

## Two, Three or Four Factors?

### Internal and External Validity of Different Factor Models of the German Psychopathy Checklist: Screening Version

[Zwei, drei oder vier Faktoren? Interne und externe Validität verschiedener Faktorenmodelle der deutschen Psychopathy Checklist: Screening Version]

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#### Zusammenfassung

Die Studie beschäftigt sich theoretisch und empirisch mit der aktuellen Diskussion zur Faktorenstruktur der Psychopathy-Checkliste und des Psychopathy-Konstrukts. Dafür wurden 299 männliche Inhaftierte in einer deutschen Justizvollzugsanstalt mit der PCL: Screening Version (PCL: SV) und dem Strukturierten Klinischen Interview für die Achse II des DSM-IV-TR (SKID-II) untersucht.

Die interne Validität des zwei-, drei- und vierfaktoriellen Modells der PCL:SV wurde durch die Verwendung verschiedener Modell-Tests geprüft (KKT; IRT). Die Konstruktvalidität wurde anhand der Beziehungen jedes Modells zu den Cluster-B-Persönlichkeitsstörungen untersucht. Die externe bzw. prädiktive Validität wurde durch die Beziehung zu intramuralen Verhaltensauffälligkeiten analysiert.

Die drei- und vierfaktoriellen Modelle waren der ursprünglichen zweifaktoriellen Struktur insgesamt überlegen. Allerdings zeigten diese beiden Modelle ähnliche Fit-Werte in den Modeltests und auch die anderen Validitätsvergleiche fielen sehr ähnlich aus. Aus diesem Grund sollte die stark statistiklastige und akademische Diskussion über die PCL-Modelle durch anwendungsbezogene Validitätsaspekte mit Praxiswert ergänzt werden. Ebenso erscheint die Entwicklung alternativer Psychopathy-Modelle (z. B. CAPP-Modell) wichtig für die zukünftige Forschung und Praxis.

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## Abstract

This study provides both theoretical and empirical contributions to the current discussion about the dimensional structure of the Psychopathy Checklist (PCL). The German edition of the PCL screening version (PCL:SV) was used to investigate 299 male offenders in a German prison.

The internal validity of the proposed two-, three- and four-dimensional models was evaluated using model tests based on classical test theory and item response theory. Theoretically expected overlaps and differences between each model's factors and cluster B personality disorders were investigated using the Structured Clinical Interview for DSM-IV (SCID-II). To examine the external validity of their different item sets, the power of the models to predict problem behaviour during the period of detention was compared.

The parsimony adjusted model fit of both the three and four dimensional models was superior to that of the classical two factor model. The item sets used by these models showed equally good predictive power for problem behaviour.

We recommend to choose the particular factor model primarily by means of the study aims instead of statistical considerations only.

## Key words

Psychopathy, factor structure, psychopathy checklist: screening version (pcl:sv), model test, validity, reliability

## Introduction

Where offenders are concerned, psychopathy in the sense used by Hare is seen as a central personality construct. On the one hand it simplifies decision-making about the type and extent of therapeutic measures and their chances of success (Hare et al., 2000; Falkenbach et al., 2003; O'Neil et al., 2003; Spain et al., 2004; Caldwell et al., 2007; Looman et al., 2005; Barbaree, 2005). On the other hand psychopathy also predicts behavioural problems during detention (Huchzermeier et al., 2006a) and recidivism following release (Hare et al., 2000; Hare, 2003; Grann et al., 1999; Tengstrom et al., 2000).

If the concept of psychopathy is to be used for these purposes in everyday forensic applications, an adequate instrument for its measurement needs to be available. The Psychopathy Checklist Revised (PCL-R) (Hare, 2003) has established itself internationally as the gold standard for this purpose (Patrick, 2006). The original version of the PCL was based on a two dimensional structure (Hare et al., 1991). An interpersonal-affective component (Factor 1) and a social deviant component (Factor 2) were distinguished.

Cooke and Michie argued later (Cooke et al., 1999; Cooke & Michie, 2001) that antisocial behaviour was not a component but rather a *consequence* of psychopathic structures. Thereupon they initiated the current discussion on the

best model structure to fit the items by proposing a hierarchical three factor model. Its fit was superior to that of the two factor version (Cooke et al., 1999; Cooke & Michie, 2001). In their analysis the items representing antisocial behaviour were eliminated from the original Factor 2 of the PCL. The remaining items were together transferred to a factor for *Impulsive and Irresponsible Behavioral Style*. The original Factor 1 was divided into one component for *Arrogant and Deceitful Interpersonal Style* and one for *Deficient Affective Experience*. In addition closely related items within the factors were grouped into testlets.

Hare reacted to the weak points that had been revealed in the first version with a draft of a four dimensional factor structure (Hare, 2003; Neumann et al., 2007). It is largely identical with Cooke and Michie's organisation but groups their excluded items into a fourth *antisocial* factor and does not include the testlets.

As can be seen by a systematic review of the literature in the relevant databases (e.g. PubMed, PsychLIT, Psyn dex, Google Scholar) a variety of studies have been published on the different versions of the PCL, namely the PCL-R, the Screening Version PCL:SV and the youth version PCL:YV. Some of these studies have identified Cook and Michie's three factor model as the most appropriate while others favour Hare's four factor model. Table 1 shows some selected studies of the factor structure of the PCL:SV.

Table 1: Overview of selected studies of the factor structure of the Psychopathy Checklist-SV.

Study	Country	Sample	Method	Factor models tested	External validity criteria	Best model fit
Strand & Belfrage, 2005	Sweden	Forensic inpatients	EFA/IRT	2 & 3	Gender differences	<b>2 &amp; 3 Factor Model (gender differences)</b>
Köhler, 2004	Germany	Male offenders	EFA	3 & 4	Personality, Intelligence	<b>3 &amp; 4 Factor Model</b>
Hill et al., 2004	North America	Male offenders	CFA	2, 3 & 4	---	<b>4 Factor Model</b>
Cooke & Michie, 1999	North America	Male offenders	IRT	2, 3 & 4	---	<b>3 Factor Model</b>
Cooke et al., 1999	North America	Male offenders	IRT	2, 3 & 4	---	<b>3 Factor Model</b>

Why are these findings so divergent? One reason is that the studies used fundamentally different analytic procedures whose use was governed by differing rules. The methods used included exploratory and confirmatory factor analysis (EFA and CFA respectively) and also model comparisons in accordance with item response theory (IRT). As they are based on fundamentally different

assumptions these procedures can even yield differing results for a single subject sample (Rost, 2004). Another reason is that results of model tests are primarily dependent on the properties of the sample under investigation. Although there is some evidence about cross-cultural generalisability as well (Cooke et al., 2005a;Cooke et al., 2005b) it is therefore not surprising that an IRT analysis of the PCL-R from North America (Bolt et al., 2004) reaches conclusions that are different from those yielded by a sample from Great Britain (Cooke et al., 2004a). The potential discrepancies are even greater when not only the culture but also the language of the instrument and the subjects varies.

These insights into the underlying statistics can put the sometimes heated debates as to the “right” factor model into perspective. They also underline the importance of separate testing of the fit of a postulated model structure for each version of the PCL and for each different language region. This needs to be done simultaneously using as many justifiable and meaningful statistical procedures as possible. These include not only the methods described above for testing the *internal* validity of a model structure but should also involve considerations of the *external* validity.

#### *Aim of the study*

For adult German subjects the PCL:SV is the only PCL version available in an authorised translation. The fit of the three and four dimensional models has not yet been tested for the German language PCL:SV. In accordance with the arguments presented above, the goodness of fit of the most discussed two, three and four factor models proposed by Hare (2003) and Cooke (et al., 1999) and Cooke and Michie (2001) was compared using various statistical methods. Using a large sample of male violent offenders in Germany tests were performed to find out which factor model offered the best fit (internal or factorial validity). The analysis made use of procedures based on classical test theory and procedures based on item response theory.

If the PCL’s predictive validity for future abnormal behaviour is to be cited as one of its strengths then the present discussion of factors must establish the importance for such predictions of the items eliminated by Cooke and Michie. Using a subgroup of the sample and a prospective design, tests were made of the appropriateness of the different factor models for predicting abnormal behaviour during the period of detention.

As a further aspect of internal validity we also examined the extent to which the *content* of the postulated factor models was consistent with other measures for describing personality structures (construct or/and content validity). As Cooke and Michie aim to eliminate antisocial behaviour from the psychopathy construct, this process paid particular attention to the extent to which antisocial behaviour is also represented in the remaining items of the three factor model.

## Method

### Sample

In the study described here we analysed data from three different samples of incarcerated male violent offenders ( $N = 299$  see table 2). Sample 1 ( $N = 141$ ) were adult prison inmates who were investigated between the years 2000 and 2004 as part of a psychotherapy project (Huchzermeier et al., 2006b). Sample 2 ( $N = 111$ ) were in youth custody and participated in a study between the years 2001 and 2003 (Köhler et al., 2009). Sample 3 ( $N = 47$ ) were patients at a secure psychiatric hospital and were also recruited as part of a study (Huchzermeier et al., 2008). All participants in the various studies had agreed to an investigation using standardised instruments and had given their informed consent to a scientific evaluation of their data.

Table 2: Sample description.

	Sample 1 Huchzermeier et al., 2006b		Sample 2 Köhler et al., 2009		Sample 3 Huchzermeier et al., 2008		Total	
<i>N</i>	141		111		47		299	
Age	29,04	7,56	19,99	1,56	38,3	8,24	26,96	8,96
<b>Personality disorder</b>	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Histrionic	2	1,4	2	1,8	0	0	4	1,3
Borderline	17	12,1	20	18	8	17	45	15,1
Narcissistic	16	11,3	13	11,7	5	10,60	34	11,4
Antisocial	65	46,1	67	60,4	20	42,6	152	50,8
Number of Personality disorders	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
	1,01	1,03	1,09	1,03	0,85	1	1,02	1,03
<b>PCL</b>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PCL total	12,91	5,14	13,98	4,28	12,62	5,62	13,26	4,93
PCL F1	5,94	3,14	5,46	2,88	5,81	3,3	5,74	3,07
PCL F2	6,97	3,21	8,52	2,39	6,81	3,3	7,52	3,04
PCL class	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
PCL low (0-13)	60	42,6	42	37,8	22	46,8	124	41,5
PCL moderate (14-17)	55	39	42	37,8	16	34	113	37,8
PCL high (18-24)	26	18,4	27	24,3	9	19,1	62	20,7

### Instruments

The instruments used were the German versions of the *Structured Clinical Interview for DSM-IV (SCID)*, to gather information on specific personality

disorders, and the Screening Version of the *Psychopathy Checklist (PCL:SV)*. The instruments were administered by psychologists and psychiatrists who had received special training in these procedures. All of them were clinically experienced in both therapeutic and forensic issues.

The subgroup of imprisoned adult offenders (sample 1) was also investigated using specially developed instruments. Each participant's behaviour while in prison was documented using a recently developed and approved instrument assessing both objective and subjective data (see Huchzermeier et al., 2008).

- *Objective data* consisted of incidents recorded in the prisoner's personal file. This file records the use of disciplinary measures for violence, drug and alcohol consumption and the like and any occasions on which the prisoner was excluded from training or work. Additional charges brought for crimes of any sort committed while in custody are also entered in the file. On this basis, an index of incidents per month was calculated for each participant.
- *Subjective* evaluation of the sentence was based on semistandardised interviews with prison department heads. They are responsible for looking after the prisoners in the individual departments of the prison and were required to rate individual prisoners in relation to 9 items in the form of a semantic differential (Osgood et al., 1957) regarding behaviour towards heads of department, behaviour towards other prison officers, behaviour towards fellow prisoners (2 items), behaviour towards people from outside the prison, behaviour on receiving negative information, behaviour at work/ training, attitude to their own crime and expectations of others' behaviour towards them.

Both evaluations were performed double blind. At the time of the interview neither the interviewer nor the interviewee knew the individual's PCL:SV score. To further avoid confounding dependent with independent variables, the data bases used for the retrospective completion of the PCL:SV and for the prospective evaluation of the course of the sentence were strictly separated. For a more detailed description of the evaluation procedures see Huchzermeier et al. (2006b, 2008).

### *Statistical evaluation*

The internal validity of the three models that have been proposed has been tested using confirmatory factor analysis (CFA) with the help of Amos 5 software. Following the recommendations of Hair et al. (1998) the fit of the model was evaluated using fit indices of differing theoretical provenance. We used the parsimony adjusted root mean square error of approximation (RMSEA) and the normed fit index (NFI). According to Hu and Bentler (1999) values of the RMSEA below 0.08 indicate reasonable fit of the model while for the NFI values above 0.9 are considered indicative of acceptable fit (Hair et al., 1998). For the sake of clarity we have refrained from presenting further indices such as CFI or GFI.

In addition the models were tested according to item response theory (IRT) using ConQuest software (Wu et al., 2003). Because of the identical answer

formats used for all items they were operationalised as Rating Scale Models (Andrych, 1978). We used Akaike's information criterion (AIC) to evaluate model fit. Since the size of the AIC depends both on characteristics of the sample and on the particular test model, there is no *absolutely* sufficient value to be achieved. Even so, smaller values of this parsimony adjusted measure indicate better fit in a *relative* sense.

Predictive validity was calculated using Pearson's correlation coefficient for correlations between PCL:SV scores and the measures of abnormal behaviour during the detention period. The construct validity of the PCL:SV models was investigated using correlations with the SCID diagnoses. Eta coefficients (Cohen, 1998; Kähler, 1996) were calculated for comparisons with these categorical data. These calculations were all made using SPSS 11.5.

Reliability of the factors of each model was calculated using Cronbach's  $\alpha$ .

## Results

### *Reliability*

The reliability (internal consistency; Cronbach's Alpha) of Factor 1 and 2 of the two factor model was .77 and .78. Splitting them up leads to .72, .75, .69, .58 for Factor 1 to 4 of the newer models.

### *Model tests of factorial validity*

On the CFA the original two factor model achieved an RMSEA value of 0.109 and an NFI value of 0.759 whereas the three factor model favoured by Cooke and Michie scored RMSEA = 0.061 and NFI = 0.938 indicating reasonable fit. The four factor model proposed by Hare also scored well on the RMSEA with a value of 0.073 but did slightly less well on the NFI, achieving a score of 0.878.

In the IRT analysis the four factor rating scale model was also superior to the two factor version. Their AIC scores were 6655.46 and 6706.13 respectively. The three factor model cannot be compared with the other factor structures on the basis of its AIC score of 5097.22 because this only gives the *relative* fit of the model. Comparisons are only possible where item sets are identical.

### *Predictive validity*

When the course of the detention period was predicted on the basis of all 12 items of the PCL:SV that are included in the two and four factor models, then a Pearson correlation of 0.43 ( $p < 0.01$ ;  $N = 35$ ) was found with the frequency of disciplinary incidents. The correlation with the assessment of personality made by staff members was also 0.43 ( $p < 0.01$ ). When we considered only the 9 items used by Cooke and Michie in their three factor model both correlations fell to 0.40 ( $p < 0.01$ ).

### Construct validity

Table 3 shows the relationships between the factors of the three models and Cluster B personality disorders in terms of the eta coefficient. With regard to the question of content validity it is striking that, as expected, Hare's fourth factor showed a very high correlation with the presence of antisocial personality disorder ( $\eta = 0.59$ ;  $p < 0.05$ ). However, the eta coefficient for the third factor was 0.50 ( $p < 0.05$ ) and thus of a similar order of magnitude. Accordingly Factor 2 of the two factor model, which unites these two factors, achieved a correlation of 0.59 and thus showed the strongest relationship with ASPD.

Table 3: Construct validity of the factor models: Correlation ( $\eta$ ) of each factor of the PCL:SV with Cluster B personality disorders.

SCID-II diagnosis <sup>†</sup>	2 Factor Model		3/4 Factor Model <sup>°</sup>				Total Scores	
	F1	F2	F1	F2	F3	F4	Total 3	Total 2/4
<b>Borderline PD</b> (N = 45)	0.20	0.22	0.18*	0.17*	0.18*	0.20*	0.24	<b>0.26</b>
<b>Narcissistic PD</b> (N = 34)	0.46*	0.13	0.50*	0.27*	0.10	0.11	0.40*	<b>0.36*</b>
<b>Antisocial PD</b> (N = 152)	0.29	0.59*	0.23*	0.25*	0.50*	0.58*	0.45*	<b>0.54*</b>
<b>Cluster B</b> (N = 171)	<b>0.39*</b>	<b>0.52*</b>	<b>0.33*</b>	<b>0.32*</b>	<b>0.43*</b>	<b>0.51*</b>	<b>0.49*</b>	<b>0.56*</b>

\* ANOVA significant with  $p < 0.05$

<sup>°</sup> because of identical item allocation in Factors 1 - 3 they are presented together.

<sup>†</sup> multiple diagnoses possible.

### Discussion

The findings presented here come from the first investigation of the factor structure of the German version of the PCL:SV with a larger subject sample. Using different procedures (CFA, IRT) we have shown that the two models recently proposed by Hare et al. and by Cooke and Michie are superior to the original two factor concept. This conclusion goes beyond the trivial finding that a larger number of factors always explains variance better. Because the considered fit indices are parsimony-adjusted, the main conclusion to be drawn is that the fit of the model actually overcompensates for the increasing complexity of the newer models.

It is not easy to make a definite choice between these two superior models. The somewhat better fit of the three factor model (RMSEA = 0.061 as opposed to 0.073; NFI = 0.938 as opposed to 0.878) argues for the three factor model. Moreover, in spite of a more parsimonious item set, it showed similar predictive power for behavioural abnormalities during detention. However, the correlation between factors 3 and 4 was very high for this sample because



only high and low scorers but not moderate scorers were included. This selection procedure was used in order to exclude those with total PCL:SV scores in the middle range, who may be poorly differentiated (Huchzermeyer et al., 2006b), but it also levels out the differences between the potential predictive validities of the two models.

Factor 4 also showed the lowest level of reliability by a considerable amount (Cronbach's  $\alpha = 0.58$  compared to 0.69 to 0.75 for Factors 1 to 3). This means that the Cooke and Michie model excludes precisely those items with the lowest precision of measurement which in turn means that better results tend to be obtained both from tests of model fit and from correlations with external measures such as behavioural abnormalities. But even if the good fit of the model is at least partly due to the elimination of bad items, this can nevertheless be seen as a strength of the 3 factor model whereas a reliability coefficient of .58 in the four factor model actually may be seen as clearly insufficient.

When the relationships with cluster B personality disorders are considered it is noticeable that – except for narcissistic personality disorder – all the eta coefficients for the total score of the three factor model are lower than for the four factor structure (total score). In addition, Factor 3 – like Factor 4 – is also highly significantly correlated with the occurrence of ASPD. This suggests that Cooke and Michie did not entirely succeed in completely removing the “antisocial” element from their model. However, Cooke and Michie nevertheless saw the personality features represented in Factors 1 to 3 as being the causal precursors of antisocial behaviour. This means that high correlations could reasonably be expected in a cross sectional view of this sort. Furthermore, Factors 3 and 4 are normally highly correlated (here  $r = 0.59$ ,  $p < 0.001$ ). This means that ASPDs are very likely to be highly correlated with Factor 3 if there is also a close correlation with Factor 4. We have not taken the opportunity to investigate this question further by analysing partial correlations. Because of the high correlation between the factors such “purification” would leave only very artificial variables.

## Conclusion

To summarise the findings presented, the two factor model proposed in the manual for the German version of the PCL:SV does not do justice to the data presented here. In our study, by contrast, both the three factor and four factor models show very good results in relation to predictive, content and construct validity. Because of its higher reliability, slightly better fit and the parsimony, Cooke and Michie's model emerges with a slender advantage. Whether one is prepared to sacrifice forensically relevant items for this advantage depends on the application context in each case. The fourth factor is necessary to test hypotheses such as those concerning the connection between antisocial behaviour, in particular, and external variables such as serotonin level (Minzenberg & Siever, 2006; Dolan & Anderson, 2003) or intelligence (Vitacco et al., 2005). However for studies of psychopathy as a whole, or of other aspects of psychopathy, this factor would not necessarily be essential. As our study

shows, an uncritical escalation process in which each research group concentrates solely on doing ever more studies to validate its favoured models (Vittacco, 2007; Neumann & Hare, 2007; Cooke et al. 2007) is unlikely to be useful and should therefore be avoided. More attention needs to be focused on the practical situation and implications for the planning of therapy for offenders. The discourse now needs to progress beyond Hare's notion of psychopathy. New psychopathy models like those underlying the Comprehensive Assessment of Psychopathic Personality can bring new scientific insights (e.g. Stoll et al., 2011).

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