner, Kirschbaum, Meinlschmid, & Hellhammer, 2003). By contrast, it must be noted that hypocortisolism also has been found to have beneficial effects for the organism (Fries et al., 2005).

However, since the present study centered on non-clinical personality, it was beyond the scope to examine the relationship between cortisol regulation and somatic or mental pathology. Therefore, future research is required to determine the extent to which personality factors such as attachment anxiety are directly involved in the development of psychopathological and psychosomatic disorders.

Moreover, since pychopathological disorders like PTSD and major depression (Gold et al., 1988; Nemeroff, 1996) typically differ in the pattern of cortisol regulation, explaining

[53] Discussing vulnerabilities for a development of hypocortisolism, Heim et al. (2000) mentioned that female as compared to male rat offspring was highly vulnerable to develop an adrenal dysfunction as a reaction to ACTH or corticosterone administration to the mother rat during pregnancy (Catalani, Marinelli, Scaccianoce, & al., 1993; Fameli, Kitraki, & Stylianopoulou, 1994). If generalizable to human beings, it might be speculated that clearer relationships between self-maturity and morning hypocortisolism might be found for women than for men.

psychopathological phenomena with one model is limited. Similarly, since I concentrated on the CRA, comparisons with findings on all-day cortisol rhythm are limited too. However, teasing apart these speculations will require clinical research that takes into consideration both self-maturity variables and chronic stress measures.

Implications of the present study

The major aim of this paper was to emphasize the role of personality (in terms of self maturation) for HPA system activity (in terms of cortisol secretion). In this regard, the present results clearly suggest self maturation impairment to be intimately related to HPA system activation in terms of both the CRA and the CRAS. Considering that personality has largely disappeared from view in the context of cortisol regulation, the present work might be instrumental for personality to regain consideration in this field. The result of entirely opposite relationships of attachment anxiety and social stress with the CRA should also be mentioned again. To the extent that negative affective traits and stress usually are strongly intertwined and the effects of either variable on resulting symptoms often can barely be separated, the present finding shows that each factor matters and none of the two factors should be dropped in favor of the other.

Limitations aside, the present study brings strong support to the hypothesis that self maturation is intimately related to cortisol regulation. Moreover, it supports the hypothesis of opposed effects of attachment anxiety and social stress on the CRA. As such, the present work can be interpreted as a further step into disentangling the puzzle of personality and cortisol regulation, on the one hand, and the puzzle of hypocortisolism on the other.

General Discussion

Shortcomings of the studies and inconsistencies concerning the findings were extensively discussed in each of the foregoing chapters. Therefore, this general discussion closes by summarizing the most important theses and findings as well as by integrating consistent and plausible outcomes into a broader framework of theorizing.

The studies presented were performed against the background of PSI theory - a functional approach towards personality and, more generally, psychological functioning. PSI theory explains human behavior and experiencing through interactions between cognitive and affective systems. While interactions between the intention memory and the intuitive behavior system preferentially relate to human behavior, the interactions between the self (or extension memory) and the object recognition system preferentially relate to human experiencing. The present work attended to the latter aspect in that it investigated the role of the self in the downregulation of negative affect (self-relaxation assumption). For this purpose, two studies were conducted approaching this topic from different methodological perspectives: While the first study examined the influence of experimental induction of self-activation on mood change, the second study examined the relationships between self-system functioning and endocrine correlates of stress regulation in terms of the glucocorticoid hormone cortisol.

A distinguishing feature of this work was a focus on implicit ("unconscious") rather than explicit aspects of affect. Indeed, that psychological processes can operate outside of conscious awareness was already assumed by Sigmund Freud and has extensively been corroborated by neuropsychological and experimental social psychological evidence within the past 20 years. Nevertheless, common psychological research still assesses affect or stress virtually exclusively via self-report questionnaires, not least because of a lack of valid implicit affect measures. To fill this gap, the present work presented and evaluated a novel instrument for assessing implicit affect, the Implicit Positive And Negative Affect Test (IPANAT). Despite some shortcomings, which are not unique to this method, the IPANAT revealed adequate test properties. As such, considerable reliability in terms of internal consistency and test-retest reliability as well as substantial validity in terms of construct and criterion-based validity were found. Considering the recent upsurge in interest in implicit measures in social, personality and clinical psychology, this instrument may provide a useful supplement to self-report measures in these fields. The IPANAT was then supplied to a study presented in chapter 3 in order to test the effect of self-system activation after negative affect induction on implicit affect. The self-system, which was a central term in this work, had been conceived of as the total of integrated networks of self-relevant information, such as personal preferences and needs, personal episodes as well as other self-aspects (Kuhl, 2000a, 2001). A highly developed self-system (or its accessibility) is thought to constitute a functional basis of personality traits like action orientation, self-esteem, and self-determination.

Numerous neurobiological findings corroborate the assumption of PSI theory that the self is supported by right prefrontal areas (Craik et al., 1999; Keenan et al., 2001; Tulving, Kapur, Craik, Moscovitch, & Houle, 1994; Wheeler et al., 1997). Particularly, the right hemisphere provides the functional prerequisites of characteristics that are related to the operating of self-

system in PSI theory. For example, the right hemisphere is advantageous over the left hemisphere in processing emotional (Tucker, 1981) and somatosensory information (Adolphs et al., 2000) – components that are considered integral parts of the self. Moreover, the right hemisphere is advantageous in processing a large amount of information in parallel (Beeman et al., 1994; Bradshaw, 1989; Kuhl, 2000a; Rotenberg, 2004; Rotenberg & Weinberg, 1999), which refers to the enormous potential of the self to integrate information that seems conflictual to the verbal-logically operating left hemisphere.

The study presented in chapter 3 was designed to directly assess the influence of self-activation in terms of exposition to self-referential information on mood improvement. Because the self and its affect regulation processes are considered to be implicit in the first place, I relied on the IPANAT to assess implicit affect regulation. In line with our hypothesis, implicit mood improved as a function of self-activation after negative affect induction. In contrast, self-activation and control groups did not differ in explicit affective changes, supporting the idea of implicitness of the self-system's operating. Additionally, this result underscores the sensitivity of the IPANAT in detecting subtle affective change. Moreover, in line with the hypothesis of impaired self-access in state-oriented individuals, particularly when in negative affect, triggering self-activation externally was more supportive to state-oriented individuals ("ruminators") than to action-oriented individuals who have sufficient self-access anyway. Having corroborated the hypothesis that self-activation attenuates negative affect may have implications for psychotherapeutic treatment of disorders associated with rumination, e.g., depression, generalized anxiety, and posttraumatic anxiety: Supporting the functions of the self-system or teaching individuals how to activate their self in stressful situations, as demonstrated by studies from Pennebaker (1993; 1995; 1997), might help patients cope with negative experiences and thoughts.

With respect to neurobiological underpinnings of the self, PSI theory attaches importance to the hippocampus in its role in supporting immediate self-access. This idea is grounded on well-established evidence on the operation of this neurobiological structure: For example, the hippocampus is involved in encoding and retrieving episodic, i.e. self-relevant, memories (Tulving, Kapur, Craik, Moscovitch, & Houle, 1994; Wheeler et al., 1997). Moreover, a huge body of literature refers to the capability of the hippocamal structure to integrate an enormous number of sensations and isolated pieces from the environment into a contextual whole (Jacobs & Nadel, 1985; Sutherland & Rudy, 1989). As such, it provides an extended and organized overview of perceptual, spatial, and cognitive representations (McClelland et al., 1995; Squire, 1992).

As argued by Kuhl (2000a), to the extent that this capability may be generalized to "internal environments", this would give a neurobiological explanation of why the activation of self-representations has the potential to regulate negative affect: Being able to activate self-representations, which are predominantly positive (Greenwald & Farnham, 2000), in a state of negative affect supports the process of associating the negative experience currently activated with existing episodic experiences or other self-aspects, what gives meaning to the current situation. Moreover, the hippocampus is intimately involved in the downregulation of Hypothalamus-Pituitary-Adrenocortical system activation (Sapolsky, 1992), which is a biological indicator of psychological stress (Selye, 1936). These ideas are congruent with the recent finding of a positive relationship between hippocampal volume and self-esteem (Prüssner et al., in press). These considerations gave grounds for conducting the study presented in chapter 4, which examined connections between self-maturity indicators and cortisol release as an indication of HPA system activation.

Specifically, the hypotheses underlying this study relied on an integration of attachment theoretical considerations on self-development (Main & Weston, 1981; Thompson, 1990) compatible with PSI theory and the model of allostatic load (McEwen, 1998b). According to

attachment theory, a quality relationship between caregiver and child can be conceived of as a prerequisite for developing a mature self in terms of an internalization of affect regulation functions and an image of the self as being loved (stable self-esteem). Conversely, according to the allostatic load model, periods of prolonged stress (e.g., inadequate caregiving) can lead to persistent alterations of HPA system functioning like hyperreactivity in response to acute stress or a reduction in diurnal cortisol release (hypocortisolism). If this is the case, the inconsistent findings on hypo- versus hypercortisolism may be due to overlapping processes: While prior periods of stress would lead to diurnal hypocortisolism, current chronic stress would - independent of this alteration - stimulate the HPA system to release cortisol. As such, it was hypothesized that indicators of impaired self-development and current chronic stress may be reversely related to the cortisol response to awakening (CRA), mutually covering the effect of the other variable on the CRA. In general, the findings were supportive of the hypotheses. In a nutshell, indicators of a weakly developed self (attachment anxiety, low self-esteem, low self-determination, and high self-criticism) were negatively related to the CRA. Interestingly, relying on multiple regression analyses, attachment anxiety revealed to be in charge of the statistical relationships revealed between each other self-maturity indicator and the CRA. Moreover, attachment anxiety showed a unique relationship with the cortisol response to acute stress (CRAS), expressed in a positive correlation. Both findings together suggest a superordinate role of attachment security in cortisol regulation. In turn, both cortisol parameters (CRA and CRAS) were negatively associated, suggesting allostatic load in terms of a persistent counteracting of the CRA due to elevated HPA reactivity to acute stress. Moreover, social stress was significantly positively related to the CRA only if attachment security was controlled for as a further predictor. This is in line with the opposite effects model.

The findings of this study are impressive in some respects. First, given that evidence on relationships between personality and cortisol regulation, whether in terms of CRA or CRAS, is yet scarce, the present study may constitute one of the milestones on the way of researching for personality correlates of cortisol regulation. Second, this is the first study known to the author that finds a direct relationship between the CRAS and the CRA. Finally, the opposed prediction of the CRA by attachment anxiety and social stress has tremendous implications for personality and clinical research: These findings give hope for the analysis of divergent effects from factors that usually are interrelated strongly, such as trait anxiety (here attachment anxiety) and self-reported stress (here social stress). Although the revealed relationships are consistent with the hypotheses of the author, the findings should be replicated by future studies.

But how may the findings of cortisol regulation become integrated into the idea of self-relaxation? The finding of reduced cortisol release in response to acute stress may be directly linked to self-relaxation: To the extent that the hippocampus, which is supposed to constitute one major neurobiological basis of the psychological self-system, inhibits HPA system functioning in acute stress, self-relaxation may be mediated by hippocampus functioning (Surely, this interpretation only counts if the present finding of reduced cortisol response was really due to the inhibitory influence of the hippocampus, which was not tested directly here). In contrast to CRAS, CRA alteration in individuals with impaired self development may not directly be related to self-relaxation: In line with the allostatic load model, alterations of circadian cortisol organization may be interpreted as an automatic physiological downregulation of cortisol level in response to high levels of early stress. With respect to the fact that maturation of the hippocampus is terminated only by the age of 3 or 4 (Schmajuk & DiCarlo, 1992), the HPA system is particularly sensitive to persistent alteration during the first years of life. As such, if the caregiver is not able to downregulate the infant's negative affect if necessary (the infant's hippocampus is not), *inflexible* (persistent) downregulation of

circadian cortisol levels may be the stopgap solution of the body to managing with high cortisol levels.

Despite these speculations and uncertainties, in sum, the present work lends strong support to the self-relaxation assumption, i.e. the idea that the self-system is actively involved in the regulation of negative affect.

Relationship to "Integrative competences and well-being"

The present work was accomplished in the context of the Graduate School "Integrative Competences and Well-being" – an interdisciplinary research training group funded by the German Research Foundation. The goal of this research group is to eluminate the relationships between integrative competences and well-being from the perspective of the respective field of research. What does "integrative competences" mean? From the perspective of personality psychology, most generally, this term may refer to *individual differences in the capability to tolerate or even dissolve subjective contradictions within the same or between different categories of representations or experiences such as affects, needs, goals, or self-attributions*. According to PSI theory, it is the self-system that constitutes the basis for this competence. As such, variability in integrative competences may be attributed to individual differences in structural features of the self (e.g., affective integration or complexity/extendedness) or access to this system, respectively[54], which in turn may function as a basis for personality traits such as rumination, self-esteem, self-determination, or even attachment anxiety (see below).

Several authors have paid attention to the organization of the self-system and its relevance to well-being. For example, Showers (1992a; 1992b; 1995; Showers & Kling, 1996) examined the relationships between affective organization of the self and acute as well as chronic well-being. She found that individuals with a tendency to blend out their negative self-aspects and keep them from their positive ones, generally have a higher level of well-being. Paradoxically at first sight, under adverse circumstances, these individuals show lower levels of well-being than those with an integrated structure of positive and negative self-aspects. Similarly, Showers & Kling (1996) examined the role of self-organization on the recovery from acute sad mood. It was found that individuals with an integrated self-structure benefited from the opportunity to be confronted with their self-aspects, whereas those focusing on their positive aspects exclusively did not. As such, individuals blending out their negative aspects, although showing positive well-being in general, might be vulnerable to rumination and depression whenever goals are thwarted because they are unable to integrate failure experiences and to come off, if necessary, of unfeasible goals (Brandtstädter & Rothermund, 2002b; Brandtstädter, Rothermund, & Schmitz, 1998). Conversely, individuals with an integrated self-structure recover from sadness or failure by relying on the self. To the extent that the self is conceived of an integrated structure of positive and negative self-aspects, negative self-aspects activate positive self-aspects, supporting the recovery from negative experiences in integrated individuals. Linville (1985; 1987b) focussed on a similar functional characteristic of the self, which is complexity (or "extended interconnectivity" of self-aspects). Similar to integrative competences as conceived of in Showers' work, Linville (1987b) found that self-complexity was *negatively* related to depressive symptoms and physical complaints in general. However, under high every day stress, self-complexity served as a buffer against the

[54] However, integrative competence does not only refer to a personality trait, i.e. to *inter*individual differences. Regarding inhibited access to the self during negative affect, as observed in state-oriented individuals (Baumann & Kuhl, 2003; Kuhl & Beckmann, 1994a; Kuhl & Kazen, 1994), integrative competence can also be conceived of as a state variable. As such, there can be intraindividual variability in integrative competence according to prevailing conditions, such as the presence of negative affect.

aforementioned symptoms. Recently, Rothermund & Meiniger (2004) linked self-complexity to the function of self-regulation, as it is also understood by PSI theory. According to the authors view, self-complexity is essential for reinterpreting negative experiences and reorientation, facilitating the recovery after negative life events (Brandtstädter & Rothermund, 2002b)[55].

Taking together the findings from Showers and Linville, individuals with high levels of integrative competences, or a highly intact self-system, may be vulnerable to negative affect in good times, but resilient in bad times, i.e. in times where resilience is most urgently needed. In PSI theory, high sensitivity towards negative experiences combined with high affect regulation capabilities is supposed to be a prerequisite for the self development: Only individuals who do not flinch from confrontations with negative experiences are able to integrate them into the landscape of personal experiences, i.e. the self, and to make meaning of them by linking them with existing positive experiences. As such, the ability to flexibly shift between negative affect, arousing through confrontation, and positive affect, arousing through its downregulation, can be seen as an integral part of integrative competences ("emotional dialectics", Kuhl, 2001). Indeed, the alternative interpretation of the cortisol response to awakening given in the discussion of chapter 3 is compatible with this view: To the extent that "normal" circadian cortisol level may be interpreted as a correlate of sensitivity to negative affect, HPA system activation triggered by the Hippocampus in the morning may be conceived of as a neurobiological underpinning of the vulnerability of the self.

These considerations have tremendous implications for the research on the link between personality and well-being: It does not suffice to relate personality to health outcomes unless the level of stress is controlled for. Thus, it may happen that individuals show higher levels of well-being in general although they may be highly susceptible to develop psychological or somatic symptoms during adverse circumstances. In contrast, those who feel less positive in general but have high self access or an intact self-system should be more stable and hold out under the stress because of their potential to self-regulate negative experiences, i.e. to associate them with positive self-aspects.

From a developmental perspective, integrative competences is considered to develop, in part, as a function of emotional warmth and affection of the caregiver (Kuhl, 2001; Main et al., 1985). In contrast, lack of "internalized" maternal warmth (insecure attachment) disables the individual to endure and counterbalance negative affects, which makes avoidance (in advance) and repression (after the encounter) of problems more likely. However, avoiding negative experiences prevents from acquiring appropriate conflict solutions in the long run, which are helpful whenever confrontation with negative experiences is inevitable. In a similar vein, repression of negative experiences is conceived of as a maladaptive way of coping, likely resulting in latent states of arousal (Gross, 1998) and, paradoxically, in greater preoccupation with the experience of concern (Wegner, 1994).

Although integrative competences in terms of self-complexity or affective integration were not directly measured in this study, the present work refers to these concepts by relying on the general idea of the self as a buffer against stress. As such, it was shown that activating the self after a negative event engenders elevated well-being in terms of acute positive affect and reduced negative affect, respectively. In this study, ruminators (state-oriented individuals) benefited from external support of self-access to a larger degree than did non-ruminators. To the extent that the self in ruminators is inhibited under high levels of stress only, it might be argued that rumination refers to the impairment of getting access to integrated competences (the self) under negative affect, whereas the aforementioned variables may refer to the

[55] In contrast to Linville, Rothermund and Meiniger understand self-complexity as the amount of different self-aspects rather than the degree of relatedness of self-aspects.

structure of the self-system as such. However, future research would be needed to explore the distinct properties of these personality functions.

Moreover, it was shown that individuals with impairments in self-development in terms of attachment anxiety show stronger cortisol increases in reaction to acute stress as well as a dysfunctional early morning cortisol regulation. Indeed, individuals with high attachment anxiety have been considered to have impairments in integrating positive and negative self-aspects (Main et al., 1985). This is in line with PSI theory, which postulates an inhibition of the self-system through high levels of negative affect. To the extent that functioning of the self-system preferentially relies on the integrative potential of the hippocampus (Kuhl, 2000a, 2001), the finding of high cortisol responses to acute stress in insecurely attached individuals might rely on inadequate hippocampus functioning during stress. For example, studies from Bremner and colleagues (Bremner & Narayan, 1998; Bremner et al., 1999; Bremner et al., 1995; Bremner et al., 1997; Schmahl, Vermetten, Elzinga, & Bremner, 2003) showed that the hippocampal structure is reduced in patients with posttraumatic-stress disorder, suffering from an inability to integrate the trauma. Consequently, a well functioning self-system (or hippocampus) may constitute a prerequisite of stable well-being and health. To the extent that the self, with both positive and negative self-aspects, is accessible, the individual can be provided by a continuous overview over personal needs and goals and can make unclouded judgments of whether needs become dissatisfied or not, for example, through infiltration of alien goals or social expectancies (Baumann & Kuhl, 2003; Kazén et al., 2003). Clearly perceiving one's personal needs and goals is also considered an integral part of self-determination (Deci & Ryan, 1983): Being self-determined as opposed to heteronomous draws on the ability to separate personal goals from alien ones. Indeed, self-determination was found to function as a determinant of well-being and life-satisfaction (Deci et al., 2001; Ryan & Deci, 2000).

To the extent that positive and negative affect function as indicators of need satisfaction or dissatisfaction, respectively, providing an implicit affect measure widens the scope of methodological approaches to investigate integrative competences: Administering the IPANAT in combination with self-report measures of affect enables to examine to which degree latent affects and those manifested in a person's consciousness are congruent or incongruent. Individuals who have difficulties to recognize their affective mental states or even "actively" suppress them in case they are negative, may thus be less informed about their personal needs and goals, which, in the end, might engender reduced well-being and health. Indeed, with respect to motives (McClelland et al., 1989) and self-esteem (Bosson, 2001; Schimmack & Diener, 2003), incongruencies between explicit and implicit representations have already been found to be associated with low well-being. The fact that impairments in the ability to recognize affects, commonly referred to as "alexithymia" (Parker & Taylor, 1997; Taylor et al., 1992), is a widespread phenomenon in patients with psychosomatic disorders, emphazises the adverse effects of impairments of integrative competences once more (provided that alexithymia is in fact a causal factor in developing somatic symptoms). That the IPANAT may be helpful in studying clinical symptoms such as alexithymia was demonstrated by a study presented in chapter 2.

The outline given in this section refers, explicitly or implicitly, to several prominent psychological constructs, such as self-congruence (Rogers, 1951), sense of coherence (Antonovsky, 1987) repression/suppression (Byrne, 1961; Freud, 1915; Gross & Levenson, 1993), alexithymia (Taylor et al., 1992), self-determination (Deci & Ryan, 1980), or emotional dialectics (Kuhl, 2001). Many others, which were not mentioned here, might be enclosed by any way one likes. At least semantically, all these terms may be subsumed under the more or less fuzzy generic term of integrative competences. To the extent that negative affect, which is considered to inhibit the self and, therefore, its integrative potential (cf.

chapter 1), “integrative competencies” is intimately linked to the topic of the present work – “The Self and the Regulation of Negative Affect”.

Brief Summary

Chapter 1 briefly sketched PSI theory, which was the theoretical framework underlying the present work. Chapter 2 presented the Implicit Positive And Negative Affect Test (IPANAT) and provided an extensive evaluation of this test. The IPANAT, which proved to be equipped with considerable reliability and validity, was then applied in an experimental study presented in chapter 3, which, as a result, supported the role of self-activation in mood improvement. Chapter 4 presented a study that demonstrated the dominant role of self-maturation, particularly attachment security (vs. anxiety), in the regulation of cortisol, which is the "endproduct" of the Hypothalamus-Pituitary-Adrenocortical "stress" system. Chapter 5 summarized the essential empirical findings of the separate chapters, linked them to each other, discussed them against the background of the topic of "self and negative affect regulation", and in turn linked the latter to the topic of "Integrative Competences and Well-being".

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Appendix

Implicit Positive and Negative Affect Test (IPANAT)

„The following words are from an artificial language. They are intended to express various moods. In all languages, there are words that already express their meanings by means of the way they sound (for example, the word „rattle“ sounds almost like something that rattles). For each of the following words, please judge how well they express different moods (for example ‚How much does the sound of the artificial word „FILNU“ conveys each of the following moods? Pleased, helpless, energetic, tense, passive, relaxed, or aggressive). In doing these judgments, follow your spontaneous feelings.

		Doesn't fit at all	Fits somewhat	Fits quite well	Fits very well
SAFME	Pleased	⓪	①	②	③
	Helpless	⓪	①	②	③
	Energetic	⓪	①	②	③
	Nervous	⓪	①	②	③
	Passive	⓪	①	②	③
	Relaxed	⓪	①	②	③
	Aggressive	⓪	①	②	③
VIKES	Pleased	⓪	①	②	③
	Helpless	⓪	①	②	③
	Energetic	⓪	①	②	③
	Nervous	⓪	①	②	③
	Passive	⓪	①	②	③
	Relaxed	⓪	①	②	③
	Aggressive	⓪	①	②	③
TUNBA	Pleased	⓪	①	②	③
	Helpless	⓪	①	②	③
	Energetic	⓪	①	②	③
	Nervous	⓪	①	②	③
	Passive	⓪	①	②	③
	Relaxed	⓪	①	②	③
	Aggressive	⓪	①	②	③
TALEP	Pleased	⓪	①	②	③
	Helpless	⓪	①	②	③
	Energetic	⓪	①	②	③
	Nervous	⓪	①	②	③
	Passive	⓪	①	②	③
	Relaxed	⓪	①	②	③
	Aggressive	⓪	①	②	③
BELNI	Pleased	⓪	①	②	③
	Helpless	⓪	①	②	③
	Active	⓪	①	②	③
	Nervous	⓪	①	②	③
	Passive	⓪	①	②	③
	Relaxed	⓪	①	②	③
	Aggressive	⓪	①	②	③
SUKOV	Pleased	⓪	①	②	③
	Helpless	⓪	①	②	③
	Active	⓪	①	②	③
	Nervous	⓪	①	②	③
	Passive	⓪	①	②	③
	Relaxed	⓪	①	②	③
	Aggressive	⓪	①	②	③

Table 16

Intercorrelations between PANAS positive and negative affect scales (N = 119)

	PA time 2	NA time 1	NA time 2
positive affect time 1	.66	-.65	-.47
positive affect time 2		-.43	-.56
negative affect time 1			.66

Notes. all p's < .001 (two-tailed)

Table 17

Pearson-Correlations between (explicit) PANAS positive and negative affect scales and diverse personality, affective, and self-regulation scales

	N	PA time 1	PA time 2	NA time 1	NA time 2
PANAS pos (chronic)	66	.42**	.49**	-.19	-.18
Extraversion (NEOFFI)	119	.56**	.52**	-.33**	-.32**
Optimistic Style (PSDI)	119	.52**	.55**	-.29**	-.25**
Schizoid Style (PSDI)	119	-.30**	-.27**	.19*	.11
Action orientation (AOF)	119	.32**	.51**	-.21*	-.31**
Action orientation (AOD)	119	.16	.29**	-.08	-.25**
Activation control (VCI)	119	.32**	.49**	-.10	-.21*
Reappraisal (PRI)	119	.22	.28*	-.08	-.04
Progressive coping (PRI)	66	.34**	.58**	-.15	-.29*
PANAS neg (chronic)	66	-.26*	-.42**	.11	.28*
Neuroticism (NEOFFI)	119	-.36**	-.49**	.32**	.41**
Depression (HADS)	66	-.06	-.16	-.06	-.08
Anxiety (HADS)	66	.04	.13	-.17	-.28*
Negativistic Style (PSDI)	119	-.11	-.20*	.28**	.31**
Regressive coping (PRI)	66	.22	.20	.05	.09
Loss of concentration (VCI)	119	-.13	-.19*	.24**	.31**

Table 18

More Pearson-Correlations between implicit affect and questionnaire variables

	N	IPA time 1	IPA time 2	INA time 1	INA time 2
Narcissistic (SEKS)	119	-.03	-.03	.30**	.39**
Narcissistic (PSDI)	119	.21	.20*	.20*	.28**
Soc. orient. in ach. motive (MET)	119	-.03	.03	.25**	.37**
Activation control (VCI)	119	.36**	.41**	.06	.04
Evaluative extremity	66	.39**	.43**	-.33**	-.29*
Alexithymia (TAS, perception)	45	.21	.18	.40**	.31**
Physical complaints (SCL-90)	66	.27*	.19	.41**	.38**
Affiliation motive (MET)	119	.23*	.16	.05	.03
Achievement_motive (MET)	119	.25**	.30**	.03	.13
Power motive (MET)	119	.13	.14	.23*	.32**
Affiliation “Intimacy” (OMT)	66	.21	.20	-.22	-.29*
Achievement “Internal standards” (OMT)	66	.16	.07	-.12	-.30*
Achievement “Competition” (OMT)	66	.13	-.03	.44**	.44**
Power “Leadership” (OMT)	66	.14	.05	-.15	-.30*
Sense of Coherence (SOC)	66	.17	.18	.07	.05
Self-esteem (RSES)	66	-.06	-.06	.04	.01
Satisfaction with Life (SWLS)	66	.07	.01	.03	.05
well-being (WBS)	66	.07	.06	-.09	-.06

Notes. * $p < .05$; ** $p < .01$ (two-tailed)

Soc. Orient. in ach. motive = Social Orientation in achievement (Individuals strongly evaluate their performance in the light of other’s performance).

Evaluative extremity = positive evaluation of trait adjectives is negatively correlated with negative evaluation (“How positive is X?” in contrast to “How negative is X?”).

Cat. = Implicit Motives Categories, see OMT

VCI = Volitional Components Inventory (Kuhl & Fuhrmann, 1998, 2001)

PSDI = Personality Style and Disorder Inventory (Kuhl & Kazén, 1997)

OMT = Operant Motive Test (Kuhl et al., 2003; Scheffer, Kuhl, & Eichstaedt, 2003)

WBS = Well-Being-Scale of the World Health Organization (Bonsignore, Barkow, Jessen, & Heun, 2001; Heun, Burkhard, Maier, & Bech, 1999)

MET = Motive Enactment Test (Kuhl, 1999)

TAS = Toronto Alexithymia Scale (Kupfer, Brosig, & Brähler, 2001; G. J. Taylor et al., 1992)

SCL-90 = Symptom Checklist (Leonard R. Derogatis, Rickels, & Rock, 1976)

Table 19

Pearson-Correlations between explicit PANAS positive and negative affect scales and questionnaire variables

	N	PA time 1	PA time 2	NA time 1	NA time 2
Narcissistic (SEKS)	119	-.12	-.16	.24**	.24**
Narcissistic (PSDI)	119	.35**	.24**	-.10	-.05
Soc. orient. in ach. motive (MET)	119	.02	-.04	.11	.10
Activation control (VCI)	119	.32***	.49***	-.10	-.21*
Evaluative extremity	66	.21	.23	-.18	-.23
Alexithymia (TAS, perception)	45	-.01	-.11	.30*	.27
Physical complaints (SCL-90)	66	-.03	-.16	.17	.36**
Affiliation motive (MET)	119	.23*	.20*	-.03	.04
Achievement_motive (MET)	119	.33**	.27**	-.12	-.17
Power motive (MET)	119	.27**	.16	-.02	.02
Affiliation “Intimacy” (OMT)	66	.00	.02	.07	.05
Affiliation “Attachment” (OMT)	66	.18	.07	-.25*	-.15
Achievement “Internal standards” (OMT)	66	.13	.06	-.19	-.18
Achievement “Learning from failure” (OMT)	66	.35**	.14	-.08	.03
Achievement “Competition” (OMT)	66	.21	.18	-.14	-.01
Power “Leadership” (OMT)	66	.23	.32**	-.22	-.44***
Sense of Coherence (SOC)	66	.22	.32**	-.16	-.21
Self-esteem (RSES)	66	.01	.20	.12	-.03
Satisfaction with Life (SWLS)	66	.13	.31**	.11	-.05
well-being (WBS)	66	.25*	.29*	-.07	-.19

Notes. * p < .05; ** p < .01; *** p < .001 (two-tailed)

Table 20

Prime stimuli either preceded by my (self-activation) or the (neutral)

German (original)	*English (translation)*
Alter	age
Bett	bed
Charakter (2 times)	character
Erfolg	success
Geburtstag	birthday
Gesicht	face
Körper	body
Misserfolg	failure
Name	name
Stil	style
Studium	studies
Zuhause	home
Haare	hair
Identität	identity
Kleidung	clothing
Musik	music
Person	person
Schwächen	weaknesses
Stärken	strengths
Stimme	voice
Träume	dreams
Vorlieben	preferences
Ziele	goals

Table 21

Short form of the Self-Determination Scale (alpha = .81) extracted from the Volitional Components Inventory (Kuhl & Fuhrmann, 1998)

1. In doing what I do, I feel it was me who chose to do it.

   [Bei meinen Handlungen spüre ich meist, daß ich es bin, der so handeln will.]

2. I feel that most of the time I really want to do the things I do.

   [Meist handle ich in dem Bewußtsein, das, was ich tue, selbst zu wollen.]

3. Even when problems appear, I'm sure most often that it will work out somehow.

   [Auch wenn Probleme auftauchen, bin ich mir meist sicher, daß es irgendwie klappt.]

4. Even in difficult situations, I trust in me coping with the problems somehow.

   [Auch in schwierigen Situationen vertraue ich darauf, daß ich die Probleme irgendwie bewältigen werde.]

Notes. First 2 items refer to self-congruence, next 2 items refer to optimism/self-confidence. Both components are relevant to self-determination.