Assessment of emotional detachment in psychopathy *via* self-report and an emotion detection task

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"Der moralisch Anästhetische kennt ganz gut die Moralgesetze, er sieht

sie, aber er fühlt sie nicht, und deshalb handelt er auch nicht danach."

F. Scholz (in Schneider, 1928)

"The immoral anesthetic knows well the moral laws, he is aware of them,

but he does not feel them, that's why he does not act according to them."

F. Scholz (in Schneider, 1928)

Zusammenfassung

Das Persönlichkeitskonstrukt *Psychopathie* rückt in der wissenschaftlichen Literatur zunehmend in den Vordergrund, jedoch liegen bisher nur wenige Daten zur Ausprägung von Psychopathie in nicht-straffälligen und weiblichen Populationen vor. In dieser Arbeit wird die *Emotionale Distanziertheit* als ein Symptom von Psychopathie in der Normalbevölkerung sowie in Patienten- und Straffälligenpopulationen untersucht.

Nach der Überprüfung der Validität des Psychopathy Personality Inventory Revised (PPI-R) bezüglich der Messung von emotionaler Distanziertheit wurde die Sensitivität des Fragebogens hinsichtlich emotionaler Distanziertheit nachgewiesen. Zudem konnte gezeigt werden, dass anhand von Emotionaler Distanziertheit Aufmerksamkeitsdefizits- und Hyperaktivitätssymptome von psychopathischen Eigenschaften unterschieden werden können. Diese Ergebnisse bestätigen darüber hinaus das Merkmal Emotionale Distanziertheit als ein Kernsymptom von Psychopathie.

Weiterhin wurden in einer Stichprobe forensisch-psychiatrischer Patientinnen zwei Emotionserkennungsaufgaben durchgeführt. Im Vergleich zu gering psychopathischen Patientinnen kategorisierten die hoch psychopathischen Patientinnen nur gerade supraliminal präsentierte traurige Gesichtsausdrücke weniger korrekt, bewerteten aber die emotionalen Gesichtsausdrücke hinsichtlich Arousal als weniger emotional bewegend.

Diese Ergebnisse zeigen, dass Emotionale Distanziertheit ein Kernsymptom von Psychopathie ist, und auch in nicht-straffälligen und weiblichen straffälligen Populationen spezifisch ist. Das Merkmal kann sowohl anhand des PPI-R als auch anhand von Aufgaben zur Emotionserkennung gemessen werden.

Abstract

The personality construct of *psychopathy* is subject of growing research, but data on psychopathy in female incarcerated and in non-institutionalized samples are rare. In this thesis *emotional detachment* as one factor of psychopathy is investigated in general population, in patients and in incarcerated samples.

After verifying the validity of the Psychopathy Personality Inventory Revised (PPI-R) measuring emotional detachment, the sensitivity of the questionnaire concerning emotional detachment has been proven. Additionally it has been shown that symptoms of attention deficit and hyperactivity disorder can be distinguished from psychopathic traits by emotional detachment. In addition, these results confirm the core role of the feature emotional detachment for psychopathy.

Furthermore, two emotion recognition tasks have been conducted in a criminal female inpatients sample. Compared to the low psychopathic patients, the high psychopathic patients showed deficits in categorization only in shortly presented sad facial expressions, but rated emotional facial expressions as less arousing.

These results point to emotional detachment as a core characteristic of psychopathy, and is specific even in non-incarcerated and female incarcerated samples. It can be measured with the PPI-R as well as with emotion detection tasks.

Contents

1 Introduction

Psychopathy is a personality trait that describes an unemotional, deceitful and remorseless person. Commonly, the prototypic psychopath is thought to be male and delinquent in terms of serious crimes. Consulting the literature there are primarily reports on psychopathy in men and incarcerated persons. Thus, the public opinion is reflected in the literature. Thus, psychopathy in women and in non-incarcerated persons is found infrequently, in public opinion as well as in literature. For public opinion, this might be due to the fact that psychopathy in women and in non-incarcerated persons is less present in the media, due to smaller incidence rates. Concerning research, sparse literature could be due to the fact that psychopathy in women and in non-incarcerated persons is rare and less pronounced. Another reason might be that psychopathy is first of all relevant to recidivism research, which is a topic of incarcerated men, inherently, as inmates are predominantly male. Hence, data concerning psychopathy in women and in non-incarcerated persons are lacking and required for understanding the construct as a whole.

A core characteristic of psychopathy is emotional detachment. This feature can be described as an egoistic, unemotional personality, not caring about other people and not knowing remorse or the feeling of guilt, of compassion or of any other strong emotion. This lack of affective depth is discussed to be part of the basis for antisocial behavior, impairing the person to understand other's emotional states.

This dissertation aimed to investigate emotional detachment in female and in non-incarcerated psychopaths. It includes an investigation of subjective descriptions of participants themselves about their emotional reactivity by self-report as well as an emotion detection task as an objective measure.

The structure of this dissertation is as follows. First, psychopathy as a clinical personality construct is introduced and the published evidence of female psychopathy and emotion processing correlates is reviewed. The empirical Part I deals with emotional detachment measured with a recent German self-report measure, the Psychopathy Personality Inventory Revised (PPI-R) in non-incarcerated populations. Evidence for the validity of measuring emotional detachment with this self-report questionnaire is reported for a student and a forensic sample. Subsequently the PPI-R is used to investigate demographic aspects of psychopathy in a student sample. Furthermore, it is used to reveal similarities and differences of psychopathy and attention-deficit-hyperactivity-disorder (ADHD) in an ADHD patient sample, based on data showing high comorbidity rates of ADHD and psychopathy and on the resulting question if this comorbidity can be found for the emotional detachment feature as well. The following empirical Part II reports on emotional detachment in female forensic inpatients measured by an emotion detection task. The empirical parts are followed by a general discussion that reviews the chances and limits of measuring emotional detachment via self-report questionnaire and emotion detection tasks, and reconsiders the pros and cons for the key role of emotional detachment in psychopathy as well as the specificity of psychopathy in women.

2 Theoretical background

2.1 Psychopathy: a construct characterization

Psychopathy is a personality construct that is often associated with antisocial behavior. A highly psychopathic person is someone who places to the front his own privilege and his own progressing, thereby brushing aside other people without noticing their distress, even sticking at nothing. Every individual holds a certain amount of psychopathic traits. Depending on the level a person reaches, he/she can be characterized by high or low psychopathy. A person, reaching high characteristic values of psychopathy is also called a psychopath or a psychopathic personality. In contrary a low psychopathic person does care about other people, commiserates with people suffering from any kind of distress and behave almost altruistic.

Throughout history, this personality trait has had various names. The pathological mind, as described by Kraepelin (1896) and later on by Schneider (1928), included the morally imbecile, the emotionally disturbed person, the antisocial and the so-called "enemy of societies". Schneider further describes the psychopath as morally insane and emotionally disturbed. The first scientifically based description of psychopathy, enumerating diagnostic criteria, was published by Cleckley in 1941. In his book "The Mask of Sanity" he characterized the psychopathic personality as a person with superficial charm and "good" intelligence, who is unreliable, untruthful and insincere, who lacks remorse or shame and who are motivated inadequately for antisocial behavior. A highly psychopathic person is described by poor judgment and a failure to learn by experience, pathologic egocentricity and an incapacity for love, general poverty in major affective reactions, a specific loss of insight, an unresponsiveness in

general interpersonal relations as well as an uninviting behavior. Such a person would rarely attempt suicide, has an impersonal, trivial and poorly integrated sex life as well as a failure to follow any life plan. However, this person does not show any delusions or other signs of irrational thinking, no "nervousness" or psychoneurotic manifestations (Cleckley, 1964). This description served as a catalog of criteria for experimental research on psychopathy beginning in the late fifties (Hare, 1965, 1965; Lykken, 1957). The researchers used Cleckley's description to diagnose someone with psychopathy on a global perspective. This categorization did not include any differential evaluation of psychopathic features, nor was it based on clear-cut and defined symptoms. The need for a standardized classification of psychopathy was also not addressed adequately in the second edition of the Diagnostic and Statistical Manual of Mental Diseases (DSM-II; American Psychiatric Association 1968). In this edition, Cleckley's criteria were in part considered for the development of the description of Antisocial Personality Disorder (APD), but several behavioral symptoms concerning antisocial behavior were added. The later editions of the DSM, DSM-III as well as DSM-IV differed even more from Cleckley's construct description emphasizing antisocial behavior (American Psychiatric Association 1980, 1994). Since the publication of Hare's Psychopathy Checklist (PCL-R; Hare, 1991), a diagnostic manual for psychopathy, the definition of psychopathy is mainly based on his 20 items which are strongly related to Cleckley's criteria.

Today, the desciptions of Cleckley (1964), Hare (1991, 2003) and DSM-IV (APA, 1994) are equally relevant for research and practice. However, comparability of studies on psychopathy is strongly impeded as these descriptions differ. As mentioned above, especially the DSM-IV criteria of antisocial personality disorder do not match Cleckley's and Hare's definitions. In Table 1, these criteria are listed, compar-

ing the inclusion of the different symptoms. Untruthfulness and insincerity, lack of remorse or shame, fantastic, uninviting behavior and inadequately motivated antisocial behavior are represented in Hare's Psychopathy Checklist as well as in the DSM-IV, whereas superficial charm, pathological egocentricity and incapacity for love, general poverty in major affective reactions, unresponsiveness in general interpersonal relations, impersonal, trivial and poorly integrated sex life, failure to follow any life plan, specific loss of insight and rare suicidal ideation can be found only in the criteria of Hare. Hare added two symptoms, which were not explicitly part of Cleckley's definition, but are also part of the DSM-IV: conning, manipulative behavior and early behavioral problems. Another major difference between Hare's and Cleckley's definition is that Hare didn't implement exclusion criteria. The absence of delusions and of psychoneurotic manifestations that were included in Cleckley's criteria is not part of Hare's checklist.

Nevertheless, the predominant list of criteria is Hare's Psychopathy Checklist (PCL-R; Hare, 1991), as Cleckley's definition lacks clear-cut item by item definitions and cut-off and the DSM-IV criteria are not dealing exactly with psychopathy and therefore are inappropriate to draw conclusions for psychopathy itself. In this thesis, the definition of psychopathy is based on Hare's checklist items and thereby is consistent with current research in psychopathy.

According to the items of the PCL-R published by Hare (Hare, 1991, 2003) mentioned in Table 1, a psychopathic person is someone who portrays himself in a positive light, is talkative and is engaged quiet frequently in impression management (Item 1: superficial charm); he is arrogant, does not see himself as having any major problems and has an attitude of superiority (Item 2: grandiose self-worth).

Table 1: Comparison of symptoms of psychopathy, described by Cleckley (1941), Hare (2003) and DSM-IV (1994).

Psychopathy (Cleckley, 1941)	Psychopathy Checklist – R (Hare, 1991, 2003)	Antisocial Personality Disorder (DSM-IV, APA, 1994)
Untruthfulness and insincerity	Pathological lying (Item 4)	Deceitfulness, indicated by repeated lying (criterion A2)
Lack of remorse or shame	Lack of remorse or guilt (Item 6)	Lack of remorse (criterion A7)
Fantastic and uninviting behavior	Poor behavioral control (Item 10)	Irritability and aggression (criterion A4)
Poor judgment and failure to learn by experience	Impulsivity (Item 14)	Impulsivity or failure to plan ahead (criterion A3)
Unreliability	Irresponsibility (Item 15), Many short-term marital relationships (Item 17)	Reckless disregard for safety of self or others (criterion A5), Consistent irresponsibility (criterion A6)
Inadequately motivated antisocial behavior	Criminal versatility (Item 20), Revocation of conditional release (Item 19), Juvenile delinquency (Item 18)	Failure to conform to social norms (criterion A1)
Superficial charm	Superficial charm (Item 1)	
Pathological egocentricity and incapacity for love	Grandiose sense of self worth (Item 2), Parasitic lifestyle (Item 9)	
General poverty in major affective reactions	Shallow affect (Item 7)	
Unresponsiveness in general interpersonal relations	Lack of empathy (Item 8)	
Sex life impersonal, trivial and poorly integrated	Promiscuous sexual behavior (Item 11)	
Failure to follow any life plan	Lack of realistic long-term goals (Item 13)	
Specific loss of insight	Failure to accept responsibility for own actions (Item 16)	
Rare suicidal ideation	Need for stimulation (Item 3)	
	Early behavioral problems (Item 12)	Evidence of conduct disorder with onset before age 15 years (criterion C)
	Conning/Manipulative (Item 5)	Deceitfulness indicated by use of aliases or conning others (criterion A2)
Absence of delusions and other signs of irrational thinking		Antisocial behavior not only during the course of schizophrenia (criterion D)
Absence of "nervousness" or psychoneurotic manifestations		Antisocial behavior not only during the course of a manic episode (criterion D)

He has an excessive need for excitement, is a sensation-seeker, enjoys living in the fast lane, often is a multi-drug-user and is not able to tolerate routine activities (Item 3: need for stimulation). The psychopath has adapted to lying, gaining gratification from lying and often uses aliases (Item 4: pathological lying). Further, he manipulates others for personal gain, exploits the weakness of others and is willing to join programs of treatment to give appearance of being rehabilitated (Item 5: conning / manipulative). He shows no affective response to the negative consequences of his actions, shifts blame to the victim, to family or society and repeatedly engages in actions, which he had claimed being remorseful about (Item 6: lack of remorse or guilt). He is not able to experience strong emotions, his own emotions are often short-lived, he shows reduced non-verbal-behavior, and he has only few affective ties to others (Item 7: shallow affect).

Moreover, he is unable to take anyone else's perspective and uses others as objects, often including aggressive behavior (Item 8: callous, lack of empathy). A psychopath persistently relies on others for financial support, makes no effort to get a steady employment, but engages in illegal dealings (Item 9: parasitic lifestyle). He has poor anger control, easily gets irritated, verbally and physically aggressive, particularly when intoxicated (Item 10: poor behavioral control). His sexual relationships are impersonal, often changing and he frequently cheats on his partner (Item 11: promiscuous sexual behavior). As a child he typically had persistent and serious behavioral problems like stealing, bullying, fighting or fire-setting, leading to sanctions at home and in school (Item 12: early behavior problems). He lives from day to day without having any plans or goals, possible plans are unrealistic and do not contain a domicile or constant work (Item 13: lack of realistic long-term goals). A psychopath does not weigh the pros and cons or consider consequences of his actions, leading

to sudden changes of plans, frequent changes of jobs and residences as well as spontaneous offences (Item 14: impulsivity). He further fails to live up to obligations and commitments, has no sense of duty and behaves irresponsible concerning financial, work and family subjects (Item 15: irresponsibility). He avoids taking personal responsibility for his own actions, criminal and non-criminal, in contrast he tends to rationalize and to minimize consequences (Item 16: failure to accept responsibility for own actions). A psychopath has frequent (more than 3 or 4) unstable relationships of marital type (Item 17: many short-term relationships). Regarding delinquency, a psychopath starts as a juvenile with serious criminal acts leading to contact with the criminal system before age of 18 (Item 18: juvenile delinquency). As an adult he violates conditional releases or escapes from custodies (Item19: revocation of conditional release) and he engages in diverse criminal acts of more than 4 different types (Item 20: criminal versatility).

2.1.1 Structure and epidemiology

Even though psychopathy has been and is still delineated as a categorical taxon using cut-off scores for criteria fulfilled, current research also includes the assumption of a continuous dimension. General population studies or studies including student samples that use self-report measures have shown that there is a considerable variation in psychopathy scores (Benning, Patrick, Blonigen, Hicks & Lacono, 2005; Sellbom, Ben-Porath, Lilienfeld, Patrick & Graham, 2005). This variance is even sufficiently large to find correlates in cortical structure, on a functional level or in physiological reactions in non-incarcerated populations as well (Gordon, Baird & End, 2004; Sellbom & Verona, 2007). Using different kinds of diagnostic measures, taxometric analyses suggest a dimensional character in incarcerated and non-

incarcerated populations (Marcus, John & Edens, 2004). However, measuring prevalence rates requires the use of cut-off scores and therefore most studies on prevalences refer to the PCL-R (Hare, 1990, 2003).

The prevalence of high psychopathy scores in general population can only be estimated, as large population studies have not been conducted yet. According to Hare (1991), lifetime prevalence in the general population is about 1%. In incarcerated populations in the United States and in Canada, the prevalence of psychopathy is about 20% (Hart & Hare, 1997) and the prevalence of antisocial personality disorder ranges from 70 to 100% (Widiger, Cadoret, Hare, Robins, Rutherford, Zanarini, Alterman, Apple, Corbitt, Forth, Hart, Kultermann, Woody & Frances, 1996). The prevalence rates in European incarcerated populations vary from 7% (Ullrich, Paelke, Kahle & Marneros, 2003) to 21% (Borchard, Gnoth & Schulz, 2003), depending on the institutions where data were collected.

Data about the prevalence of high psychopathy in female versus male inmates are inconsistent. Whereas some research groups report lower scores for female inmates (e.g., Louth, Hare & Linden, 1998), others report no differences in prevalence for male and female inmates (e.g., Vitale, Smith, Brinkley & Newman, 2002). Data about gender differences in the general population are inconsistent. Using self-report measures, most of the studies report lower scores in women compared to men (Lilienfeld & Hess, 2001; Lilienfeld & Andrews, 1996). However, one study reported similar scores on psychopathy for males and females (Hamburger, Lilienfeld & Hogben, 1996). Hence, current literature suggests that men and women differ in some of the psychopathic features, but high psychopathy is equivalent in both genders but less prevalent in male as well as female persons.

2.1.2 Etiology and behavioral correlates

The etiology of psychopathy is not yet well understood. Several risk factors for the development of high psychopathic traits were detected. Twin studies provide evidence for an important genetic influence (Blonigen, Carlson, Krueger & Patrick, 2003; Larsson, Andershed & Lichtenstein, 2006). This genetic factor is stronger for psychopathy than for antisocial personality disorder (Waldman & Rhee, 2006). Other studies focusing on psychopathy found evidence for heritability of the dysfunction of the emotion circuitry (Blonigen et al., 2003) as well as of callous unemotional traits (Viding, Blair, Moffitt & Plomin, 2005). There is also evidence for the heritability of reactive aggression (Brendgen, Vitaro, Boivin, Dionne & Perusse, 2006), nevertheless this does not add evidence for the heritability of psychopathy (Blair, Mitchell & Blair, 2005). Further, early risk factors for the emergence of psychopathy like physical neglect (OR = 4.8), uninvolved fathers (OR = 4.7), convicted fathers (OR = 4.4), low family income (OR = 3.9), delinquent sibling (OR = 3.6) and low verbal IQ (OR = 3.5) were described (Marshall & Cooke, 1999). Hence the development of psychopathy could be in large part hereditary, but it is also related to characteristics of socialization, at least on a correlational level.

Personality features are not assumed to be diagnosable in children and juveniles because of the convertibility of personality in early developmental stages (see DSM-IV criteria for personality disorders). For psychopathy there are only few studies with children and juveniles. Nevertheless, the core feature of emotional detachment has been found in juveniles as well as in children in terms of callous-unemotional traits (Barry, Frick, Deshazo, Mccoy, Ellis & Loney, 2000; Salekin & Frick, 2005). These traits have also been shown in behavioral correlates like reduced capability to

correctly classify emotional words or sounds (Blair & Coles, 2000; Kimonis, Frick, Fazekas & Loney, 2006; Stevens, Charman & Blair, 2001).

To summarize, highly psychopathic persons are characterized by deficient interpersonal contact, antisocial behavior, unsteady lifestyle, and impaired emotional experience as a core feature. High values of psychopathy are more prevalent in incarcerated populations than in the general population and more prevalent in men compared to women. From a developmental point of view, psychopathy could be defined by callous unemotional traits that can be found even in children, confirming the assumption of a strong genetic component in psychopathy.

2.2 Measuring Psychopathy

Psychopathy can be measured by self-report or by expert ratings. Self-report is convenient, as it is economic in time, but it may be more sensitive to lying or manipulating tendencies, which is highly prevalent in psychopaths. An external rating addresses this problem as it includes an interview with the person, which is compared with to criminal records. The following paragraphs describe both the external ratings and the self-report measures for psychopathy.

2.2.1 External rating of psychopathy

As described above the first attempts to measure psychopathy were those of referring to Cleckley's items as a checklist. However, there were neither standard procedures nor validity or reliability tests.

Because of the lack of a standardized measurement, Hare began to develop a rating scale in 1980 for research purposes, leading to the well-established Psychopa-

thy Checklist that is now available in its revised second version (Hare, 2003). It comprises ratings of 20 items in a 0 – 1 – 2 format based on interview- and file information, with zero indicating that the feature is not present, with one indicating that the feature is partly present and with two indicating that the feature is present. The total score thus ranges between zero and 40 and "provides an estimate of the extent to which a given individual matches the prototypical psychopath" (p. 109, Hare, 2006). The 20 items were listed in chapter 2.1 and in Table 1. The item generation was based on the features of Cleckley (1964) and started with a 100-item version that was shortened to the 20 best and ratable items. The PCL-R has a high internal consistency (offender sample: r = .85, forensic patients sample: r = .87) and a similarly high intra-class correlation for a single rating (offender sample: r = .87, forensic patients sample: r = .86, Hare & Neumann, 2006).

The mean score in populations of inmates is about 23 (Hare, 2003), in forensic psychiatric institutions about 20 (Hare, 2003). The cut-off for research purposes is 30. This is, persons scoring 30 or higher are those who are referred to as psychopaths. This the validity of this cut-off has been questioned for European samples by Cooke and colleagues (Cooke, Michie, Hart & Clark, 2005) who claim that an appropriate cut-off would be 28 in Europe. However, the results of re-analyses of these data published by Bolt and colleagues (Bolt, Hare & Neumann, 2007) argue for a pan-cultural cut-off of 30. A multifactorial analysis of German and North-American data confirmed this hypothesis for German offender samples (Mokros, Neumann, Stadtland, Osterheider, Nedopil & Hare, submitted).

The factorial structure is still a subject of debate. In his first handbook for the PCL-R, Hare suggested a 2-factor model, one personality factor and one antisocial behavior factor (Hare, 1991). Cooke and Michie proposed a three-factor model with a

factor of arrogant and deceitful interpersonal style, a factor of deficient affective experience and a factor of impulsive and irresponsible behavioral style (Cooke & Michie, 2001). In his second edition of the PCL-R Hare argues for a 4-factor-model, including an interpersonal factor, an affective factor, a behavioral lifestyle factor and an antisocial factor (Hare, 2003; Neumann, Hare & Newman, 2007).

Taking into account data about the increased risk of recidivism and treatment resistance in psychopaths the PCL-R is nowadays not only used in research context but also in forensic and clinical settings (e.g., Barbaree, 2005; Dahle, 2006). The relevance of the construct psychopathy and thus of the PCL-R in the criminal justice system is even increasing due to the steady interest of crime prevention by reducing recidivism.

2.2.2 Self report measures

There are several self-report measures, all of them in English and only two measures in German, one still in preparation and one near publication. The questionnaires, which can be filled in by the persons themselves have the advantage of being not as time consuming as an external rating. Another strong argument for self-report measures is the possibility to survey the general population, as there is no need to involve any files, documents or records about the person. Furthermore, it is also worthwhile to use the self as an observer, which has been shown to be advantageous for traits that are not observable in the context of personality measurement (Lilienfeld & Fowler, 2006).

Nevertheless, self-report measures face the problems of possible faking and manipulation by the person as well as a possible lack of insight and a semantic aphasia concerning the emotional vocabulary (Jackson & Richards, in press; Lilien-

feld & Fowler, 2006). As pathological lying is one of the features of psychopathy, it is highly probable that psychopaths try to cheat when filling in the questionnaire. Although most of the self-report measures include a virtuous responding scale, high scores on these scales only indicate cheating but do not allow any analysis of the questionnaire. Another problem consists of the psychopaths' reduced access to themselves in terms of a self-perception that does not match the perception of others. Therefore psychopaths' answers could be less applicable in estimating their thoughts and feelings. The latter also points to the third problem of self-report measures. Assuming a lack of emotional experiences could constitute a semantic aphasia concerning those states they never experienced and therefore lead to problems in the usage of this specific vocabulary. Thus, for psychopaths it could be difficult even to answer these questions. Despite these disadvantages and potential problems the gain of normal population data is countervailing.

2.2.2.1 Psychopathy Personality Inventory

The Psychopathy Personality Inventory (PPI; Lilienfeld, 1991; Lilienfeld & Andrews, 1996) was developed in order to measure psychopathic traits in non-incarcerated as well as clinical populations. The features that were used for the construction of the questionnaire were derived form descriptions of Cleckley (1964), Hare (1991), Lykken (1957), Albert and colleagues (Albert, Brigante & Chase, 1959), Quay (1965) and Gorenstein & Newman (1980). The main aspects considered for the item generation were not to include any item on antisocial behavior or criminality, to draft the items as socially desirable as possible, to use positive and negative formulations for the items and to use a Likert-answer-scale without an intermediate answer category ranging from 1 (false) to 4 (true). Two additional scales of virtuous and de-

viant responses were included to control for manipulating and lying tendencies. The first version consisted of 187 items, the first standardized version of 167 items. Factor analyses detected eight subscales: Machiavellian egocentricity, social potency (called social influence in the PPI-R), coldheartedness, carefree nonplanfulness, fearlessness, alienation (called blame externalization in the PPI-R), impulsive nonconformity (called rebellious nonconformity in the PPI-R), and stress immunity. The revised version was corrected for items that refer to culture specific formulations or items that could become out of date. Furthermore, items of insufficient psychometrical quality were eliminated and new items for the subscale stress immunity were included.

The new 154-item version reached high internal consistencies both in a community (N = 985; total score: r_α = .92; subscales: r_α = .78 - .87) and an offender sample (N = 154; total score: r_α = .84; subscales: r_α = .71 - .83). The retest reliability for the total score was .93, for the subscales .82 - .95. Equally to the results of the earlier version men had higher scores than women on all subscales and the total score (Lilienfeld & Widows, 2005).

The subscales can be summed up to three content scales, one of self-centered impulsivity, consisting of the subscales Machiavellian egocentricity, rebellious nonconformity, blame externalization and carefree nonplanfulness, one of fearless dominance, consisting of the subscales social influence, fearlessness and stress immunity, as well as a factor of coldheartedness.

For the convergent validity, the PPI-R was compared with Levenson's Self-Report Psychopathy Scale (LSPS; Levenson, Kiehl & Fitzpatrick, 1995) and with the Self-Report Psychopathy scale (SRP-II; Hare, 1991). Correlational analyses revealed strong associations for the PPI-R total score and primary and secondary psychopa-

thy of Levenson's Self-Report Psychopathy Scale in a community sample as well as in an incarcerated sample. For the SRP-II, the total scores are highly correlated, the PPI-R total score is highly correlated with the behavioral factor in the community and the offender sample, whereas the personality factor is related to the PPI-R total score only in the community sample (Lilienfeld & Widows, 2005).

The PPI-R was further analyzed for correlations with the NEO-FFI components (Ostendorf & Angleitner, 2004). Showing a significant negative correlation between the PPI-R total score and agreeableness as well as conscientiousness, a high positive correlation with openness, which is due to a high correlation rebellious nonconformity and openness.

2.2.2.2 Other Self-Report Measures

The Self-Report-Psychopathy scale, developed by Hare and colleagues in the 1980s (SRP-II, Hare, Harpur & Hemphill, 1991) was the first self-report measure, based on the PCL items. The revised version (SRP-II) consists of 29 items that have to be answered on a 1-7-point scale ranging from disagreeing strongly to agreeing strongly. Two factors can be extracted, one reflecting the personality features of psychopathy and one the behavioral features. Reliability for the behavioral factor is higher than for the personality factor (Benning, Patrick, Salekin & Leistico, 2005). The SRP-II correlates highly with measures of antisocial behavior and with the PCL-R, the personality factor correlates moderately with a measure of narcissistic personality and the behavior factor is correlated with a measure of trait-anxiety (Hare, 1991). Furthermore, the SRP-II is highly correlated with the Psychopathy Personality Inventory (PPI-R; Lilienfeld & Andrews, 1996) and thus features relevant convergent validity.

The Antisocial Process Screening Device (APSD, Frick & Hare, 2001) was originally developed as an alternative for PCL-R for use in children. It consists of questionnaires to be filled in by parents and teachers. The APSD consists of 20 items that rely on the PCL-R items and are also rated on a three-point scale indicating 'not true', 'sometimes true' and 'definitely true'. The questionnaire has been shown to depict three components of psychopathy, narcissism, impulsivity and callous-unemotional traits. The internal consistencies of the narcissism and the impulsivity factor are high across 11 studies, whereas the factor callous-unemotional does not reach high internal consistency rates in none of the studies (Poythress, Douglas, Falkenbach, Cruise, Lee, Murrie & Vitacco, 2006). Nevertheless it is widely used, especially in youth populations for clinical as well as research purposes.

Another self-report measure of psychopathy is Levenson's Self-Report Psychopathy Scale (LSRP, Levenson, Kiehl & Fitzpatrick, 1995), which was constructed for measuring psychopathy in non-institutionalized samples and is also based on the PCL-R. It contains a first factor of primary psychopathy, referring to psychopathic personality traits, like egoism, carelessness or manipulation, and a second factor of secondary psychopathy referring to antisocial behavior, self-defeating lifestyle and impulsivity. In the first validation the personality factor has been shown to be highly reliable, whereas the behavioral factor reached lower internal consistency. Validity tests showed positive relations with sensation-seeking and antisocial behavior (Lynam, Whiteside & Jones, 1999), but the personality factor (primary psychopathy) is related to the behavior factor (secondary psychopathy) and to antisocial behavior, which questions its construct validity (Lilienfeld & Fowler, 2006).

2.3 Psychopathy in women

Although Cleckley (1964) had incorporated in his description of psychopathy males as well as females, the construct of psychopathy is commonly thought to be a male phenomenon. Based on the prevalence rates that derive from studies with inmates, the lower base rates could be due to less prevalent antisocial behavior, leading to less incarceration in women compared to men. Nevertheless, general population studies using self-report measures consistently found lower scores in female subjects than in male (Levenson et al., 1995; Lilienfeld & Andrews, 1996).

Recent analysis on the factor structure of psychopathy based on the PCL-R applying item-response-theory found differences in item-functioning between male and female samples for the items that are related to antisocial behavior and for the item conning/manipulative, whereas the factor structure has not been found to be different in male or female (Bolt, Hare, Vitale & Newman, 2004; Hare, 2003). These results suggest specific attention for the use of the PCL-R with women. Some authors even suggest the use of 28 instead of 30 points as cut-of for women (Nicholls, Ogloff, Brink & Spidel, 2005; Salekin, Rogers, Ustad & Sewell, 1998).

The personality correlates of psychopathy seem to be equal for male and female psychopaths. They are similar in self-reported emotional deficits, deficient empathy, self-control and socialization (for an overview: Verona & Vitale, 2006). Regarding the criminal and antisocial behavior as a behavioral correlate, male psychopaths often show more prior convictions and arrests than female psychopaths, but the relation of psychopathy and elevated risk for recidivism is the same for both genders (Vitale et al., 2002).

The few studies on affective processing did not find any differences between male and female psychopaths. In the affective startle modulation paradigm, there is evidence for a reduced startle potentiation in response to negative emotional pictures (Sutton, Vitale & Newman, 2002), matching the findings in men (see chapter 2.4.1 for more details on psychophysiological impairments in psychopathy).

In sum, female psychopaths differ from male psychopaths primarily in their behavior. Especially antisocial behavior is less pronounced in female psychopaths. There are only few studies on psychophysiological correlates of psychopathy but they suggest no difference in the psychophysiological behavior.

2.4 Correlates of emotion processing in psychopathy

One core factor of psychopathy is the emotional detachment that results in poor sense of guilt, incapacity to be engaged in a normal range of emotional feelings as well as a lack of empathy. These deficits are subject to intensive research since the early fifties up to now. On the one hand this research investigates psychophysiological correlates of these observable features as well as structure and activations of cortical regions involved in emotional processing. These findings are the basis of several neuropsychological models of psychopathy. On the other hand behavioral reactions to emotional stimuli are in the center of attention aiming to specify the impairment in emotion recognition and its relation to social and antisocial behavior.

The Violence Inhibition Model by Blair (VIM; 2005; 1995) refers the emotional detachment to the lack of empathy that also carries instrumental antisocial behavior, whereas the Fear Dysfunction Hypothesis (Patrick, 1994) relates the emotional detachment to a deficit in the fear system related to the repeatedly evidenced reduced functioning of the amygdala.

2.4.1 Psychophysiological correlates

The first reported psychophysiological studies on psychopathy were done by Lykken (1957) and Hare (1965). Although these studies were based on inconsistent criteria for psychopathy the results all pointed to impairments in psychophysiological measures and to a reduced psychophysiological activity in response to emotionally relevant stimuli. Lykken used a classical conditioning paradigm, linking a buzzer (conditioned stimulus) to an electric shock (unconditioned stimulus). He found reduced responses in skin conductance (conditioned reaction) to the conditioned stimulus in psychopaths compared to non-psychopaths. This was one of the first psychophysiological evidence for the low-fear-hypothesis of psychopathy, matching Lykken's findings of low self-reported anxiety (Lykken, 1957). The dysfunction of conditioned fear reactions matched the theory of a behavior inhibition system (BIS; Gray, 1987) that recommended a unitary fear system. This fear system is activated by punishment, non-reward, unknown or fear stimuli and brings about behavioral inhibition as well as arousal and high attention. Ongoing research confirmed Lykken's suggestion of the low-fear-hypothesis and the BIS-hypothesis in negative fear conditioning studies, as for example those of Hare and colleagues (Hare, Frazelle & Cox, 1978), Aniskiewicz (1979), Flor and colleagues (Flor, Birbaumer, Hermann, Ziegler & Patrick, 2002) as well as Birbaumer and colleagues (Birbaumer, Veit, Lotze, Erb, Hermann, Grodd & Flor, 2005). While Hare and colleagues (Hare et al., 1978) specified that the reduction of physiological reactivity to negative stimuli is present only in skin conductance level, not in heart rate, Flor and colleagues ruled out attentional reasons for the deficient fear reaction by evaluating event-related potentials (Flor et al., 2002). Birbaumer and colleagues (Birbaumer et al., 2005) extended these previ-

ous results on low-fear-hypothesis in their functional brain imaging study to a missing activation in limbic-prefrontal circuits in psychopaths compared to healthy persons.

Another important psychophysiological measure for emotional reactivity is the startle reflex that is known to be modulated by the emotional content of stimuli (Vrana, Spence & Lang, 1988). The startle reflex itself can be elicited for example by loud noises and is typically measured with electromyogram (EMG) of the orbicularis oculis muscle. The reflex can be enhanced by negative stimulus content and reduced by positive stimulus content.

Different from normal population, psychopaths show a reduced startle reflex in reaction to positive stimuli though, but no enhancement of the startle reaction in response to negative stimuli (Benning, Patrick & Iacono, 2005; Patrick, Bradley & Lang, 1993). In a sample of female psychopaths the lack of the startle reflex modulation was dependent on anxiety, antisocial behavior and emotional detachment (Sutton et al., 2002). The startle potentiation in response to negative stimuli was lacking only in low anxious psychopaths and only in psychopaths with high scores on antisocial behavior as well as emotional detachment.

In sum, several psychophysiological correlates of psychopathy have been found so far, but not all aspects of emotion have been investigated, such as emotion recognition, elaboration of facial expression of emotion or self-report of valence and arousal.

2.4.2 Cortical structure and activation

In structural studies using magnetic resonance imaging (MRI) it has been shown that psychopaths hold less grey matter than control participants, especially in the orbitofrontal cortex (Raine, Lencz, Bihrle, Lacasse & Colletti, 2000; Yang, Raine,

Lencz, Bihrle, Lacasse & Colletti, 2005). This area is primarily related to emotional learning and social behavior. Studies including patients with lesions of the orbitofrontal cortex report similar deficits in instrumental learning, in processing emotional stimuli and in extinction of learned conjunctions, as there are in psychopaths (Mitchell, Richell, Leonard & Blair, 2006; Mitchell, Stoner & Reynolds, 2004).

Applying imaging techniques extends these insights using differences in cerebral activation as dependent variable. It has been shown that during presentation of emotional stimuli, psychopaths show reduced activation in the frontal cortex compared to non-psychopathic control participants (Gordon et al., 2004; Intrator, 1997; Kiehl, Smith, Hare, Mendrek, Forster, Brink & Liddle, 2001). Especially orbito-frontal and ventrolateral prefrontal cortex activation seem to be dysfunctional in psychopaths (Mitchell, Colledge, Leonard & Blair, 2002), but this is not specific to psychopathy as prefrontal cortex dysfunctions are also present in antisocial behavior disorder and even more general in incarcerated populations (Morgan & Lilienfeld, 2000). These results contribute to the frontal-lobe-dysfunction-hypothesis of psychopathy, arguing that the symptoms of psychopathy derive from an abnormal functioning of the frontal lobe. However, the dysfunction in the frontal cortex is discussed as a consequence of drug abuse, which is highly prevalent in incarcerated populations (Blair, 2006).

The amygdala, which is crucial for (spontaneous) emotional reactions has also been shown to be less activated compared to the non-psychopathic participants (Gordon et al., 2004; Intrator, 1997; Kiehl et al., 2001). This points to an impairment of the amygdala function which may lead to diminished emotional reactions to sad or fearful stimuli or situations and to a reduced capability of moral learning (Blair, 2006). Another brain region that is discussed to be impaired is the right anterior temporal gyrus that is associated with the distinction of abstract and concrete stimuli (Kiehl,

Smith, Mendrek, Forster, Hare & Liddle, 2004). This distinction is relevant in the context of psychopathy in terms of difficulties in engaging in cognitive functions that involve material that has no concrete realization in the external world. The authors suggest the possibility that complex social emotions such as love, empathy, guilt and remorse may be a form of more abstract functioning and therefore cannot be experienced by psychopaths.

Again, these results are only correlational, but nevertheless the cortical and functional correlates of psychopathy can be clues to confirm or disprove the existing theories about the construct.

2.4.3 Decoding emotional facial expressions

Reactions to emotional stimuli can also be measured at the behavioral level, asking participants to react by pressing buttons. In the broad range of emotional stimuli, emotional facial expressions are of high interest, as they are stimuli of daily social and communicational relevance. As Cleckley described psychopathy by unresponsiveness in general interpersonal relations (1964), a reduced capability to understand others facial expressions in psychopaths can be assumed. Not knowing other people's emotional status reduces the capability to react adequately in social situations, for example to recognize victim's sadness or fear.

Reported results on facial expression categorization in psychopathic men vary from no group differences (e.g., Campanella, Vanhoolandt & Philippot, 2005; Glass & Newman, 2005; Kreklewetz & Roesch, 2005) to group differences for different facial expressions (e.g., Blair, Mitchell, Peschardt, Colledge, Leonard, Shine, Murray & Perrett, 2004; Stevens et al., 2001). Data published by Glass and Newman (2006) showed no impairment of psychopaths in categorizing emotional facial expressions,

independent of an attention modulation task. Similarly, no significant differences in hit rates between psychopaths and non-psychopathic control participants were found in a facial discrimination task to evaluate psychopaths' categorizing capacity (Kreklewetz & Roesch, 2005). However, further studies using a multimorph facial expression task or a static categorizing task found a significantly reduced sensitivity to fearful expressions in psychopaths (Blair et al., 2004; Stevens et al., 2001).

The methodological variance in all of these studies is very high, since different sets of emotional facial expressions, different combinations of emotions, different intensities and also different presentation times were used. Nevertheless, the major part of studies reports impaired emotion categorization for negative emotional expressions in psychopathic participants.

In addition to these classical categorizing tasks, based on Ekman's idea of distinct emotions, dimensional evaluations based on the model of Russell (Lang, 1979; Posner, Russell & Peterson, 2005) can be collected by asking subjects to rate their self-perceived valence and arousal levels watching different emotional facial expressions. None of the studies on emotional facial expression decoding in psychopathy included this kind of evaluations. The use of these ratings could provide a more detailed picture about the emotion decoding deficit as by the dimensional rating and furthermore combines a quite obvious question on emotion in the valence dimension and a rather indirect question on emotion decoding in the arousal dimension.

3   Empirical part I: Emotional detachment in the PPI-R

The emotional detachment feature of psychopathy seems to be of high relevance for this construct because of its specificity and its assumed relation to antisocial and non-empathic behavior. Cleckley (1964) described this pattern as a lack of remorse or shame and a general poverty in major affective reactions as well as a specific loss of insight. That is, emotional detachment consists of a reduced capability to experience emotional movements and of an impairment in understanding others' emotional state. Both competences are related to subcortical functioning, which has been shown to be different in psychopaths compared to healthy control participants in several studies (for an overview: Blair, 2006) as mentioned above (see Chapter 2.4). Thereby lack of empathy is a major aspect of emotional detachment. Based on studies that found no impairment in theory of mind tasks in psychopaths but impairments in physiological reactions in response to distress cues, Blair concluded that psychopaths seem to have reduced emotional empathic reactions but are capable of cognitive empathy (Blair, 2005). This is in line with the frequently cited statement "psychopaths know the words but not the music" (p. 217, Johns & Quay, 1962). This is, psychopaths know the functioning of emotions but they do not know the experience of the emotions.

This core feature of in psychopathy is represented in all of the different measures of psychopathy, although is not labeled consistently. In Hare's checklist emotional detachment is represented in the items lack of remorse or guilt, shallow affect and callous, lack of empathy. These items constitute one of the four factors according to Hare (2003) together with the additional item failure to accept responsibility. Self-report questionnaires like the Self Report Psychopathy Scale (SRP-II; Hare,

1991) or Levenson's Self Report Psychopathy Scale (LSRP; Levenson et al., 1995) that are based on the PCL-R items incorporate the emotional detachment items as well. One of the subscales of the Antisocial Process Screening Device (APSD, Frick & Hare, 2001) is the factor callous / unemotional traits. The Psychopathy Personality Inventory (PPI-R; Lilienfeld & Andrews, 1996) is supposed to measure emotional detachment related traits, which are coldheartedness and Machiavellian egoism (Mullins-Nelson, Salekin & Leistico, 2006). However, the validity of the German version of the PPI-R for measuring emotional detachment still has to be proven.

Using this PPI-R, it could be possible to detect socio-demographical differences as well as differential aspects in clinical groups concerning emotional detachment. Until now different studies have been published that reported a positive relationship between self-reported psychopathy and emotional detachment in psychophysiological measures (Benning et al., 2005; Gordon et al., 2004; Sellbom & Verona, 2007). But there are only a few studies on socio-demographical differences in emotional detachment. Gender differences using analyses of differential item functioning were only reported for the antisocial behavior component but not for the affective component (Bolt et al., 2004). This indicates that the affective component might not discriminate between male and female psychopaths.

Data on differences in emotional detachment in the general population with respect to different professions are lacking. Assuming that not all psychopaths engage in criminal activities but search for environments where they can express their psychopathic features or even need them to succeed in their position (successful psychopaths), there are some studies including participants of general population. Widom (1977) recruited some non-incarcerated participants with high scores of psychopathy and found reduced scores in empathy as well as elevated scores in extra-

version in contrast to reduced levels of criminality. This points to the relevance of the affective component for psychopathy even in successful psychopaths. Considering the case examples of Cleckley (1964) and Babiak (1995), hypotheses about differ- ences in psychopathic traits between certain professional categories suggest higher scores of psychopathic features in highly charged professions as well as in so-called "independent gentlemen".

One possibility to measure psychopathic traits in normal population of different interests could be to investigate students of different majors. A very recent study in a sample of students of nursing and criminal justice majors showed that students choosing criminal justice as a major express more pronounced psychopathic traits (measured by the PPI-R) compared to students choosing nursing as a major (Clow & Scott, 2007). This was the case for the total PPI-R score and especially for the sub- scale Machiavellian egocentricity, but the authors did not report any data concerning the subscales related to emotional detachment.

Another group of interest in the context of emotional detachment and psycho- pathic traits are patients with attention deficit and hyperactivity disorder (ADHD). ADHD is characterized by inattention, hyperactivity or impulsivity. Inattention includes symptoms like careless mistakes, difficulties in organizing, or avoidance of sustained mental effort, while the hyperactivity–impulsivity component of ADHD involves symp- toms like fidgeting, excessive talking, and difficulties in waiting (American Psychiatric Association 1994).

Descriptively, individuals scoring high on psychopathy and ADHD patients share several symptoms that may be traced back to similar neuronal dysfunctions. In their observable behavior, both show impulsive actions, leading to interpersonal problems, delinquent behavior, substance abuse or living-in-the-fast-lane. The rela-

tionship between psychopathy and ADHD has been the subject of several descriptive studies. One line of research examined children or adolescents with ADHD and matched control participants. From this perspective ADHD is strongly related to psychopathic traits, especially to callous unemotional traits and impulsivity (Barry et al., 2000; Colledge & Blair, 2001; Loeber, Farrington, Stouthamer-Loeber, Moffitt, Caspi & Lynam, 2001; Mathias, Furr, Daniel, Marsh, Shannon & Dougherty, 2007). Further investigations of the relationship between psychopathic traits, ADHD and conduct disorder (CD) in children revealed their high correlation. Nevertheless, antisocial behavior is best predicted by psychopathy, even after controlling for the influence of ADHD (Piatigorsky & Hinshaw, 2004). A very recent study (Mathias et al., 2007) is dealing with the differential aspects of the relation between ADHD and psychopathy, undermining adolescents with a diagnose of conduct disorder or ADHD with the Antisocial Process Screening Device (APSD; Frick & Hare, 2001). The impulsivity component of psychopathy was mainly related to the hyperactivity component of ADHD, whereas the narcissistic and unemotional traits were marginally related to the inattentive component of ADHD. According to the authors and matching the model of Colledge and Blair (2001), these results point to a common underlying mechanism for the conduct problems in psychopathy and ADHD. Another line of research studied prevalence of ADHD and psychopathy in high-risk adult populations. Torgersen et al. (2006) found an elevated percentage of antisocial personality disorder (APD) (44%) in an adult ADHD sample compared to general population (3-5%). Similarly, Roesler et al. (2004) found an elevated percentage of adult ADHD in general prison populations (45%). However, research focussing on specific personality trait psychopathy and ADHD in adults is limited to prison samples, reporting correlations between ADHD and the behavioral and lifestyle features of psychopathy (Kaplan &

Cornell, 2004; Soderstrom, Nilsson, Sjodin, Carlstedt & Forsman, 2005), a high predictive value of self-reported childhood ADHD for conduct disorder and psychopathy (Abramowitz, Kosson & Seidenberg, 2004), as well as in a longitudinal study a high predictive value of impulsivity for psychopathy in adolescent inmates (Vitacco & Rogers, 2001). Yet data of patients with the adult form of ADHD on psychopathic traits could add new aspects of the relation between those two phenomena.

In sum, the aim of the empirical part I is first to demonstrate the validity of the German Psychopathy Personality Inventory (PPI-R; Eisenbarth & Alpers, 2007) in measuring emotional detachment in general population and forensic inpatients samples (Study 1), and second to investigate emotional detachment as part of psychopathic traits in students with different majors as well as in adult ADHD patients compared to a matched healthy control group (Study 2).

3.1 Study 1

3.1.1 Hypotheses

For the first study we expected the Psychopathy Personality Inventory to measure emotional detachment with its subscale coldheartedness, thus correlating with measures of empathy and psychopathy.

3.1.2 Method

For the validation of the Psychopathy Personality Inventory Revised (PPI-R; Eisenbarth & Alpers, 2007) for measuring emotional detachment we included different samples, a students sample and a forensic inpatients sample.

3.1.2.1 Samples

The student sample consisted of 51 female and 49 male students with a mean age of 23.84 years (SD = 2.81, range: 20-32). These students mainly (60%) chose psychology as major (31% other majors, 6% medicine, 4% law) and all of them stated German to be their first language. The student sample filled in the Psychopathy Personality Inventory Revised in its German version (Eisenbarth & Alpers, 2007) and the Kieler Psychopathie Inventar Revised (Koehler, Hinrichs & Huchzermeier, in preparation).

The forensic inpatients sample consisted of 33 men aged between 19 and 48 years (M = 33.42 ± 8.68) from a forensic institution. The major part of the inpatients had a college degree (86%). 52% had a professional education (n = 13). 91% speci-

fied German to be the first language (see Table 2). The main diagnosis of the Participants was any kind of personality disorder (28 patients), thereof 8 patients with an antisocial personality disorder as first or further diagnosis. The diagnoses were adopted from the medical staff of the institutions. Participants were all convicted for major crimes (murder, sex offenses, robbery) and were obligated to therapy. In order to control for reduced capabilities for lexical understanding, the Multiple choice vocabulary test (MWT; Lehrl, Merz, Burkhard & Fischer, 1991) was used. Three participants reached less points than one standard deviation below the mean of the questionnaire and therefore were excluded from further analyses, leading to a sample of 30 participants. There was no further information about psychopathic traits. Aside from the MWT, the forensic inpatients filled in the PPI-R and the Saarbrücker Persönlichkeitsfragebogen (SPF; Paulus, 2000).

Table 2: Descriptive data of the samples for empirical part I.

	Student sample for validation	Forensic inpatients sample for validation	Student sample for gender and study major aspects	ADHD patients	Healthy control sample
N	100	33	289	28	41
age	23.84 ± 2.81	33.42 ± 8.68	23.29 ± 3.63	35.15 ± 8.50	37.71 ± 10.14
gender	51f; 49m	0f; 33m	170f; 119m	17f; 12m	21f; 20m
derived from	university	forensic hospital	university	general population	general population

3.1.2.2 Measures

3.1.2.2.1   German version of the Psychopathy Personality Inventory

The Psychopathy Personality Inventory Revised (PPI-R) is a popular and very well validated self-report measure in English. This questionnaire claims to measure the core personality factor of psychopathy omitting the behavioral factor that is part of most of the existing measures. This qualifies the PPI-R for use in non-delinquent samples and in samples of less extreme occurrence of psychopathy, as early and current delinquent behavior is not subject of the items. We chose it for translation in order to fill the gap of German self-report questionnaires on psychopathy.

The English original has been shown to comply with the established require-ments for questionnaires (Benning et al., 2005; Falkenbach, Poythress, Falki & Manchak, 2007; Lilienfeld & Andrews, 1996). It has been validated in samples of dif-ferent culture (Vitacco, Neumann & Jackson, 2005), delinquency and education (Uzieblo, Verschuere & Crombez, 2007), in retest-assessments and in analyses of correlations (Lilienfeld & Widows, 2005). The internal consistency of the 154-Item original concerning the sum score in a students samples (N = 985) has been r = .93, the internal consistency in an offender sample (N = 154) was r = .86. The retest-reliability for a testing distance of 20 days ranged from r = .82 (subscale coldhearted-ness) to r = .95 (subscale social influence).

For the German version all items were translated, back-translated for confir-mation and validated in a student's sample (N = 350). The factor structure of the original questionnaire has been replicated almost completely, finding eight subscales and one subscale of virtuous responding. The subscales are blame externalization, rebellious nonconformity, coldheartedness, social influence, carefree nonplanfulness,

fearlessness, Machiavellian egocentricity and stress immunity. The reliability (Cronbach's Alpha) of the complete questionnaire is r_α = .85, which reflects a relatively high internal consistency. The reliability of the subscales ranges between r_α = .67 (virtuous responding) and r_α = .88 (blame externalization).

3.1.2.2.2   Multiple-choice Vocabulary Test

The Multiple-choice Vocabulary Test (MWT; Lehrl et al., 1991) is an established measure for verbal intelligence that is independent of situational impact and any psychiatric disorder. The MWT is using 37 word and non-word lists where the participants have to find the words that are real words out of a number of non-words. It is correlated with global intelligence measures, especially with the vocabulary test of the Hamburg-Wechsler-Intelligence-Test.

3.1.2.2.3   Kieler Psychopathie Inventar

The Kieler Psychopathie Inventar (KPI-R; Koehler et al., in preparation) is a self-report questionnaire on psychopathy, based on the Psychopathy Checklist of Hare (1991). The 149 Items can be assigned to 16 subscales, that are charm, parasitizing lifestyle, self-esteem, incapacity of behavior control, need for stimulation, promiscuity, pathological lying, lack of long-term goals, conning manipulative, impulsivity, lack of consciousness, irresponsibility, superficial emotions, no acceptance of responsibility, lack of empathy and many marital relationships. The validity of the KPI-R is currently being tested, first results showed high correlations with the PCL screening version (PCL:SV; r = .64) as well as with antisocial (r = .73) and narcissistic (r = .43) personality traits, measured by the Persönlichkeitsstil- und Störungsinventar (PSSI; Kuhl & Kazén, 1997).

3.1.2.2.4   Saarbrücker Persönlichkeitsfragebogen

The Saarbrücker Persönlichkeitsfragebogen (SPF; Paulus, 2000) is a 37 item measure for empathy, translated and validated from the Interpersonal Reactivity Index (IRI) of Davis (1983). The SPF combines affective and cognitive aspects of empathic reactions and therefore includes the subscales perspective taking, fantasy, empathic concern and personal distress. Perspective taking is pointing to the ability to see things from another person's perspective spontaneously, fantasy measures the tendency, to put oneself in the position or role of characters in motion pictures or novels. The subscale empathic concern is constructed to display emotions directed to others as remorse or care of people in trouble, the personal distress subscale though is related to emotions oriented to oneself as concern or indisposition in close interpersonal relationships.

Whereas the subscales empathic concern, fantasy and personal distress are related to emotional empathy, perspective taking is related to cognitive empathy, which is also called theory-of-mind (Davis, 1983). The SPF total score consists of the subscales empathic concern and perspective taking as a more global score of empathy.

3.1.2.3 Procedure

For the students' sample, data were collected in psychology classes. The students received course credits for their participation.

The forensic sample filled in the questionnaire including all of the other measures in a group session. The participants received 5 € for participation and completed the questionnaires on site of the forensic institution in a group setting.

All participants gave written informed consent. In every case the participation was voluntary and provided that participants could quit the study whenever they wanted to. Questions of understanding concerning the items were rare and were answered shortly but comprehensively by the experimenter.

3.1.2.4 Statistical analyses

All analyses were done with SPSS 14 (SPSS Inc., Chicago, IL, USA). Analyses of variance were conducted for group differences as well as a linear regression analysis including the subscales of the PPI-R and the total score of the PPI-R as predictors and group as criterion. Forensic patients were grouped by diagnoses: substance dependency or abuse, personality disorder, others (3), ADHD patients were compared to the healthy control group (2). Post-hoc tests were Bonferroni corrected.

3.1.3 Results

3.1.3.1 Convergent validity in the KPI-R

Correlational analyses in the student sample for validating the emotional detachment measurement including all subscales of the PPI-R and the KPI-R revealed significant correlations between both total scores ($r = .79$) as well as significant correlations between the PPI-R total score and all subscales of the KPI-R, except incapacity of behavior control (see Table 3). The subscales lack of consciousness, superficial emotions and lack of empathy that are supposed to measure emotional detachment by the KPI-R, are positively correlated with the PPI-R total score as well as the sub-

scales Machiavellian egoism and coldheartedness. The subscales lack of conscious-ness and superficial emotions are positively correlated with rebellious nonconformity as well.

Table 3: Pearson's correlation coefficients for subscales and total scores of PPI-R and KPI-R (* $p < .001$; ** $p < .01$; * $p < .05$).**

	PPI-R: Rebellious Nonconformity	PPI-R: Coldheartedness	PPI-R: Machiavellian egoism	PPI-R: Total score
KPI-R: Lack of con-sciousness	.28**	.57***	.33**	.49***
KPI-R: Superficial emotions	.26**	.30**	.31**	.32**
KPI-R: Lack of empathy	.20*	.57***	.37***	.44***
KPI-R: Total score	.67***	.29**	.66***	.79***

Linear regression analysis including a sum of the emotional detachment re-lated subscales of the KPI-R (lack of consciousness, superficial emotions and lack of empathy) as dependent variable and the subscales of the PPI-R as predictors pro-duces a model explaining large parts of variance ($R^2 = .77$; $F(8,91) = 16.37$; $p < .001$). In this regression equation coldheartedness ($\beta = .59$; $p < .001$) and blame ex-ternalization ($\beta = .31$; $p < .001$) contribute most to explaining the variance of the KPI-R emotional detachment scale. Including only coldheartedness as predictor reduces predictability of the KPI-R emotional detachment score, the equation of regression

still predicts the KPI-R emotional detachment score significantly right (R^2 = .36; $F(1,98)$ = 56.36; p < .001) (see Figure 1).
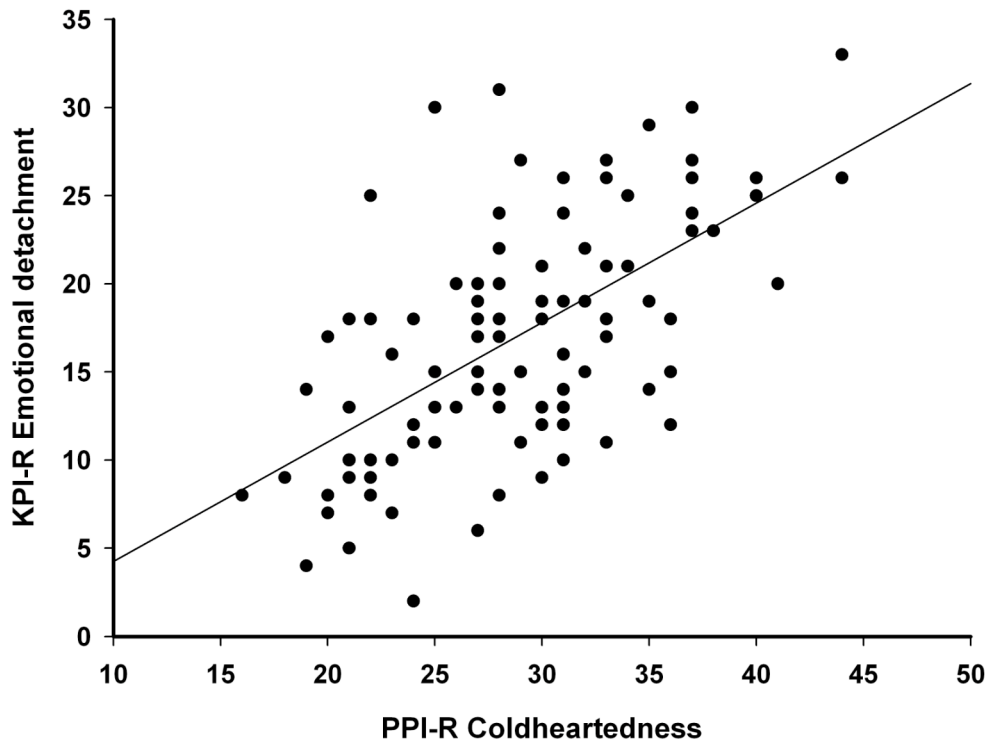
Figure 1: Regression line for PPI-R subscale coldheartedness predicting KPI-R emotional detachment

3.1.3.2 Convergent validity in the SPF

Analyses of correlations in forensic inpatients revealed significant relations between the PPI-R subscales and the SPF scales (see Table 4). The subscale coldheartedness of the PPI-R correlates negatively with the total score of the SPF measuring empathy and perspective taking (r = -.84). The subscale carefree nonplanfulness is negatively correlated with the SPF total score (r = -.52), whereas the other subscales of the PPI-R are not related to the SPF total score. On subscale level, empathy (r = -

.84) and perspective taking (r = -.62) are negatively correlated with coldheartedness, whereas their correlation with carefree nonplanfulness is reduced but significant (r = -.47).

Table 4: Pearson's correlations of the PPI-R and SPF subscales and total score (* p < .001, ** p < .01, * p < .05).**

	SPF: Fantasy	SPF: Empathy	SPF: Perspective taking	SPF: Total score (E+P)
PPI-R: Blame externalization	.43**	.28	.33	.34
PPI-R: Rebellious nonconformity	.53**	-.28	-.15	-.25
PPI-R: Stress immunity	.03	-.23	.13	-.08
PPI-R: Social influence	.19	-.01	-.09	-.05
PPI-R: Coldheartedness	-.23	-.84***	-.62***	-.84***
PPI-R: Machiavellian egoism	.33	-.35	-.16	-.30
PPI-R: Carefree nonplanfulness	.03	-.47*	-.47**	-.52**
PPI-R: Fearlessness	.38*	-.14	.04	-.07
PPI-R: Total score	.44*	-.42*	-.18	-.36

Linear regression analysis using the SPF total score as dependent variable and the subscales of the PPI-R as predictors is leading to a model explaining large parts of variance (R^2 = .77; $F(8,24)$ = 14.71; p < .001). The subscales contributing most to the regression equation are coldheartedness (β = -.86; p < .001) and fear-

lessness (β = .37; p = .03). Predicting the SPF total score by coldheartedness itself

reduces the explained variance, but still predicts the SPF scores (R^2 = .72; $F(1,31)$ =

81.85; p < .001) (see Figure 2).
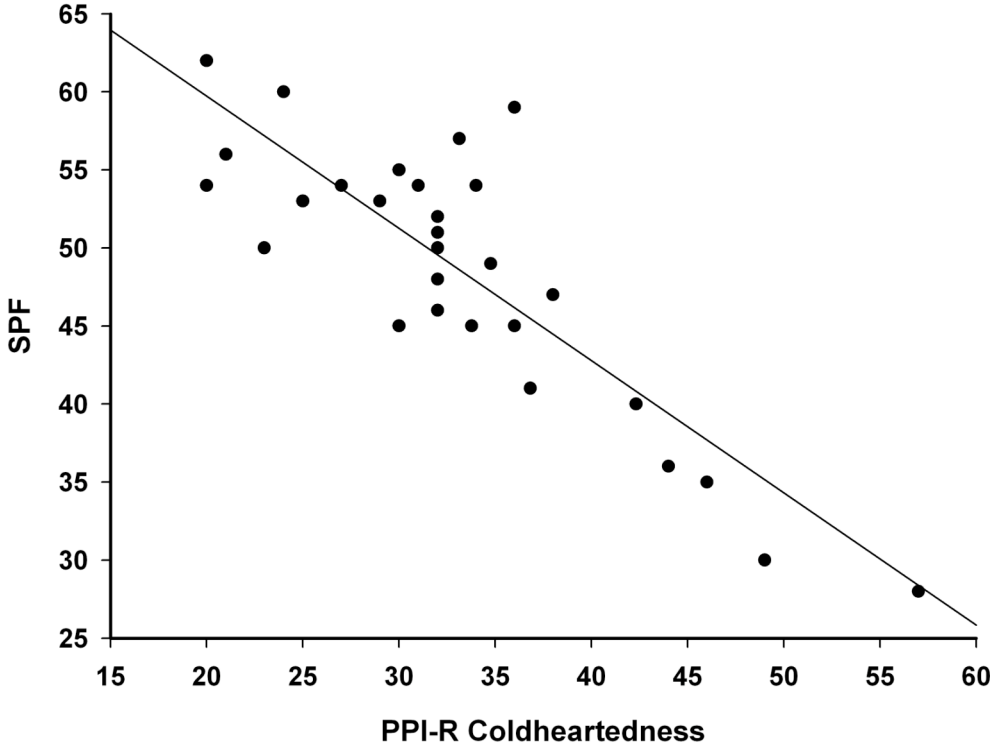
Figure 2: Regression line for PPI-R coldheartedness predicting SPF total score

3.2 Study 2

3.2.1 Hypotheses

For the second study, we supposed the PPI-R to detect differences between several groups in emotional detachment. In detail, we expected differences concerning emotional detachment in students for gender and for their study majors. Whereas in ADHD patients compared to controls, we expected to find no differences on callous unemotional traits, but differences on those subscales of the self-report questionnaire, which reflect the specific impairments of ADHD patients and point to similarities of psychopathy and ADHD in unstructured lifestyle and antisocial behavior (corresponding to Hare's lifestyle factor, Hare, 2003).

3.2.2 Method

For investigating emotional detachment with the Psychopathy Personality Inventory Revised (PPI-R; Eisenbarth & Alpers, 2007) in different non-incarcerated populations, we included a students sample and a sample of adult ADHD patients and healthy control group participants.

3.2.2.1 Samples

The students' sample consisted of 119 male and 170 female participants, aged from 19 to 44 years ($M = 23.29 \pm 3.63$). The participants were students of psychology (27%), law (35%), medicine (16%) and other majors (13%, such as economics, history, education, etc.). 33% were in their first three semesters. Almost all of

them stated to be German native speaker (97%); the remaining participants were fluent in German language (see Table 2). This student sample filled in only the PPI-R.

The ADHD patients and healthy control group participants sample consisted of 28 adult ADHD patients ($M = 35.15 \pm 8.50$) and 41 healthy participants ($M = 37.71 \pm 10.14$) (see Table 2). The groups were matched for age ($T = -1.08$, $p = .28$), gender (37w; 32m) and education (56% high school, 44% higher education).

Participants were recruited via newspapers and family doctors for an experimental study on ADHD, reported elsewhere (Conzelmann, Mucha, Weyers, Gerdes, Jacob, Bähne, Lesch, Alpers & Pauli, 2007). Exclusion criteria were age below 18 or above 60, severe somatic disorders or hearing problems and lifetime or actual diagnosis in SCID-I or SCID-II in the healthy participants. Subjects gave written informed consent and were paid 10 Euro for participation.

All participants were assessed with the Structural Clinical Interview of DSM-IV (SCID-I and SCID-II for axis I and II psychiatric disorders, First, Gibbon, Spitzer, Williams & Benjam, 1996, 1997). ADHD was diagnosed by DSM-IV criteria (American Psychiatric Association 1994) with adjustment to adult symptomatology (Weiss, Hechtman & Weiss, 1999) and by the Wender Utah Rating Scale (WURS; Ward, Wender & Reimherr, 1993) for symptoms during childhood. All patients were tested after discontinuing ADHD medication for at least one week. As a continuous variable the number of criteria fulfilled for inattention and for hyperactivity was included.

3.2.2.2 Measures

For measuring emotional detachment, the German version of the Psychopathy Personality Inventory Revised (PPI-R; Eisenbarth & Alpers, 2007) was used. For detailed description see 3.1.2.2.1.

3.2.2.3 Procedure

For the students' sample, data were collected in part within an experimental study about emotion recognition. The students received candies or course credits for their participation in the whole study and filled in the PPI-Rafter the experiment in the laboratory. Another part of the participants filled in the questionnaire in the breaks between university courses nearby the experimenter; their participation was not compensated. The major part of students was recruited in the university library and received candies for taking part.

The ADHD patients and the healthy control participants got the questionnaires to take them home in the framework of an experimental study. They sent back the answered questionnaire by mail. Demographic and diagnostic information was obtained from the experimental study.

All participants gave written informed consent. In every case the participation was voluntary and provided that participants could quit the study whenever they wanted to. Questions of understanding concerning the items were rare and were answered shortly but comprehensively by the experimenter.

3.2.2.4 Statistical analyses

All analyses were done with SPSS 14 (SPSS Inc., Chicago, IL, USA). Four students groups were built according to their study majors, psychology or education, medicine or dentistry, law and others (4), forensic patients were grouped by diagnoses: substance dependency or abuse, personality disorder, others (3), ADHD patients were compared to the healthy control group (2). Post-hoc tests were Bonferroni corrected. Discriminant analyses were conducted for group membership of students with different majors according to their PPI-subscale-scores.

3.2.3 Results

3.2.3.1 Emotional detachment in students

Multivariate analysis of variance for gender and study major differences including all subscales except virtuous responding revealed a significant main effect for gender ($F(8,274) = 4.51$; $p < .001$; $\eta^2 = .12$) and study major ($F(24,828) = 1.69$; $p = .02$; $\eta^2 = .05$). The overall interaction between gender and study field was not significant but points to a trend ($F(24,828) = 1.41$; $p = .09$; $\eta^2 = .04$).

For the relevant subscales that are related to emotional detachment, coldheartedness and Machiavellian egoism, significant differences can be found in part. Male students score higher on coldheartedness ($F(1,281) = 17.44$; $p < .001$; $\eta^2 = .06$) but do not differ on Machiavellian egoism compared to female students. The effect of the study major is significant for both subscales coldheartedness ($F(3,281) = 3.92$; $p = .01$; $\eta^2 = .04$) and Machiavellian egoism ($F(3,332) = 4.62$; $p = .004$; $\eta^2 = .05$). There is no significant interaction of gender and study major. Bonferroni corrected post-hoc

tests for study major revealed significant lower scores on coldheartedness for students with psychology or education science as major compared to students with medicine ($T(150)$ = -3.53; p = .01) or compared to students with law as major ($T(205)$ = -3.83; p = .002). For Machiavellian egoism the Bonferroni-corrected post-hoc tests show lower scores for the students of other majors compared to students with law as major ($T(135)$ = -3.85; p = .001).
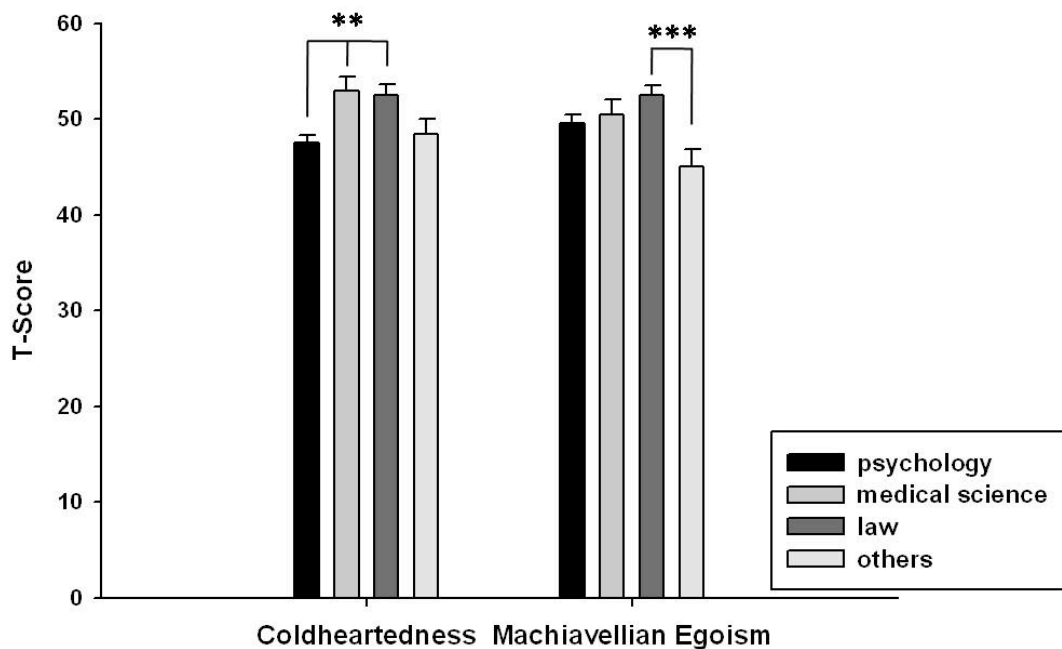

Figure 3: T-scores of students with psychology/educational science, medicine, law and other majors on subscales coldheartedness and Machiavellian egoism (p < .01, *** p < .001).**

Discriminant analysis with stepwise inclusion of the predictors (subscales) revealed only coldheartedness to be predictive of group membership (Wilk's Lambda =

.948, χ^2 = 18.63, p = .001). This model explains 35% of the variance in subscales scores due to group affiliation.

3.2.3.2 Emotional detachment in ADHD patients

3.2.3.2.1 Group differences

The multivariate overall ANOVA revealed significant main effects for group (patients vs. healthy participants) and for gender. Between ADHD patients and healthy participants there was no difference in the total score ($F_{(1,65)}$ = 2.00, p = .15, η^2 = .03) but in most of the subscales. Patients had higher scores than healthy participants in rebellious nonconformity ($F_{(1,65)}$ = 15.79, p < .001, η^2 = .20) and carefree nonplanfulness ($F_{(1,65)}$ = 24.25, p < .001, η^2 = .27) as well as lower scores for stress immunity ($F_{(1,65)}$ = 28.62, p < .001, η^2 = .31) and coldheartedness ($F_{(1,65)}$ = 12.48, p = .001, η^2 = .16). There were no significant differences between ADHD patients and healthy participants neither in blame externalization, social influence or Machiavellian egoism nor in fearlessness.

As expected, differences between male and female participants were replicated in terms of higher scores for male participants in the total score ($F_{(1,65)}$ = 9.40, p = .003, η^2 = .13) and the subscales rebellious nonconformity ($F_{(1,65)}$ = 7.23, p = .01, η^2 = .10), Machiavellian egocentricity ($F_{(1,65)}$ = 4.02, p = .05, η^2 = .06) and fearlessness ($F_{(1,65)}$ = 10.09, p = .002, η^2 = .13).

There were significant interactions between gender and group for the total score ($F_{(1,65)}$ = 6.11, p = .02, η^2 = .09) and for the subscales rebellious nonconformity ($F_{(1,65)}$ = 4.20, p = .05, η^2 = .13) and Machiavellian egoism ($F_{(1,65)}$ = 6.30, p = .02, η^2 = .09).
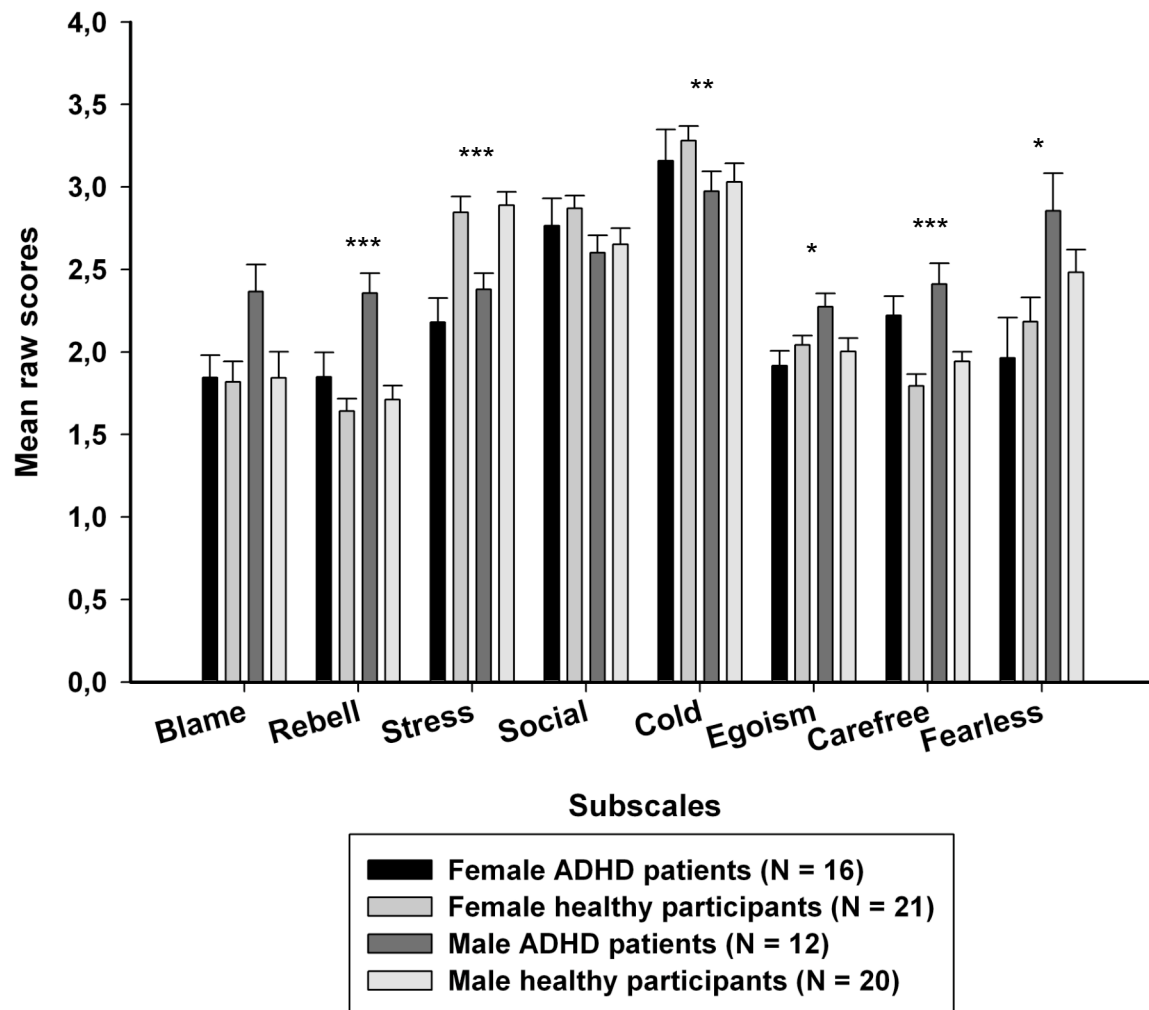
Figure 4: Means and standard deviations of PPI-R subscales for female and male ADHD patients and healthy control participants (effects for four-group comparison: *** *p* < .001, ** *p* < .01, * *p* < .05)

Bonferroni corrected analyses were done separately for male and female participants. Male patients have significantly higher scores than healthy men on rebellious nonconformity ($F_{(1,30)}$ = 19.93, *p* < .001), carefree nonplanfulness ($F_{(1,30)}$ = 14.46, *p* = .001) and on the total score ($F_{(1,30)}$ = 8.22, *p* = .01) as well as lower scores

on stress immunity ($F_{(1,30)}$ = 15.63, *p* < .001). Female patients have lower scores in stress immunity ($F_{(1,35)}$ = 15.39, *p* < .001) and coldheartedness ($F_{(1,35)}$ = 8.53, *p* = .01) and higher scores on carefree nonplanfulness ($F_{(1,35)}$ = 10.71, *p* = .002) compared to healthy female participants (see Figure 4).

3.2.3.2.2   *Correlational analyses*

The correlations between symptom severity (number of criteria fulfilled for inattention and for hyperactivity) and the subscale scores as well as the total score confirm the results obtained from group comparisons for patients and healthy controls. The correlations between the PPI-R scores and the symptom severity were similar for hyperactive and inattentive symptoms. Independent of gender significant correlations were found for blame externalization (inattention: *r* = .24, *p* = .05; hyperactivity: *r* = .28, *p* = .02), rebellious nonconformity (inattention: *r* = .42, *p* < .001; hyperactivity: *r* = .43, *p* < .001), stress immunity (inattention: *r* = -.64, *p* < .001; hyperactivity: *r* = -.50, *p* < .001), coldheartedness (inattention: *r* = -.42, *p* < .001; hyperactivity: *r* = -.39, *p* = .001) and carefree nonplanfulness (inattention: *r* = .52, *p* < .001; hyperactivity: *r* = .44, *p* < .001).

Separate consideration of correlations for male and female participants reflects the group comparisons for patients and healthy controls reported above: The correlation of the symptom severity and blame externalization (inattention: *r* = .40, *p* = .02; hyperactivity: *r* = .50, *p* = .003) and the correlation with rebellious nonconformity (inattention: *r* = .59, *p* < .001; hyperactivity: *r* = .70, *p* < .001) is only present in male participants, whereas the correlation with coldheartedness is present in female participants (inattention: *r* = -.41, *p* = .01; hyperactivity: *r* = -.43, *p* = .01) and in male participants only concerning inattention (inattention: *r* = -.45, *p* = .01; hyperactivity: *r*

= -.31, n.s.). The correlations with stress immunity and carefree nonplanfulness do not differ for male and female participants. In male participants there were additional correlations corresponding to the analysis of variance for Machiavellian egoism (inattention: r = .39, p = .03; hyperactivity: r = .50, p = .004) and for the total score (inattention: r = .39, p = .03; hyperactivity: r = .59, p < .001).

3.2.3.2.3   Classification of groups according to PPI-R subscales

Logistic regression analysis reveals that the PPI-R subscales can predict group affiliation correctly for 91% of the subjects (χ^2 (8, N = 69) = 60.27, p < .001). However, this model also includes the subscales that do not show significant weights for the equation. Involving only the subscales that contribute significantly, i.e., rebellious nonconformity (β = -.22, p = .01), stress immunity (β = .34, p = .01), Machiavellian egocentricity (β = .43, p = .03) and carefree nonplanfulness (β = -.21, p = .02), the true amount of correct classification of participants as patients or healthy participants is reduced to 86% (χ^2 (4, N = 69) = 57.61, p < .001). Using only the total score as a predictor further reduces the percentage of correctly classified participants to 64% (χ^2 (1, N = 69) = 0.91, p = .33). Coldheartedness does not contribute to a correct classification of patients and healthy control participants.

3.3 Discussion empirical part I

The aim of these studies was to validate the German version of the PPI-R for measuring emotional detachment. Based on this valid measurement differences in emotional detachment in non-incarcerated populations, first between students with different study majors were investigated, second between ADHD patients and healthy control subjects. The results provide evidence for the validity of the PPI-R measuring emotional detachment. The results on non-incarcerated populations showed that emotional detachment measured by the PPI-R differs between students with varying majors and that emotional detachment does not differ in ADHD patients and healthy control participants.

The correlational and regression analyses of the PPI-R in a student and a forensic inpatient sample showed that scales measuring lack of empathy, superficial affect, lack of consciousness as well as scales of empathy and perspective taking are most strongly related to the coldheartedness scale of the PPI-R. Although there are some weaker relationships to Machiavellian egoism, rebellious nonconformity, carefree nonplanfulness or blame externalization, this can be an evidence for the validity of the coldheartedness scale to measure emotional detachment as supposed by the Violence Inhibition Model published by Blair (VIM; Blair, 2005; Blair, 1995). The model suggests the lack of empathy as a major point in psychopathy and especially as an impairment in emotional empathy, compared to the lack of empathy in autism, which is more a lack of cognitive and motor empathy (Blair, 2005). Of note, in this study the subscale perspective taking of the SPF that is related to cognitive empathy according to Davis (1983), was negatively related to coldheartedness. This is contradictory to the theory of Blair (2005) and does not fit the results in a healthy population

found by Mullins-Nelson and colleagues (Mullins-Nelson et al., 2006). However, there is a clear negative association of emotional empathy and coldheartedness, thus indeed validating the PPI-R for measuring emotional detachment.

Using the PPI-R to measure emotional detachment in students revealed expected effects in gender and selected majors. The reduced scores of female students are in line with lower scores of psychopathy in women published previously (Benning et al., 2005; Lilienfeld & Andrews, 1996). As male and female students differ only in the subscales coldheartedness, stress immunity, rebellious nonconformity and fearlessness, emotional detachment seems to be one of the features differentiating between men and women in general population. Thus, high scores of emotional detachment could be less frequent in women.

Regarding the majors of the students, students with the major law or medicine reached highest scores for emotional detachment associated subscales. This is in line with recent results published by Clow and Scott (2007) and further specifies that the coldheartedness subscale and thereby the emotional detachment also differs between professions. Furthermore, this contributes to the idea that some professions even ask psychopathic characters in terms of focusing on one' s own goals and leaving behind social aspects, being competitive or even to be immune to other's suffering. On the contrary, auxiliary professions might primarily attract people aiming to care about patients, victims or any other suffering person. These considerations were included in Cleckley's characterizations of psychopaths, but have been picked up only in the last few years (Babiak & Hare, 2006).

In ADHD patients and healthy participants interrelationships concerning emotional detachment were even negative, as ADHD patients had lower scores on coldheartedness compared to healthy participants, although this difference was due to

the female participants. As for the logistic regression analysis coldheartedness was not relevant, its role in differentiating between ADHD patients and healthy participants is negligible compared to the relevance of the lifestyle-factor subscales such as rebellious nonconformity, carefree nonplanfulness and stress immunity. These results are in line with the model of Colledge and Blair (Colledge & Blair, 2001) who suggest a common underlying mechanism for behavioral problems in ADHD and psychopathy, predominantly based on behavioral aspects, deriving from impulsivity and unstable lifestyle, but less on emotional detachment features.

Taken together the PPI-R seems to be capable to measure emotional detachment. Data presented in this study provide evidence for it's capacity to differentiate via the coldheartedness subscale. The PPI-R subscales distinguish male and female students, as male students score higher on emotional detachment, and between students with variable majors, especially between students with psychology as major and students with law or medicine as major. In contrast, there were no significant and persistent differences between ADHD patients and healthy participants in emotional detachment, which points to no significant emotional impairment in ADHD patients, as it is the core part of psychopathy.

However, the PPI-R has to be further validated for the measurement of emotional detachment in different samples, for example in high psychopathic samples or in autistic samples. The weakness of this study is due to the small sample sizes that do not allow extensive interpretations. However, to speak with Johns and Quay (1962), the results provide clear evidence of relevant descriptive inter-individual differences concerning the capability to know the music, not only the words that display the own or others' emotional state.

4   Empirical part II: Emotional detachment in an emotion decoding task

The above-mentioned Violence Inhibition Model (VIM; Blair, 1995) postulates that in psychopathic people distress cues do not inhibit aggressive behavior as they do in healthy people. According to this model the absent effect of distressing stimuli is due to a failure of the psychopathic individual to decode emotional stimuli. As part of the deficient affect this decoding deficit can be found in reduced physiological or cortical activations in response to emotional stimuli (i.e., Benning et al., 2005; Kiehl et al., 2001) as well as in reduced behavioral responses. Especially reactions to stimuli of sad of fearful content evoke less reactions in psychopathic persons than in controls (e.g., Blair, Colledge & Mitchell, 2001; Levenston, Patrick, Bradley & Lang, 2000). Nevertheless, data reported in literature vary from no group differences (e.g., Campanella et al., 2005; Glass & Newman, 2005; Kreklewetz & Roesch, 2005) to group differences for different facial expressions (e.g., Blair et al., 2004; Montagne, Van Honk, Kessels, Frigerio, Burt, Van Zandvoort, Perrett & De Haan, 2005).

All of these studies found impaired emotion categorization in psychopathic participants for negative emotional expressions, but past research included only male participants. To our knowledge, no data on emotion detection or emotion categorization in psychopathic women have been published so far. Therefore, this study investigates the measurement of emotional detachment by an emotion detection task including facial affect recognition and evaluations in female psychopaths.

In a classical categorizing task based on Ekman's idea of distinct emotions, facial expressions of all 7 basic emotions were included and were presented for two different presentation durations. In one block facial expressions were shown briefly

and then masked, so as to limit the processing time for decoding the corresponding emotion category. This mode of presentation reveals deficits in psychopaths' spontaneous emotion categorization in contrast to deficits in cognitively elaborated emotion decoding. The latter condition was included in a second block of presentations with ad libitum duration, until participants decided which button they wanted to press.

In addition to this classical task, a dimensional evaluation task based on the model of Russell (Lang, 1979; Posner et al., 2005) was included, asking subjects to rate their self-perceived valence and arousal levels. The use of these ratings could provide a more detailed picture about the emotion decoding deficit as by the dimensional rating and furthermore combines a quite obvious question on emotion in the valence dimension and a rather indirect question on emotion decoding in the arousal dimension. In sum, this study examined differences in categorization and evaluation of emotional faces between psychopathic and non-psychopathic women and a control group represented by female employees.

4.1 Hypotheses

According to the VIM-model, we expected lower hit rates in the categorizing task for the psychopathic patients compared to non-psychopathic patients and compared to healthy employees, similar to the impairment that has been documented in male psychopaths. Furthermore, we expected that these differences specifically appear in a short presentation time condition, which is more difficult to solve. For the dimensional rating task we expected ratings that reflect a reduced emotionality of psychopathic patients compared to non-psychopathic patients and healthy employees.

4.2 Method

4.2.1 Sample

Three groups of participants were included in this study (N = 44). Two groups of female forensic patients were recruited of a forensic hospital in Northern Italy. The patients are inmates in the high security psychiatric facility and are convicted for crimes against bodies or lives. For a control group, female employees working at the Faculty of Psychology of the University of Padova (n = 16) were recruited. The PCL-R scores (Hare, Harpur, Hakstian, Forth, Hart & Newman, 1990) were appraised for all forensic patients and two groups were built, one with scores above 30 (n = 13, M = 31.77, SD = 1.17, range: 30-34), according to the guidelines of Hare (1990) and one with scores below 30 (n = 15, M = 17.40, SD = 6.21, range: 7-28). Exclusion criteria were psychotic symptoms or diagnoses and MINDERBEGABUNG. In both groups the primary diagnoses of the patients were personality disorders (PD). The distribution of the single personality disorders' diagnoses (histrionic PD, borderline PD, paranoid PD, schizotypical PD and antisocial PD) was not equal due to the pre-defined groups. As PCL-R scores in normal population use to be very low, the group of employees was suggested to be low on psychopathy and PCL-R was not administered in the employees group.

All three groups differed significantly in age due to predefinition of groups (F(2,41) = 7.08; p = .01). The psychopathic patients (M = 33.00; SD = 7.66) were the youngest and differed significantly from non-psychopathic patients (M = 46.67; SD = 14.88) and from employees (M = 44.19; SD = 5.19). There were no differences between non-psychopathic patients and employees in age (see Table 5).

For the level of education, there was an overall difference between all groups ($F(2,41) = 8.24$; $p = .01$). This difference is due to lowest level of education of the psychopathic patients ($M = 8.15$; $SD = 3.08$) as well as a higher level of non-psychopathic patients ($M = 11.60 \pm 3.70$) and employees ($M = 13.94$; $SD = 4.17$).

The forensic groups did not differ in intelligence measured by Raven scores ($T(26) = 1.48$; $p = .15$) that were corrected for age and education (see Table 5).

Table 5: Numbers of participants, numbers of right- hander / ambidextrous, means and standard deviations for age, education and Raven standard progressive matrices.

	Psychopathic patients	Non-psychopathic patients	Employees	Sum
N	13	15	16	44
Right-hander/ ambidextrous	10 / 3	14 / 1	16 / 0	40 / 4
Age	33.00 (7.66)	46.67 (14.88)	44.19 (5.19)	41.73 (11.47)
Education	8.15 (3.08)	11.60 (3.70)	13.94 (4.17)	11.43 (4.42)
Intelligence (Raven)	83.81 (29.55)	99.36 (25.99)	-	92.14 (28.30)

Written informed consent was obtained from all participants. Each participant understood that participation was voluntary and would neither result in financial or other gain nor in advantages concerning their imprisonment, and that consent could be withdrawn at any stage of the study.

4.2.2 Design

This study was conducted in a 3 (group: psychopathic patients, non-psychopathic patients and employees) x 2 (duration: short picture presentation and ad libitum picture presentation) x 7 (emotion: afraid, angry, disgust, happy, neutral, sad, surprise) factorial design. The dependent variables were the hit rates and the ratings of the stimuli for valence and arousal. Age, years of education and age- and education-related intelligence quotients, measured by the Raven's Standard Progressive Matrices set A (Raven, 1938) were taken into account as covariates.

Statistical analyses were done with SPSS 14.0 (The Apache Software Foundation, Forest Hill, MD, U.S.A). Analyses of variance were conducted using the above-mentioned design. For post-hoc analyses alpha level was corrected for multiple testing.

4.2.3 Measures

4.2.3.1 The Psychopathy Checklist Revised (PCL-R)

As mentioned above, the PCL-R contains 20 items on behavioral and personality features. An expert who draws on information from file review and from a semi-structured interview rates the items. Its validity and reliability were demonstrated repeatedly (Hare, 2003). Thus, the PCL-R is a measure that takes into account the pathological behavior as well as the specific personality style of individuals scoring high on psychopathy. The clinical staff of the forensic institution rated the PCL-R for all patients. The recommended cut-off of 30 points (Hare, 1991, 2003) was chosen to build two groups of patients.

4.2.3.2 The Raven's Standard Progressive Matrices

The Raven's Standard Progressive Matrices (Raven, 1938) is a standard measure for intelligence. They contain two main components of "general intelligence" in a directly measurable way using robust and directly interpretable procedures. The Raven Progressive Matrices (RPM) tests are made up of a series of diagrams or designs with one part missing. Those taking the tests are expected to select the correct part to complete the designs from a number of options printed beneath. By the use of this task, both components of intelligence, educative and reproductive ability, can be measured.

4.2.4 Procedure

First, participants gave written consent for their participation in the study and filled in a questionnaire for demographic variables. The experimental part was conducted on a Laptop via Presentation 9.70 software (Neurobehavioral Systems, 2005) and an external keyboard. Pictures of six women and six men from the Karolinska Directed Emotional Faces set (KDEF; Lundqvist, Flykt & Ohman, 1998) were chosen, each depicting anxious, angry, disgusted, happy, neutral, sad and surprised expressions in size of 20.78° x 7.98° angle of vision.

In the first block of trials half of the pictures were presented once in random order for 33 ms and masked by blurred versions of each actor's neutral expression (Adobe Photoshop 6.0, San Jose). In the second block of trials, the remaining pictures were shown until a button press of the participant (ad libitum) was registered. For both blocks the participants had to choose one of seven buttons, labeled with the nouns of all basic emotions (anxiety, anger, disgust, happiness, sadness and sur-

prise) and neutral, that better matched the presented facial expression. The third task was to rate all pictures for valence (How positive or negative was this picture?) and arousal (How arousing was this picture?) on scales ranging from -4 to 4 and from 1 to 9 respectively. After this experimental part, patients were tested for intelligence with the Raven Standard Progressive Matrices (Raven, 1938) and received a little gift for their participation.

4.3 Results

4.3.1 Categorizing emotional facial expressions

An ANOVA for repeated measures revealed main effects in categorizing accuracy for Duration factor. The accuracy was higher for ad libitum than for short presented ones ($F(1,41) = 109.31$, $p < .001$) (Table 6).

Another main effect was found for the factor Emotion category: best accuracy was found for happy faces and worst for afraid faces ($F(6,246) = 51.22$, $p < .001$). The significant main effect for Group factor showed that the employees were the most accurate, while patients with high psychopathy-scores performed worst ($F(2,41) = 4.16$, $p = .02$) in the categorizing tasks. The trend for an interaction of Emotion and Group further defines that these main group differences exist for all emotions except for happy and afraid faces ($F(12,246) = 1.75$, $p = .08$).

Table 6: Mean percent of correct responses and standard deviations for all conditions and all participant groups; ANOVA results.

		Psychopathic patients	Non-psychopathic patients	Employees	Significance F (p)
short presentation	afraid	23.08 (16.01)	22.22 (16.27)	22.92 (15.96)	0.01 (.99)
	angry	41.03 (26.01)	40.00 (24.23)	41.67 (29.81)	0.02 (.99)
	disgust	47.44 (39.00)	35.56 (35.00)	51.04 (25.44)	0.91 (.41)
	happy	76.92 (16.01)	81.11 (30.12)	91.67 (10.54)	2.01 (.15)
	neutral	53.85 (40.34)	61.11 (39.67)	78.13 (33.18)	1.62 (.21)
	sad	19.23 (17.80)	46.67 (31.62)	48.96 (31.90)	4.68 (.02)
	surprise	47.44 (31.80)	64.44 (32.65)	81.25 (25.73)	4.56 (.02)
ad libitum presentation	afraid	32.05 (19.79)	32.22 (22.24)	39.58 (32.13)	0.43 (.66)
	angry	76.92 (27.67)	85.56 (26.63)	91.67 (14.91)	1.43 (.25)
	disgust	52.56 (28.74)	52.22 (29.46)	81.25 (14.75)	6.87 (.01)
	happy	93.59 (8.44)	90.00 (23.40)	96.88 (6.72)	0.82 (.45)
	neutral	69.23 (32.52)	82.22 (23.96)	96.88 (6.72)	5.30 (.01)
	sad	57.69 (24.17)	66.67 (27.46)	72.92 (22.67)	1.35 (.27)
	surprise	64.10 (31.80)	75.56 (32.65)	88.54 (26.33)	2.37 (.11)

Post-hoc tests for the interaction between emotion and group revealed significant effects between groups for sad, disgusted, neutral and surprised expressions, not for happy, afraid or angry ones. Bonferroni adjusted post-hoc analyses for these group effects showed significant differences in categorization of sad expressions between psychopathic patients and employees, of disgusted expressions between non-psychopathic patients and employees, of neutral expressions between psychopathic patients and employees and of surprised expressions between psychopathic patients and employees (Figure 5).
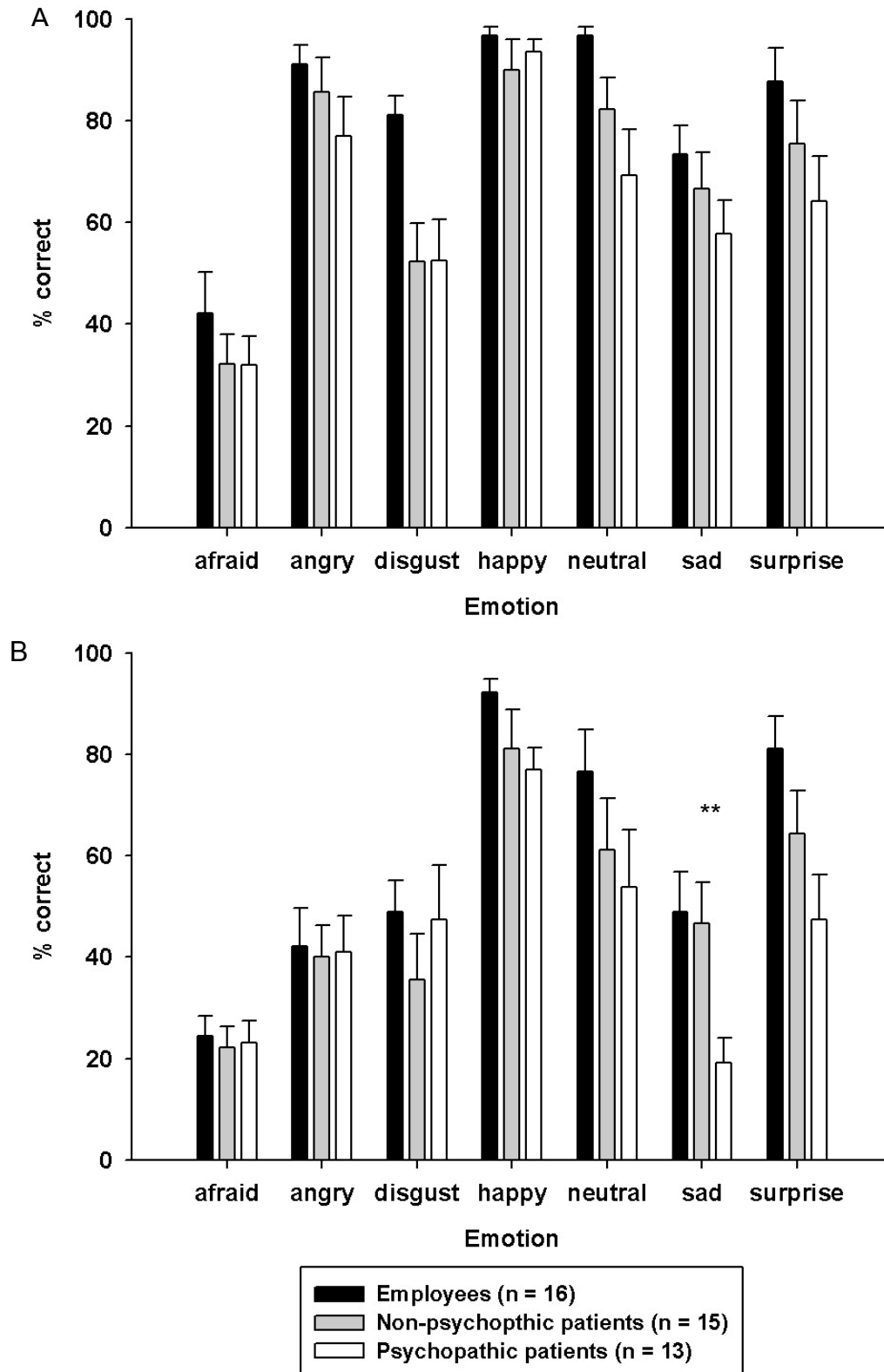
Figure 5: Percent of correct responses for ad libitum (A) and short (B) presented facial expressions (p < .050)**

Planned contrasts between psychopathic and non-psychopathic patients in the short presentation condition showed significant differences only for sad faces ($T(26)$ = 2.77, p = .04).

Taking into account the group differences in age and education as well as handedness as covariates, the main effect of Group remained significant ($F(2,38)$ = 4.00, p = .03), whereas the main effects of Duration and of Emotion were not significant. The relevance of age for the effects concerning the categorization task was mirrored in the significant main effect of the factor age ($F(1,38)$ = 10.50, p = .01) as well as in an interaction of duration and age ($F(1,38)$ = 4.56, p = .04).

Ratios of false positive evaluations and false negative evaluations were calculated for each emotion (Σ (false positive) / Σ (false negatives)) as a measure of emotion specific response bias. Significant differences between short and ad libitum presentation ($F(1,41)$ = 29.96, p < .001) as well as a trend to a difference between groups ($F(2,41)$ = 2.52, p = .09) were found. Furthermore, the interaction of duration, emotion and group ($F(12,246)$ = 2.74, p = .01) resulted significant. Thus, psychopathic patients more often categorized short presented unhappy faces as happy with respect to other emotions (mainly surprise, angry, sad and neutral) and with respect to the other groups ($F(2,41)$ = 5.46, p = .01). The ad libitum presented faces (mainly the afraid ones) were more often categorized as angry by psychopathic patients than by employees ($F(2,41)$ = 2.791 p = .07). Compared with employees, non-psychopathic patients more often erroneously categorized ad libitum presented faces (mainly afraid and sad faces) as surprise ($F(2,41)$ = 3.32, p = .05).

4.3.2 Validating emotional facial expressions

Picture subjective evaluation of valence and arousal dimensions were analyzed for factors of emotion category and group as well as for the kind of emotional dimension (valence vs. arousal)

4.3.2.1 Valence ratings

For emotional valence evaluations there was a main effect of emotion category ($F(6,246) = 77.57$, $p < .001$), but no main effect of group nor interaction of emotion category and group. The subjective evaluation of valence showed more negative evaluations for afraid, angry, disgusted and sad faces, more positive evaluations for happy faces and neutral evaluations for neutral and surprised faces (Figure 6).

4.3.2.2 Arousal ratings

Besides a main effect of emotion category ($F(6246) = 15.47$, $p < .001$), in terms of more arousal for happy faces and less arousal for neutral faces compared to all other emotional faces, there was a main effect of the group ($F(2,41) = 3.15$, $p = .05$), indicating the psychopathic group to perceive all facial expressions less arousing than the three other groups (Figure 6).

Bonferroni corrected post-hoc-tests for planned contrasts show a trend for differences in arousal ratings between psychopathic and non-psychopathic for surprised facial expressions ($T(26) = 2.56$, $p = .05$), neutral facial expressions ($T(26) = 2.46$, $p = .08$) and angry facial expressions ($T(26) = 2.40$, $p = .09$).
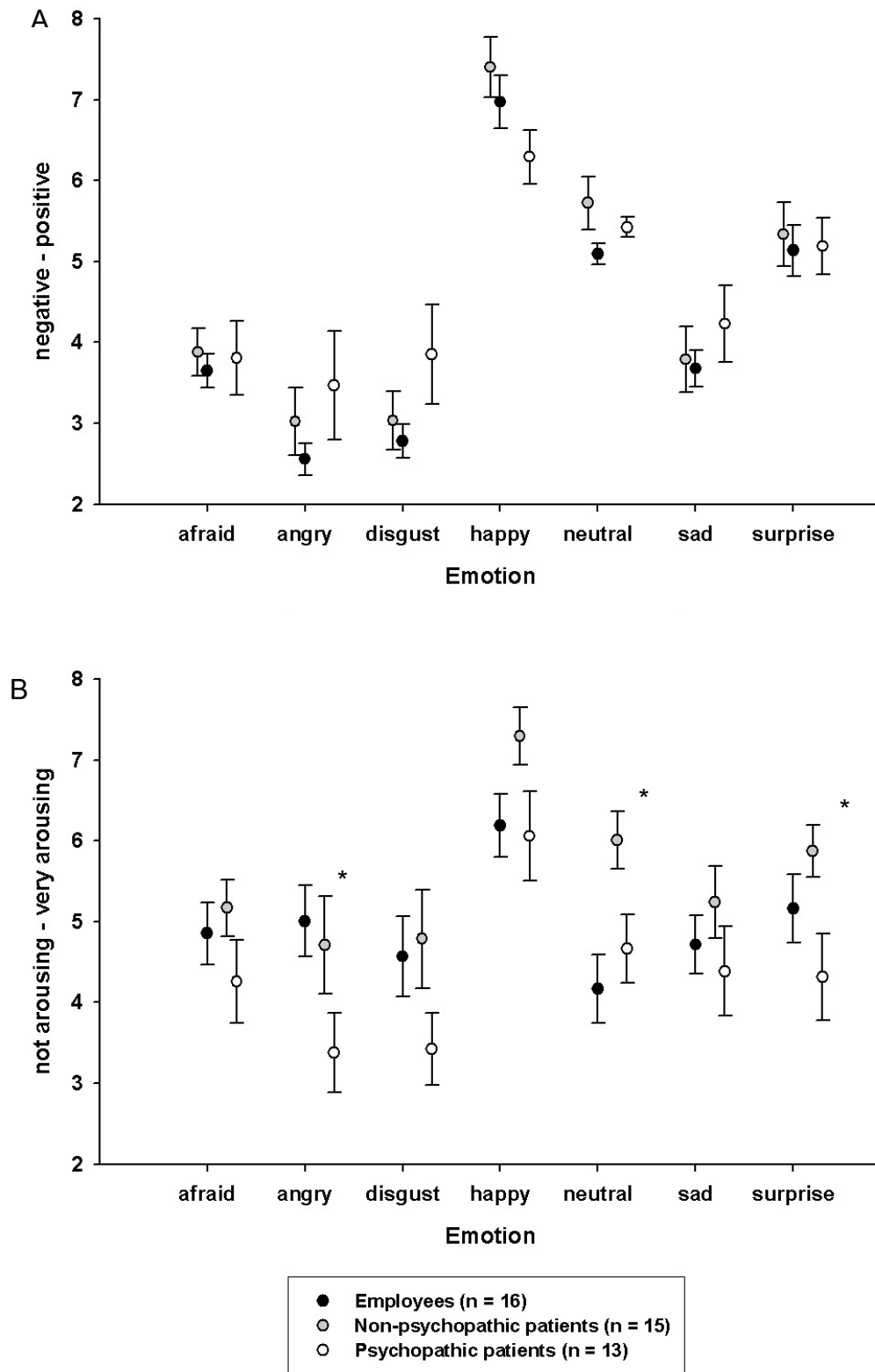
Figure 6: Mean and standard deviations of valence (A) and arousal (B) ratings

(* *p* < .10 for difference between non-psychopathic and psychopathic patients)

4.4 Discussion empirical part II

This study tested the hypothesis that there are differences in emotional detachment between psychopathic and non-psychopathic women as well as a control group of employees, measured by an emotion detection task including emotional face recognition and evaluation.

Results showed a decline of categorization accuracy starting from employees, to non-psychopathic patients and psychopathic patients who performed worse in categorizing all emotions, except happy. Nevertheless there were no group differences for categorizing pictures with happy faces that were recognized quite well, and pictures with afraid faces that were categorized very poorly by all participants, independent of presentation duration.

In the categorizing task, psychopathic patients differed in their accuracy from non-psychopathic patients only in one condition: the short presentation of sad faces. This is in accordance with previous results for men (Fullam & Dolan, 2006; Stevens et al., 2001). However, it also points to the influence of the presentation duration that reduces the time for cognitively evaluating the stimulus. Thus, the impairment in categorizing facial expressions could be elicited by conditions of reduced cognitive elaboration.

More relevant, to our knowledge, this study is the first to report a response bias, showing that the psychopathic group categorized short presented angry, sad, surprised and neutral faces as happy ones, but interpreted ad libitum presented afraid faces as angry ones. This misclassification directly contributes to the hypotheses that false interpretations of emotional faces could be a relevant factor for antisocial behavior, which is often observed in psychopathic individuals. Moreover these

results could be an explanation for the Violence Inhibition Model (VIM; Blair, 1995) to that effect that if sad or fearful faces are misinterpreted by psychopathic persons as happy or angry stimuli, this information can not inhibit aggressive behavior.

Results about the dimensional evaluation of emotional faces are new and provide first evidence for a reduced subjective activation of psychopathic women in response to emotional faces. Valence ratings showed no between-groups differences; indeed, psychopathic patients rated nearly all emotional faces, especially angry, disgusted, neutral and surprised faces as less arousing than students and employees did. These results together with data from literature suppose that there are differences between psychopathic and non-psychopathic inmates not only at physiological, but also at subjective level concerning negative emotional contents. The observed impairment in the perception of emotional faces might contribute to increase our knowledge about the altered mechanisms of social interaction, in which psychopathic patients often tend to display a clear antisocial behavior. Consequently, this impairment raises the question whether it could be possible to improve psychopaths' ability of recognizing emotional contents in other's faces via focused training, but additional studies with larger samples are needed.

A limitation of these results is that only a female sample was tested. Even if men and women with psychopathic attributes are both emotionally impaired (Hamburger et al., 1996; Warren, Burnette, South, Chauhan, Bale, Friend & Van Patten, 2003) and, in general, psychopathic women show reduced physiological responses to emotional stimuli (Sutton et al., 2002), the conclusions cannot be directly generalized to psychopathic men. Future research should directly compare male and female psychopaths. Moreover the group differences in age and intelligence argue for including age- and intelligence-matched samples in these studies.

Why the afraid faces were categorized erroneously by all groups independently of the presentation duration, and at the same time have been rated (as expected) as rather negative and highly arousing cannot be answered from this study. Possibly, the facial stimuli did not represent adequately an effective prototype of fear facial expression. Alternatively, the difficulty of attributing might have been increased because of the high number of categories among which to choose (Kreklewetz & Roesch, 2005). In principle, facial expression of fear should be highly facilitated over all other emotions. Here it occurs the opposite, but under natural ecological conditions, the other (negative) emotions, disgust, angry, surprise are not considered and only fear would be activated, but when a choice among many emotions is forced subject is confused and compensates the preferred choice (fear) with alternative probable emotions. In other terms presenting other biologically irrelevant emotional faces would represent an unnatural laboratory condition. However, results of this study permit to confirm the hypothesis that, similarly to psychopathic males, the perception of emotional faces is impaired in psychopathic women.

5   General discussion

The focus of the studies presented in this thesis was the emotional detachment feature of psychopathy. It documented differential aspects in non-incarcerated populations and specified the emotion perception deficit in a female forensic sample. The results provide evidence that emotional detachment can be assessed by the PPI-R predominantly via its subscale coldheartedness that is strongly related to lack of empathy and shallow affect. Furthermore, using the PPI-R to determine lack of emotionality in male and female students with variable majors revealed lower emotionality in male students compared to female students and lower emotionality for students with law or medicine as major compared to students with psychology as major. In contrast there was no reduced emotionality in ADHD patients compared to healthy study participants. Regarding the perception of emotional stimuli, psychopathic women categorize emotional facial expressions almost as correctly as non-psychopathic women, but psychopathic women rate emotional facial expressions as less arousing which supports the above mentioned citation that "psychopaths know the words, but not the music" (Johns & Quay, 1962).

These results provide evidence for the specific function of lack of emotionality in psychopathy. They contribute to the amygdala dysfunction hypothesis and to the idea of a dysfunction of the emotion processing circuit (Blair, 2005).

5.1   Emotional detachment as the main feature of psychopathy

The emotion processing circuit dysfunction model suggests emotional impairment to be the core feature of psychopathy, deriving from structural and functional deficits in the limbic system as well as in orbito ventrolateral frontal areas (Blair,

2005). According to Blair psychopathy can be characterized by a primary amygdala dysfunction of unknown origin that inhibits operant learning processes, especially those including negative consequences. This lack of learning experiences contributes to the development of behavioral problems. At the same time the deficit in the emotion processing system contributes to deficits in social interactions. Psychopaths do not perceive the negative emotional valence of cues and thus cannot inhibit violent actions (Violence Inhibition Model; Blair, 1995). The deficits in validating emotional facial expressions reported above specify this incapacity in emotion perception and points to a subcortical deficit rather than a deficit on higher levels of processing, as the differences in categorizing performance between psychopathic and non-psychopathic patients were rather small and only present in the short presentation condition. However, these data are behavioral and thus need to be supported by studies using brain imaging to discriminate functional differences, as it was done by Kiehl and colleagues (Kiehl et al., 2001) as well as Veit and colleagues (Veit, Flor, Erb, Hermann, Lotze, Grodd & Birbaumer, 2002). A very recent study on error related negativity in an emotional versus a semantic task (Munro, Dywan, Harris, Mckee, Unsal & Segalowitz, in press) heads for the question of emotional versus higher level stimulus processing impairment. The authors described differences in error related negativity related to the level of psychopathy in a face flanker task, but no difference in a letter flanker task. Though these differences were present also in the behavioral data. The higher the level of psychopathic traits, the more errors participants made on the face flanker task. Interpreting the face flanker task from an emotional processing perspective as a rather implicit measure of emotional understanding, these data are in line with our findings using valence ratings as implicit measures of emotion perception.

Using the dimensional perspective of psychopathy and focusing on a disorder that is challenged to be related to psychopathy further underlines the core function of emotional detachment in psychopathy. ADHD is discussed as similar to psychopathy not only in characteristics and but also in pathogenesis (Abramowitz et al., 2004; Barry et al., 2000; Kaplan & Cornell, 2004). A close look at the subscale-level, verified in correlational as well as regressional analyses, showed that similar symptoms of ADHD and psychopathy arise from similar features of conduct problems. Those could be due to comparable underlying processes, as Colledge and Blair as well as Mathias and colleagues suggest (Colledge & Blair, 2001; Mathias et al., 2007). However, similarities between ADHD and psychopathy can not be put down to emotional detachment features, because there are no general correlations between psychopathy and ADHD, but only on conduct disorder related features. The missing differences between ADHD patients and healthy participants in emotional detachment related features point to the efficiency of those features to distinguish psychopaths from non-psychopaths. However, this assumption is based on few data derived from self-report and therefore has to be proved in further studies, not only involving larger samples but also applying different measures of psychopathy, self-report, external ratings and psychophysiological correlates.

In sum, the data presented support the core function of emotional detachment in psychopathy which is an important detail for understanding the construct psychopathy, its etiology and last but not least for developing therapeutical strategies. Based on the assumption of the central role of emotion processing, therapy for criminal psychopaths should emphasize training in emotion decoding on an implicit level, bearing in mind the incapacity of psychopaths in operant learning. First implications in that vein for therapy have been made by Wong and Hare (Wong & Hare, 2006),

proposing emotion management programs, stress management trainings and the use of positive reinforcers instead of punishment. Nevertheless, there is a clear need for the development of therapy modules specifically designed for the emotional detachment itself, dealing with the "music" of emotions.

5.2 Aspects of psychopathy in women

The lack of knowledge about the „music" of emotions in female psychopaths has been reported in previous publications as well as in the results of the second empirical part. However, looking at the data of this thesis on differential aspects of emotional detachment questions this assumption.

As mentioned above, female psychopathy is not in the focus of research, but interest and published studies are increasing (Berardino, Meloy, Sherman & Jacobs, 2005; Sutton et al., 2002; Verona & Vitale, 2006; Vitale, Brinkley, Hiatt & Newman, 2007). Structural analyses on the PCL-R (Hare, 1991, 2003) revealed gender differences only for antisocial behavior items and the conning/manipulative item, but no differences in item functioning for emotional detachment items such as lack of empathy, lack of remorse and shallow affect. Although it is discussed to use a lower cut-off for women than for men (Nicholls et al., 2005), prevalence for high scores is smaller for female compared to male psychopaths (Grann, 2000). This could be an explanation for the reduced level of emotional detachment in the female student sample, reflecting lower rates of strong psychopathic traits. That is, comparing general population samples of males and females arises base rate differences similar to those in incarcerated samples. Additionally, the differential effects show that there is dimensionality in a normal population sample, deriving from divers study majors, as well as in a forensic inpatients sample.

For the emotion detection study a forensic inpatient sample was classified into two groups, one of high psychopathic and one of low psychopathic patients and those groups performed differently in evaluating emotional facial expressions. Thus, high scoring female psychopaths are not as numerous as high scoring male psychopaths, but they show similar emotional detachment as male psychopaths.

5.3 Future directions

Implications drawn from the results reported in this dissertation concern several aspects. On the one hand subsequent studies on emotional detachment in general population and on the other hand in patients samples of males as well as females have to be conducted.

In order to learn more about emotional detachment studies in general population of different professions are needed, especially studies that contribute to the discussion on psychopaths at work. Insights from those studies could amplify our knowledge derived from the results on students with different majors and confirm the idea of the "snakes in suits" (Babiak & Hare, 2006) that is not based on reliable data up to now.

Based on our conclusion of emotional detachment being the core feature of psychopathy, future research should include the development and functioning of the emotion processing circuits, where psychopathy could be a helpful model to investigate. The specific difference between ADHD and psychopathy should be further investigated, specifically if underlying processes leading to conduct problems have the same bases.

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