Exploring the Possibilities and Boundaries of the IPANAT: Distinct Emotions and Affect Regulation

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I dedicate this dissertation to my parents, Hans-Heinrich and Getraude Bode.

May it be worthy of all the effort you put into supporting me while I was writing it.

Ich widme diese Dissertation meinen Eltern Hans-Heinrich und Gertraude Bode.

Ich hoffe, dass sie all der Unterstützung von Euch, die ich während meiner Arbeit an ihr von Euch bekommen habe, würdig ist

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General Abstract

This dissertation extends previous work on the Positive and Negative Affect Test (IPANAT), a test that was developed to measure affective processes at an implicit (supposedly automatic, preconscious) level. In particular, the first manuscript that is included in this dissertation demonstrates that the IPANAT picks up on processes resembling counter-regulation (cf. Rothermund, Voss, & Wentura, 2008) after exposure to negatively valenced emotional stimuli. The IPANAT might therefore be a suitable measure of affect regulation in some contexts. Furthermore, the second manuscript introduces a version of the IPANAT that was designed for the measurement of distinct emotions, the IPANAT for distinct emotions (IPANAT-DE). Finally, the third manuscript and an additional supplemental study not yet submitted for publication provide evidence that the subscales of the IPANAT-DE are sensitive to priming with different emotional expressions, and that facial expressions of the same valence but of different distinct emotions trigger emotion specific changes of IPANAT-DE scores. In the last part of this dissertation, the three manuscripts and the supplemental study are discussed with respect to three overarching issues: 1. The kinds of processes that might drive IPANAT scores and whether these processes are indeed influenced by affective experience or whether they are purely cognitive. 2. How IPANAT scores are related to other aspects of affect. 3. How the IPANAT can be adapted to different research questions as well as to applied contexts.

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1 Introduction to the Dissertation

Affect is central to human functioning. It influences human behavior both directly via action tendencies (e.g., Frijda, 1986) as well as indirectly by influencing cognition in all its different forms (e.g., Lerner & Keltner, 2001). Mirroring the central role of affect, theories on its functions and origins reach back to the beginnings of modern psychology and the works of Darwin (1872) and James (1884). Furthermore, affect itself and interventions aimed at changing maladaptive affective states play a central role in clinical psychology. Yet, even though there are a number of influential contemporary theories of affect (e.g., Ekman, 1972; Frijda, 1988; Scherer, 1982, 1984), and while an even greater amount of research (sometimes tacitly) assumes a mediating or moderating role of affect or affect related phenomena in the relationship of cognition and behavior (e.g., Greenberg, Pyszczynski, & Solomon, 1986), the role of affect in human functioning appears to be under-investigated if one considers that affective processes are likely to be involved in some form in practically all types of human behavior and cognition. After all, just as humans cannot stop perceiving or thinking, they cannot stop feeling either.

One of the reasons for this imbalance might be that affective processes are notoriously hard to define (Frijda & Scherer, 2009) and that the discussion on the basic nature and definition of affective processes is still ongoing. Another related reason might be that even if one is successful in defining affect, it remains hard to measure. In fact, most affective research has relied on self-report of affect – a technique that is vulnerable to limitations to individuals' introspective abilities (e.g., Lane et al., 1996; Sifneos, 1972) and to demand effects (Westermann, Spies, Stahl, & Hesse, 1996). As a remedy to this situation, Quirin, Kazén, and Kuhl (2009) have introduced an alternative to self-report measures, the Implicit Positive and Negative Affect Test (IPANAT). The IPANAT circumvents some of the processes that influence traditional self-report measures in unwanted ways by asking participants to rate how much a number of artificial words sound like several affective adjectives instead of asking them directly how much they feel like each of the adjectives.

While previous work on the IPANAT supports its validity and usefulness as a measure of undifferentiated positive and negative affect, the work introduced in this dissertation aims to extend these findings by (a) investigating changes in IPANAT scores as a result of affective counter-regulation (Koole & Jostmann, 2004; Rothermund, Voss, & Wentura, 2008), (b) introducing a new version of the IPANAT that is able to distinguish between distinct emotions instead of between undifferentiated positive and negative affect, and (c) showing that this new version is sensitive to emotional priming of specific emotions. In addition to these three main topics, I will also present some preliminary evidence that the IPANAT can be adapted to the measurement of affective time course and that it can be successfully applied in different cultural contexts. I will then discuss several unanswered questions concerning the processes underlying the IPANAT and suggest ways how the IPANAT can be further improved. First, however, I will briefly review the theoretical foundation underlying the IPANAT, previously obtained evidence of its validity and reliability, as well as why application of the IPANAT to the measurement of emotion regulation and distinct emotions is desirable.

1.1 Foundations of the IPANAT

The procedure used in the IPANAT is projective in nature and resembles the procedures of several other implicit tests, such as the Affect Misattribution Procedure (AMP; Payne, Cheng, Govorun, & Stewart, 2005), an implicit attitude measure in which participants judge whether they like or do not like neutral Chinese ideographs, and the Name Letter Task (Nuttin, 1985) an implicit measure of self-esteem in which participants rate the letters of the alphabet (higher ratings of the letters of their name compared with other letters indicates higher self-esteem). In addition, as other implicit measures, the IPANAT is assumed to tap into automatic, associative, low-effort processes described in two-process models[1] (cf. Smith & DeCoster, 2000) rather than the deliberate, systematic, high effort process on which self-report measures are based. In this context, Quirin, Kazén, and Kuhl (2009) have defined implicit affect as measured by the IPANAT as “the automatic activation of cognitive representations of affective experiences“ (p. 508). As such, the IPANAT does not directly measure the affective core experience[2], which is probably based on activation of subcortical and evolutionarily old brain structures, such as the limbic system (Panksepp, 1998), but their cognitive reflection in the cerebral cortex.

Furthermore, IPANAT scores have been shown to have both, a state and a trait component, which can be separated through repeated measurement. According to Bower (1981; Bower & Forgas, 2000), different affective states are represented as nodes that become activated if an individual experiences the respective state. These affective nodes are in turn linked via associative networks to adjective labels referring to the respective state. The stronger a node, the more easily the node itself and the associated adjective labels become activated. The adjective labels are then used preferentially to rate the artificial words that are part of the IPANAT, thereby influencing the trait component of implicit affect (which has been shown to correlate with affect-related personality traits, such as neuroticism in the case of implicit negative affect and extraversion in the case of implicit positive affect, cf. Quirin, Kazén, & Kuhl, 2009). In contrast, the state component of implicit affect is based on the actual momentary activation of a concept by the situation, that is, the part of the activation of the associative network that can be explained by recent exposure to affective stimuli of some kind.

1.2 Properties of the IPANAT: Validity and Reliability

In previous studies, the IPANAT has been shown to be a reliable and valid instrument. In particular, Quirin, Kazén, and Kuhl (2009) found that the mean adjective scores (i.e., mean ratings for each adjective across all artificial words) of the original version of the IPANAT load on two orthogonal components that represent positive and negative affect in a principle components analysis. When applying this version of the IPANAT, the mean adjective scores are therefore further summarized into a positive and a negative implicit affect subscale. In their second study, Quirin, Kazén, and Kuhl also showed that IPANAT scores correlate with several personality and affective measures related to positive and negative affectivity, thereby demonstrating convergent validity. In particular, positive implicit affect correlates positively with explicit positive state and trait affect as well as with extraversion (cf. Lucas & Fujita, 2000). Negative implicit affect, on the other hand, correlates positively with explicit negative state and trait affect, with neuroticism and with physical complaints (cf. Nemanick & Munz, 1997). Moreover, IPANAT positive and negative affect scales but not corresponding explicit affect scales correlated with an alternative measure of implicit affect, namely positive versus negative word fragment solutions, respectively, suggesting that the IPANAT indeed measures implicit affect rather than derivatives of explicit affect.

Additional work by Quirin, Kazén, Rohrmann, and Kuhl (2009), which investigated the relationship of implicit affect and changes in saliva cortisol concentration, further found that negative implicit (but not explicit) affect was positively correlated to increases in cortisol after acute stress while positive implicit (but not explicit) affect was negatively correlated with circadian cortisol response. Furthermore, Quirin and Lane (2012) have discussed potential brain mechanisms that might underlie implicit affect and stressed the importance of implicit affect.

The IPANAT has been shown to be sensitive to priming with emotional pictures as well as with movie clips that have an emotional content (Quirin, Kazén, & Kuhl, 2009). Finally, previous results suggest that the IPANAT might be sensitive to reminders of death and terrorism (Luckey, 2009). This is particularly interesting since studies reminding participants of their mortality usually find no changes in explicit affect (Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989).

1.3 The IPANAT as a Measure of Affect Regulation

An important topic with regard to the just presented findings, for example the negative correlation between implicit positive affect and circadian cortisol response (Quirin, Kazén, Rohrmann, et al., 2009), is the possible role of implicit affect in affect regulation. Affect regulation refers to changing the time course and duration of an affective episode (Koole, 2009). Affect regulation has largely dealt with conscious an effortful ways to change a negative affective state to a more positive one, for example through conscious reappraisal (e.g., Beck, Rush, Shaw, & Emery, 1979; Gross & John, 2003; Lazarus, 1993; note, however, that reappraisal might also occur automatically, see Gross & John). However, recent research has also found evidence for automatic, effortless forms of affect regulation that influence attention to information instead of on appraisal of already perceived information. For example, Rothermund and his colleagues (2008) have found evidence that individuals shift their attention automatically to stimuli of the opposite valence after being confronted with positive or negative performance feedback, supposedly in order to avoid perpetuation of their emotional state and to stay open to information of the opposite valence that might be relevant to them. Replies on the IPANAT might – in contrast to deliberated replies on self-report measures of affect –be influenced by such low-level automatic processes. In fact, participants completing the IPANAT after a negative mood induction might even pay selective attention to the features of the artificial words that they judge as positive in order to regulate their emotion.

1.4 Undifferentiated Affect versus Distinct Emotions

As previously described, the IPANAT in its original form measures unspecific positive and negative affect. While some researchers have stated that what I have called core affective experience (and what they call core affect) is, in fact, undifferentiated and defined by the two dimensions valence (positive vs. negative) and arousal (high vs. low), and that seemingly distinct emotions are situation dependent interpretations of this core affect (e.g., Barrett & Russell, 1999), other researchers argue that distinct emotions exist even on the subcortical “core” level (e.g., Panksepp, 1998). In addition, there is research linking certain appraisal patterns (i.e., interpretations of environmental stimuli) to distinct emotions and associated action tendencies (e.g., Lerner & Keltner, 2001).

In this context, it is also conceivable that affect regulation does not always work by changing a negative affective state into a more positive one (or, probably more rarely, a positive into a more negative one). Instead, one negative emotion might be changed into a different negative emotion under certain circumstances. For example, a disappointing or hurtful event might first lead a person to feel sad and/or helpless. By reinterpreting the circumstances that lead to the event, however, this sadness might change into anger, a change that can be functional in certain situations since anger is more conductive to taking action than sadness. To assess such a process at the implicit emotional level the IPANAT would need to measure distinct negative emotions instead of undifferentiated positive and negative affect.

1.5 The Present Dissertation

In the remainder of this dissertation, I will present three manuscripts, one which has been published (see Quirin, Bode, & Kuhl, 2011) and two which have been submitted for publication. The first, published, manuscript deals with the IPANAT as a measure of affect regulation, the second manuscript deals with the development and factor structure of an IPANAT version designed to measure four distinct emotions, the IPANAT-DE, and the third manuscript deals with the application of some of the subscales of the IPANAT-DE in priming experiments. Further included in the dissertation is the description of a supplemental study which answers some of the questions concerning priming of distinct emotions and its influence on the IPANAT-DE that are not answered in the third manuscript. The dissertation closes with a discussion of the nature of implicit affect in general, the mechanisms underlying the IPANAT, as well as with a discussion of the findings and adaptations presented in this dissertation. In particular, I will raise a number of questions that need to be answered in order to adequately interpret IPANAT scores and propose research approaches that might contribute to the required answers. […]

[This is an electronic short version of the dissertation meant for publication. For reasons of copyright, the three manuscripts meant for publication in peer-reviewed journals as well as the respective supplemental material have been omitted.]

2 Increases in Implicit Positive Affect: An Indicator of Affect Regulation (Manuscript 1)

Previous research has shown that positive affect plays a vital role in coping with negative affective experiences. The manuscript describes two studies in which changes in positive and negative affect implicit and explicit affect in response to a threat-related prime were assessed. Results showed an increase in implicit positive affect, which we interpreted as an indicator of affect regulation. In addition, Study 2 also provided evidence that such an increase can be promoted by priming self-referential stimuli, which suggests that the self might be implicated in this type of affect regulation.

The full manuscript has been published as:

Quirin, M., Bode, R. C., & Kuhl, J. (2011). Recovering from negative events by boosting implicit positive affect. *Cognition and Emotion, 25,* 559-570.

3 Measuring Distinct Emotions at the Implicit Level: The IPANAT-DE (Manuscript 2)

The manuscript introduces a version of the Implicit Positive and Negative Affect Test (IPANAT) that has been developed for the measurement of the distinct emotions happiness, fear, sadness, and anger (IPANAT-DE). Exploratory factor analysis in two German and a Turkish Sample provided evidence that the intended four subscales correspond to the underlying structure of the measure. Furthermore, a confirmatory factor analysis on data from a pooled sample also found that the four factor solution outperforms an alternative two and three factor solution.

The full manuscript has been submitted as:

Bode, R. C., Kuhl, J., & Quirin, M. (2014). Measuring distinct emotions at the implicit level: The IPANAT-DE. Manuscript submitted for publication.]

4 That Makes Me Implicitly Sad or Happy: The Influence of Facial Primes on Implicit Emotions (Manuscript 3)

The manuscript describes evidence that the happiness and sadness subscales of the IPANAT-DE are sensitive to changes in state affect that occur in response to supraliminal (Study 1) or subliminal (Study 2) visual primes. While participants that were primed with happy faces showed a significant increase in happiness, participants primed with sad faces showed a significant increase in sadness. Apart from further validating the IPANAT as a measure of implicit emotions, the data also provides evidence that emotions can be primed subconsciously.

The full manuscript has been submitted as:

Bode, R. C., Quirin, M. (2013). That makes me implicitly sad or happy: The influence of facial primes on implicit emotions. Manuscript submitted for publication.

5 Effects of Priming with Happy, Angry, and Sad Faces on Implicit Happiness, Anger, Sadness, and Fear (Supplemental Study)

5.1 Introduction

I have provided evidence that both, implicit sadness as well as implicit happiness change in response to priming with emotional faces, which supports the usefulness and validity of the implicit sadness and happiness subscales of the IPANAT-DE. However, these findings cannot answer the question whether different implicit negative emotions as assessed with the IPANAT-DE can be selectively primed. It is still possible that the fear and anger subscales of the IPANAT-DE would have shown the same pattern as the sadness subscale. It is further possible that no distinct patterns of change would have been obtained for the different negative emotion subscales if different negative primes had been used (e.g., angry or fearful looking faces). Based on the presented data it therefore cannot be concluded that the IPANAT-DE actually offers an improvement over the original IPANAT when used in priming studies. Furthermore, my findings also allow no inferences concerning the existence of distinct emotions at the implicit level.

To remedy these shortcomings, I will present an additional study that has not yet been submitted for publication. This study extends the two studies in Manuscript 3 by (a) using several different types of negative facial primes and (b) assessing the influence of these primes on all four subscales of IPANAT-DE – including the three subscales for different negative emotions. If implicit sadness, fear, and anger actually exist as distinct emotions, it should be possible to selectively prime one of them without also priming the others. In contrast, if distinct negative emotions do not exist at the explicit level, it should not be possible to find differential effects of different negative primes. Instead, all three negative emotions should increase indistinctly to any negative prime, regardless of the prime's specific features.

In the following study, I used two different negative primes: Angry and sad faces. In addition, happy faces were used as a positive prime. Based on the assumption that happiness, sadness, anger, and fear are distinct negative emotions, I expect specific priming patterns for each of these emotions. With respect to implicit happiness I predicted that happy primes increase implicit happiness, while both, angry and sad primes should either have no effect on or decrease implicit happiness. Also in line with Manuscript 3 (Section 4), I predicted that sad primes increase implicit sadness, while happy and angry primes should either have no effect on or decrease sadness. Regarding implicit anger and fear, I expected both, happy and sad primes to either have no effect or to decrease implicit anger and fear.

I made no predictions concerning possible main effect of angry primes on either implicit anger or fear since the effect of priming with angry faces of these primes have previously found to depend on moderating personality factors. In particular, an angry face looking at the observer might evoke fear or anger, depending on the observer's personality (e.g., Phan, Fitzgerald, Nathan, & Tancer, 2006; see also Schultheiss & Hale, 2007). Therefore the study does include a number of personality measures, which were investigated as possible moderators of the influence of angry primes on implicit anger and fear.

Further, I included a measure for explicit emotions. However, since I used prime durations that I expected to result in subliminal priming, and since I did not find significant priming effects on explicit emotions in Study 2 in Manuscript 3 (Section 4.4) I did not predict any prime congruent changes in explicit emotions in this study.

5.2 Method

5.2.1 Design

The design used was a 2 (Emotion Primed, between participants: anger, sadness, or happiness) x 2 (Prime Duration, between participants: 14 ms or 100 ms) x 2 (Time of Measurement, within participants: pre or post manipulation) x 4 (Emotions Measured, within participants: anger, sadness, fear, and happiness) mixed design. Both, implicit and explicit emotions were measured as dependent measures. A number of personality variables was also measured and assessed as possible moderators of the relationship between primes and implicit emotions.

5.2.2 Participants

Sixty-four undergraduate students at Osnabrück University who majored in various subjects other than psychology participated in the study in return for 6 euro compensation. Fourteen participants were excluded from analysis because they indicated during debriefing that they had correctly recognized the facial expression of the primes shown to them (mentioning the correct valence but no or the wrong specific emotion was rated as a correct recognition) and that they had also guessed that the study dealt with the influence of emotional primes on their replies to other parts of the experiment (see Results section for details). The remaining participants (14 females, 35 males, one participant of unknown gender) were aged between 19 and 42 years, M = 23.10 years, SD = 3.94 years.

5.2.3 Materials

Priming stimuli. We used pictures from the Montreal Set of Facial Displays of Emotion (Beaupré & Hess, 2005) as emotional primes. In particular, we used pictures of 12 models, each of which was pictured three times, each time with a different facial expressions (happy, angry, or sad). Four models each were of African (models 31, 33, 36, and 38), Asian (models 11, 12, 15, and 16), and European (models 21, 23, 26, and 28) descent with equal numbers of male and female models representing each ethnicity.

Implicit Positive and Negative Affect Test. We used a version of the IPANAT-DE (Manuscript 2) with four artificial words (*VIKES*, *BELNI*, *TALEP*, and *TUNBA*) and twelve adjectives. The adjectives were identical to the ones used in Study 1 of Manuscript 2 (Section 3.3). Participants rated the artificial words according to how much they sounded like each of the adjectives on a scale from 1 (*doesn’t fit at all*) to 6 (*fits very well*). Just as in the studies described in Manuscript 3 (Section 4), participants were given exactly 5 s to rate each adjective-artificial-word pair. If they entered their rating before the allotted time was over, the pair would stay on screen until the 5 s had passed. The specific procedure, in particular the order in which primes and adjective-artificial-word pairs were presented, is described below in the Procedure (Section 5.2.4). Cronbach’s alpha values for the

IPANAT-DE subscales in the sample used for the analyses at baseline and during the priming block can be found in Table 5.1.

Explicit Affect Measure. The explicit affect measure consisted of the twelve adjectives already used in the IPANAT-DE. In particular, each adjective was presented within sentences taking the form *I currently feel [adjective]*. Participants indicated how much they agreed with each of the resulting 12 statements on 6-point scales ranging from 1 (*doesn't fit at all*) to 6 (*fits very well*). Cronbach's alpha values in the sample used for the analyses of all four scales pre- and post-manipulation are shown in Table 5.1.

Table 5.1
Internal Consistency (Cronbach's Alpha) of IPANAT-DE and Explicit Affect Subscales at Baseline and During/Post-Priming

Time	Happiness	Anger	Sadness	Fear
		IPANAT-DE		
Baseline	.88	.67	.82	.68
Priming	.89	.77	.84	.84
		Explicit Scales		
Baseline	.74	.92	.89	.90
Post-Priming	.91	.92	.92	.93

Personality Measures. Power, affiliation, and intimacy motive as well as a generalized fear factor were measured with the ultra-short version of the Unified Motive Scales (Schönbrodt & Gerstenberg, 2012; three items per scale). Achievement motive, which is also part of the UMS was not included since I did not expect it to moderate the effect of facial primes in general and of angry faces in particular on participants affective state because it is not a social motive. Three Factors of the Big Five, Neuroticism, Extraversion, and Agreeableness, were measured by the respective items of the German 21-item short version of the Big Five Inventory (Rammstedt & John, 2005). I included these factors but not Openness and Conscientiousness because Extraversion and Neuroticism have previously been linked to positive and negative affect respectively (e.g., Lucas & Fujita, 2000;

Nemanick & Munz, 1997) while Agreeableness determines social behavior and has been identified as a possible moderator of implicit affect changes after exposure to facial primes in Manuscript 3, Study 1 (Section 4.3). Finally, I measured self-esteem with the Rosenberg Self-Esteem Scale (Rosenberg, 1965; see von Conalli & Herzberg, 2003, for the German version used in this research). Cronbach's alpha of all personality scales except for the intimacy scale of the UMS were above .68 and therefore judged as satisfactory. For intimacy, Cronbach's alpha was .46 and therefore somewhat low.

5.2.4 Procedure

In line with the cover story (see below) participants were recruited for participation in a study on "intuition and knowledge of human nature". After arriving in the lab, participants were seated in separated cubicles, and completed the baseline IPANAT-DE and explicit affect measure on a computer. During the IPANAT-DE, each artificial word was paired with all twelve adjectives before the next artificial word appeared. The order of artificial words was partially counterbalanced while the order of adjectives was randomized for each artificial word. More specifically, participants completed one of four versions of the IPANAT-DE, each version beginning with a different artificial word, but with the absolute order of words staying constant across participants. The items of the explicit affect measure were presented in a random order.

After completing the baseline implicit and explicit affect measures, participants completed a paper-pencil questionnaire package containing the scales described above as well as some other scales that were completed as part of a pilot study and are not further described. In total, completion of the paper-pencil questionnaires took approximately 10 to 15 min.

The paper-pencil questionnaires were followed by prime presentation alternated with rating the artificial words of the IPANAT for a second time. To reduce participants' suspicions concerning the true aim of the study, the IPANAT-DE was introduced as a measure of situational intuition – supposedly an important determinant of impression formation. For each trial, participants first saw a fixation cross for 500 to 1,750 ms. They were then presented with the first happy, angry, or sad prime, for either 14 or 100 ms, depending on the randomly assigned condition. Each prime was followed by a mask which consisted of a blurred picture of the previously shown person with a neutral facial expression and was shown for 100 ms. Directly after the mask, participants rated one artificial word according to four adjectives, one adjective from each emotion scale, with each adjective-artificial-word pair staying on screen for five seconds. Consequently, it took a group of three primes until participants had rated the respective artificial word according to all twelve adjectives. Afterwards, the next group of three primes followed between which participants rated the next artificial word. The order of primes was randomized, while the order of artificial words was the same as during baseline for each participant. Furthermore, the order and specific identity of the adjectives that were presented after each prime was also randomized.

After priming and completion of the second IPANAT-DE, participants completed the explicit affect measure for a second time with the single items once more being presented in random order. To check if participants had recognized the facial expression with which they were primed, they were then shown each of the faces used in the priming procedure with a happy, sad, and angry expression, with each set of three pictures of one person presented on a separate screen and for an unlimited amount of time. Participants were asked to indicate which facial expression they had previously seen via pressing 1, 2, or 3 with each of the numbers being assigned to one of the pictures. After each set, participants were asked to indicate how likeable they found the pictured person on a scale from 1 (*not at all*) to 6 (*very much*). Finally, participants were asked three quantitative control questions concerning their guesses and suspicions of the aim of the study:

1. *Did you notice something unusual about the faces shown during the intuition measurement?*
2. *If possible, please describe the faces you were presented with*.
3. *What do you think was the aim of the experiment?*

Afterwards, they were thanked, paid, and given the opportunity to sign up with their email address for a later debriefing via email on a separate list that could not be matched with their anonymously collected data.

5.3 Data Analysis and Results

5.3.1 Exclusion of Participants on Basis of the Control Questions

As mentioned during the description of the sample, several participants were excluded based on their answers to the control questions. In particular, I excluded all participants who had mentioned in response to one or both of to the first two control questions that they had predominantly or exclusively seen faces with the respective priming emotion and who at the same time mentioned in response to the third control question that the study dealt either with the effect of the primes on their subsequent responses, with the effect of the primes on their emotions, or with the effect of emotions on ratings of objects or words. The reasoning behind requiring both (conscious) recognition of the facial expressions used during priming and some notion of the aim of the study was that in order for participants to consciously adjust their ratings on the IPANAT-DE based on their knowledge about the aim of the study they would have to know both, the emotion that was primed as well as (a rough version of) my hypotheses. Note that I applied rather lenient criteria concerning what was counted as recognition of the emotion: If participants mentioned the correct valence but not the correct specific type of the emotion, in other words if they expressed that the faces had all shown a specific negative emotion other than the one actually shown, or if they said that the faces had shown general negative expressions in either the sadness or anger condition, this was counted as a correct reply. Similarly, the criteria applied to what counted as a possible recognition of the hypothesis were also quite lenient. Therefore, not all excluded participants might have actually have had enough knowledge to adjust their replies. However, the criteria were chosen in order to maximize the likelihood that the results were indeed untainted by demand effects.

Overall, 20 participants who were exposed to primes for 100 ms and 8 participants who were exposed to primes for 14 ms correctly recognized at least the valence of the primed emotion. Fourteen participants who were exposed to primes for 100 ms and 11 participants who were exposed to primes for 14 ms indicated that they might have guessed at least the general direction of the hypotheses. As already mentioned, 14 participants, 12 of whom were exposed to primes for 100 ms and 2 of whom were exposed to primes for 14 ms, had both recognized the valence of the priming emotion and indicated that they might have guessed the hypothesis and were excluded from the analysis. As can be seen from these numbers, participants more often named the facial expression they were primes with if they were exposed to 100 ms primes instead of 14 ms primes. I did not test for the significance of this difference, though, since prime duration had no effect for any of the main outcomes of the study except for the correct recognition of the specific primes used (see next section).

5.3.2 Recognition of Specific Primes

Based on participants' answers to the questions which of the three specific pictures they had seen for each of the models, I computed three two-way ANOVAs with prime duration and emotion primed as between-participants factors and number of (correctly or incorrectly) recognized angry, happy, and sad faces as the respective dependent variables. All three ANOVAs found a significant main effect of emotion primed, $F\ (2, 44) = 8.17$, $p = .001$, $\eta^2 = .27$ for recognized angry faces, $F\ (2, 44) = 16.92$, $p < .00001$, $\eta^2 = .44$, for recognized happy faces, and $F\ (2, 44) = 19.55$, $p < .000001$, $\eta^2 = .47$ for recognized sad faces, respectively. Furthermore, there was a significant Prime Duration x Emotion Primed interaction for the number of recognized angry faces, $F\ (2, 44) = 3.58$, $p = .04$, $\eta^2 = .14$, as well as for recognized happy faces, $F\ (2, 44) = 4.17$, $p = .02$, $\eta^2 = .16$, but not for recognized sad faces, $F\ (2, 44) = 2.26$, $p = .12$, $\eta^2 = .09$.

As can be seen in Table 5.2, differences between priming conditions, particularly between the happy priming condition and the two negative priming conditions, were larger for a prime duration of 100 ms as compared to a prime duration of 14 ms. However, according to simple effects analysis directly comparing the effect 14 ms and 100 ms primes in the different priming conditions on the number of recognized angry and happy faces this effect was not significant within the single conditions. Note that this analysis was carried out with a sample in which participants who had answered the control questions in a way that might indicate ability to adjust their replies due to conscious concerns had been excluded. The results therefore indicate that even the remaining participants recognized the faces used for priming in their condition above chance in a forced-choice paradigm. Priming therefore was not truly subliminal. Please also note that some of the cell sizes of the results listed in Table 5.2 were very small due to the previous exclusion of participants based on their replies to the control questions.

Table 5.2
Numbers of (Correctly or Incorrectly) Recognized Happy, Sad, or Angry Primes by Emotion Primed and Prime Duration

	Happy Primes		Sad Primes		Angry Primes	
Duration	*M*	*SD*	*M*	*SD*	*M*	*SD*
			Recognized Happy			
14 ms	6.27	2.61	3.40	3.72	4.33	3.47
100 ms	9.00	2.27	0.86	1.07	2.00	1.41
			Recognized Angry			
14 ms	3.00	1.34	3.10	1.52	4.33	2.06
100 ms	1.88	1.55	4.57	1.13	6.00	1.41
			Recognized Sad			
14 ms	2.73	1.56	5.50	2.46	3.33	2.57
100 ms	1.13	1.25	6.57	0.79	4.00	0.00

Note. Bolded numbers refer to correctly recognized primes.

5.3.3 Analysis of Implicit and Explicit Emotions

5.3.3.1 Implicit Emotions

In preparation to computation of the scores for the three implicit emotions, ratings of adjective-artificial-word pairs that were made during the first 500 ms after the respective pair appeared on screen were excluded (cf. Procedure of Study 1 in Manuscript 3, Section 4.3.1.4). Afterwards, IPANAT-DE scores for each of the four measured emotions were computed separately for the baseline measure and the measure that was completed during the priming block. In particular, and as described before, I first computed means for all adjectives across all artificial words. In a second step, grand means were computed across each set of three adjectives belonging to the same emotion.

An Emotion Primed (between) x Prime Duration (between) x Time of Measurement (within) x Emotion Measured (within) four-factorial mixed ANOVA showed no main or interaction effects of Prime Duration. The same was true for explicit emotions. However, please remember that some of the cell sizes, particular for primes of 100 ms prime duration, might have been too small to find effects of this factor. Due to the missing effect and to increase cell size to an acceptable standard, prime duration was dropped as a factor from all further analysis. However, note that the patterns reported for the subsequent analyses stayed the same regardless if prime duration was included or not.

Means and standard deviations of the four implicit emotions by priming condition and time are displayed in Table 5.3. A Emotion Primed (between) x Time of Measurement (within) x Emotion Measured (within) three-factorial mixed ANOVA yielded a significant Primed Emotion x Time of Measurement x Emotion Measured effect (see Table 5.4 for the full results of the ANOVA).

Table 5.3
Means and Standard Deviations at Baseline and During Priming by Emotion Primed for the Implicit Emotions Measured with the IPANAT-DE

	Happiness		Anger		Sadness		Fear	
Time	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
				Happy Primes				
Baseline	3.43	0.72	3.12	0.66	2.95	0.65	2.56	0.64
Priming	3.85	0.53	2.44	0.68	2.45	0.75	2.26	0.56
				Angry Primes				
Baseline	3.61	0.78	3.15	0.78	2.86	3.01	2.81	0.63
Priming	2.70	0.96	3.22	0.97	0.57	0.64	2.89	1.06
				Sad Primes				
Baseline	3.42	0.75	3.26	0.52	2.90	0.73	2.70	0.57
Priming	2.64	1.16	2.65	0.49	3.41	0.85	2.75	0.55

Table 5.4
Results of Emotion Primed x Time of Measurement x Emotion Measured Mixed ANOVA for Implicit Emotions Measured with the IPANAT-DE

Factor	*SS*	*df*	*MS*	*F*	*p*	η^2
			Between			
Constant	862.59	1	862.59	3287.21	.001	.99
Emotion Primed (EP)	0.36	2	0.18	0.69	.51	.03
Error	12.33	47	0.26			
			Within			
Time of Measurement (T)	4.23	1	4.23	12.22	.001	.21
T x EP	0.19	2	0.10	0.27	.76	.01
Error T	16.28	47	0.35			
Emotion Measured (EM)	18.66	3	6.22	9.37	.000	.17
EM x EP	15.71	6	2.62	3.94	.001	.14
Error EM	93.63	141	0.66			
T x EM	4.41	3	1.47	5.15	.002	.10
T x EM x EP	17.34	6	2.89	10.13	.000	.30
Error T x EM	40.24	141	0.29			

To make sure that the observed three-way interaction was not caused by differences in implicit emotions between the priming conditions at baseline, I computed an Emotion Primed x Emotion Measured two-factorial mixed ANOVA with implicit emotion scores at baseline as dependent variable. This analysis only yielded a significant main effect of emotion measured (which is to be expected since positive emotions are generally rated higher than negative emotions), F (3, 141) = 14.26, $p < .001$, $\eta^2 = .23$, but no main effect of emotion primed or interaction of emotion primed and emotion measured, both Fs < 1. I therefore concluded that the previously found three-way interaction was due to the changes from baseline implicit emotion scores to implicit emotion scores obtained during the priming block.

I continued to investigate the Emotion Primed x Time of Measurement x Emotion Measured three-way interaction by first computing the difference between post- and pre-manipulation for all four implicit emotions. The resulting difference scores were then used as dependent measures in four separate one-way ANOVAs with the between-participants factor emotion primed. I further performed a simple effects analysis by choosing the print parameters option in the general linear model of SPSS. This step is equivalent to computing a regression analysis and results in the display of *B*-coefficients for the highest coded condition. I repeated the last step three times for each measured emotion, each time coding a different emotion primed condition with the highest number.

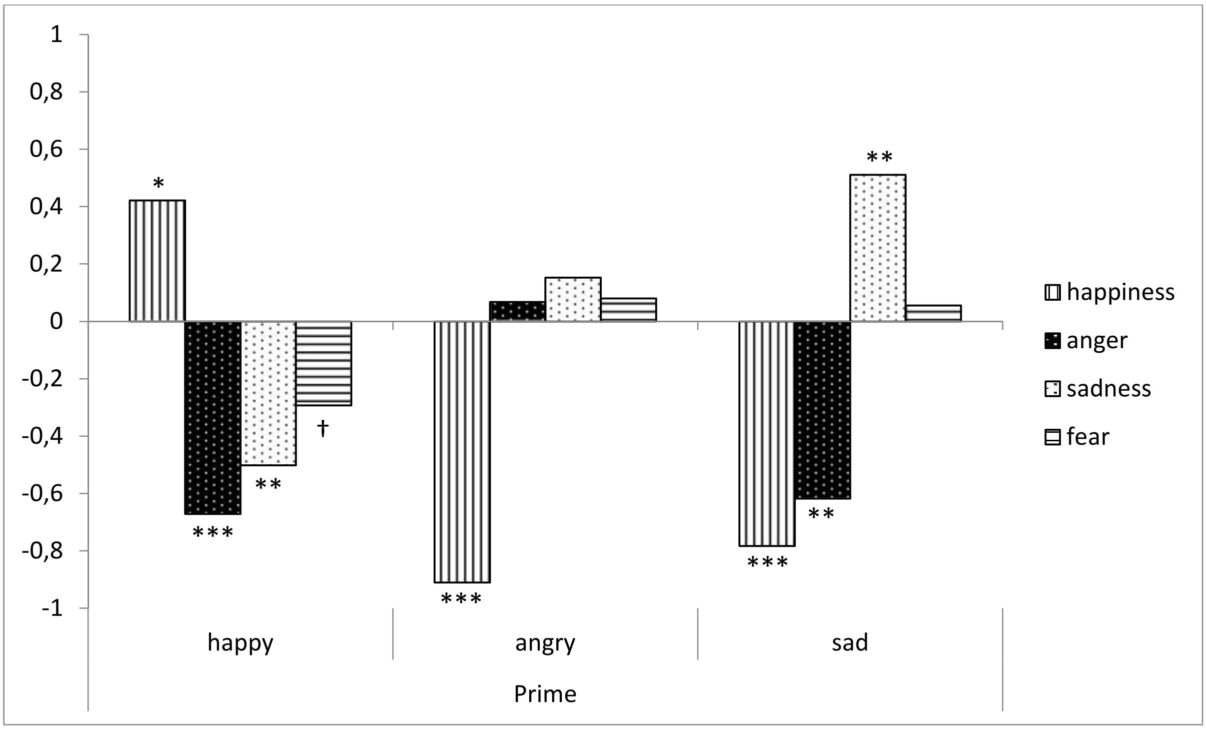

Figure 5.1. Changes in implicit emotions.
†$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$.

Results indicated a significant effect of emotion primed on the change (i.e., the difference variable) of all three implicit emotions, F (2, 47) = 12.08, $p < .001$, $\eta^2 = .34$, for implicit happiness, F (2, 47) = 8.88, $p = .001$, $\eta^2 = .27$, for implicit sadness, and F (2, 47) = 4.55, $p = .02$, $\eta^2 = .16$, for implicit anger, respectively. The effect on the change of fear, however, was not significant, F (2, 47) = 1.46, p

= .24, η^2 = .06. The overall pattern of change in implicit emotions for each priming condition is shown in Figure 5.1.

5.3.3.2 Explicit Emotions

Table 5.5
Means and Standard Deviations at Baseline and Post Priming by Emotion Primed for the Explicit Emotions

	Happiness		Anger		Sadness		Fear	
Time	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
				Happy Primes				
Baseline	3.79	0.96	1.37	0.70	1.74	1.11	1.26	0.42
Priming	3.47	1.15	1.46	0.76	1.79	0.83	1.40	0.57
				Angry Primes				
Baseline	3.55	0.88	1.60	1.32	2.17	1.26	1.45	1.32
Priming	3.02	1.15	1.55	1.32	2.17	1.40	1.52	1.39
				Sad Primes				
Baseline	3.45	1.00	1.55	0.64	1.98	1.16	1.39	0.80
Priming	3.75	1.33	1.80	0.94	2.08	1.15	1.45	0.88

The analysis for explicit emotions followed the same pattern as the previously described analysis for implicit emotions. Means and standard deviations of the four explicit emotions measured by time of measurement and emotion primed are shown in Table 5.5. A three-factorial mixed ANOVA with the between participants-factor prime and the within-participant factors time of measurement and emotion measured only found a significant main effect of emotion measured, F (3, 141) = 62.41; p < .0001, η^2 = .57. As mentioned earlier for implicit emotions, this effect was to be expected since it has been consistently reported in the literature that participants report positive levels of subjective well-being (Diener & Diener, 1996). No other effects reached significance. Furthermore, examination of the means displayed in Table 5.5 and the difference scores in Figure 5.2 indicate that the pattern of change did not resemble the pattern of change for implicit emotions which makes it unlikely that the failure to find significant prime congruent changes was simply caused by a lack of statistical power.

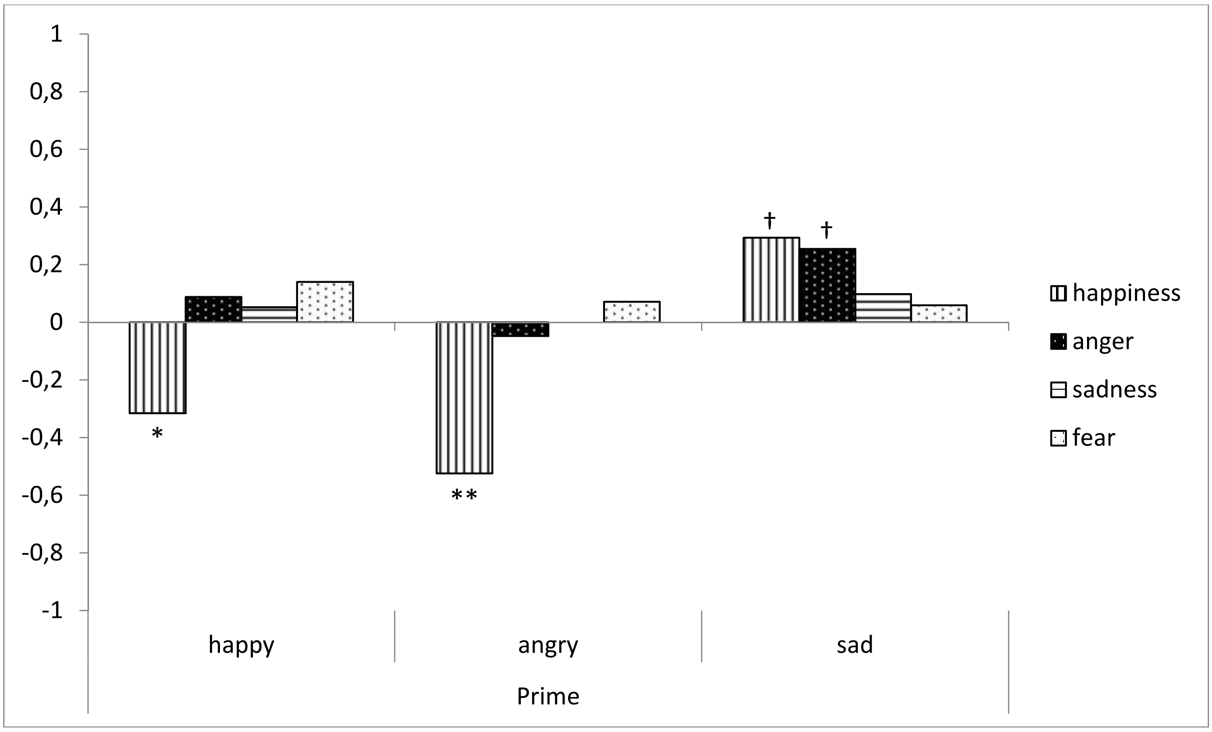

Figure 5.2. Changes in explicit emotions.
$^{\dagger}p < .10$; $*p < .05$; $**p < .01$.

5.3.3.3 Personality Differences as Moderators

In order to investigate if any of the measured personality differences moderated the effect of the primes on implicit and explicit emotions, I computed separate ANCOVAs with the factors emotion primed, time of measurement, and emotion measured, and the centered score of one of the personality differences as covariate. Models were adjusted so that all interactions with the respective covariate and the factors were included. None of these exploratory ANCOVAs indicated one of the personality factor as a moderator of the effect of the primes on the change in implicit or explicit emotions.

However, while I did not state a directional hypothesis concerning the effect of one of the covariates, I did expect changes in anger and sadness after angry primes might be affected by one of the personality factors. Therefore, I conducted a more specific test by computing a series of ANCOVAs with one of the personality differences as covariate in each analysis and with either the change in implicit sadness or the change in implicit anger as dependent variable. I then obtained parameter estimates for anger as emotion primed by making sure that anger was coded zero on both dummy variables representing the emotion primed factor. These more specific tests for effects of the anger prime on changes in implicit sadness and anger, however, did not yield any effects either. In particular, the parameter estimate of the main effect of the respective covariate was not significant in any of the ANCOVAs. Furthermore, the parameter estimate of the constant, which would indicate a change in anger or respectively sadness was not significant in any of the ANCOVAs either. I therefore concluded that the results show no influence of personality, which contradicts the findings in Manuscript 3, Study 2 (Section 4.4).

5.3.4 Discussion

All specific hypothesis were confirmed for implicit affect. In particular, implicit happiness did indeed increase only after happy primes while implicit sadness increased only after sad primes. In addition, neither sadness nor anger or fear increased after happy primes, in fact all three emotions decreased at least marginally. Even more importantly, neither happiness, nor anger or fear increased after sad primes. In fact both, happiness and anger decreased after sad primes. Particularly the decrease of implicit anger after sad primes supports that different implicit negative emotions can be differentially primed and therefore exist as distinct entities. Furthermore, as expected and in contrast to implicit affect, explicit affect did not show any significant changes in response to the primes. As in Manuscript 3, Study 2, however, this might have been a result the attenuation of the priming effects over time since post-manipulation explicit affect was always measured after post-manipulation implicit affect.

Finally, the unmoderated pattern obtained after angry primes did not show a main effect on change of implicit or explicit anger or fear. In particular, there was a decrease in both implicit happiness after angry primes while implicit anger, fear, and sadness did not change significantly. While the lack of change in implicit anger and fear across all participants might very well have been due to changes in these emotions that were different for participants with different personalities, however, no specific moderating personality difference could be identified. In this context it is important to remember, though, that based on previous findings the most promising potential moderator of the effect of angry-face primes on implicit anger and fear would be social anxiety (Phan et al., 2006), a personality factor that I neglected to measure in this study. Future studies on the effect of anger primes therefore need to include a social anxiety measure.

6 General Discussion of All Findings

In the manuscripts that are part of this dissertation I have presented evidence that IPANAT scores are indicators of affect regulation (Manuscript 1, Section 2). Furthermore, the affect regulation indicated by an increase in implicit positive affect as measured with the IPANAT appears to be self-related as evidenced by stronger increase in implicit positive affect when participants were primed with self-related concepts (Manuscript 1, Study 2, Section 2.4).

In addition to these findings on the role of implicit affect in affect regulation, I have introduced a new version of the IPANAT, the IPANAT-DE, which was designed to measure cognitive activations that reflect distinct emotions rather than undifferentiated positive and negative affect. I have shown that this version of the IPANAT fits the expected four-factor structure, with each factor reflecting one distinct emotion (Manuscript 2, Section 3). I have further provided evidence that this factor structure remains stable when the test is administered to Turkish rather than German participants.

In the final manuscript I have also shown that scores on the happiness and sadness subscales of the IPANAT-DE change in prime congruent ways when participants are primed with happy or sad faces (Manuscript 3, Section 4). Finally, I have provided evidence that exposure to sad and angry primes leads to distinguishable and partially prime congruent effects on the four subscales of the IPANAT-DE in a supplemental study that is not yet part of a manuscript prepared for publication (Section 5).

Overall, these findings extend previous research on the IPANAT as a measure of implicit cognitive activation of affective concepts. In particular, they provide first evidence that the IPANAT is not just an indicator of implicit affect, but also of certain types of affect regulation and that it is suitable to assess not just undifferentiated affect, but specific affective phenomena such as distinct emotions. They also provide some information that is relevant to the question what mechanisms underlie the formation of IPANAT scores. There are, however, a number of open questions concerning the IPANAT and the processes it taps into that are not conclusively answered in the included manuscripts or in other previous work using the IPANAT.

In this context, a first group of open questions deals with different aspects of the mechanisms underlying the IPANAT. The most pressing issue among them might be the question whether the IPANAT truly assesses “hot” cognition – that is, cognition that is influenced by affective experience, or whether it assesses “cold” cognition in the form of activation of affective knowledge in absence of the corresponding affective experience. I have mentioned in the introduction to this dissertation as well as in the single manuscripts that Quirin, Kazén, and Kuhl (2009) have defined implicit affect as “the automatic activation of cognitive representations of affective experiences“ (p. 508). This definition clearly refers to a “hot” process. However, while it has been assumed that the IPANAT reflects experience and not just knowledge it has not yet been shown conclusively that this is indeed the case. And while correlations of the positive and negative subscales of the original IPANAT with extraversion and neuroticism (Quirin, Kazén, & Kuhl, 2009), as well as correlations between the IPANAT and cortisol changes (Quirin, Kazén, Rohrmann, et al., 2009) are suggesting that there is at least some connection between IPANAT scores and affective experience, more direct evidence is needed to settle the question. Furthermore, the relation between the subscales of the IPANAT-DE and the actual experience of distinct emotions remains even more speculative.

After it is established that the IPANAT measures indeed an affective process, or more correctly a process directly related and influenced by affective experience, it needs to be established that it assesses an implicit process, that is, a process that is based on an parallel-processing, impulsive associative network (Smith & DeCoster, 2000). Since implicit processes are assumed to operate at least partially outside of consciousness and since the results of these processes have been suggested to remain unconscious under certain circumstances, a related question concerns whether changes in IPANAT scores in response to an affect induction can occur in absence of participants awareness of (a) the affect induction and (b) the affective core experience induced by it. Alternatively, the IPANAT could be an implicit test of explicit affect that is, a test that measures the outcome of an analytic, deliberate, sequential process which circumvents the many drawbacks of self-report (cf. Fazio & Olson, 2003).

I have also laid out that the IPANAT is based on Bower's (1981) work on the representations of affective experience in memory, and on how these representations influence unrelated judgments through affect priming (cf. Forgas, 1995). It remains untested, however, if this is truly an accurate account of situational changes in IPANAT scores or if other processes might be involved in addition or instead of affect priming. Previous work on the IPANAT has neglected to discuss what alternative mechanisms might drive affect congruent judgments of the artificial words of the IPANAT and which additional processes might contribute to error variance in the IPANAT and how that error variance might be reduced statistically. Furthermore, as already mentioned by Quirin, Kazén, and Kuhl (2009) the IPANAT reflects both, trait and state variance. While it has been used as a trait as well as a state measure, however, a systematic investigation that allows for quantification of state and trait variance as well as for an estimation of error variance has not been undertaken.

A second group of open questions concerns how implicit affect is related to other aspects of affective phenomena, such as explicit, self-reported affect, but also affective core experience, physiological changes related to affect, and last but not least behavior. Since affect regulation should influence several of these aspects to be effective, I will discuss it together with the interplay of these aspects. In particular, while Manuscript 1 (Section 2) suggests that the IPANAT assesses affect regulation, and particularly self-related affect regulation it is still unclear which exact types of affect regulation are captured by the IPANAT, under which circumstances these affect regulation processes take place, and how they might not just influence implicit affect but also self-reported affect, and possibly also physiological markers of affect related arousal.

Finally, a third group of issues concerns the adaptability of the IPANAT to certain research contexts, such as the measurement of distinct emotions, the assessment of affective time course, and the adaptation of the IPANAT to the measurement of non-affective phenomena, and the role of the IPANAT in cross-cultural research.

In the following discussion, I will address all of these issues separately and in more detail. Since clarification of the mechanisms underlying the IPANAT is fundamental to the resolution of each of these, I will start with and put most emphasis on the questions that aim to illuminate these mechanisms.

6.1 Open Questions concerning the Processes Underlying IPANAT Scores

As mentioned before, questions concerning the mechanisms driving the IPANAT are the most pressing issues addressed in this discussion since they are highly relevant for the interpretation of the IPANAT scores. Fortunately, while there is insufficient data at this moment to give definite answers concerning the mechanisms underlying the IPANAT, there exists quite a bit of research on other implicit tests and processes which can serve as a basis to approach these issues. In particular, there are a number of procedures and models designed to analyze and often quantify the contribution of different processes that contribute to participants' answers on psychological measures. In this section I will suggest adaptions of these previous techniques to the analysis of the IPANAT.

6.1.1 Does the IPANAT Measure an Emotional or a Cognitive Process?

As just stated, a fundamental question about the processes underlying the IPANAT concerns its affective versus cognitive nature. This question becomes particularly relevant in light of recent research by Blaison, Imhoff, Hühnel, Hess, and Banse (2012) which provides evidence that the AMP – a measure that is based on similar reasoning as the IPANAT as I have discussed in the introduction – assesses cognitive and not emotional processes. In particular, Blaison et al. adapted the AMP so that participants were no longer asked to indicate if they liked a Chinese character but instead decided if the given character visually evoked fear or anger. Participants were then primed with angry and fearful faces on a trial by trial basis. In addition, participants' social anxiety was assessed via a self-report questionnaire. As argued by the authors, socially anxious individuals should experience fear when confronted with an angry face (cf. Phan, et al., 2006). Therefore, if the AMP assessed affective processes, there should be an interaction of social anxiety and type of prime, with highly socially anxious participants judging the Chinese ideographs more often as fear-evoking then little socially anxious participants. However, such an interaction was not found. Instead participants judged the Chinese ideographs more often as anger-evoking than as fear-evoking after they had been exposed to an angry face as compared to after they had been exposed to a fearful face regardless of their level of social anxiety. The authors replicated this finding in two additional studies, thereby providing sound evidence that the AMP assessed semantic activation of emotional concepts, that is, a cognitive process, rather than an affective process.

Could the same be true for the IPANAT? Based on my own data as well as based on previous research using the IPANAT, I cannot rule out this possibility conclusively (even though fear and anger scores measured with the IPANAT-DE have not been indicative of an increase in implicit anger in response to priming with angry faces, cf. Supplemental Study, Section 5). Furthermore, while none of the measured personality differences moderated the effect of anger primes on the IPANAT-DE, it remains possible that such a moderator exists and that the lack of a net change in anger and fear scores can be explained by some participants reacting with increased fear and decreased anger, while other participants reacted with the opposite pattern. In particular, based on the work by Blaison et al. (2012) social anxiety would by a candidate for such a personality difference that future studies should assess. In addition, there are other potentially relevant personality differences, such as an avoidant or a narcissistic personality style, which might moderate the change in fear and anger in the predicted direction, in an adequately large sample to ensure sufficient power. In this context it might be worthwhile to also use personality observation-based rather than self-report based personality measures (cf. Leising, Krause, Köhler, Hinson, & Clifton, 2011).

If future studies would indeed find that the IPANAT assess “hot” process that are directly influenced by affective experience while the AMP assesses “cold” cognitive processes that are not directly related to affective experience what could explain this discrepancy? With regard to this question, the procedures of the IPANAT and the AMP differ in several small but potentially important ways. First of all, as already mentioned the neutral objects used in the AMP are Chinese ideographs, not artificial words. Since the instructions of the IPANAT tell participants to judge the artificial words by their sound (cf. Quirin, Kazén, & Kuhl, 2009) the two tests might therefore tap into different sensory channels. At present, it is unclear how this might influence the underlying mechanism. However, it could, for example, influence the strategies that participants use to rate an AMP or an IPANAT item (cf. Blaison, et al., 2012).

A second difference between IPANAT and AMP concerns the presentation time of the stimuli used in the two tests. In the AMP, Chinese ideographs are presented only for very brief periods (as short as 100 ms; cf. Payne, et al., 2005) while exposure to the artificial words of the IPANAT is either unlimited in the paper-pencil version or continues for several seconds in the timed computerized version. This might increase the likelihood that affect priming, the mechanism that has been suggested by Quirin, Kazén, and Kuhl (2009) as basis of the IPANAT, actually occurs (see Forgas, 1995, for a discussion how longer processing time is conductive to affect priming).

Finally, different to the IPANAT, the AMP (Blaison, et al., 2012; Payne, et al., 2005) uses a dichotomous response format. This means that participants have to decide between two emotions or two different attitudes. In contrast, the IPANAT uses unipolar interval scales of which each assesses only one type of affect (positive or negative) or one specific emotion. How exactly this would be conductive to measure “hot” instead of “cold” processes is unclear. Yet, at the very least it does allow for the measurement of mixed answers. That is, both, anger and fear ratings could increase in response to a prime when the IPANAT is used while the same would not be possible when using Blaison et al.’s version of the AMP – something that might become meaningful if accessibility of affective concepts after priming increases in response to both, “hot” and “cold” processes. In that case, the AMP would only assess the dominant process while the IPANAT would assess a mixture of both processes. The effects of these differences between AMP and IPANAT could be investigated in a series affect-induction studies using different hybrid versions of AMP and IPANAT that systematically vary the differences between the two tests (e.g., one group completing a version of the IPANAT using Chinese ideographs, one group completing a version of the AMP with stimulus exposure times of several seconds, etc.).

Importantly, it is also possible that the IPANAT and the AMP both measure “hot” cognition if the circumstances are conductive to “hot” but not “cold” cognition. As just mentioned, the cognitive activations underlying the IPANAT might be influenced by both, affective “hot” and non-affective “cold” processes. In particular, “cold” processing should be dominant if affective knowledge is activated in the absence of an actual congruent affective experience. One factor that might have led to the dominance of the influence of “cold” processes in the studies described by Blaison et al. (2012) is the use of static pictures of human faces with angry or fearful expressions. While this type of stimulus certainly conveys affective content and therefore activates affective knowledge, it might not succeed in inducing actual affect since the stimuli are somewhat artificial in nature and lack personal relevance. This might make it more likely that the activation caused by correct, knowledge-based recognition of the facial expressions overpowers any affective reactions that might also be present. It therefore might be worthwhile to use affective stimuli that are closer to stimuli causing affective reactions in real life, such as the Trier Social Stress Test (Kirschbaum, Pirke, & Hellhammer, 1993) as an induction of general negative affect (with affect being measured during the test, see Hellhammer & Schubert, 2012) in studies using the IPANAT to reduce the likelihood that affective knowledge is activated predominantly through processes other than affective experience.

In addition, it is important to note that in contrast to the AMP the IPANAT assesses not just state, but also trait implicit affect (or, alternatively state and trait activation of affective concepts). Trait activation of implicit concepts should be based on the history of previous activations of these concepts. In particular, chronic judgment of neutral stimuli as angry-, sad-, fearful-, or happy-sounding probably indicates that the corresponding cognitive concepts are regularly activated. In as much as the activation of affective concepts in the absence of actual affective experience probably is less common in daily life compared to the laboratory, the trait component of IPANAT scores should predominantly reflect affective processes which would make them reasonably informative of participants’ trait affectivity.

6.1.2 What is Implicit About the IPANAT?

As discussed earlier, it also remains unclear what exactly is implicit about the IPANAT: The underlying type of affect-based activation or the test that assesses it. To this question it also is important to define what implicit means in the context of the IPANAT. If one speaks of an implicit measure of an explicit process, this quietly presupposes that something being implicit means that it occurs without awareness, its original definition as it stems from cognitive psychology (Schacter, 1987). In contrast, the second possibility allows for two definitions of implicit, (a) implicit as unconscious, but this time referring to the process itself (which might be based on activation of the same system as an explicit process though the activation would probably be weaker) and (b) implicit as based on the impulsive memory system described in two-process models, a system which might but does not have to operate unconsciously (cf. Fazio & Olson, 2003; see also Gawronski, LeBel, & Peters, 2007).

The question of what is implicit about the IPANAT is quite difficult to tackle. A starting point might be to have participants describe on which basis they decided if a given artificial word sounded like the affective adjectives (cf. Blaison, et al., 2012). In addition, if the IPANAT is an implicit measure of an explicit process, the correlation of IPANAT scores with an explicit measure should systematically vary in dependence of social desirability. This would be relatively easy to investigate by conducting studies in which social desirability is measured, and ideally also studies in which it is manipulated. Furthermore, methods from neuroscience such as functional magnetic resonance imaging and transcranial magnetic stimulation could be used to identify the brain regions whose activation correlates with IPANAT but not explicit affect scores in response to an affect induction, to test if their activation or deactivation has an influence on IPANAT scores and their correspondence to explicit affect scores (at least as long as the respective regions are located in the cortex), and to compare if the location of these regions overlap with regions activated during other implicit processes.

An additional vital step would be the assessment of the correlation between implicit affect measured with the IPANAT and explicit affect across large samples of participants and the investigation of possible moderators of this correlation (cf. Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005). In this dissertation I have further tried to affect implicit affect without influencing explicit affect (cf. Manuscript 3, Study 2, Section 4.4 and Supplemental Study, Section 5). If certain types of affect-inducing primes lead to changes in implicit but not explicit affect, this would be an indicator that implicit and explicit affect are somewhat dissociable. Since some of the induced emotions were socially acceptable this is also evidence that the effect is not just due to social desirability concerns influencing explicit but not implicit affect. However, the observed dissociation might have been simply an artifact of measuring explicit affect after implicit affect. In addition, as discussed earlier it is also possible that the primes used did not induce a change in emotions or other types of affect, but simply activated the corresponding cognitive concepts, and that the IPANAT measures activation of these concepts.

6.1.3 Processes Underlying IPANAT Scores

In addition to establishing whether IPANAT scores are driven by processes of the impulsive system, it is important to establish the exact underlying mechanisms. In this section, I will discuss two existing models, the affect infusion model (AIM; Forgas, 1995) and the quad model (QM; Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005), which might serve as starting points to disentangle the processes contributing to how an individual rates the artificial words that are part of the IPANAT.

6.1.3.1 Affect Infusion Model

I have stated in the introduction that the IPANAT has been developed based on Bower's account how affective states prime the used of related concepts in cognitive processing (Bower, 1981; Bower & Forgas, 2000; see also Isen, 1984). However, as detailed by Forgas (1995) this type of affect infusion is just one possible mechanism that can underlie the affective coloring of judgments.

In total, Forgas (1995) lists four different mechanisms by which affective coloring of can happen: (a) through *direct access* of a preexisting attitude or judgment of the respective evaluated object, (b) through *motivated processing*, for example based on a goal of mood repair, (c) by directly using *affect as information* on which the respective judgment is based, and (d) through the type of *affect priming* detailed by Bower (1981). I will discuss all four mechanisms and the ways in which they might influence IPANAT scores below.

The first process described by Forgas (1995), direct access to an already colored attitude or judgment, can be largely ruled out to affect assessment of the unfamiliar artificial words used in the IPANAT since it only applies to well-known, familiar targets. This is important to note, since judgments based on preexisting attitudes are not based on momentary or chronic affect. Nonetheless it remains possible that preexisting attitudes to some features of the artificial words, such as to certain letters or sounds, might add to error variance in the IPANAT. In this context, it is important in how far associations with letters and sounds remain constant across participants and in how far they are unique for each participant. Especially stable associations that are unique for each participant can present a problem for the validity of IPANAT scores since they cannot easily be controlled for. Their influence might be minimized, however, by using a greater number of artificial words with a diverse set of phonetic features and letters.

Motivated processing, the second alternative to affect priming listed by Forgas (1995), might very well influence judgments of the artificial words under certain circumstances. In particular, motivated processing might underlie the counter-regulation process that was found in Manuscript 1 (cf. Rothermund, et al., 2008; see also Koole, 2009). In fact, I and my co-authors actually used the attention to smiling faces in a crowd of angry faces as an additional measure for affect regulation (cf. Hansen & Hansen, 1988; Koole & Jostmann, 2004; Öhman, Lundqvist, & Esteves, 2001) – a measure that is in line with previous research which found an increase in attention to information of the opposite valence after positive or negative performance feedback (Rothermund, et al., 2008). Importantly, even though motivated processing would be a different process as the one originally proposed to underlie the IPANAT, IPANAT scores shaped by this process would still be in line with the purpose of measuring (implicit) affect since the degree to which such motivated processing occurs should indeed predict affective changes.

The third mechanism, using affect directly as information to judge a stimulus, is the most likely alternative account to affect priming of how IPANAT scores are influenced by affective processes under most circumstances. According to the affect as information account (Schwarz, 2012; Schwarz & Clore, 1983, 1988), individuals sometimes refer directly from their affective state how they feel about an object. In case of the artificial words used in the IPANAT, for example, an individual might notice that he or she feels angry while reading one of the artificial words, conclude that the word caused the anger, and therefore judge the word as sounding as if it expresses anger. Schwarz (2012) stresses that this process does not have to be conscious. However, it remains questionable if the affective itself can be unconscious while being used as information or if the affective state needs to be conscious while its use in a given judgment can occur unconsciously (or, perhaps more accurate, without paying attention). This question would need to be clarified in order to decide under which circumstances affect as information might drive changes in IPANAT scores after affect induction. In addition, as Forgas (1995) as well as Schwarz and Clore (1983, 1988) note, affect-as-information effects tend to occur only if individuals do not know or do not pay attention to the true source of their affective state. Finally, similar to other heuristic strategies, affect as information is used in circumstances when individuals are either not motivated or do not have the cognitive resources to engage in more elaborate stimulus processing.

Finally, there is the kind of effect that I referred to throughout the earlier sections of this dissertation – unconscious affect priming that occurs if a stimulus is processed substantively by an individual who simultaneously experiences an unrelated affective state. It occurs because information in line with the affective state – such as verbal labels referring to it – are already somewhat activated and therefore come more easily to mind when thinking about the affective meaning of the stimulus (Bower, 1981; Forgas, 1995). Interestingly this type of affect infusion becomes stronger the more deeply the stimulus is processed. Factors that influence depth of processing in this context are on the one hand situational factors, such as mental capacity or time restrictions, and motivational factors such as personal relevance on the other hand.

It should be noted that three of the four processes – motivated processing, affect as information, and affect priming could be based on either implicit or explicit and to either conscious as well as unconscious affect. That is, none of these three processes are necessarily restricted to the case when IPANAT scores truly indicate implicit affect but also if the IPANAT is merely an implicit measure of explicit affect. While I have argued earlier, affect-as-information effects might actually be restricted to consciously accessible affect, this needs to be tested. Furthermore, motivated processing might actually occur due to a conscious affective state even though the immediate outcome might be unconscious (i.e., a person might consciously feel a negative emotion and then unconsciously shift attention to positive information, a process that might first influence IPANAT scores, and only later explicit affect). Finally, since both, implicit as well as explicit affect should go hand in hand with activation of affective concepts, both types of affect should be able to influence ratings of unfamiliar objects such as artificial words, even though participants should have a harder time to control for influences of implicit affect since implicit affect does not have to be conscious. Furthermore, it should be noted that while Forgas (1995) discusses all of the four processes separately, there is no reason why IPANAT scores should not be influenced by several of these processes in any given situation. For example, it is feasible that affect priming and motivated processing might simultaneously influence participants' judgment of artificial words under certain circumstances. To quantify the degree to which each of these processes influence IPANAT scores, another type of approach is needed, such as the approach described in the QM which I will now introduce.

6.1.3.2 Quad Model

The QM (Conrey, et al., 2005) is a multinomial model (cf. Batchelder & Riefer, 1999), which has been developed to analyze the processes that contribute to performance on the implicit association test (IAT; Greenwald, McGhee, & Schwartz, 1998). During the IAT, participants are asked to sort stimuli as quickly and accurately as possible into according to categories, two evaluative categories such as *good* and *bad* and two target categories such as *flowers* and *insects*. For this purpose, one evaluative and one target category each are assigned to the same key, two categories to a key on the left and the other two categories to a key on the right side of the computer keyboard. Participants are instructed to press the left key with their left index finger whenever stimuli of the first evaluative category (e.g., *evil* for the category *bad)* or the first target category (e.g., *rose* for the category *flower*) appear on screen. Likewise, they are instructed to press the right key with their right index finger whenever stimuli of the second evaluative category (e.g., *nice* for the category *good*) or the second evaluative category (e.g., *bee* for the category *insect*) appear on screen. During a second phase of the test, the target categories are reassigned to the respective other key so that all four combination of evaluative and target categories occur during testing. Due to the activation of preexisting attitudes towards the two target categories during the testing phase and due to activation of response tendencies in line with these attitudes, participants should find it easier to press a key if the evaluative and the target stimuli assigned to it are congruent in valence. For example, a person who likes flowers more than insects should find it easier to press the same key for the category *good* and the category *flowe*r than for the category *good* and the category *insect* and harder to press the same key for the category *bad* and the category *flower* than for the category *bad* and the category *insect*. IAT scores are computed on basis of the difference in reaction times between the different pairings of evaluative and target categories. In addition to evaluating the IAT in terms of reaction times for different category pairs, it is also possible to assess the error rates that occurred within each category pairing. It is these error rates that are analyzed in the QM.

This example illustrates one important difference between the type of test to which multinomial models such as the QM can be applied and the IPANAT: Multinomial models are designed for tests using categorical scales (cf. Batchelder & Riefer, 1999). The QM in particular has been designed for the analysis of implicit tests that consist of tasks with a true and a false answer between whom the participant has to choose. In contrast to these tasks, there are no correct or incorrect answers in the IPANAT. Furthermore, the IPANAT is reaction-time based and requires very fast replies. The same is not true for the paper-pencil version of the IPANAT and while my colleagues and I have applied the computerized IPANAT using a time limit for participants' replies, this time limit still allows for reaction times that are far longer than the reaction times in the IAT. Therefore, the processes driving replies might be different. Despite these differences, the QM can provide useful information how a similar model could be built to quantify the contributions of different types of processes to IPANAT scores. I will therefor now outline the QM and then outline how similar processes might be involved in the IPANAT.

The QM analyzes IAT scores according to four potential constituting parameters (Conrey, et al., 2005): The successful or unsuccessful determination of the correct answer (the *discriminability* or D parameter), the activation or non-activation of an automatic bias (the *association activation* or AC parameter), the successful or unsuccessful correction of said automatic bias (the *overcoming bias* or OB parameter), and finally any response bias differing from the AC parameter such as deliberately using the key assigned to the positive evaluative stimulus category as a strategy to avoid appearing negatively biased or answering more often with the right as compared with the left index finger by default (the guessing or *G* parameter). Importantly, while the AC parameter is based on an automatic, associative (and possibly although not necessarily unconscious) process, the D and OB parameter as characterized by the developers of the model are based on conscious, deliberated processing, and the G parameter can be based either on conscious, deliberated processes, for example if participants reply more often with the key assigned to the positive evaluative category for tactical reasons, or on automatic, probably unconscious biases, for example if right handed participants reply more often with the right as opposed to the left index finger. The QM therefore assumes that implicit tests such as the IAT are not process pure, and that replies are actually the result of a mixture of different kinds of automatic processing and deliberative, conscious processing. This assumption is based on a large number of previous studies which show that a number of processes drive IPANAT scores, not just the unconscious preferences that were originally thought to underlie them (e.g., Brendl, Markman, & Messner, 2001; S. G. McFarland & Crouch, 2002; Mierke & Klauer, 2003).

Conrey et al. (2005) have shown in a series of four studies that the QM model fits IAT data and that all four different parameters contribute to IAT scores under certain circumstances. They further have shown that the degree to which each parameter contributes to a particular IAT score depends on specific, predictable factors that can be manipulated. For example, the D parameter more strongly contributes to scores if participants do not have to react to the stimulus within a certain time limit, therefore allowing participants to deliberate more on the correct answer. They have further shown in a fifth study that the QM can also successfully be applied to the analysis of a sequential priming measure with categorical response options.

In this context, it is important to note that application of the QM is not only restricted to tests in which the response to any given stimulus is categorical and can take only two values (true or false). The QM also assumes that every single parameter contributing to this response can only take on one of two values. For example, automatic bias is either activated or not activated, an activated automatic bias is either overcome or not overcome, and the respective stimulus is either correctly discriminated or not discriminated. The likelihood of the respective parameter taking one or the other value depends on the specific experimental situation. For example, different stimuli might have different likelihoods to be correctly recognized, influencing the D parameter. This example shows that the QM is designed for tests that use stimuli which are already known to participants. The IPANAT does not belong to this category, which is an additional reason why the QM in its original form is not applicable to it. I will, however, now give a rough outline how processes similar to the ones described in the QM might apply to the IPANAT and how they correspond to or complement the processes described in the AIM.

6.1.3.3 Comparing AIM and QM

As just mentioned, the QM was developed to explain scores of implicit tests of automatic evaluations such as the IAT that use some kind of priming stimuli and in which participants have to perform tasks which have categorical answers. Affective processes are not really necessary in the context of the QM – the proposed processes can be explained purely on basis of cognitive, affectively neutral associations, even though affect certainly can play a role, for example by limiting processing resources or by serving as motivation for certain biases included in the G parameter or in the processing used to overcome bias described by the OB parameter. The AIM (Forgas, 1995), in contrast, is inherently affective and describes how affect influence judgments and evaluations including but not limited to the judgments made in implicit tests. Interestingly, despite these differences, the models show a number of parallels. Most importantly, there is quite a bit of overlap in the processes that are part of each of the two models.

Direct access as discussed in the AIM is most clearly reflected in the AC parameter of the QM. As mention before, the AC parameter refers to automatic access to learned associations with the judged object. The AC parameter clearly refers to an involuntary, automatic process. In the AIM, deliberate versus automatic and conscious versus unconscious are not clearly separated. It seems reasonable, however, that recall of a pre-existing attitude of an object can occur consciously and deliberately as well as unconsciously and automatically. In fact, this is what the separation between implicit and explicit attitudes is all about. The direct access strategy therefore includes more than just activation of learned associations. In addition to the AC parameter, it also is connected to the D parameter, since discriminability (i.e., correct conscious recognition of the attitude object) is a prerequisite for consciously (but not unconsciously) recalling a preexisting attitude. As the direct access strategy in the AIM, the process underlying the D parameter is described as deliberative and conscious (as well as effortful) in the QM.

Motivated processing in the AIM shows considerable overlap with the process underlying the OB parameter of the QM. In both cases, automatically activated associations are overcome by a motivated process, even though the motivations mentioned in the two models are different. In particular, Forgas (1995) mentions affect regulation as a possible motivation in his AIM while Conrey et al. (2005) mention impression management as a possible motivation in their QM. These differences reflect the different foci of the two models on either explaining the influence of affect on judgments or on explaining the processes underlying implicit attitude tests. Motivated processing for affect regulation can but does not have to occur automatically and unconsciously as demonstrated by Rothermund et al. (2008). Furthermore, there is also some evidence that automatic activation of unconscious associations not in line with one's conscious attitudes can also be overcome by an automatic process under certain circumstances (Moskowitz, Gollwitzer, Wasel, & Schaal, 1999). Finally, affect as information in the AIM does not have a clear parallel in the QM, and neither does affect priming. Furthermore, the G parameter of the QM has no clear equivalent in the AIM.

Finally, as can be gleamed form the previous discussion of the automatic versus deliberate and conscious versus unconscious in nature of the processes, the distinction between automatic and deliberate as well as conscious and unconscious is not always clear-cut (cf. Bargh, 1994).

6.1.3.4 Proposing Processes Contributing to IPANAT Scores Based on AIM and QM

Based on AIM and QM, a number of processes can be named that might contribute to IPANAT scores. Some of these processes are automatic and also are likely to originate from an associative nodes in a memory network (cf. Bower, 1981). Some others are automatic but not necessarily unconscious, and might originate from an either conscious or unconscious source. Finally, some of these processes are likely to be conscious and deliberate. Furthermore, some of these processes are potentially based on "hot", affect based processing, while some of them probably result from "cold" cognitive processes. In particular, I propose the following processes to contribute to IPANAT scores:

1. A conscious, deliberate process based on declarative memory that uses meanings of similar sounding words from any given language or other consciously available associations with letters or sounds to judge the artificial words of the IPANAT. This process is similar to the direct access strategy described in the AIM. Like the direct access strategy, it is related to both, AC and D parameter of the QM. In the context of the IPANAT, it contributes to error variance.
2. A semi-automatic process based on feelings of liking or non-liking for a particular artificial word that originate from automatically activated, probably unconscious associations. This process is also somewhat similar to the direct access strategy of the AIM, but is even closer

related to the AC parameter of the QM. It is also the main process that should underlie the name-letter task, an implicit self-esteem measure which uses positive associations with ones initials to evaluate implicit self-liking (Nuttin, 1985). In the context of the IPANAT, this process also contributes to error variance.

3. A motivated, though automatic and possibly unconscious process that resembles counter-regulation as described by Rothermund et al. (2008). This process is related to the motivated processing described in the AIM and to the OB parameter in the QM. Similar to the motivated strategy and different from the OB parameter this process probably serves mood repair and therefore should be particularly important when participants have been exposed to negative stimuli. Measuring it should measure implicit affect in so far as the respective process should predict a change in (implicit) affect by activating positive associations.
4. A process that is based on the heuristic use of affect as information on which the evaluation of a given artificial word is based. This process is identical to the heuristic process in the AIM. It reflects implicit affect in as much as that can occur automatically (cf. Schwarz, 2012; Schwarz & Clore, 1983, 1988). Whenever the deliberate counterpart of this process is used that is, when participants consciously asks themselves how they feel about one of the artificial words of the IPANAT in order to judge the words according to the respective affective adjectives, it should measure explicit but not implicit affect. This could artificially increase the correlation of IPANAT scores and implicit affect without correctly reflecting the type of implicit affect that has been proposed to underlie the IPANAT.
5. A process identical to the affect priming process occurring during substantive processing described by Forgas (1995) in the AIM and by Bower (1981). It occurs unconsciously and automatically and should reflect implicit affect.
6. Several motivated (and conscious, deliberative, and effortful) response biases that together constitute a sub-type of the G parameter described in the QM. An example would be if a participant adjusts his or her answers to IPANAT items because he or she correctly guessed

the aim of the IPANAT (which is rare, seeQuirin, Kazén, & Kuhl, 2009). This type of process contributes to error variance.

7. Several non-motivated (and automatic, non-deliberative) response biases, that together form a second sub-type of the G parameter. Examples would be the tendency to give a positive reply (acquiescence bias, e.g., D. W. Fiske, 1982) and the tendency to reply consistently, that is, to give similar ratings for adjectives with similar meaning on the IPANAT (e.g., Schmitt, 1994). This type of processes also contributes to error variance.

Together the processes just described could be used to construct a model similar to the QM that can be used to analyze IPANAT scores. As for the IAT, I assume that the relative contribution of the single processes is influenced by situational factors (cf. Conrey, et al., 2005). However, while Conrey et al. assume that the processes suggested by them influence the IAT sequentially, I expect the processes that I just described as possible contributors to IPANAT scores to exert their influence in parallel.

6.1.4 State and Trait Variance in the IPANAT

In the previous paragraphs I have discussed which automatic and deliberative processes might contribute to IPANAT scores. However, during this discussion I have largely ignored the important distinction between state and trait implicit affect that I have mentioned earlier. In their paper introducing the IPANAT for assessment of general positive and negative implicit affect, Quirin, Kazén, and Kuhl (2009) reported re-test correlations of .6 between measurement occasions two months apart for both, implicit positive affect and implicit negative affect. Even when measurement occasions were twelve months apart, the correlations were equally strong. These correlations suggests a sizeable trait-component in IPANAT scores. It is important to note, however, that some of the processes discussed earlier as likely non-affect-based contributors to IPANAT scores can be assumed to be somewhat stable over time and therefore would contribute to trait variance and in particular trait error variance. (An example would be liking for specific artificial words or sounds.) It therefore becomes important to separate state and trait from each other, as well as trait error variance from trait variance based on affective processes. This can be done by adapting latent state-trait analysis (Steyer, Schmitt, & Eid, 1999) to the IPANAT.

In Figure 6.1 I am introducing a latent state-trait model that can be applied to the single subscales of the original positive-negative affect IPANAT as well as to the IPANAT-DE. The model calls for application of the IPANAT at two separate measurement occasions. It is an adaptation of the model that Schmukle and Egloff (2005) used to analyze the trait and state components of an extraversion IAT (Mierke & Klauer, 2003) and an anxiety IAT (Egloff & Schmukle, 2002). In the following I will describe the application to the model to the IPANAT-DE instead of the original version of the IPANAT measuring positive and negative affect since this dissertation dealt in particular with the development and validity of the IPANAT-DE (see Manuscripts 2 and 3, Sections 3 and 4).

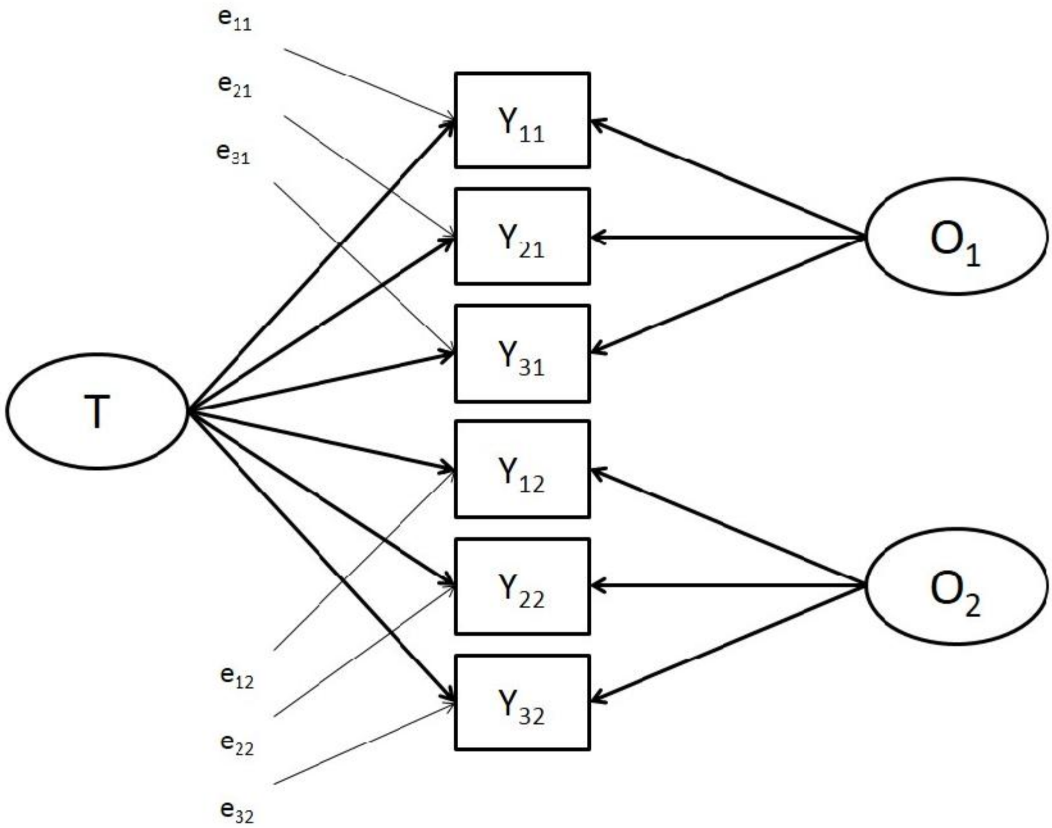

Figure 6.1. Latent state-trait model to assess state and trait variance of any of the four IPANAT-DE subscales. Adapted from Schmukle and Egloff (2005; Figure 1). Y = ratings of respective adjective, O = latent occasion specific variable (state affect would be reflected by this variable), T = latent trait variable (trait affectivity would be contained in but not identical to this variable), e = measurement error. The first index of the manifest variables refers to the identity of the respective IPANAT adjective, the second to the measurement occasion.

The manifest variables used in the model shown in Figure 6.1 are the mean adjective ratings for one subscale (e.g., happiness) across all artificial words used in the IPANAT. The latent variables are the two occasion specific affect variables and the type of trait affect measured by the respective subscale (i.e., happiness if happiness adjectives are used). To further develop the subscales of the IPANAT-DE, it might be worthwhile to apply the model to several versions of each subscale, with each version using a different set of adjectives (see e.g., the adjectives used in Manuscript 2, Materials of Study 3, Section 3.5.1.2 of this dissertation). It might very well be that adjectives that load equally well on a factor representing the respective emotion they aim to measure differ in trait and state variance.

It should be noted that the model shown in Figure 6.1 does not assess variance introduced through the use of different artificial words since it uses mean scores across all artificial words as manifest variables. However, participants' specific associations with the single artificial words are a major potential source of error variance in the IPANAT and estimating the error variance associated with the single artificial words could serve as a tool to improve the IPANAT by choosing artificial words in a way that minimizes this type of error variance as much as possible. Figure 6.2 provides an example of how a model taking into account the variance introduced by single artificial words would look like. In order to keep the figure readable I have restricted it to showing just three artificial words. I also have omitted the error terms contributing to each of the manifest variables in order to somewhat simplify the figure.

The occasion specific affect variables are identical to the occasion specific variables in Figure 6.1, except that they are estimated now directly from the ratings of the adjective-artificial-word pairs instead of from the mean adjective ratings. For the trait affect estimate, scores for each adjective-artificial-word pair across measurement occasions are first estimated. These scores, the first level of latent trait variables labeled with T's with two indices, are then used to estimate scores for single artificial word ratings according to all three adjectives (T's with one index). These three adjective scores are then used to estimate the type of trait affect measured with the respective subscale (T without index; i.e., happiness in the example used earlier). Note that the second level – estimation of scores for single artificial word ratings according to all three adjectives of one emotion – could be estimated for occasion specific variance, too. However, this would further complicate the model. In addition, it would be less informative in a study where the IPANAT is applied at two different measurement occasions without affect induction since occasion specific variance is particularly interesting if participants have been exposed to an affectively charged stimulus.

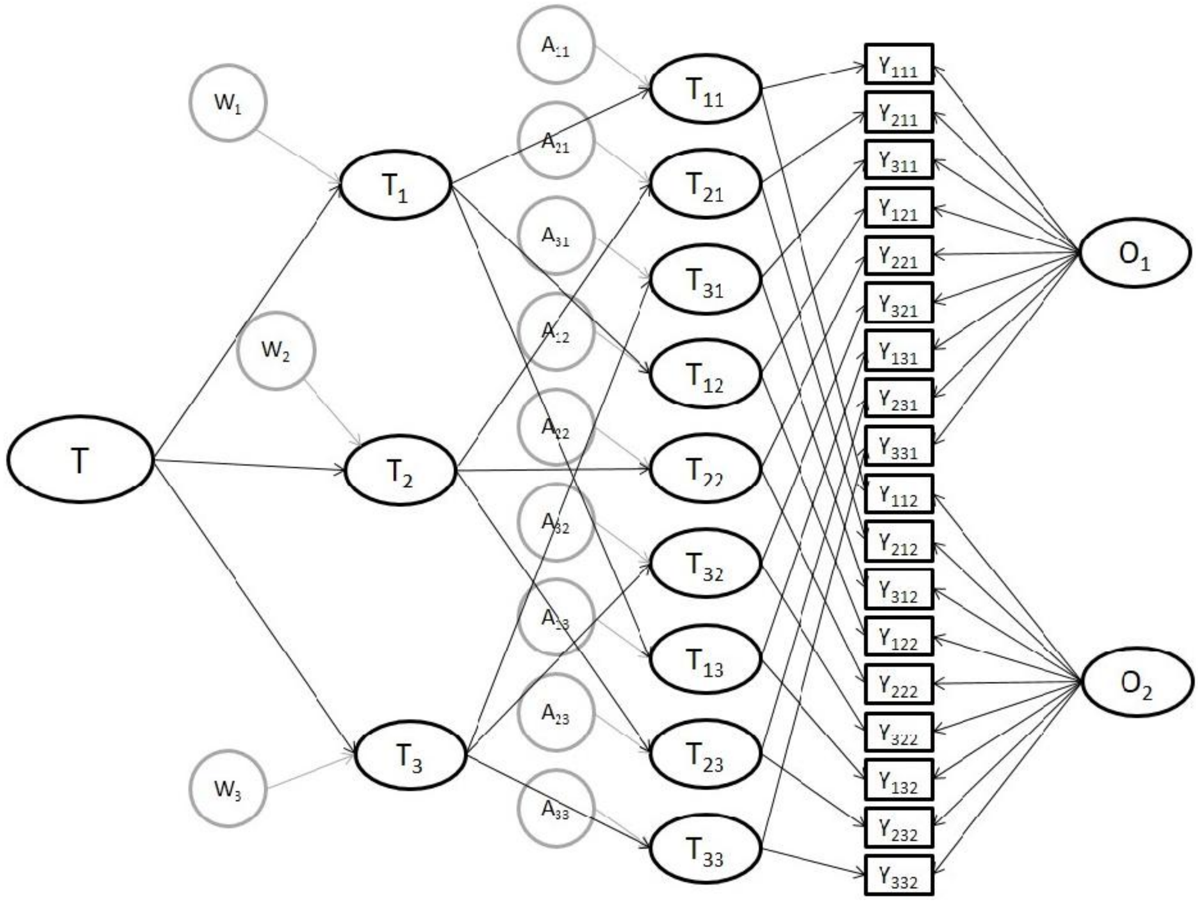

Figure 6.2. Model for three artificial words. The first index of Y denotes the artificial word, the second index denotes the adjective, the third index denotes measurement occasion. The index of O represents the occasion. The first index of T when two indices are present represents the artificial word, the second the adjective. The index of T when only one index is present represents the artificial word. Y, O, and T correspond to the variables symbolized by these letters in Figure 6.1. A = latent variable specific for the respective adjective-artificial-word pair. W = latent artificial word specific variable. Error terms of manifest variables are omitted in order to increase readability of the figure.

Of particular interest with respect to investigating the contributions of single artificial words to the total score of the respective subscale are the variables labeled A and W in Figure 6.2. These variables denote systemic error in form of rating differences between adjective-artificial-word pairs (A's) and between artificial words (W's) respectively and should be as small as possible. As can be seen, however, even a model for just one IPANAT subscale with three artificial words, three adjectives (that is, all adjectives from one subscale), and two measurement occasions becomes quite complex and would need a relatively large participant set in order to arrive at reliable estimates for the latent variables. While a model with three artificial words might therefore not be feasible, a similar model with two words could be used. Including two artificial words might already provide important insights into how artificial word-identity contributes to IPANAT scores even though it cannot estimate the influence of artificial-word identity on the whole IPANAT or on one of the subscales.

Structural equation models such as the latent state-trait models just discussed also could provide information about the number of artificial words that maximizes the ratio of variance reflecting affective processes to error variance in the test. On strategy might be adaption of the model introduced in Figure 6.2 for different numbers of artificial words and application of these models to data from groups of participants that completed IPANAT versions identical with respect to the adjectives but differing in the numbers of artificial words. However, as mentioned earlier, any model with more than two or three artificial words would become exceedingly complex. Simpler models that nonetheless are suitable to investigate the unique (and unwanted) contributions from the single artificial words to IPANAT scores might be obtained by restricting the model to one measurement occasion. Of course, this would no longer allow for the separation of state and trait variance. Nonetheless it would be a useful step since variance associated with specific features of single artificial words can be assumed to remain relatively stable over time.

6.2 The IPANAT and Other Aspects of Affect: Implicit Affect, Explicit Affect, Affect Regulation, and Behavior

Suggesting that implicit and explicit affect might be functions of the two different processes/systems as described for other psychological constructs in dual-process models of cognition (see Smith & DeCoster, 2000; Strack & Deutsch, 2004), as I have done earlier and as Quirin, Kazén, and Kuhl (2009) have done, not only poses the question how these two types of affect differ and if they are indeed based on different systems (see Introduction to this dissertation, Section 1, as well as Section 6.1.2 in this Discussion) but also makes it necessary to discuss the underlying systems and their relationship in more detail. First of all, it is important to note that both, explicit, self-reportable affective experience supposedly based on deliberate, systematic processing, and implicit affect, supposedly based on automatic, associative processing are cognitive reflections of a deeper affective core experience and its reflections in the sensory cortex (cf. Derryberry & Tucker, 1992). From an evolutionary perspective, affect is a relatively old phenomenon that is present at least in all mammals. Furthermore, the core of the affective experience is based on processes in subcortical areas of the brain, which are well conserved between different species (cf. Panksepp, 1998). The two memory systems supposedly underlying implicit and explicit affect, however, are both part of the neo-cortex (Derryberry & Tucker, 1992). This is also represented in the definition of implicit affect introduced by Quirin, Kazén, and Kuhl (2009), which states that implicit affect is the activation of cognitive representations of the affective core experience. So how might implicit and explicit affect be related to this affective core and to each other? I have discussed the possible connections between the underlying processes in previous sections at a superficial level, but I will now take a more thorough look at them. I will again do this on the basis of dual-process models.

6.2.1 Predicting the Relationship of Implicit and Explicit Affect on Basis of Dual-Process Models

First and foremost it is important to note that a number of dual-process models exist. While all of them posit the existence of two processes - usually two processes based on two separate memory systems - there are also important differences between them (see Smith & DeCoster, 2000). One of the prominent differences mentioned by Smith and DeCoster, which is relevant for how implicit and explicit affect might be related to each other, is whether the two processes are suggested to occur sequentially or simultaneously, or whether they are, in fact alternatives of each other. At least with respect to implicit and explicit affect the third option can likely be ruled out since alternative processes make it hard to explain the often-found dissociation between implicit and explicit affect. If only one process occurred at a given time, both, explicit affective self-report, as well as IPANAT scores would have to be based on the process used at that given moment and therefore should correlate quite highly. However, both a sequential and simultaneous operation of the two processes remain possible.

Sequentially (e.g., Brewer, Srull, & Wyer, 1988; S. T. Fiske & Neuberg, 1988) and simultaneous processes (e.g., Epstein, 1991; Sloman, 1996) lead to different predictions concerning the relationship of implicit and explicit affect. Assessing and comparing the time course for both, implicit and explicit affect might provide important information in this regard. If it can be shown that implicit affect changes more quickly after or, in fact, during an affect induction than explicit affect, for example, this would be evidence that the processes either occur sequentially or that they start simultaneously but that the implicit process is faster than the explicit process (cf. Smith & DeCoster, 2000). Of course, it is also possible that both types of processes occur too quickly to be adequately separated with relatively slow measures such as the IPANAT or an explicit self-report measure. An alternative possibility might be to look for components of event-related potentials assessed via electroencephalography that are uniquely associated with either IPANAT scores or scores on an explicit affect measure. Separated components occurring at different times might hint at a sequential processes.

In this context it should be noted that dual-process models that propose sequential processes often state that the deliberate, systematic process that is the process supposedly underlying explicit affect only occurs under certain circumstances, for example if participants are particularly motivated to process some information analytically (Chaiken, 1980; Petty & Cacioppo, 1981). If the deliberate, systematic process is not carried out, explicit, self-reported affect should be informed alone by implicit affect. Note that in both, Chaiken’s model as well as Petty & Cacioppo’s model, the outcome of automatic, associative process is not unconscious in nature and therefore can be self-reported. The process itself, however, can very well be assumed to be unconscious – something that is not true for the conscious deliberation that characterizes the second process.

Distinguishing if implicit and explicit affect are based on sequential or simultaneous processes also has important implication for a possible information exchange between the two systems underlying the processes. While information can only flow uni-directionally for sequential processes, information could potentially flow bi-directionally between the two systems for simultaneous processes (e.g., Strack & Deutsch, 2004). It should be noted, however, that information flow between the two processes is not mandatory in either case – it is also possible that the two systems work completely independent of each other. In order to investigate whether such information flow is present and whether it is present how it looks like, an investigation of factors moderating the concordance of the two types of affect (cf. Hofmann et al., 2005) would be a first step. However, such moderators can only be interpreted as indicators of information exchange between the two systems if they (a) are theoretically related to this type of exchange and (b) if their role cannot be adequately explained by their influence on the relationship between affective core experience and implicit and explicit affect. Finally, it is important to remember that the possibility that implicit and explicit affect measures do not assess separate processes but that they are simply different ways to assess one and the same process as I have discussed in Section 6.1.2.

6.2.2 Affect Regulation at the Implicit and Explicit Level

Questions concerning the systems underlying implicit affect measured with the IPANAT and explicit, self-report based affect scales as well as their relationship and the possible information exchange between them and with the systems underlying core affective experience have important implications for a number of topics in affective research. Possibly the most notable of these topics, both because of its theoretical as well as its practical importance, is affect regulation. As mentioned, the core of affective experience is based on subcortical processes. However, intrapersonal affect regulation, that is, affect regulation that is based on changes in attention, appraisal, or action (cf. Gross, 2013; Gross & Thompson, 2007), is based on cortical systems that might overlap with the systems that underlie implicit and explicit affect. For example, conscious reappraisal, such as the type taught to patients during cognitive therapy for depression (e.g., Beck, et al., 1979) should be a function of a deliberate, rule-based operating system which should be either identical or closely related to the system producing explicit affect. Therefore, I would expect conscious reappraisal to influence explicit self-reported affect more strongly than implicit affect since the influence on explicit affect can be direct, that is, reappraisal might directly influence self-reports of emotion without first changing core affective experience. Still, the indirect route of reappraisal changing core affective experience changing, which in turn changes self-reported affect certainly is possible and likely occurs sometimes since reappraisal has been found to down-regulate autonomic arousal (e.g., Gross, 1998) even though this down-regulation could not be replicated in all studies which found an influence of reappraisal on self-reported affect (cf. Steptoe & Vögele, 1986). The indirect route should also influence implicit affect. Furthermore, with time, formation of new associations in the system underlying implicit affect might lead to this type of reappraisal to become automatic, effortless and possibly unconscious (cf. Gyurak, Gross, & Etkin, 2011). Future studies on implicit affect and reappraisal therefore should focus on when implicit affect is influenced by reappraisal, if this potential influence of reappraisal on implicit affect is as strong as on explicit affect and what situational factors and personality differences moderate the effect of reappraisal on implicit affect and the correspondence of (or lack thereof) implicit affect and explicit affect changes after reappraisal.

In addition to emotion regulation strategies which are based on deliberate, conscious processing, such as reappraisal, there are also automatic (and possibly subconscious) forms of emotion regulation (cf. Gyurak, et al., 2011; Koole & Rothermund, 2011; see also Kuhl, 2001). An example is automatically shifting attention to information opposite in valence to one’s current emotional state (Rothermund, et al., 2008), an effect that might underlie the counter-regulation effect that my colleagues and I found in Manuscript 1 (Section 2). A related example is the activation of positive affective information in order to down-regulate a negative affective state (C. McFarland & Buehler, 1997; Parrott & Sabini, 1990). As discussed in Manuscript 1 (Section 2) as well as in Section 6.1.3.1 and Section 6.1.3.4 of this discussion, these processes are likely to be intimately linked to affect-incongruent changes in IPANAT scores (Forgas, 1995). This link is either mediated via the influence of affect-incongruent activated concepts on the judgment of artificial words or through their influence on implicit affect, which should be more closely related to automatic processes than explicit affect. Furthermore, the ability to recall positive information while in a negative affective mood might be increased through repeated experience of positive affect after negative affect, which should strengthen the remote associations between information of opposite valence in memory (Kuhl, 2001). Individuals with extensive experience of mastering difficult and stressful situations might therefore show a stronger and quicker increase of positive affect and particularly of positive implicit affect in a negative affective state.

Another interesting phenomenon with respect to affect regulation mechanisms is the effect of mindfulness on affective experience. Mindfulness – that is, the practice of paying attention to one's affective and bodily states in non-judgmental ways– has been shown to improve depression and general well-being (e.g., Brown & Ryan, 2003). Since mindfulness is aimed at noticing but not at consciously changing one's affective state, however, it seems unlikely that it changes affective experience through conscious processes related to the analytic, sequential system. On the other hand, at the core of mindfulness lies conscious awareness – something that not usually associated with the automatic processes that I have suggested as basis for implicit affect. In fact, instead of directly acting on either implicit affect or explicit affect, mindfulness might operate by lowering the threshold at which individuals become aware of their emotional states which should result in greater congruence of implicit and explicit affect and which might make it easier to act on them in adaptive ways. In fact, previous work has suggested that affect acknowledgment, a concept that is related to mindfulness moderates the recall of positive life events to regulate negative affective states (C. McFarland & Buehler, 1997). Furthermore, previous research on the effect of mindfulness meditation on implicit and explicit self-esteem (an affect related concept) has found that it increases the correlation between the two (Koole, Govorun, Cheng, & Gallucci, 2009). Future research should investigate whether these effects can be replicated for implicit and explicit affect.

6.2.3 Influence of Implicit and Explicit Affect on Behavior

A related question to how implicit and explicit affect are connected concerns their relationship to behavior. In fact, research on the effects of implicit versus explicit attitudes on behavior has found that implicit attitudes towards an outgroup predict (and probably drive) nonverbal behavior towards a member of that outgroup while explicit attitudes predict verbal, deliberate behavior (Dovidio, Kawakami, & Gaertner, 2002). Considering these findings it is tempting to predict that – parallel to the relationship or implicit and explicit attitudes with behavior - implicit affect is related to nonverbal, spontaneous behavior while explicit affect is related to verbal, deliberate behavior. However, there are two important differences between attitudes and affect that need to be kept in mind when attempting to draw a parallel between the two.

However, while attitudes can directly shape behavior – in case of explicit attitudes even through conscious deliberation – the same is less plausible for implicit and explicit affect. Rather, the aspect of affect that is most likely to shape behavior is core affective experience. Since there is just one core affective experience underlying implicit and explicit affect, it is questionable whether implicit and explicit affect can truly have disparate influences on behavior. In fact, this seems only plausible if implicit and explicit affect both directly refer to core affective experience while at the same time capturing separate aspects of it. However, predicting the existence of such separate aspects would also require their definition.

A first step that could be taken is to investigate whether implicit affect does indeed predict behavior, whether this prediction of behavior through implicit affect can also be shown if implicit and explicit affect diverge, and whether there are moderators of the potential relationship between implicit affect and behavior. Experiments investigating these questions could be used as a starting point to develop a theory which deals with the relationship of implicit affect, explicit affect, affective core experience, and behavior. In addition, results supporting a relationship between IPANAT scores and behavior would also support the affective nature of the IPANAT (cf. Section 6.1.1).

6.2.4 Beyond Dual Processes

Until now, I have assumed a dual-process structure as basis for possible models to explain the relationship between implicit and explicit affect. However, two processes might not be enough to explain the cognitive aspects of human affect. In particular, the parallel-processing, associative system proposed in these models might not be sufficient to explain certain phenomena that have been observed with the IPANAT as well as in studies using other measures that have been used to assess implicit affect. For example, as discussed in Manuscript 1 (Section 2), Koole and Jostmann (2004) found that the speed at which participants were able to recognize a happy face in an angry crowd was mediated by the ability to access self-related knowledge. While the intuitive affect regulation measured in this study should be based on an automatically operating system, such as the associative system described by dual-process models, it is unclear why operation of such a system should go hand in hand with activation of self-knowledge. Similarly, Study 2 in Manuscript 1 (Section 2.4) found an increase in positive implicit affect after a sadness prime if participants' self-knowledge was activated through self-referential primes but not if participants were primed with non-self-referential control primes. Here, too, affect regulation based on an automatic, associative system as proposed in dual-process models cannot adequately account for this. Instead, a different model that includes a processing system that is tied to self-knowledge is needed to explain these findings. Such a model is provided by personality systems interaction (PSI) theory (Kuhl, 2000, 2001).

In particular, PSI theory proposes the existence of not one, but two systems operating automatically and associatively: A system called *intuitive action control* which overlaps in many ways with the automatic, associative system proposed by dual-process model, and a more "intelligent" intuitive system which actively integrates positive and negative information through remote associations and which stores, among other things, self-referential knowledge such as autobiographical information but also personal motives and goals, the so-called *extension memory*. In fact, my colleagues and I referred to the self-referential part of extension memory as the self when we discussed our findings in Manuscript 1 (Section 2.5.1).

Is it always extension memory instead of intuitive action control that underlies implicit affect as measured with the IPANAT? This question cannot be conclusively answered at the moment. It is very well possible that there are two types of implicit affect that is, implicit cognitive representations of affective core processes: One type that is based in extension memory and one type that is based in intuitive action control. IPANAT scores might be the result of a mixture of these two (in addition to the other explicit and implicit processes that I have discussed in Section 6.1.3). Furthermore, the involvement of each system in the generation of IPANAT scores might depend on personality and situation.

For example, spontaneity should be associated with activation of intuitive action control. Highly spontaneous people should therefore tend to have IPANAT scores based on this system (see Kuhl, 2001, for a detailed discussion of the activation and interaction of different cognitive systems for different personality styles). In addition, as already mentioned highly self-relevant affective stimuli should activate predominantly extension memory. IPANAT scores after priming with self-relevant stimuli should therefore be strongly based on affective representations in this system. Furthermore, PSI theory proposes that activation of extension memory is linked to low negative affect while activation of intuitive action control is linked to high positive affect (Kuhl, 2001). Stimuli designed to selectively induce these affective states might therefore be able to target the different systems which in turn might influence on which of the two systems IPANAT scores are predominantly based in a given situation.

Finally, if IPANAT scores are based on intuitive action control or extension memory in any given individual or situation might also be reflected in the affect regulation strategies preferred by that individual or in that situation. For example, Koole (2009) describes three different classes of affect-regulation strategies: need-oriented, goal-oriented, and person-oriented strategies. While need-oriented strategies are based on hedonic motives and aim to maximize pleasure and minimize pain in the short-term, person-oriented strategies aim at balancing out different needs, motives, and goals in the long term, often while accepting short-term pain or discomfort to a limited degree. An example of a need-oriented strategy would therefore be avoiding or delaying an unpleasant task while an example of a person-oriented strategy would be creating a more pleasant and relaxing environment to tackle the task. Need-oriented strategies share typical features with and might be based on intuitive action control, while person-oriented strategies share features with (e.g., the integration of positive and negative information) and might be based in extension memory. For implicit affect this would mean that a change in implicit affect due to action originating from the respective system might correlate with activation of the system.

To test these hypotheses, a similar procedure as the one used by Koole and Jostmann (2004, Study 3) can be useful. In particular, activation of extension memory should be reflected in increased accessibility of self-related information. This accessibility can be operationalized in terms of reaction times during self-judgments which should mediate any relationship between self-referential primes and implicit affect. Furthermore, since extension memory integrates positive and negative information, mixed affective states (e.g., increased implicit sadness in combination with increased implicit happiness; cf. Kuhl, 2001) should be found predominantly for people with a highly active extension memory.

6.3 Adapting the IPANAT to Different Research Contexts

Other than analyzing the processes underlying the IPANAT as well as the relationship of implicit affect and other aspects of affective experience, it is worthwhile to consider to which research contexts and questions the IPANAT procedure can be successfully adapted. In fact, adaptation of the IPANAT has played a central role in the papers included in this dissertation. In particular, I and my colleagues have investigated in Manuscript 2 (Section 3) whether the factor structure of a variant of the IPANAT with adjectives designed to capture four different emotions supports application of the IPANAT to research interested in distinct emotions. I have further proposed an adaptation for the assessment of affective time course in Manuscript 3 (Section 4.5.1), as well as introduced a version of the IPANAT in a language other than German in Study 2, Manuscript 2 (Section 3.4).

I will now discuss these adaptations in light of relevant findings on the measurement and neural underpinnings of distinct emotions, the need for affective measures able to assess time course, and the importance and pitfalls of adapting the IPANAT to different languages and cultures. I will then briefly discuss the application of the procedure used in the IPANAT to psychological constructs other than affective phenomena, such as motives and attitudes. Finally I will discuss whether the IPANAT can be used in applied settings such as market research and clinical practice.

6.3.1 Measurement of Distinct Emotions with the IPANAT

The theoretical disentanglement of the systems and processes underlying the IPANAT and proposals on how this theoretical basis can be tested empirically are vital prerequisites for a meaningful discussion of and in how far the findings presented of this dissertation concerning the separability of different (negative) emotions with an implicit tests such as the IPANAT are informative about the structure of affect. In Manuscript 2 (Section 3) I have provided evidence that it is possible to construct a version of the IPANAT that measures different negative emotions as separable factors instead of just general negative affect. In the Supplemental Study (Section 5) I have further shown that priming with pictures of facial expressions of anger, sadness, and happiness leads to prime specific changes on the separate emotion scales on the IPANAT-DE.

What does this mean for the nature and structure of affective experiences? First of all, in the light of the previous discussion, it is important to remember that the IPANAT is designed to measure implicit affect and that implicit affect is defined as a cognitive representation of affective core experiences. Since the cognitive representation of an affective experience might be influenced by other factors than just the affective core experience itself and therefore does not represent the core experience one to one, the cognitive representation might differ in structure from the more basic level of the affective core experience, even if it is an implicit (vs. explicit) cognitive representation. For example, knowledge of verbal labels is a prerequisite for the type of cognitive representation measured with the IPANAT and these verbal labels are strongly culturally influenced (cf. Wierzbicka, 1999b). In fact, according to Wierzbicka (2009), while all languages have words to express positively and negatively experienced affective states, direct translations for specific emotion words are often not possible. On the other hand, other researchers (e.g., Church, Katigbak, Reyes, & Jensen, 1998) have found evidence that words expressing affective states in different languages can be mapped on the so-called basic emotions in different cultures even though translations of single words might not be exact.

The similarities and differences between affect-expressing words between cultures are important since there is an ongoing discussion whether distinct emotions actually exist at the most fundamental level of the emotional experience (cf. Barrett et al., 2007; Izard, 2007; Panksepp, 2007, 2008; Russell & Barrett, 1999). Researchers on one side of this discussion hold that this basic core of the affective experience is undifferentiated and defined alone by the two dimensions valence and arousal and that the more differentiated emotions measured via (implicit or explicit) verbal scales are culturally shaped interpretations of different combinations of the affective core dimensions (e.g., Russell, 1980; Russell & Barrett, 1999). If this view of emotion is correct, than the use of an IPANAT version measuring distinct emotions such as the IPANAT-DE is limited. In contrast, researchers on the other side of this discussion argue that at least a minimum number of distinct emotions are products of evolution which are a function of distinct subcortical systems that humans share with other mammals and which serve both, to prepare the respective organism for specific actions that are adaptive for survival in the situation which triggered the emotion (e.g., Panksepp, 1998) and to serve a communicative function to other organisms, for example via facial expressions (cf. Gosselin, Kirouac, & Doré, 1995).

Personally, I tend to agree with the position of the latter side for several reasons. First, I find the argument that specific emotions are adaptive in an evolutionary context to be convincing while I have a hard time to see the adaptive sense of unspecific negative affect that is only further differentiated by arousal. Two situations can be highly negative and highly arousing and still require two totally different classes of action. For example, a direct threat to one's life should trigger not just negative affect and high arousal, but some kind of emotion which is associated with avoiding or getting away from that threat while an obstacle that hinders access to some resource necessary for survival – another situation which would be highly negative and highly arousing – should trigger an emotion associated with overcoming or fighting the obstacle instead of avoiding it.

Opponents of the existence of differentiated emotions at a basic, non-cognitive level have stated that empirically evidence does not support this kind of reasoning because it has been found that no emotion leads unfailingly to one action and furthermore that the same action can be associated with different emotions (e.g., Russell & Barrett, 1999). For example, both, anger and fear can lead an organism to fight. However, while fear certainly can also prompt fighting, this should only be the case if the organism has no immediate opportunity to flee. In addition, at least in humans, emotions only preference a type of action (cf. Frijda, 1988), they do not cause it unfailingly – probably because of advanced abilities to regulate emotions.

It should also be noted, that there is actual evidence for separate sub-cortical systems underlying different emotions in the brain (see Panksepp, 1998). In particular, Panksepp lists four emotional systems for whose existence in mammals there appears to be sound physiological evidence: SEEKING, RAGE, FEAR, and PANIC. However, while the labels give hints to which emotions might correspond to activation of which system, the labels should at this point be used with caution as Panksepp himself notes.

In particular, the SEEKING system is associated with appetitive behavior and self-stimulation (i.e., it is reflective of some kind of approach related positive emotion), and the PANIC system is related to the emotional state related to separation from an attachment figure – it therefore should be related to sadness and grief. This is interesting since panic in daily language denotes a type of fear, and as implied by Panksepp's labeling. Particularly children separated from attachment figures do not just display sadness but actually something that is very similar to fear. The existence of separate systems for separation anxiety, which is not just fear, but also sadness related to separation and fear of a potentially dangerous stimulus could maybe explain the difficulty to separate fear and sadness with the IPANAT-DE as reflected in Study 1, Manuscript 2 (Section 3.3).

In addition to the four emotional systems that Panksepp (1998) regards as well-established, he also proposes the existence of three additional emotional systems: LUST, CARE, and PLAY. These three additional systems all are related to different types of positive emotions, suggesting that not just separate negative emotions, but also separate positive emotions are represented in the brain subcortically. Furthermore, Panksepp also states that further additional systems might be discovered in the future, and that the list likely remains incomplete at this time.

While it is not clear whether subcortical systems such as identified by Panksepp (1998) directly correspond to different verbal concepts of (positive or negative) emotions, a recent study did find that the time course of several positive emotions did dissociate when assessed repeatedly before, during, and after an exam. In particular, the emotions joy, interest, and activation could be separated by asking students to complete the positive affect subscale of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988), at the three separate time points (Egloff, Schmukle, Burns, Kohlmann, & Hock, 2003). This finding is also notable because the PANAS actually was designed to measure general positive and negative affect, not distinct emotions. A future study might aim to replicate these findings using a version of the IPANAT designed to measure different positive emotions to investigate whether positive emotions are separable at the implicit level also.

Furthermore, neurobiological findings do suggest that different positive emotions are associated to different degrees with approach motivation (Gable & Harmon-Jones, 2010). Also in this context it would be interesting to try to replicate the finding using a version of the IPANAT developed to measure the respective positive emotions: Do different implicit positive emotions increase if participants are primed with strongly approach-related primes compared to primes that are positive in nature but not necessarily approach related? Investigation of this question could aid both, further validation of the IPANAT as well as investigation of the nature of different positive emotions.

6.3.2 The IPANAT in Cross-Cultural Research

In the previous section, I have already cited evidence for and against the cross-cultural constancy of cognitive concepts of emotion (see also Ekman, Friesen, O'Sullivan, & Chan, 1987; Wierzbicka, 1999a). In the context of distinct emotion research using the IPANAT, comparing results gathered with the IPANAT in different cultures becomes a particular tempting option to verify that the respective subscales correspond to distinct, basic emotions that are a constant across cultures. In fact, the positive-negative affect version of the IPANAT developed by Quirin, Kazén, and Kuhl (2009) has already been translated to a number of languages (e.g., Hicks & King, 2011). Furthermore, I and my colleagues have described a Turkish version of the IPANAT-DE and replicated the factor structure found in German samples with it in Study 2, Manuscript 2 (Section 3.4).

However, while translation of psychological measures in general has a number of challenges and equivalency of different-language versions of the same test can never be taken for granted this is particularly true for affect measures. In particular, all tests using emotional expressions, irrespective of if they are explicit measures or implicit measures such as the IPANAT are especially challenging to translate since it is often impossible to find exact translations of the respective expressions (e.g., Kayyal & Russell, 2012; Wierzbicka, 2009; cf. also the difficulty of finding an exact English translation of the German word bedrückt reported in Manuscript 2, Section 3) So, special care needs to be taken if results are going to be compared across cultures.

Most importantly, the subscales of the IPANAT need to be as close in meaning as possible across languages to heighten the chance of valid cross-cultural comparisons. In this context, the equivalency of different language versions of complete subscales is far more important than equivalency of the single adjectives. Back translation, the technique usually used to translate questionnaires (Brislin, 1970), might therefore not be the optimal option in this case. Instead, techniques tying the translations to the emotional experiences they are supposed to express might be most useful. For example, one could show participants with different mother tongues facial expressions of the different emotions one wants to measure and ask them to rate which on a list of adjectives expresses the pictured emotion best (cf. Ekman & Friesen, 1971). Alternatively, one could use short scenarios describing situations which should evoke a specific emotion instead of facial expressions (in fact, scenarios like this have previously been used to investigate the cross-cultural recognition of facial expressions, cf. Ekman & Friesen, 1971; see also Wierzbicka, 2009). Ideally, a combination of several techniques would be used. Considering these points, the Turkish translation of the IPANAT-DE introduced in Manuscript 2, Study 2 (Section 3.4) might be better judged as a starting point for a translation of a Turkish equivalent to the German version of the IPANAT-DE rather than definitive version.

In addition, all these possible procedural advancements of translated versions of the IPANAT do not circumvent another problem: While core affective experience reflective of emotion specific systems in the brain should be universal across cultures (Panksepp, 1998) the fact remains that conscious emotional experience depends not just on core affective experience but also its culture specific interpretation. These differences interpretations are influenced by differences in language (and differences in language in turn reflect differences in culture). For example, while humans are probably all born with the ability to experience certain emotions (cf. what Panksepp describes as emotional "birthrights" that we have as mammals) these emotions are likely to be less complex than the emotions felt by an adult. The complexity of adult emotions is probably shaped by language. In addition, humans learn which emotion is appropriately experienced in a specific context as well as which label is attached to this emotion through interactions with care takers in our childhood (Lindquist, 2013) and in different cultures (or subcultures) this process and its outcomes might look very differently. Moreover, as demonstrated by reappraisal used spontaneously in daily life as well as deliberately in cognitive therapy of depression (Beck, et al., 1979; Gross & John, 2003; Lazarus, 1993), the interpretation and reinterpretation of emotion arousing experiences does not just change the label we give to an emotion but effects to some degree which emotion is experienced (Averill, 1983). Since these interpretations differ between cultures, this is one possible route in which emotional experience might differ between cultures, too. Since the IPANAT is language based these issues should apply to it just as much as to explicit affect measures. Special care therefore needs to be taken not just while translating the IPANAT but also while interpreting cross-cultural findings obtained with the IPANAT. In particular it would be helpful to also measure physiological arousal and action tendencies in addition to implicit affect when doing cross-cultural research. Even if all these points are kept in mind, however, IPANAT raw scores should not be directly compared between cultures. Patterns of changes in IPANAT scores over time after an affect induction or a naturally occurring event might be safe to compare, though.

6.3.3 Assessment of Affective Time Course with the IPANAT

A further innovation concerning the ongoing development of the IPANAT procedure introduced in this dissertation in addition to its application to distinct emotions concerns the assessment of the time course of implicit emotions via the IPANAT. By analyzing the IPANAT-DE on artificial word by artificial word basis as I have done in Manuscript 3 (Section 4), and the Supplemental Study (Section 5) it becomes possible to follow the change in implicit emotions over time. Furthermore, while I achieved temporal resolutions of up to 30 s, it might be possible to obtain even better resolutions if not just the order of artificial words is (partially) counterbalanced between participants, but if the same type of counterbalancing is also used for adjectives assessing one and the same emotion and between the groups of adjectives assessing different emotions. If three emotions were assessed with three adjectives each in one and the same experiment and if participants were given 5 s for each adjective-artificial word pair, this type of procedure would be able to achieve a temporal resolution of 15 s. If only two emotions were assessed, the temporal resolution would be 10 s.

There are some caveats, however. First and foremost, the second type of counterbalancing procedure can only applied to large participant samples. If only the artificial words are counterbalanced, a number of participants that is a multiple of the number of artificial words has to be used in each experimental group, which is usually still manageable. If, however, the adjectives are also counterbalanced in the suggested way, the minimum number of participants per experimental group rises to the number of artificial words times the number of emotions assessed times the number of adjectives per emotion subscale. In an experiment where just two emotions are assessed and a standard IPANAT-DE with five artificial words is used, this would mean a minimum of thirty participants per experimental group. Furthermore, counterbalancing of artificial words will only control for non-emotional effects on words that are (at least on average) shared between participants. If individual associations with certain sounds or syllables are too strong, the effect of them might influence the results.

In addition, it is not clear how exclusion of single participants affects the data if this procedure is used. In particular, the effect of artificial word and/or adjective identity of any given rating is not controlled for any longer if the design is no longer fully counterbalanced. Therefore, all drop-outs should ideally be replaced to maintain a fully balanced sample. For similar reasons, missing data can influence the results in unknown ways – however, it is unclear how this missing data problem can be tackled since introducing a time limit for the ratings as it is necessary to assess the time course also introduces at least a minimum number of missing ratings. In my studies, I have not controlled for these factors – analyses with random participants missing gave the same pattern of results as reported, however, which seems to indicate that the procedure is at least somewhat robust. Still, the reported concerns should be investigated systematically before it is decided that they are not a problem. Finally, setting a (relatively short) time limit for each rating might also change which processes dominate the generation of IPANAT scores by limiting the influence of affect priming on the ratings (cf. Section 6.1.3).

Yet, using the IPANAT to assess the time course of emotions or other affective phenomena also provides great opportunities. In particular, as has been stressed by a number of emotion researchers for many years, emotions are highly dynamic phenomena. However, to my knowledge there exist only very few measures that are able to assess emotional changes across relatively short time frames other than physiological measures which usually have the drawback that they are rather emotion unspecific (however, see Sonnemans & Frijda, 1994, for a measure assesing the time course of explicit emotion episodes through retroactive self-report), for an example of a measure assessing the time course of explicit emotion episodes through retroactive self-report). In this context assessing the time course of emotions with the IPANAT starts to fill the dire need for measures of emotional time course at least at the implicit level and opens exciting new opportunities for research.

6.3.4 *The IPANAT for Measurement of Non-Affective Phenomena*

Similar to the adaptability of other implicit procedures such as the IAT, which was originally developed to measure attitudes but has been adapted to measure implicit self-image and implicit self-esteem (Greenwald & Farnham, 2000; see also Egloff & Schmukle, 2002) the procedure used in the IPANAT might be useful to measure non- affective implicit cognitive representations. In particular, Drosten (2012) has recently developed a variant of the IPANAT that measures implicit motives, the IPANAT for Motives (IPANAT-M). In this variant, the adjectives used refer to behavioral traits that indicate a power, affiliation, or achievement motive (e.g., *influential* for power, *sociable* for affiliation, and *hard-working* for achievement). Drosten (2013) has further shown that IPANAT-M scores correlate with implicit measures assessed via other implicit motive measures, such as the Operant Multi-Motive Test (OMT; Kuhl & Scheffer, 1999) and the Multi-Motive Grid (MMG; Sokolowski, Schmalt, Langens, & Puca, 2000). Furthermore, Drosten also found that discrepancies between implicit motives measured with the IPANAT-M and explicit motives measured with the Motive Enactment Test (MUT; Kuhl, 1999) predicted higher scores on the German version of the Center for Epidemiological Studies Depression Scale (Hautzinger & Bailer, 1993; see Radloff, 1977, for the original version).

In another line of research, Luckey (2009) has adapted the rating of artificial words without a defined meaning for the measurement of implicit prejudices towards Arabic Muslims versus European Christians. For this purpose, he generated and pre-tested artificial words that sound stereotypically Arabic and stereotypically European to German average German participants (e.g., *MULADAD* as an example of an Arabic sounding word and *DROTEN* as an example of a European sounding word). He then asked participants how much they liked each group of artificial words. In general, German participants tended to like the words that sounded Arabic to them.

Luckey's (2009) approach is particularly interesting since it shows that the subjective properties of the artificial words and not just the properties of the adjectives paired with them can be used to measure implicit cognitive representations. Furthermore, both, Drosten's (2012) as well as Luckey's adaptations speak for the flexibility of the procedure underlying the IPANAT. In fact, even if it turns out that the IPANAT is not able to adequately tap affective processes but rather measures activation of affective concepts in absence of an influence of affective core experience the underlying procedure might still prove useful to measure constructs such as motives and stereotypes that – while affectively influenced – are cognitive at their core and based on activations of cortical activations rather than cognitive reflections of sub-cortical processes.

6.3.5 The IPANAT in Applied Settings

In the previous sections of this dissertation I have discussed how the IPANAT can be adapted to different basic research questions. However, is that IPANAT also useful in applied settings? While the IPANAT could easily be used in applied contexts where it would be administered to a group of people, such as consumer research, special care should be taken if it is used with individuals. In particular, the IPANAT cannot be used to establish an implicit affect baseline in individuals since individual IPANAT scores are influenced by too many non-affective processes that cannot be separated from the influence of the actual affective processes that the IPANAT aims to measure at the individual level as I have discussed in this dissertation (Sections 6.1.3 and 6.1.4). While it should be possible and desirable to estimate the variance explained by these non-affective processes at a population level, it will remain unclear how strongly the IPANAT scores of any given individual are influenced by them. However, similar concerns apply to explicit self-report measures of affect to a lesser extent. For example, explicit affect scores cannot easily be compared between different individuals either since people might differ in their interpretation of scale anchors.

While IPANAT raw scores cannot be diagnostic for individuals, it might be useful to apply the IPANAT repeatedly in order to assess the change of implicit affect over time (cf. Section 6.3.2 for a discussion of similar concerns in cross-cultural research). If the IPANAT is applied repeatedly to an individual, especially if it is applied more than two or three times on different days, special care should be taken that the respective individual is and remains unaware of the actual purpose of rating the artificial words that are part of the IPANAT. Parallel IPANAT version with stimuli that are less likely to evoke person-specific associations, such as computer-generated faces with ambiguous gender and controlled attractiveness that show an ambiguous facial expression (obtained by simulating activation of facial muscles engaged during different emotional expressions, cf. Ekman & Friesen, 1978). Remember, however, that assessing affective time course by splitting up the IPANAT discussed in Section 6.3.3 is a technique that should not be used with individuals since counterbalancing to account for the influence of single artificial words can only be done in a group of participants.

In addition, it should be taken into account that any given individual might remember previous ratings and might adjust their answers based on those memories. The IPANAT might therefore overestimate the stability of implicit affect. While this might also be the case in a research setting, this process would generally influence results in direction of the null-hypothesis therefore making a positive result due to a measurement artifact unlikely. Finally, despite its limited usefulness in clinical diagnosis and practice, the IPANAT can be used in clinical research.

6.4 Future Research/Conclusion

In this dissertation I have extended previous work on the measurement of implicit affective processes with the IPANAT (Quirin, Kazén, & Kuhl, 2009). In particular, I have presented evidence that the IPANAT assesses affect regulation process, introduced the IPANAT-DE, a version of the IPANAT that has been designed to measure distinct emotions, and described findings on the change of different implicit emotions after priming obtained by using scales of the IPANAT-DE.

However, as demonstrated by the many open questions concerning the nature and interpretation of IPANAT scores that I have raised in the previous discussion, the empirical research presented in this dissertation only covers a small part of the work that needs to be done before the IPANAT can be routinely applied to asses affective processes. Still, not all the questions are equally pressing. In particular, while the questions in Section 6.1 on the mechanisms underlying the IPANAT - most notably the question if the IPANAT does indeed measure an affective process (Section 6.1.1) - need to be answered as soon as possible, questions on the relationship of implicit affect measured with the IPANAT (Section 6.2) and other aspects of affect as well as questions concerning the applicability of the IPANAT to specific research contexts (Section 6.3) are not as urgent. Furthermore, many of the studies proposed in Section 6.1 will yield data that is also highly relevant for tackling the issues raised in section 6.2 and 6.3 and can therefore provide a starting point.

Considering the number of unanswered questions that I have raised (and the additional number of unanswered but important questions that I have not thought of), one might ask whether a method with so many associated uncertainties really represents a useful tool at all. This ignores that the IPANAT shares many of the issues I have raised with other implicit measures that are well established in psychology, such as the IAT. In addition, while explicit self-report measures of affect but also of personality differences or clinical disorders might seem easier to interpret, the development of implicit measures was a reaction to the vulnerability of these measures when it comes to factors such as social desirability concerns, self-serving biases, and a lack of introspective abilities.I In case of the IPANAT, it also needs to be kept in mind that it aims to assess affect - a psychological construct that is extremely hard to measure, not least because it is based on subcortical processes (Panksepp, 1998), but that is nonetheless central to human functioning.

Keeping this in mind I believe that the IPANAT is a still imperfect, but vital step in the right direction. Justified skepticism of new and indirect measures should not cause researchers to avoid them, but rather should caution them to over interpret the results obtained with them and stimulate research investigating their mechanisms

7 References [...]

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8 Footnotes

[1] Please note that two-process or respectively dual process and two-systems models are used interchangeably in this dissertation, even though this is not always the case in the literature. In particular, I am assuming the existence of two separate memory systems whenever I use one of the expressions.

[2] Note that while the two concepts are related, affective core experience as used in this dissertation is not the same as (undifferentiated) core affect as defined by Barrett and Russell (1999) but instead corresponds to activation in the subcortical affective systems described by Panksepp (1998)

[Footnotes from manuscripts meant for publication have been omitted.]

9 Appendix: Supplemental Material Manuscript 2 (Section 3)

[This appendix is not part of this electronic version. It has been submitted as supplemental material for:

Bode, R. C., Quirin, M. (2013). That makes me implicitly sad or happy: The influence of facial primes on implicit emotions. Manuscript submitted for publication.]