The Mask of Sanity

Facial Expressive, Self-Reported, and Physiological Consequences of Emotion Regulation in Psychopathic Offenders

Nentjes, L.; Bernstein, D.P.; Meijer, E.; Arntz, A.; Wiers, R.W.

DOI
10.1521/pedi_2016_30_235

Publication date
2016

Document Version
Final published version

Published in
Journal of Personality Disorders

Journal of Personality Disorders, 30(6), 828-847, S1–S8, 2016

THE MASK OF SANITY: FACIAL EXPRESSIVE, SELF-REPORTED, AND PHYSIOLOGICAL CONSEQUENCES OF EMOTION REGULATION IN PSYCHOPATHIC OFFENDERS

Lieke Nentjes, PhD, David P. Bernstein, PhD, Ewout Meijer, PhD, Arnoud Arntz, PhD, and Reinout W. Wiers, PhD

This study investigated the physiological, self-reported, and facial correlates of emotion regulation in psychopathy. Specifically, we compared psychopathic offenders (n = 42), nonpsychopathic offenders (n = 42), and nonoffender controls (n = 26) in their ability to inhibit and express emotion while watching affective films (fear, happy, and sad). Results showed that all participants were capable of drastically diminishing facial emotions under inhibition instructions. Contrary to expectation, psychopaths were not superior in adopting such a "poker face." Further, the inhibition of emotion was associated with cardiovascular changes, an effect that was also not dependent on psychopathy (or its factors), suggesting emotion inhibition to be an effortful process in psychopaths as well. Interestingly, psychopathic offenders did not differ from nonpsychopaths in the capacity to show content-appropriate facial emotions during the expression condition. Taken together, these data challenge the view that psychopathy is associated with either superior emotional inhibitory capacities or a generalized impairment in showing facial affect.

Psychopathy is a severe disorder that is characterized by behavioral tendencies (such as impulsivity, a lack of behavioral controls, and criminality), as well as interpersonal/affective features (e.g., pathological lying and a lack of remorse and empathy; Hare, 2003). Severe emotional deficits are believed to play an important role in the etiology of this disorder (Hare, 2003; Lykken, 1995; Patrick, 1994). Research indeed shows that psychopathy is related to a number of affective aberrances, such as a reduced experience of bodily signals

From Department of Clinical Psychological Science, Maastricht University, the Netherlands (L. N., D. P. B., E. M.); Forensic Psychiatric Center "de Rooyse Wissel," the Netherlands (D. P. B.); Department of Clinical Psychology, University of Amsterdam. the Netherlands (A. A.); and Addiction, Development and Psychopathology (ADAPT)-Lab, Department of Developmental Psychology, University of Amsterdam, the Netherlands (R. W. W.). Lieke Nentjes is now at the Department of Clinical Psychology, University of Amsterdam, the Netherlands.

We are grateful for the collaboration of the board of directors, staff, and participants of Veenhuizen Penitentiary, Forensic Psychiatric Clinic Assen, Forensic Psychiatric Centre (F.P.C.) Veldzicht, F.P.C. Dr. S. van Mesdag, F.P.C. De Rooyse Wissel, and F.P.C. Oostvaarders clinic.

Address correspondence to Lieke Nentjes, University of Amsterdam, Department of Clinical Psychology, 1018 XA, Amsterdam, the Netherlands. E-mail: l.nentjes@uva.nl

accompanying emotion and a decreased affective startle reflex (Herpertz et al., 2001; Nentjes, Meijer, Bernstein, Arntz, & Medendorp, 2013; for a review, see Brook, Brieman, & Kosson, 2013). Despite this expanding literature, the mechanisms underlying the affective flatness that characterizes psychopathy remain far from clear.

A potential explanation for this emotional poverty could be that psychopathy is generally characterized by an increased capacity and tendency to restrain affective responses. Such emotional over-control could be considered a type of emotion regulation, with the latter being generally defined as the strategies that individuals use to influence the course and expression of emotion (Gross, 2002). Various emotion regulation problems (including the over-control of emotion and difficulties in regulating negative affective states) are increasingly recognized as potential risk factors for criminal behavior (Howells, 2009) and, consequently, as treatment targets in offender rehabilitation (Bernstein et al., 2012; Day, 2009). Nonetheless, scant experimental research has focused on the regulatory processes by which psychopaths control and possibly adjust their emotions.

The current study therefore examined whether psychopathy is associated with a superior capacity to regulate emotions. In doing so, this research focused on expressive suppression. This emotional regulation strategy has received considerable empirical interest, and refers to the reduction of the overt expressive behavior that results from inner emotion experience (John & Gross, 2004). Normally, such suppression is associated with a physiological cost (that is, an increase in skin conductance and a decrease in heart rate; e.g., Kunzmann, Kupperbusch, & Levenson, 2005; Roberts, Levenson, & Gross, 2008). A study by Casey, Rogers, Burns, and Yiend (2012) showed psychopathy to be unrelated to changes in self-reported emotion or cardiovascular responsivity when suppressing emotions while watching affective pictures. Unfortunately, facial expressiveness was not taken into account in this study. Importantly, facial displays provide an important means to evaluate emotional reactivity, as different response systems (e.g., facial expressions vs. physiology) do not always show identical patterns (Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005).

The current study aimed to fill this hiatus and had a twofold focus. First, it was investigated whether psychopathy is associated with an increased capacity to suppress emotions, taking into account self-reported emotion, psychophysiology, and facial expressiveness. Second, it was examined whether psychopaths are in fact able to show emotions when being asked to do so. This second research question was included as an empirical test of some of the contrasting theoretical perspectives that have developed to explain psychopathy. That is, some theorists argue that psychopathy finds its roots in stable, trait-like impairments (e.g., Blair, Mitchell, & Blair, 2005), whereas in other perspectives, psychopathic symptomatology is considered to be more context-dependent and amendable to change (e.g., Baskin-Sommers, Curtin, & Newman, 2011; Bernstein et al., 2012; Newman, 1998). This present investigation provides an inquiry of these theories by examining whether psychopaths' emotional deficiencies are so severe that even when pushing their displays of emotion, psychopaths' facial expressiveness is not as intense or appropriate, or, whether

these individuals are in fact capable of expressing facial emotions. Besides having important theoretical implications for the perspectives described above, such an investigation could also be highly relevant for offender treatment. That is, results could support and inform forensic interventions aimed at changing the emotional flatness that is believed to play a major role in psychopaths' antisocial behavior (e.g., Bernstein et al., 2012).

We therefore compared nonpsychopathic offenders and nonoffender controls in their ability to manipulate emotions while watching two series of differently valenced film clips (fear, happy, and sad). Prior to one series, participants were instructed to inhibit all their emotion, while during the other, they were asked to express their emotion. Concerning inhibition, we expected psychopaths to have a superior capacity to inhibit their facial emotions in comparison with the controls, reflecting the aforementioned over-control of emotion. That is, we did expect controls to be able to suppress their facial affect to some extent, yet we predicted psychopaths to be better at adopting a "poker face," reflected in less facial emotion during inhibition. (In all our group comparisons, we expected the nonpsychopathic offenders to fall in between the psychopaths and the controls.) We also expected psychopaths' capacity to inhibit their emotion to be reflected in a reduced physiological cost of emotion suppression. We did expect to see these physiological changes in the controls during inhibition. As we assumed psychopaths to inhibit their emotion with less effort, we hypothesized that these individuals would be characterized by a smaller difference in physiological increase than the controls during inhibition, relative to the expression condition.[1] We did not expect to see any group differences in self-reported emotion, as psychopathy is generally unrelated to subjective reports of emotion (Brook et al., 2013).

Research has shown psychopathy to be constituted by at least two underlying components. Factor 1 describes interpersonal/affective traits (e.g., manipulation, shallow affect), and Factor 2 reflects lifestyle/antisocial characteristics (e.g., impulsivity, criminal versatility; Harpur, Hakstian, & Hare, 1988). Regarding these dimensions, we expected Factor 1 to be related to a superior capacity to inhibit emotion, as reflected in the hypotheses described above. In contrast, we hypothesized Factor 2 to be associated with less successful inhibition of facial emotions and a larger physiological inhibition cost, assuming impulsive offenders to have more difficulty suppressing biologically prepared responses (Schreiber, Grant, & Odlaug, 2012). Also, these findings would match a previous study by **Porter,** ten Brinke, Baker, and Wallace (2011) who found that students high in interpersonal, self-reported psychopathic traits were better at hiding their facial emotions while viewing affective pictures. In contrast, lifestyle psychopathic features were negatively related to this capacity.

1. Previous research indicates that psychopaths are characterized by a decreased modulation of physiological responding as a function of stimulus valence (neutral to emotional; see Brook et al., 2013). Therefore, all our hypotheses on participants' physiological responsivity while inhibiting emotion concern participants' responses under inhibition instructions, relative to the expression condition in which participants did not have to suppress their emotions. This approach enabled us to disentangle potential group differences in general physiological responsiveness to affective material from the physiological reactivity associated with affective inhibition.

The direction of our hypotheses for expression was different depending on the theoretical model on which these predictions were based. From a perspective in which psychopathy is considered trait-like, it would be expected that psychopaths show a decreased capacity to display facial emotions when compared to controls, even when being asked to show emotions. In contrast, one would predict psychopaths and nonpsychopaths not to differ in facial expressivity in the expression condition when considering a perspective in which psychopaths' emotional functioning is believed to be more context-dependent, rather than fundamentally impaired.

METHOD

PARTICIPANTS

The current sample also participated in a number of other studies on psychopathy and emotion (see for example, Nentjes et al., 2013; Nentjes, Bernstein, Arntz, van Breukelen, & Slaats, 2015). Offenders (n = 85) were recruited from six forensic psychiatric centers (n = 73) and a prison (n = 12) in the Netherlands. One offender did not complete the emotional regulation task, resulting in n = 84 offenders. Thirty-six offenders were also participating in a randomized controlled trial (RCT) on the effectiveness of schema therapy versus treatment as usual for forensic patients with cluster B personality disorders (PDs; Bernstein et al., 2012). Inclusion criteria were (a) an antisocial, narcissistic, borderline, or paranoid PD, or a PD not otherwise specified with at least five cluster B PD traits, and (b) good understanding of the Dutch language. Exclusion criteria were (a) current psychotic symptoms, (b) schizophrenia or bipolar disorder, (c) current drug or alcohol dependence (but not abuse), (d) an IQ ≤ 80, (e) serious neurological impairment, (f) an autistic spectrum disorder (ASD), and (g) fixated pedophilia. These criteria also applied to offenders who did not participate in the RCT (n = 49) so that a homogeneous sample was created. Offenders were divided into psychopaths (n = 42) and nonpsychopaths (n = 42), all of whom were thus suffering from one or more PDs. For this division, a cut-off score of 25 was adopted, as cross-cultural research on the underlying trait structure of the Hare Psychopathy Checklist–Revised (PCL-R) suggests that this score is equivalent to the North American cut-off score of 30 in European samples (Cooke & Michie, 1999). Although psychopathy is thought to be dimensional in nature (e.g., Edens, Marcus, Lilienfeld, & Poythress, 2006), this categorization enabled us to include the controls (who could not be PCL-R assessed) in our analyses (see below).

The controls (n = 26) were recruited from the general population. An inclusion criterion was a) a good understanding of the Dutch language. Exclusion criteria were (a) any axis I disorder, (b) threshold minus two criteria for any personality disorder (PD), (c) a PD diagnosis not otherwise specified (i.e., fulfilment of five or more PD criteria), (d) an IQ ≤ 80, (e) serious neurological impairment, (f) an autism spectrum disorder (ASD), and (g) a high level of self-reported psychopathy.

Ten different nationalities were represented in the forensic sample, with the most prevalent being Dutch (73.8%), Moroccan (7.1%), and Surinamese

(8.3%), whereas all of the nonoffender controls were Dutch. Types of crime committed by the offenders included homicide offenses (28.6%), assault (20.2%), property crime with (10.7%) and without (1.2%) violence, pedophilic (10.7%) and nonpedophilic (19.0%) sexual offenses, arson (6.0%), and xdrug offenses (3.6%). PD diagnoses in the offender group included antisocial (83.3%), borderline (31.0%), narcissistic (32.1%), paranoid (9.5%), avoidant PD (2.4%), and PD NOS with five or more cluster B traits (10.7%). Further demographic and clinical features of the sample are reported in Table 1.

Post-hoc power analyses were conducted using G*Power software based on the current study's parameters (α = .05; 1–ß = .80; *n* = 110; average correlation between conditions [inhibit vs. express], *r* = .00; average correlation between film types [fear, happy, sad], *r* = .50). These analyses showed the current study to have the power to detect a small to medium effect size for psychopathy × condition effects (*f* = .21), as well as psychopathy × film type effects (*f* = .14) (for which .10, .25, and .40 are small, medium, and large effects, respectively; Faul, Erdfelder, Lang, & Buchner, 2007; see below for data analytical approach).

SCREENING MEASURES

SIDP-IV. The Structured Interview for DSM-IV PDs (SIDP-IV; Pfohl, Blum, & Zimmerman, 1995) was used to assess PDs in the offenders. Fifty-two assessments were derived from clinical files. For a subset of these interviews (*n* = 18), the single measures (*l*) intraclass correlation coefficients (ICCs; absolute agreement [*A*]) ranged between ICC(*A*, *l*) = .53 and .95 (*M* = .72), and average rater (*k*) ICCs ranged between ICC(*A*, *k*) = .70 and .97 (*M* = .83). Ratings were averaged if interviews had been scored twice. The SIDP-IV was administered by the first author (L.N.) for the remaining offenders (*n* = 33). In a subset of five interviews, inter-rater reliability ranged from ICC(*A*, *l*) = .75 to .96 (*M* = .84).

TABLE 1. Sample Characteristics (*n* = 110)

	Psychopathic offenders (*n* = 42)		Nonpsychopathic offenders (*n* = 42)		Nonoffenders (*n* = 26)		
	M (*SD*)	Range	*M* (*SD*)	Range	*M* (*SD*)	Range	Test statistics
Age (years)	39.1 (9.5)	23–65	39.1 (10.1)	24–64	35.6 (13.5)	18–57	$F(2, 107) = 1.07$, p = .35
IQ	94.9 (11.4)	80–120	96.2 (11.2)	80–121	101.2 (12.5)	80–128	$F(2, 107) = 2.53$, p = .08
INST	7.4 (4.5)	0.5–20.0	6.5 (3.4)	1.0–15.0	—	—	$t(82) = -0.95$, p = .34
PCL-R Total	29.5 (3.2)	25.0–36.8	18.4 (4.1)	9.5–24.0	—	—	$t(82) = -13.89$, p < .001
PCL-R Factor 1	12.0 (2.8)	6.0–16.0	8.4 (3.1)	3.0–16.0	—	—	$t(82) = -5.58$, p < .001
PCL-R Factor 2	13.9 (2.5)	7.2–18.0	7.8 (3.9)	0.0–15.0	—	—	$t(69.3) = -8.46$, p < .001

Note. PCL-R = Psychopathy Checklist–Revised; INST = length of institutionalization since the last offense in years.

SCID I and II. The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I; First, Spitzer, Gibbon, & Williams, 1997) and the SCID for Axis II PDs (SCID-II; First, Spitzer, Gibbon, Williams, & Benjamin, 1994) were used to screen the controls for axis I and II pathology. ICCs(*A*, *l*) ranged from .79 to .99 (*M* = .88) for five patients that did not take part in the current study. In these patients, there were not enough axis I diagnoses present to determine kappas, yet a high level of consistency was observed (agreement on the presence of 24 out of 26 disorders).

AQ. Controls who were suspected of having an ASD based on clinical impressions were assessed with the autism-spectrum quotient and excluded when their score was higher than 32 (Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001). Offenders were excluded if they had been diagnosed with an ASD by an institution's clinical staff.

LSRP. Nonoffenders were excluded if they exceeded a score of 58 or higher on the Levenson Self-Report Psychopathy Scale (LSRP; Levenson, Kiehl, & Fitzpatrick, 1995), which is approximately one *SD* above the mean LSRP score generally found in males in European samples (e.g., Uzieblo, Verschuere, van den Bussche, & Crombez, 2010).

IQ. Full scale IQs were obtained from Wechsler Adult Intelligence Scale–III assessments (WAIS-III; Wechsler, 1997). When these had not been conducted, a shortened test was administered (*n* = 49), in which an IQ estimate was derived from the WAIS-III Block Design and Vocabulary subtests (Jeyakumar, Warriner, Raval, & Ahmad, 2004).

MEASURES FOR MAIN INDEPENDENT AND OUTCOME VARIABLES

PCL-R. The PCL-R (Hare, 2003) was used to assess psychopathy in the offenders, based on an extensive interview, as well as on institutional and judicial file information. When available, scores were obtained from clinical files (*n* = 65; these interviews had all been administered by thoroughly trained diagnostic staff). For a subsample of these interviews (*n* = 16), ICCs(*A*, *l*) for PCL-R total, Factor 1, and Factor 2 scores were .76, .74, and .74, respectively. The first author (L.N.) administered the PCL-R when scores were not available (*n* = 10). L.N. held regular consensus meetings with author D.B., who has extensive experience in PCL-R assessment. For the entire sample, standardized Cronbach's alphas for PCL-R total, Factor 1, and Factor 2 scores were .74, .82, and .83, respectively.

Emotion Regulation Task. Film fragments for the emotion regulation task were selected based on previous research showing these clips to elicit significantly higher self-reported ratings of their respective target emotion than any other emotion (Gross & Levenson, 1995; Hewig et al., 2005). For fear, we used excerpts from *The Shining* (83 sec.) and *Silence of the Lambs* (202 sec.). The

sad film clips were taken from *The Champ* (167 sec.) and *Return to Me* (169 sec.), whereas the happy film fragments were selected from *On Golden Pond* (32 sec.) and *An Officer and a Gentleman* (115 sec.). The neutral film clips were given low intensity and valence ratings in previous research (Hewig et al., 2005) and were taken from *Crimes and Misdemeanors* (65 sec.) and *All the President's Men* (67 sec.).

The task consisted of two blocks, during each of which four clips were shown (neutral, fearful, happy, sad). Both blocks started with the presentation of a neutral (baseline) film clip, after which an instruction was given for the emotional fragments. For one block, participants received the instruction not to show any emotions (i.e., the inhibition condition), while for the other, they were told to show all the feelings they experienced during the clips (i.e., the express condition). Between each emotional film clip within a block, a short instruction reminder was presented. All participants thus sequentially received both the inhibition and expression instructions. Condition order was counterbalanced and the order in which the clips were presented was randomized, with the restriction that each valence was presented once per block. Continuous recordings were made of participants' facial expressions and physiological responses, and after each film fragment, subjects indicated how they had felt during the video clip. After the task, participants answered five questions on Likert scales (ranging from 0 to 8) concerning the extent to which they tried to inhibit versus suppress their emotions.

Facial Emotions. A digital video camera on a tripod was used to record a frontal view of participants' upper torso and face during each film clip. Four graduate psychology students (three women) were extensively trained in coding participants' facial behavior, using the Emotional Expressive Behavior Coding System (Gross, 1996). This system covers 18 expressive responses, including anger, confusion, disgust, fear, happiness, interest, sadness, surprise, body movement, face touching, overall facial movement, mouth movement, (un)pleasantness, intensity, smiles, yawns, blinks, and obscuring vision. The occurrence of smiles, yawns, blinks, as well as participants obscuring their vision, was counted during each film clip. (Un)pleasantness was rated on a 0 (*very unpleasant*) to 4 (*very pleasant*) Likert scale and intensity was rated on a 0 (*not emotionally expressive at all*) to 6 (*extremely emotionally expressive*) Likert scale, whereas the rest of the expressive behaviors were coded on a 7-point Likert scale constituted by two dimensions (intensity and duration). Ratings for each of the 18 categories were converted to a score per minute. All clips were rated by at least three raters, and ICCs were determined for all possible combinations of three raters. The movement behaviors (body movement, face touching, overall facial movement, and mouth movement) were dropped as we were interested in facial emotions. In addition, confusion and interest were excluded from further analyses as we considered these terms less relevant to emotional functioning (Frijda, 2008). Last, ratings of anger, fear, disgust, sadness, and yawning were excluded from further analyses, because base rates were too low to adequately determine ICCs. For the remaining codes, ICCs(A, k) were excellent, ranging from .86 to .98 (M = .93). Partici-

pant groups did not differ in the frequency with which they obscured their vision to any of the films (for example, by looking away or closing their eyes, *F*s[2, 107] ranging from 0.26 to 2.25, all *p*s > .10).

Self-Reported Emotion. Directly after viewing each clip, participants rated the extent to which they had felt fear, happiness, disgust, surprise, amusement, content, sympathy, anger, sadness, tenseness, and interest on Likert scales ranging from 0 (*not at all*) to 8 (*very much*). Again, as we were interested in terms directly related to basic emotionality, we dropped tenseness and interest from further analyses.

Psychophysiological Responses. We assessed skin conductance (SC) as an index of emotional arousal. In addition, heart rate (HR; expressed in beats per minute) and HR variability (HRV) were measured. All physiological signals were amplified and recorded continuously using a portable BrainAmp system with a sample rate of 500 Hz. Signal processing was performed using BrainVision software. SC was assessed via two Ag/AgCl electrodes (8 mm diameter), which were supplied with an external constant 0.5 voltage. The electrodes were filled with isotonic paste (0.5% NaCl) and secured to the volar surface of the medial phalanges of the second and third fingers of the nondominant hand. Participants' SC data were imported using Ledalab software and analyzed by means of continuous decomposition analyses (Benedek & Kaernbach, 2010), by which the phasic component of participants' electrodermal activity was extracted during each film clip (expressed as the integrated SC response; ISCR). Continuous decomposition analyses also provided the number of SC responses (nSCRs; i.e., each response ≥ 0.02 μS), which were converted to SCRs per minute.

To assess HR and HRV, an Einthoven lead II electrocardiogram (ECG) was recorded using Ag/AgCl adhesive electrodes (36 × 45 mm diameter) placed on the lower left rib and below both clavicles. The ECG signal was filtered with a bandpass from 0.1 to 35 Hz. R-peaks were detected using a BrainVision analyzer algorithm, after which ECGs were visually inspected and manually corrected for aberrances and missing beats (Benedek & Kaernbach, 2010; Task Force, 1996). Subsequently, HRV measures were algorithmically extracted from the ECG signal, including the SDNN (standard deviation of the normal-to-normal [NN; representing R-waves] interval) and the RMSDD (square root of the mean squared differences of successive NN intervals). The RMSSD is thought to represent parasympathetically mediated HRV, whereas the SDNN reflects both sympathetic and parasympathetic activity (Task Force, 1996).

PROCEDURE

The current study was approved by the standing ethics committee of the Faculty of Psychology and Neuroscience of Maastricht University. The measures described above were administered in counterbalanced blocks together with a variety of other tests assessing different emotional capacities. Participants were

told that the study was aimed at investigating personality and emotions and signed informed consent before being tested individually in a quiet, designated testing room. All subjects were reimbursed with 25 euros.

DATA PREPARATION AND ANALYSES

Data Preparation. Data were inspected for missing values, showing that for psychophysiology, facial expressions, and self-reported emotion < 1.0, 1.0, and 1.3% of the data were missing, respectively. Missing values were replaced using a regression approach in which missing values served as dependent variables. Next, all raw dependent variables (except for HR) were log-transformed in order to reduce deviations from normality. For all the affective film clips (sad, happy, and fear), change scores were computed for each dependent measure as an index for emotional responsivity during the emotional film fragments (i.e., untransformed response during the emotional clip minus untransformed response during the neutral clip preceding that emotional fragment).

Preparatory Analyses. First, it was investigated whether time had an effect on any of the raw baseline scores for the self-reported, facial expressive, and physiological dependent measures. For this purpose, a 2 (order of task conditions: inhibition first vs. expression first) × 2 (time: first vs. second neutral clip) × 3 (psychopathy: nonoffender controls, nonpsychopathic offenders, psychopaths) mixed design ANOVA was conducted. These analyses were also used to determine whether groups differed in baseline responsivity on any of the dependent measures, by examining the main effect of psychopathy. Further, it was investigated whether the emotional clips induced raw self-reported, physiological, and facial responses that deviated from the responses that were elicited by the neutral baseline clips. For this purpose, a 2 (condition: inhibition vs. expression) × 4 (film type: neutral, happy, sad, fear) repeated measures ANOVA was conducted for each dependent measure.

Main Analyses. A 2 (condition: inhibition vs. expression) × 3 (psychopathy: controls, nonpsychopathic offenders, psychopaths) × 3 (film type: fear, happy, sad) mixed design ANOVA was conducted for the dependent measures in each domain (using change scores). The effect of condition was not of main interest, yet was examined to see whether our instructions had been effective. To test our main hypotheses, significant main and interaction effects of psychopathy were followed up on using similarly structured mixed design ANOVAs, univariate ANOVAs, and/or Bonferroni corrected pairwise comparisons. When analyses were run per film type, the film clip order within this valence was controlled for.

In order to examine factor-specific effects, the analyses described above were run again with the offenders only, using Factor (F1) and Factor 2 (F2) as covariates (instead of using psychopathy as a between-subject factor). F1 and F2 were always included in the same models in order to control for their shared variance. In all our main analyses, age and IQ were included as covariates, as these variables might influence emotion regulation attempts.

RESULTS

PREPARATORY ANALYSES

Online supplements are available (see the appendix) describing participants' raw self-reported, facial, and psychophysiological responses to the different film types. These supplements also describe the ANOVAs on which conclusions about time effects on the baselines, group differences during baseline, emotional film type effects, and condition effects are based (see the following subsections).

Time Effects on the Neutral Baselines. Analyses showed that some self-reported emotions decreased, while some of the physiological indices increased over time. For facial affect, both increases and decreases were observed over time. It was therefore decided to use change scores for the main analyses (see Data Preparation and Analysis section above). Based on these results, it was also decided to control for condition order in all analyses. Order effects are not reported though, as these were not relevant to our hypotheses.

Group Differences During the Neutral Baselines. Results indicated that psychopaths only expressed more facial pleasantness than controls during the baselines. Groups thus differed on only one dependent variable during baseline.

Manipulation Check: Effect of the Emotional Films. Each film type evoked a distinct pattern of emotion when compared to the neutral baselines. Participants, for example, reported significantly more content-matching emotion during the fearful (e.g., fear), happy (e.g., happiness, amusement), and sad film types (e.g., sadness). Concerning facial expressions, the fearful and sad film types induced more blinking and a decrease in pleasantness, whereas the opposite was true for the happy film type. Last, participants showed an increase in nSCRs per minute during all three emotional film types and a deceleration in HR during the sad film type when compared to baseline.

Manipulation Check: Effect of Condition. Over the entire sample, participants showed significantly less facial expressive affect during inhibition when compared to the expression condition for the majority of emotion terms. Concerning self-reported affect, participants reported less amusement during inhibition than during expression. Last, condition affected psychophysiology, in that participants' HR decreased during inhibition relative to expression.

Manipulation Check: Group Differences in Regulation Effort. Psychopathy did not have a main effect on any of the questions assessing the extent to which participants tried and succeeded to inhibit and express affect, *F*s ranging from 0.27 to 2.00 (*df*s 2, 107), all *p*s > .10; for the inhibit questions: $M = 4.7$, $SD = 2.5$; for the express questions: $M = 4.6$, $SD = 2.2$.

MAIN ANALYSES

Online supplements are available in which responses to the emotional film types (change scores) are described by condition and psychopathy level for

each measurement domain (see the appendix). In the current article, Table 2 displays the main effect of the categorical psychopathy variable and its interaction with film type and condition on all dependent variables (facial expressions, self-reported emotions, and psychophysiology). Table 3 shows the results of similarly structured ANOVAs in which the dimensional Factor 1 and 2 scores were used. As the main effects of film and condition were already described as part of the manipulation checks, the results below concern only those relevant to our main hypotheses (i.e., main effects of psychopathy and its factors or their interaction with film type and/or condition).

TABLE 2. Mixed Factorial ANOVAs With Main Effect of Psychopathy and Its Interaction With Condition and Film Type on Facial Expressions, Self-Report, and Psychophysiology (Change Scores) (*N* = 110)

	Psychopathy	Psychopathy × condition	Psychopathy × film type	Psychopathy × condition × film type
	F-value	*F*-value	*F*-value (*df*)	*F*-value (*df*)
Facial expressions				
Happiness	2.01	0.99	$F(2.53, 129.02) = 1.33$	$F(3.11, 158.69) = 1.13$
(Un)pleasant	1.03	0.03	$F(2.42, 123.18) = 1.54$	$F(2.33, 118.57) = 0.87$
Intensity	0.33	0.15	$F(2.34, 119.16) = 1.66$	$F(2.35, 119.86) = 1.04$
Surprise	0.95	2.35	$F(2.70, 137.65) = 1.01$	$F(2.69, 136.97) = 0.46$
Smiles	0.39	0.54	$F(2.33, 118.64) = 1.44$	$F(2.51, 127.81) = 0.53$
Blinks	1.52	1.49	$F(4, 204) = 0.53$	$F(4, 204) = 0.24$
Self-report				
Fear	0.19	1.10	$F(3.26, 166.39) = 0.38$	$F(4, 204) = 1.53$
Happiness	1.20	3.04+	$F(3.13, 159.77) = 0.57$	$F(3.38, 172.61) = 1.68$
Disgust	0.12	2.84+	$F(3.56, 181.36) = 0.56$	$F(3.44, 175.21) = 1.16$
Surprise	0.29	1.04	$F(3.58, 182.57) = 0.35$	$F(3.78, 192.62) = 0.40$
Amused	0.09	2.35	$F(3.37, 171.85) = 1.34$	$F(4, 204) = 0.13$
Content	0.23	1.08	$F(3.36, 171.58) = 0.42$	$F(4, 204) = 0.87$
Sympathy	2.39+	0.34	$F(3.63, 184.87) = 1.88$	$F(4, 204) = 0.46$
Anger	0.74	2.39+	$F(3.59, 183.27) = 2.65$*	$F(3.45, 176.12) = 0.47$
Sadness	2.68+	1.31	$F(3.14, 160.16) = 2.63$*	$F(3.42, 174.33) = 0.14$
Psychophysiology				
nSCRs	0.41	0.38	$F(3.17, 165.43) = 0.30$	$F(3.35, 170.59) = 1.86$
ISCR	0.73	1.98	$F(3.59, 182.85) = 1.86$	$F(4, 204) = 0.68$
HR	1.10	0.25	$F(2, 204) = 0.10$	$F(3.31, 168.54) = 1.73$
SDNN	2.47+	0.02	$F(3.73, 190.06) = 2.61$*	$F(3.67, 187.02) = 0.11$
RMSDD	0.27	0.27	$F(2, 204) = 1.67$	$F(3.74, 190.96) = 1.84$

Note. nSCRs = number of skin conductance responses per minute; ISCR = integrated skin conductance response (time integral of phasic driver over the film clip duration); HR = heartbeats per minute; SDNN = standard deviation of the normal-to-normal interval; RMSDD = square root of the mean squared differences of successive normal-to-normal intervals. ANOVAs were conducted controlling for condition order (inhibition first vs. expression first), IQ, and age. Psychopathy: nonoffenders, nonpsychopathic offenders, psychopathic offenders. Degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity when *df*s are reported with two decimals (i.e., when Mauchly's test statistic was significant at $p < .05$). Degrees of freedom were $df = 2, 102$ for the effects of psychopathy and $df = 2, 102$ for the interactions between psychopathy and condition. +$p < .10$. *$p < .05$.

TABLE 3. Mixed Factorial ANOVAs With Main Effect of Factors 1 and 2 and Their Interactions With Condition and Film Type on Facial Expressions, Self-Report, and Psychophysiology (Change Scores) (n = 84)

	F1	F2	F1 × condition	F2 ×condition	F1 ×film type	F2 ×film type	F1 ×condition ×film type	F2 ×condition ×film type
	F-value	*F*-value	*F*-value	*F*-value	*F*-value (*df*)	*F*-value	*F*-value (*df*)	*F*-value
Facial expressions								
Happiness	1.62	0.30	3.62+	0.31	*F*(1.30, 101.56) = 0.09	0.81	*F*(1.63, 126.89) = 0.44	1.39
(Un)pleasant	2.08	0.22	0.16	0.87	*F*(1.25, 97.32) = 1.43	0.48	*F*(1.17, 90.85) = 0.08	0.81
Intensity	0.03	0.20	1.65	0.22	*F*(1.19, 92.80) = 1.15	1.31	*F*(1.18, 92.28) = 0.50	1.79
Surprise	2.59	0.76	0.04	1.67	*F*(1.28, 99.83) = 0.18	0.03	*F*(1.30, 101.38) = 0.13	1.09
Smiles	0.03	0.06	1.01	0.65	*F*(1.14, 88.62) = 0.06	1.34	*F*(1.25, 97.11) = 0.19	0.23
Blinks	1.19	0.48	0.11	0.53	*F*(2, 156) = 0.35	2.59+	*F*(2, 156) = 0.10	0.10
Self-report								
Fear	3.28+	6.04*	0.38	3.31+	*F*(1.69, 131.57) = 3.57*	3.32*	*F*(2, 156) = 1.18	2.53+
Happiness	9.98**	2.08	2.08	1.13	*F*(1.59, 123.78) = 0.11	1.25	*F*(1.75, 136.47) = 1.36	1.20
Disgust	0.26	2.59	1.39	1.29	*F*(1.69, 131.68) = 0.44	1.39	*F*(1.80, 140.58) = 0.04	0.19
Surprise	2.67	3.86+	0.27	0.27	*F*(1.84, 143.65) = 0.05	0.26	*F*(2, 156) = 1.49	0.72
Amused	1.41	0.01	1.24	0.03	*F*(1.69, 132.09) = 1.68	1.03	*F*(2, 156) = 0.77	1.57
Content	2.64	0.01	0.17	0.00	*F*(1.65, 128.91) = 0.64	1.60	*F*(2, 156) = 1.85	0.69
Sympathy	0.33	5.26*	2.37	0.71	*F*(1.86, 144.87) = 0.76	3.15+	*F*(2, 156) = 0.85	3.24*
Anger	0.35	2.49	0.05	4.80*	*F*(2, 156) = 4.12*	2.99+	*F*(1.71, 133.09) = 0.15	0.49
Sadness	1.51	2.28	1.22	5.97*	*F*(1.67, 130.57) = 1.89	2.75+	*F*(1.80, 140.43) = 0.60	0.39
Psychophysiology								
nSCRs	0.45	7.62**	0.39	0.32	*F*(1.56, 121.37) = 0.81	0.09	*F*(1.63, 127.14) = 0.04	0.21
ISCR	0.05	4.26*	0.88	0.01	*F*(1.78, 138.98) = 0.28	6.06**	*F*(2, 156) = 1.57	0.34
HR	0.59	1.45	1.19	0.23	*F*(2, 156) = 0.69	0.86	*F*(1.59, 124.00) = 1.63	2.75+
SDNN	3.58	0.48	0.36	0.75	*F*(1.86, 144.76) = 2.05	1.81	*F*(1.75, 136.35) = 0.01	0.17
RMSDD	3.89+	4.39	0.47	2.85+	*F*(1.84, 143.86) = 0.10	0.32	*F*(2, 156) = 0.71	1.96

Note. F1 = Factor 1; F2 = Factor 2; nSCRs = number of skin conductance responses per minute; ISCR = integrated skin conductance response (time integral of phasic driver over the film clip duration); HR = heartbeats per minute; SDNN = standard deviation of the normal-to-normal interval; RMSDD = square root of the mean squared differences of successive normal-to-normal intervals. ANOVAs were conducted controlling for condition order (inhibition first vs. expression first), IQ, and age. Degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity when *dfs* are reported with two decimals (i.e., when Mauchly's test statistic was significant at $p < .05$). Degrees of freedom were $df = 1, 78$ for the effects of F1, F2, F1 × condition, and F2 × condition. For each dependent variable, *dfs* for F2 × film type were the same as for F1 × film type. *Dfs* for F1 × condition × film type and F2 × condition × film type were also the same. +$p < .10$. *$p < .05$. **$p < .01$.

FACIAL EXPRESSIVE BEHAVIOR

Results showed no main or interaction effects of the psychopathy grouping variable or factors 1 and 2 on any of the facial expressive behaviors.

SELF-REPORTED EMOTION

Results showed no main or interaction effects of the psychopathy grouping variable or factors 1 and 2 on self-reported disgust, surprise, amusement, or content. For the other self-reported emotions, analyses revealed the following:

Fear. Analyses showed an effect of F1 × film type. Analyses, however, showed F1 not to be significantly predictive of self-reported fear during the fearful, $F(1, 77) = 3.02$, $p = .09$); happy, $F(1, 77) = 1.38$, $p = .25$; or sad film type, $F(1, 77) = 3.94$, $p = .05$. Self-reported fear was also predicted by F2 and F2 × film type. F2 did not predict fear during the fearful, $F(1, 77) = 3.93$, $p = .05$, or happy film type, $F(1, 77) = 0.00$, $p = .95$). During the sad film type, offenders scoring high on F2 did report relatively more fear, $F(1, 77) = 5.32$, $p = .02$.

Happiness. Analyses showed F1 to be associated with the report of more happiness.

Sympathy. F2 and F2 × condition × film type predicted sympathy. For the fearful film type, sympathy was not predicted by F2, $F(1, 77) = 1.55$, $p = .22$, or F2 × condition, $F(1, 77) = 3.89$, $p = .05$. For the happy film type, F2, $F(1, 77) = 0.10$, $p = .76$, and F2 × condition, $F(1, 77) = 1.21$, $p = .28$, also did not predict sympathy. F2 did predict the report of higher levels of sympathy during the sad film type, $F(1, 77) = 5.50$, $p = .02$. The effect of F2 × condition, $F(1, 77) = 0.81$, $p = .37$, did not reach significance during the sad film type.

Anger. Self-reported anger was predicted by psychopathy × film type. Psychopathy, however, did not have a main effect on anger during the fearful, $F(2, 101) = 2.02$, $p = .14$; happy, $F(2, 101) = 0.52$, $p = .60$; or sad film type, $F(2, 101) = 1.20$, $p = .33$. Regarding the factors, self-reported anger was predicted by F1 × film type. However, analyses showed F1 not to be predictive of anger during the fearful, $F(1, 77) = 0.17$, $p = .68$; happy, $F(1, 77) = 0.76$, $p = .39$; or sad film type, $F(1, 77) = 3.35$, $p = .07$. Analyses also revealed anger to be predicted by F2 × condition. Offenders relatively high in F2 reported more anger than those low in F2 during inhibition, $F(1, 78) = 5.32$, $p = .02$, but not during expression, $F(1, 78) = 0.10$, $p = .75$.

Sadness. Psychopathy × film type predicted self-reported sadness. Psychopathy did not predict sadness for the fearful, $F(2, 101) = 0.10$, $p = .91$, or the happy film type, $F(2, 101) = 0.26$, $p = .79$. For the sad film type, psychopathy did predict self-reported sadness, $F(2, 101) = 3.52$, $p = .03$, with psychopathic offenders ($M = 5.0$, $SE = 0.3$) reporting more sadness than controls ($M = 3.5$, $SE = 0.4$, $p = .03$), but not than nonpsychopathic offenders ($M = 4.7$, $SE = 0.3$,

$p = 1.00$). Nonpsychopathic offenders and controls did not differ from each other ($p = .11$).

Regarding the factors, self-reported sadness was predicted by F2 × condition, with offenders relatively high in F2 reporting more sadness than offenders low in F2 during inhibition, $F(1, 78) = 2.81$, $p < .01$, but not during expression, $F(1, 78) = 0.06$, $p = .81$.

Summary of Findings on Self-Report. During the sad film type, psychopathic offenders reported more sadness than controls, with nonpsychopathic offenders falling in between both groups. When looking at the factors, F1 was related to reporting elevated levels of happiness. F2 was associated with reporting more fear and sympathy (during the sad film type), and anger and sadness (during inhibition).

PSYCHOPHYSIOLOGY

Results showed no main or interaction effects of the psychopathy grouping variable or factors 1 and 2 on HR or RMSDD. For the other variables, analyses showed the following:

nSCRs. F2 was negatively predictive of offenders' nSCRs.

ISCR. F2 and F2 × film type predicted ISCR. F2 was predictive of a decreased ISCR during the sad film type, $F(1, 77) = 6.58$, $p = .01$, but not during the fearful, $F(1, 77) = 1.50$, $p = .22$, or happy film type, $F(1, 77) = 0.10$, $p = .76$.

SDNN. A significant effect was found for psychopathy × film type. For the fearful films, psychopathy predicted SDNN, $F(2, 101) = 5.35$, $p < .01$, with psychopaths ($M = 0.1$, $SE = 2.3$) showing a decreased SDNN responsivity compared to controls ($M = 9.7$, $SE = 3.0$, $p = .04$), but not to nonpsychopathic offenders ($M = –2.3$, $SE = 2.3$, $p = 1.00$). Nonpsychopathic offenders and controls also differed in SDNN ($p < .01$). Psychopathy did not predict SDNN for the happy, $F(2, 101) = 0.34$, $p = .71$, or sad film type, $F(2, 101) = 2.25$, $p = .11$.

Summary of Findings on Psychophysiology. Results did not indicate psychopathy or its factors to be related to a different physiological cost of suppression on any of the physiological measures, as reflected in the nonsignificance of interactive effects with condition. Regardless of condition, (non)psychopathic offenders did show a reduced SDNN response during the fearful film type compared to controls. Over all the film types, F2 was related to a lower nSCRs. During the sad film type, F2 was related to a decreased ISCR.

DISCUSSION

In this study, we investigated differences between psychopathic offenders, nonpsychopathic offenders, and nonoffender controls on a task that required

the regulation of emotion while watching differently valenced film clips (i.e., fear, happy, sad). Interestingly, psychopathic individuals did not have a superior capacity for affective inhibition compared to nonpsychopathic participants, nor did they differ in their ability to display facial affect.

In general, participants were able to significantly reduce their facial emotions under inhibition instructions, paralleling previous studies (e.g., Gross & Levenson, 1997; Kunzmann et al., 2005). Contrary to our expectations, psychopaths were not better able to adopt such a "poker face," nor was this capacity related to the interpersonal/affective factor (Factor 1) of psychopathy. Potentially, the nonoffenders in this study were already quite successful at reducing their facial expressions, making it difficult to detect individual differences in this capacity. Perhaps such variations would come to light under far more extreme circumstances (e.g., when witnessing others suffering in real life). In the present context, however, our findings do not support the notion that psychopathic offenders have a superior capacity to inhibit facial emotions.

Psychopaths were also not characterized by reduced changes in the physiological indices that are associated with affective suppression. Over the entire sample, participants showed a deceleration in HR during inhibition when compared to the expression condition, extending earlier research (e.g., Kunzmann et al., 2005; Roberts et al., 2008). This effect was, however, not dependent on participants' psychopathy scores. An explanation for these results might be that we contrasted our inhibition condition to an expression condition. Previous research in nonclinical samples used comparison conditions in which instructions entailed merely watching film fragments. Instead, we chose to use an expression condition in order to enable the investigation of whether psychopaths have the capacity to show adequate affective expressions if they try. Some participants, however, might have enhanced affective expressiveness rather than just portrayed actually felt emotions under expression instructions. As previous research has shown that such affective enhancement results in similar increases in SC as expressive suppression (Kunzmann et al., 2005), we might not have observed differences in electrodermal activity between our conditions. Findings on the effect of suppression on SC, however, have been somewhat equivocal (Gross & Levenson, 1997; Kunzmann et al., 2005; Robert et al., 2008), whereas affective suppression seems to affect HR more robustly (Kunzmann et al., 2005; Roberts et al., 2008). Moreover, HR does not seem to be influenced by the enhancement of emotions (Kunzmann et al., 2005). Therefore, our findings do support the notion that attempts to conceal emotion do not result in differences in cardiovascular cost between psychopaths and nonpsychopaths, suggesting that emotion inhibition is an active, effortful process in psychopathic offenders as well (Gross & Levenson, 1997). These results are in line with findings by Casey and colleagues (2012), who also found no association between psychopathy factor or total scores and HR during emotion suppression.

One of our other hypotheses concerned offenders high in lifestyle/antisocial psychopathic traits (Factor 2) to be worse at hiding their emotions, due to the emotional and impulsive nature of this dimension. However, Factor 2 was also unrelated to facial or physiological responsiveness over conditions (inhibition vs. expression). These findings seem at odds with studies showing

the impulsive component of psychopathy to be related to self-reported emotion regulation difficulties (e.g., Long, Felton, Lilienfeld, & Lejuez, 2014). Possibly, these latter disturbances might be more pronounced for other affective states, such as when controlling anger (Hare, 2003).

Concerning subjective experience, few group differences emerged in self-reported affect, adding to a growing number of studies indicating that psychopathy is not related to aberrances in subjective judgments of affective material (e.g., Casey et al., 2012; Herpertz et al., 2001). We did find psychopaths to report relatively more sadness during the sad film type. These findings seemed to be explained by Factor 2, which was associated with the tendency to report a variety of negative emotions. These results might indicate that the negative aspects of our stimulus material might have been more salient for offenders high in Factor 2. This interpretation fits with previous research revealing this antisocial psychopathy component to be related to more self-reported negative emotionality, whereas Factor 1 has contrastingly been associated with increased positive emotionality (e.g., Verona, Patrick, & Joiner, 2001). These latter findings converge with the observation that in the current study, Factor 1 was also positively related to self-reported happiness, and stresses the importance of taking both factors into account when studying the correlates of psychopathy.

Another important focus of the current study was psychopaths' capacity to display affective facial behavior when being explicitly instructed to show emotion. In general, the intensity of participants' expressive behavior increased significantly during expression when compared to the inhibition condition. Also, each of the emotional film types produced facial emotions that matched stimulus valence over the entire sample. Strikingly, these effects were not dependent on psychopathy (or its factors), meaning that psychopaths did not differ from nonpsychopaths in their affective facial behaviors under expression instructions. There could be different explanations for these intriguing findings.

First, psychopathy might be associated with deficits in emotional expressivity, yet in our study, these deficiencies might have "normalized" due to our explicit instructions to attend to the stimulus material and to display all experienced emotions. Such an interpretation is in line with theoretical accounts claiming that the affective aberrances that are associated with psychopathy might be more context-dependent than is generally assumed (e.g., Bernstein et al., 2012; Newman, 1998). This reasoning might also explain why some research has found psychopathy to be associated with decreased emotional corrugator activity (i.e., frowning) (e.g., Herpertz et al., 2001), while other studies could not reveal such an association (e.g., Lobbestael & Arntz, 2010). Following this reasoning, psychopaths being attentive to our stimulus material might also explain why these individuals were not characterized by a reduced cardiovascular effort during the inhibition of emotions.

A different explanation might be that, in general, facial expressiveness (and its inhibition) might simply not be part of the emotional domains in which psychopaths show abnormalities. That is, psychopathic offenders might also be capable of showing genuine emotions in the absence of experimental manipulations of, for example, willingness or attention. Such an explanation

does contrast previous research (Herpertz et al., 2001) and calls for more research in which affective facial expressivity in psychopathy is investigated under conditions in which participants receive no instructions whatsoever, versus conditions aimed at manipulating emotion. If psychopathy would indeed be generally unrelated to abnormalities in facial expressivity, this would imply that theories that put gross emotional dysfunctions at the core of psychopathy (e.g., Blair et al., 2005; Hare, 2003; Patrick, 1994) are in need of refinement as to which affective domains these aberrances are limited to.

A last interpretation of our findings is that psychopathy is related to the simulation of facial emotions. This explanation coincides with Cleckley's highly influential theory, in which psychopaths' affective displays are described as a mask of sanity: "facsimiles of actual feeling, an automatic and undesigned mimicry" (Cleckley, 1941, p. 136). This account is in keeping with offenders in this study not differing in facial expressivity, while at the same time being characterized by a decreased HRV when compared to controls during the fear-inducing film type. In addition, the antisocial psychopathy component appeared to be related to decreased skin conductance. These observations appear to reflect a decreased sympathetically mediated arousal (Task Force, 1996), especially during the fear- and sadness-inducing films. This decreased arousal could be an indication that offenders' emotional expressiveness was, in fact, not authentic. Potentially, psychopaths made use of a cortical, compensatory mechanism to produce affective displays in the absence of genuine emotional experience. This interpretation receives support from neuroscientific studies indicating that psychopaths might make use of alternative cognitive strategies to process and respond to material that involves more visceral, emotional processes in nonpsychopathic individuals (Glenn, Raine, Schug, Young, & Hauser, 2009; Kiehl et al., 2001). Future studies should clarify this latter possibility, and in doing so, should disentangle in what way different psychopathy components are related to such affective abnormalities. Although it is generally assumed that Factor 1 explains affective deficiencies in psychopathy, several studies suggest Factor 2 to be associated with such deficits as well (see Brook et al., 2013). The current study adds to such research by showing Factor 2, rather than Factor 1, to have an effect on skin conductivity while watching emotional material.

CONCLUSIONS, LIMITATIONS, AND IMPLICATIONS

The current investigation showed that psychopaths do not have better poker faces than nonpsychopathic offenders and controls. Findings suggested that these three groups did not significantly differ in HR changes associated with emotional inhibition either. Interestingly, psychopathic offenders also showed an increase in content-appropriate affective facial displays when asked to show emotions, in which they did not significantly differ from both nonpsychopathic groups. The present results cannot be used as evidence for the null hypothesis of no difference between psychopaths and nonpsychopaths, as our sample size of $N = 110$ enabled us to detect medium effect sizes. This study can thus not rule out the existence of small effects. However, if differences between psychopaths and nonpsychopaths would indeed only be small, the emotion

regulation indices that were studied in the current research do not seem to be central to psychopathy.

There are potential limitations to this study that deserve some attention. First, we used different instruments to assess PDs in the offenders and controls, the SIDP-IV and the SCID-II, respectively. Although research shows good to excellent convergence between these two interviews for borderline and antisocial PD (Saylor, 2003), it cannot be ruled out that this assessment strategy might have resulted in some measurement imprecision. Second, we only recruited offenders with cluster B PDs. Although the latter are highly prevalent in both nonpsychopathic and psychopathic offenders (e.g., Hildebrand & de Ruiter, 2004), it has to be mentioned that our findings therefore do not generalize to individuals suffering from, for example, mental retardation or a psychotic disorder. A third concern might be that we primarily relied on the effect of interaction terms to test our main hypotheses, with the latter being somewhat more unreliable than main effects. Future research could adopt a design in which the current findings are used to generate more specific hypotheses that can be investigated using main effect testing. Last, a rather large number of tests were conducted in this study, increasing the chance of type I errors. It has to be noted though that the majority of our main conclusions were based on the nonsignificance of effects, rather than the observation of significant group differences, as well as on patterns that emerged over multiple variables within our measurement domains. This analytic approach does, however, call for replication of, for example, our secondary findings on psychopathy and HRV.

The current findings have some important theoretical and clinical implications. First, results suggest that emotional inhibition is related to physiological changes in both controls and (psychopathic) offenders. This could imply that inhibiting emotions might have similar adverse consequences in offenders as has been demonstrated for nonclinical populations, such as cardiovascular disease and mental health problems (John & Gross, 2004). In forensic institutions, the expression of intense emotions is often considerably restricted. Also, even though psychopathy was not associated with superior inhibitory emotion regulation capacities, it might still very well be that psychopathic offenders have a relatively strong tendency to make use of such emotion suppression. This study suggests that creating a safe atmosphere in which (psychopathic) offenders are given the opportunity to express their feelings could protect these individuals from the adverse consequences of holding back emotions. Moreover, the finding that psychopaths did not differ in their emotional facial expressivity calls for further research on the specificity, malleability, and state-dependency of emotion in this severe disorder. If psychopathic individuals are indeed capable of showing genuine emotions, rather than being skilled "simulants," this would be very promising for therapeutic interventions. If these individuals are, on the other hand, capable of successfully mimicking emotion, this could seriously threaten the monitoring of treatment progress. In any case, future studies should further challenge the widely held conceptual belief that psychopathy is per definition associated with a generalized incapacity of experiencing and showing emotions.

REFERENCES

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The Autism-Spectrum Quotient (AQ): Evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. *Journal of Autism and Developmental Disorders, 31,* 5–17.

Baskin-Sommers, A. R., Curtin, J. J., & Newman, J. P. (2011). Specifying the attentional selection that moderates the fearlessness of psychopathic offenders. *Psychological Science, 22,* 226–234.

Benedek, M., & Kaernbach, C. (2010). A continuous measure of phasic electrodermal activity. *Journal of Neuroscience Methods, 190*, 80–91.

Bernstein, D. P., Nijman, H., Karos, K., Keulen-de Vos, M., de Vogel, V., & Lucker, T. (2012). Schema Therapy for forensic patients with personality disorders: Design and preliminary findings of a multicenter randomized clinical trial in the Netherlands. *International Journal of Forensic Mental Health, 11*, 312–324.

Blair, R. J. R., Mitchell, D. G. V., & Blair, K. S. (2005). *The psychopath: Emotion and the brain* (pp. 110–140). Oxford, UK: Blackwell.

Brook, M., Brieman, C. L., & Kosson, D. S. (2013). Emotion processing in Psychopathy Checklist-assessed psychopathy: A review of the literature. *Clinical Psychology Review, 33*, 979–995.

Casey, H., Rogers, R. D., Burns, T., & Yiend, J. (2012). Emotion regulation in psychopathy. *Biological Psychology, 92,* 541–548.

Cleckley, H. M. (1941). *The mask of sanity.* St. Louis, MO: Mosby.

Cooke, D. J, & Michie, C. (1999). Psychopathy across cultures: North America and Scotland compared. *Journal of Abnormal Psychology, 108*, 58–68.

Day, A. (2009). Offender emotion and self-regulation: Implications for offender rehabilitation. *Psychology, Crime & Law, 15*(2/3), 119–130.

Edens, J. F., Marcus, D. K., Lilienfeld, S. O., & Poythress, N. G. (2006). Psychopathic, not psychopath: Taxometric evidence for the dimensional structure of psychopathy. *Journal of Abnormal Psychology, 115,* 131–144.

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39,* 175–191.

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. (1997). *Structured clinical interview for DSM-IV axis I disorders (SCID-I).* New York, NY: New York State Psychiatric Institute.

First, M. B, Spitzer, R. L, Gibbon, M., Williams, J. B., & Benjamin, L. (1994). *Structured clinical interview for DSM-IV axis II personality disorders (SCID-II).* New York, NY: New York State Psychiatric Institute.

Frijda, N. H. (2008). The psychologists' point of view. In M. Lewis, J. M. Haviland-Jones, & L. Feldman Barrett (Eds.), *Handbook of emotions* (pp. 68–87). New York, NY: Guilford.

Glenn, A. L., Raine, A., Schug, R. A., Young, L., & Hauser, M. (2009). Increased DLPFC activity during moral decision-making in psychopathy. *Molecular Psychiatry, 14,* 909–911.

Gross, J. J. (1996). *Emotional Expressive Behavior (EEB) Coding System.* Unpublished manual, Department of Psychology, Stanford University.

Gross, J. J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology, 39*, 281–291.

Gross, J. J., & Levenson, R. W. (1995). Emotion elicitation using films. *Cognition and Emotion, 9*, 87–108.

Gross, J. J., & Levenson, R. W. (1997). Hiding feelings: The acute effects of inhibiting positive and negative emotions. *Journal of Abnormal Psychology*, *106*, 95–103.

Hare, R. D. (2003). *Manual for the Psychopathy Checklist–Revised* (2nd ed.). Toronto, ON: Multi-Health Systems.

Harpur, T. J., Hakstian, A. R., & Hare, R. D. (1988). Factor structure of the Psychopathy Checklist. *Journal of Consulting and Clinical Psychology, 56*, 741–747.

Herpertz, S. C., Werth, U., Lucas, G., Qunaibi, M., Schuerkens, A., Kunert, H., . . . Freese, R. (2001). Emotion in criminal offenders with psychopathy and borderline personality disorders. *Archives of General Psychiatry, 58,* 737–745.

Hewig, J., Hagemann, D., Seifert, J., Gollwitzer, M., Naumann, E., & Bartussek, D. (2005). A revised film set for the induction of basic emotions. *Cognition and Emotion, 19,* 1095–1109.

Hildebrand, M., & de Ruiter, C. (2004). PCL-R psychopathy and its relation to DSM-IV Axis I and II disorders in a sample of male forensic psychiatric patients in the Netherlands. *International Journal of Law and Psychiatry, 27*, 233–248.

Howells, K. (2009). Recent developments and future directions in understanding cognition and emotion in offenders: A commentary. *Psychology, Crime & Law, 15*(2/3), 285–292.

Jeyakumar, S. L. E., Warriner, E. M., Raval, V. V., & Ahmad, S. A. (2004). Balancing the need for reliability and time efficiency: Short forms of the Wechsler Adult Intelligence Scale–III. *Educational and Psychological Measurement, 64*, 71–87.

John, O. P. & Gross, J. J. (2004). Healthy and unhealthy emotion regulation: Personality processes, individual differences, and life span development. *Journal of Personality, 72,* 1301–1333.

Kiehl, K. A., Smith, A. M., Hare, R. D., Forster, B. B., Brink, J., & Liddle, P. F. (2001). Limbic abnormalities in affective processing by criminal psychopaths as revealed by functional magnetic resonance imaging. *Biological Psychiatry, 50*, 677–684.

Kunzmann, U., Kupperbusch, C., & Levenson, R. W. (2005). Behavioral inhibition and amplification during emotional arousal: A comparison of two age groups. *Psychology & Aging, 20,* 144–158.

Levenson, M. R., Kiehl, K. A., & Fitzpatrick, C. M. (1995). Assessing psychopathic attributes in a non-institutionalized population. *Journal of Personality and Social Psychology, 68*, 15–158.

Lobbestael, J., & Arntz, A. (2010). Emotional, cognitive and physiological correlates of abuse-related stress in borderline and antisocial personality disorder. *Behaviour Research and Therapy, 48*, 116–124.

Long, K., Felton, J. W., Lilienfeld, S. O., & Lejuez, C. W. (2014). The role of emotion regulation in the relations between psychopathy factors and impulsive and premeditated aggression. *Personality Disorders: Theory, Research, and Treatment, 5,* 390–396.

Lykken, D. T. (1995). *The antisocial personalities*. Mahwah, NJ: Erlbaum.

Mauss, I., Levenson, R., McCarter, L., Wilhelm, F., & Gross, J. J. (2005). The tie that binds? Coherence among emotion experience, behavior, and physiology. *Emotion, 5,* 175–190.

Nentjes, L., Bernstein, D. P., Arntz, A., van Breukelen, G., & Slaats, M. (2015). Examining the influence of psychopathy, hostility biases, and automatic processing on criminal offenders' theory of mind. *Journal of International Law and Psychiatry, 38,* 92–99.

Nentjes, L., Meijer, E. H., Bernstein, D. P., Arntz, A., & Medendorp, W. N. (2013). Investigating the relationship between psychopathy and interoceptive awareness. *Journal of Personality Disorders, 27*, 617–624.

Newman, J. P. (1998). Psychopathy: An information processing perspective. In D. J. Cooke, A. E. Forth, & R. D. Hare (Eds.), *Psychopathy: Theory, research, and implications for society* (pp. 81–104). London, UK: Kluwer Academic Press.

Patrick, C. J. (1994). Emotion and psychopathy: Startling new insights. *Psychophysiology, 31,* 319–330.

Pfohl, B., Blum, N., & Zimmerman, M. (1995). *Structured interview for DSM-IV personality: SIDP-IV*. Iowa City: University of Iowa College of Medicine.

Porter, S., ten Brinke, L., Baker, A., & Wallace, B. (2011). Would I lie to you? "Leakage" in deceptive facial expressions relates to psychopathy and emotional intelligence. *Personality and Individual Differences, 51,* 133–137.

Roberts, N. A., Levenson, R. W., & Gross, J. J. (2008). Cardiovascular costs of emotion suppression cross ethnic lines. *International Journal of Psychophysiology, 70,* 82–87.

Saylor, K. I. (2003). *The assessment of personality disorders: A comparison of five semi-structured interviews* (Doctoral dissertation). *Dissertation Abstracts International: Section B: The Sciences and Engineering*, *63*, 12B.

Schreiber, L.N.R., Grant, J. E., & Odlaug, B. L. (2012). Emotion regulation and impulsivity in young adults. *Journal of Psychiatric Research, 46*, 651–658.

Task Force of the European Society of Cardiology and the North American Society of Pacing Electrophysiology. (1996). Heart rate variability: Standards of measurement, physiological interpretation, and clinical use. *Circulation, 93*, 1043–1065.

Uzieblo, K., Verschuere, B., van den Bussche, E., & Crombez, G. (2010). The validity of the Psychopathic Personality Inventory–Revised in a community sample. *Assessment, 17,* 334–346.

Verona, E., Patrick, C. J., & Joiner, T. E. (2001). Psychopathy, antisocial personality disorder, and suicide risk. *Journal of Abnormal Psychology, 110,* 462–470.

Wechsler, D. (1997). *WAIS-III administration and scoring manual*. San Antonio, TX: Psychological Corporation.

APPENDIX: PREPARATORY ANALYSES

In preparation for the main analyses that were used to test our hypotheses, a number of preparatory analyses were conducted. These included the investigation of time and psychopathy effects on the neutral baselines, as well as an examination of the effects of the different film valences (sad, happy, fear) on our three measurement domains (self-reported emotions, facial expressiveness, and psychophysiology). All these analyses were based on raw scores (rather than change scores) and used log-transformed dependent variables (except for heart rate). In order to facilitate interpretation, the means and standard errors of the untransformed variables are reported. Last, as a means to check whether our manipulation (inhibition and expression) succeeded, condition effects were examined (change scores).

TIME EFFECTS ON NEUTRAL BASELINES

Facial Emotion. Ratings of pleasantness went up over time, $F(1, 104) = 7.97$, $p < .01$, whereas blinking rate decreased, $F(1, 104) = 26.58$, $p < .001$. These time effects did not depend on psychopathy level (i.e., the effect of psychopathy × time was *ns* for all expressive measures, *F*s[2, 104] ranging from 0.00 to 1.53, all *p*s > .05) or on the order of the conditions (i.e., the effect of time × condition order was *ns* for all expressive measures, *F*s[1, 104] ranging from 0.001 to 1.10, all *p*s > .05).

Self-Reported Emotion. Time had a main effect on self-reported ratings of fear, $F(1, 104) = 8.78$, $p < .01$, happiness, $F(1, 104) = 22.05$, $p < .001$, disgust, $F(1, 104) = 8.13$, $p < .01$, surprise, $F(1, 104) = 5.84$, $p = .02$, amusement, $F(1, 104) = 15.25$, $p < .001$, content, $F(1, 104) = 29.23$, $p < .001$, and sympathy, $F(1, 104) = 5.52$, $p = .02$. All these self-reported emotions decreased over time. Time effects did not depend on psychopathy level (i.e., the effect of psychopathy × time was *ns* for all self-reported ratings, *F*s[2, 104] ranging from 0.02 to 1.33, all *p*s > .05) or on the order of the conditions (i.e., the effect of time × condition order was *ns* for all self-reported emotions, *F*s[1, 104] ranging from 0.00 to 3.32, all *p*s > .05).

Physiological Responsiveness. Time had a main effect on nSCRs, $F(1, 104) = 1003.24$, $p < .001$, and SDNN, $F(1, 104) = 25.92$, $p < .001$, which both increased over time. Time effects for the physiological measures did not depend on psychopathy level (i.e., the effect of psychopathy × time was *ns* for all physiological measures, *F*s[2, 104] ranging from 0.28 to 1.37, all *p*s > .05) or on the order of the conditions (i.e., the effect of time × condition order was *ns* for all measures, *F*s[1, 104] ranging from 0.04 to 0.60, all *p*s > .05).

INFLUENCE OF PSYCHOPATHY ON NEUTRAL BASELINE RESPONSIVITY

Facial Emotion. Psychopathy had a main effect on pleasantness, $F(2, 104) = 3.40$, $p = .04$. Psychopathic offenders ($M = 1.9$, $SE = 0.04$) were given higher pleasantness ratings than controls ($M = 1.7$, $SE = 0.1$, $p < .05$), but not than nonpsychopathic offenders ($p = .19$). No differences in pleasantness were observed between nonpsychopathic offenders ($M = 1.8$, $SE = 0.04$) and controls ($p = 1.00$).

Self-Reported Emotion. Psychopathy did not have a main effect on any of the self-reported emotion terms during baseline, $Fs(2, 104)$ ranging from 0.07 to 2.00, all ps > .05.

Physiological Responsiveness. Psychopathy did not have an effect on any of the physiological measures during the neutral baselines, $Fs(2, 104)$ ranging from 0.34 to 1.74, all ps > .05.

MANIPULATION CHECK: EFFECT OF THE EMOTIONAL FILMS

Tables S1 through S3 display participants' mean (*SE*) responses to the different film types (neutral, fear, happy, sad) for facial expressiveness, self-reported emotion, and psychophysiology, respectively. These tables also describe the results of the ANOVAs that were conducted to investigate whether the emotional films induced responses that deviated from baseline responsivity. In general, the following patterns emerged from these analyses:

TABLE S1. Mean (*SE*) Facial Responses to the Different Film Types (Neutral, Fear, Happy, and Sad) by Condition (Inhibition vs. Expression) (*N* = 110)

	Inhibition				Expression				
	Neutral	Fear	Happy	Sad	Neutral	Fear	Happy	Sad	Film type
	M (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*F*-value (*df*)
Happiness	$0.36_{}$ (0.09)	$0.29_{}$ (0.07)	0.61_{a} (0.15)	0.15_{a} (0.04)	0.40_{a} (0.08)	0.39_{b} (0.07)	1.94_{abc} (0.25)	0.30_{c} (0.05)	$F(1.74, 209.08) = 37.35$***
Pleasantness	1.80_{a} (0.04)	1.00_{a} (0.05)	2.55_{a} (0.14)	0.59_{a} (0.02)	1.80_{a} 0.03)	0.96_{a} (0.05)	2.84_{a} (0.18)	0.60_{a} (0.02)	$F(2.48, 268.26) = 1520.29$***
Intensity	1.14_{a} (0.11)	$0.85_{}$ (0.08)	$1.14_{}$ (0.16)	0.66_{a} (0.04)	0.99_{a} (0.10)	0.91_{b} (0.07)	2.45_{abc} (0.25)	0.88_{c} (0.05)	$F(2.45, 264.23) = 16.66$***
Surprise	0.64_{a} (0.09)	$0.40_{}$ (0.06)	0.54_{b} (0.10)	0.24_{ab} (0.03)	0.56_{a} (0.08)	$0.56_{}$ (0.06)	1.02_{ab} (0.17)	0.41_{b} (0.04)	$F(2.75, 296.97) = 8.26$***
Smiles	$0.21_{}$ (0.05)	0.17_{a} (0.04)	0.45_{a} (0.09)	0.12_{a} (0.03)	0.23_{a} (0.06)	0.35_{b} (0.07)	1.66_{abc} (0.21)	0.27_{c} (0.06)	$F(1.75, 189.02) = 47.82$***
Blinks	15.50_{a} (1.05)	17.37_{b} (1.17)	12.03_{abc} (1.05)	16.01_{c} (1.17)	16.57_{ab} (1.25)	17.53_{a} (1.19)	12.96_{a} (1.07)	18.80_{ab} (1.22)	$F(2.58, 278.70) = 54.10$***

Note. Degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity when *df*s are reported with two decimals (i.e., when Mauchly's test statistic was significant at $p < .05$). ANOVAs were conducted controlling for condition order (inhibition first vs. expression first). Degrees of freedom for condition were *df*s = 1, 108 for each measure. ANOVAs were conducted using log-transformed values. In order to facilitate interpretation, the mean and standard error columns display untransformed values. Mean scores in each row that share subscripts within a condition (inhibition vs. expression) differ significantly at $p < .05$ (Bonferroni corrected). ***$p < .001$.

Facial Emotion. While watching the negatively valenced film types (fear and sad), participants blinked more and showed a decrease in facial pleasantness when compared to the neutral baseline clips. The happy film type evoked less blinking, more smiling, and a higher score on facial happiness and pleasantness than any of the other film types (see Table S1).

Self-Reported Emotion. After watching the fearful film type, participants reported significantly more fear than after any of the other emotional film types. Also, they reported more sympathy, sadness, anger, disgust, and surprise than during the neutral films. The sad films induced more self-reported sympathy, anger, and sadness than any other emotional film type. Also, participants reported more fear and disgust during the sad films than during the neutral films. After watching the happy film type, more happiness, amusement, and content was reported than after any other film type (see Table S2).

Physiological Responsiveness. Participants showed an increase in nSCRs during all three emotional film types when compared with the neutral baselines. This effect was most pronounced for the happy film type (in nSCRs as well as ISCR). Overall, no differences in heart rate, SDNN, or RMSDD were observed

TABLE S2. Mean (*SE*) Self-Reported Emotional Responses to the Different Film Types (Neutral, Fear, Happy, and Sad) by Condition (Inhibition vs. Expression) (*N* = 110)

	Inhibition				Expression				
	Neutral	Fear	Happy	Sad	Neutral	Fear	Happy	Sad	Film type
	M (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*F*-value (*df*)
Fear	0.26_{a} (0.08)	1.71_{ab} (0.22)	0.15_{b} (0.05)	1.14_{ab} (0.20)	0.19_{a} (0.07)	1.74_{ab} (0.20)	0.19_{b} (0.09)	1.13_{ab} (0.19)	$F(1.85, 200.25) = 74.26^{***}$
Happiness	0.64_{a} (0.12)	0.40_{b} (0.09)	3.44_{ab} (0.23)	0.92_{b} (0.17)	0.43_{a} (0.10)	0.76_{b} (0.16)	3.59_{ab} (0.24)	1.15_{a} (0.20)	$F(2.59, 280.08) = 176.15^{***}$
Disgust	0.25_{ab} (0.09)	0.67_{ac} (0.13)	0.24_{cd} (0.08)	0.77_{bd} (0.15)	0.24_{ab} (0.08)	0.99_{ac} (0.16)	0.34_{cd} (0.10)	1.05_{bd} (0.19)	$F(2.62, 282.93) = 17.63^{***}$
Surprise	0.78_{ab} (0.16)	1.70_{a} (0.19)	1.58_{bc} (0.22)	2.21_{ac} (0.24)	0.71_{abc} (0.14)	2.06_{a} (0.21)	1.96_{b} (0.23)	2.47_{c} (0.26)	$F(3, 324) = 34.87^{***}$
Amused	1.24_{a} (0.15)	2.65_{a} (0.21)	3.36_{a} (0.23)	1.98_{a} (0.21)	0.99_{a} (0.14)	2.80_{a} (0.21)	3.79_{a} (0.23)	2.21_{a} (0.23)	$F(2.69, 290.08) = 60.15^{***}$
Content	1.58_{a} (0.18)	1.71_{b} (0.19)	3.14_{abc} (0.24)	1.39_{c} (0.20)	1.58_{a} (0.18)	1.71_{b} (0.19)	3.14_{abc} (0.24)	1.39_{c} (0.20)	$F(2.79, 301.48) = 47.05^{***}$
Sympathy	0.16_{a} (0.06)	1.01_{ab} (0.16)	0.47_{b} (0.12)	5.15_{ab} (0.23)	0.27_{a} (0.07)	1.38_{ab} (0.20)	0.61_{b} (0.13)	5.44_{ab} (0.23)	$F(2.46, 265.94) = 355.21^{***}$
Angry	0.22_{a} (0.09)	0.73_{b} (0.18)	0.13_{b} (0.05)	1.53_{ab} (0.22)	0.29_{a} (0.08)	0.68_{b} (0.15)	0.17_{b} (0.06)	1.88_{ab} (0.24)	$F(2.09, 225.38) = 45.80^{***}$
Sad	0.15_{a} (0.07)	0.57_{a} (0.14)	0.30_{b} (0.10)	4.61_{ab} (0.24)	0.16_{a} (0.05)	0.61_{ab} (0.13)	0.28_{b} (0.10)	4.66_{ab} (0.26)	$F(2.20, 237.89) = 400.25^{***}$

Note. Degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity when *df*s are reported with two decimals (i.e., when Mauchly's test statistic was significant at $p < .05$). ANOVAs were conducted controlling for condition order (inhibition first vs. expression first). Degrees of freedom for condition were *df*s = 1, 108 for each measure. ANOVAs were conducted using log-transformed values. In order to facilitate interpretation, the mean and standard error columns display untransformed values. Mean scores in each row that share subscripts within a condition (inhibition vs. expression) differ significantly at $p < .05$ (Bonferroni corrected). $^{***}p < .001$.

between the film types, except that participants showed a deceleration in heart rate during the sad film type when compared to baseline (see Table S3).

MANIPULATION CHECK: EFFECT OF CONDITION

In order to investigate whether our manipulation of emotion succeeded, the effect of condition was examined.

Facial Expressive Behavior. For the majority of facial emotions (happiness, intensity, surprise, and smiles), condition had a main effect, with less emotion being displayed during inhibition than during expression, *F*s(1, 102) ranging from 6.92 to 21.99, all *p*s < .05. Condition did not have a significant effect for pleasantness and blinks, *F*s(1, 102) ranging from 0.01 to 0.83, all *p*s > .05.

Self-Reported Emotion. Condition had a main effect on amusement, $F(1, 102) = 4.54$, $p < .05$, with less amusement being reported during inhibition than during expression. Condition did not have a main effect on all the other self-reported emotion terms, *F*s(1, 102) ranging from 0.00 to 3.82, all *p*s > .05.

Psychophysiology. Condition had a main effect on heart rate, $F(1, 102) = 4.34$, $p < .05$. Participants' heart rate decreased during inhibition when compared with expression. For the other psychophysiological indices, no condition effects were observed, *F*s(1, 102) ranging from 1.34 to 3.32, all *p*s > .05.

TABLE S3. Mean (*SE*) Psychophysiological Responses to the Different Film Types (Neutral, Fear, Happy, and Sad) by Condition (Inhibition vs. Expression) (*N* = 110)

	Inhibition				Expression				
	Neutral	Fear	Happy	Sad	Neutral	Fear	Happy	Sad	Film type
	M (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*F*-value (*df*)
nSCRs	2.95_{abc} (0.23)	5.85_{a} (0.39)	6.30_{b} (0.41)	5.53_{c} (0.37)	2.87_{abc} (0.24)	6.22_{a} (0.36)	6.99_{b} (0.48)	5.81_{c} (0.37)	$F(2.79, 301.28) = 209.89^{***}$
ISCR	14.14_{a} (1.74)	11.43_{b} (1.06)	16.82_{bc} (2.66)	10.98_{ac} (1.15)	11.27_{a} (0.97)	11.48_{b} (1.03)	15.52_{abc} (1.76)	12.57_{c} (1.18)	$F(3, 324) = 13.14^{***}$
HR	70.14_{a} (1.29)	69.53 (1.25)	69.74 (1.28)	69.00_{a} (1.25)	69.93 (1.26)	70.21 (1.25)	70.54 (1.30)	69.54 (1.27)	$F(3, 324) = 4.82^{**}$
SDNN	58.61 (2.94)	58.37 (3.09)	56.89 (2.94)	53.68 (2.52)	57.34 (2.81)	60.49 (3.14)	58.45 (3.28)	56.03 (2.77)	$F(2.79, 300.91) = 2.62^{+}$
RMSDD	40.18 (2.65)	42.83 (2.83)	41.89 (2.99)	41.23 (2.75)	42.80 (3.09)	41.36 (2.78)	42.52 (3.19)	44.20 (2.96)	$F(3, 324) = 0.60$

Note. nSCRs = number of skin conductance responses per minute; ISCR = integrated skin conductance response (time integral of phasic driver during film clip); HR = heartbeats per minute; SDNN = standard deviation of the normal-to-normal interval; RMSDD = square root of the mean squared differences of successive normal-to-normal intervals. ANOVAs were conducted controlling for condition order (inhibition first vs. expression first). Degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity when *df*s are reported with two decimals (i.e., when Mauchly's test statistic was significant at $p < .05$). Degrees of freedom for condition were $df = 1, 108$ for each measure. ANOVAs were conducted using log-transformed values for SCRs, ISCR, SDNN, and RMSSD. In order to facilitate interpretation, the mean and standard error columns display untransformed values. Mean scores in each row that share subscripts within a condition (inhibition vs. expression) differ significantly at $p < .05$ (Bonferroni corrected). $^{+}p < .10$. $^{**}p < .01$. $^{***}p < .001$.

SELF-REPORTED, FACIAL, AND PSYCHOPHYSIOLOGICAL RESPONSES PER FILM TYPE

Tables S4 through S7 describe participants' raw self-reported, facial, and psychophysiological responses per film type (neutral, fear, happy, and sad, respectively).

TABLE S4. Mean (*SD*) Responses to the Neutral Baselines Preceding the Inhibition and Expression Condition by Group (*N* = 110)

	Nonoffender controls (*n* = 26)		Nonpsychopathic offenders (*n* = 42)		Psychopathic offenders (*n* = 42)	
	Neutral – Inhibit	Neutral – Express	Neutral – Inhibit	Neutral – Express	Neutral – Inhibit	Neutral – Express
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Self-reported emotion						
Fear	0.4 (0.8)	0.2 (0.5)	0.2 (0.5)	0.2 (0.9)	0.3 (1.1)	0.1 (0.6)
Happiness	0.9 (1.4)	0.8 (1.4)	0.5 (1.0)	0.4 (1.0)	0.7 (1.5)	0.3 (0.8)
Disgust	0.3 (0.7)	0.4 (0.9)	0.2 (0.7)	0.3 (1.1)	0.3 (1.3)	0.1 (0.4)
Surprise	0.8 (1.4)	0.7 (0.9)	0.7 (1.3)	0.9 (2.0)	0.9 (2.1)	0.5 (1.2)
Amused	1.4 (1.7)	1.4 (1.9)	1.3 (1.7)	0.8 (1.4)	1.3 (1.8)	1.3 (1.7)
Content	1.4 (1.7)	1.4 (1.9)	1.8 (2.3)	1.3 (2.0)	1.5 (2.0)	1.3 (1.8)
Sympathy	0.2 (0.5)	0.3 (0.9)	0.2 (0.7)	0.3 (0.7)	0.2 (0.6)	0.3 (0.8)
Anger	0.1 (0.3)	0.3 (0.7)	0.2 (0.8)	0.4 (1.0)	0.3 (1.3)	0.2 (0.9)
Sadness	0.2 (0.5)	0.2 (0.5)	0.1 (0.5)	0.1 (0.5)	0.2 (0.9)	0.2 (0.7)
Facial emotion						
Happiness	0.4 (0.8)	0.2 (0.6)	0.1 (0.3)	0.4 (0.9)	0.6 (1.3)	0.4 (1.0)
Pleasantness	1.8 (0.3)	1.7 (0.3)	1.7 (0.2)	1.8 (0.4)	1.9 (0.5)	1.9 (0.4)
Intensity	1.0 (0.9)	0.9 (1.0)	1.1 (1.1)	1.0 (1.0)	1.8 (0.2)	1.3 (1.3)
Surprise	0.5 (0.9)	0.4 (0.8)	0.8 (1.1)	0.6 (0.7)	0.6 (0.9)	0.6 (0.9)
Smiles	0.3 (0.5)	0.1 (0.3)	1.0 (0.3)	1.0 (0.3)	0.3 (0.7)	0.3 (0.7)
Blinks	15.6 (9.9)	15.1 (9.9)	13.9 (10.2)	13.9 (10.2)	16.9 (12.7)	17.0 (13.2)
Psychophysiological responses						
nSCRs	2.9 (3.2)	3.1 (3.7)	2.8 (3.9)	2.9 (3.5)	3.0 (4.0)	2.8 (4.0)
ISCR	10.6 (7.0)	11.5 (9.1)	13.4 (13.0)	11.8 (10.1)	17.0 (26.0)	10.6 (11.0)
HR	68.4 (15.0)	67.1 (13.0)	69.6 (13.7)	69.8 (13.3)	17.7 (12.5)	71.8 (13.1)
SDNN	65.8 (36.0)	65.5 (31.3)	59.0 (32.5)	57.9 (34.5)	53.5 (25.4)	52.1 (23.3)
RMSDD	47.3 (31.6)	55.1 (37.2)	41.1 (31.9)	41.1 (37.4)	34.9 (18.8)	36.9 (20.2)

Note. nSCRs = number of skin conductance responses per minute; ISCR = integrated skin conductance response (time integral of phasic driver during film clip); HR = heart rate in beats per minute; SDNN = standard deviation of the normal-to-normal interval; RMSDD = square root of the mean squared differences of successive normal-to-normal intervals. Neutral – Inhibit = neutral baseline that preceded the inhibition condition. Neutral – Express = neutral baseline that preceded the expression condition.

TABLE S5. Mean (*SD*) Responses (Change Scores) to the Fearful Film Type by Condition and Group (*N* = 110)

	Nonoffender controls (*n* = 26)		Nonpsychopathic offenders (*n* = 42)		Psychopathic offenders (*n* = 42)	
	Inhibit	Express	Inhibit	Express	Inhibit	Express
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Self-reported emotion						
Fear	1.8 (2.2)	1.2 (1.6)	1.5 (2.1)	1.7 (2.1)	1.2 (2.0)	1.6 (2.4)
Happiness	–0.4 (1.3)	0.1 (1.9)	–0.1 (1.2)	0.1 (1.4)	–0.3 (1.7)	0.8 (2.3)
Disgust	0.5 (1.7)	0.4 (1.4)	0.6 (1.6)	0.7 (1.8)	0.1 (1.6)	1.0 (1.8)
Surprise	0.7 (2.2)	1.0 (1.4)	1.0 (2.2)	1.4 (2.5)	1.0 (1.9)	1.6 (2.4)
Amused	2.2 (2.4)	2.0 (1.8)	1.0 (2.7)	2.0 (2.9)	1.3 (1.8)	1.6 (2.5)
Content	0.3 (2.3)	0.2 (2.5)	0.0 (2.9)	0.7 (2.7)	0.2 (2.3)	0.4 (2.3)
Sympathy	0.9 (1.2)	1.0 (2.6)	1.2 (2.1)	1.2 (2.2)	0.7 (1.3)	1.0 (2.0)
Anger	0.4 (1.0)	–0.1 (0.7)	1.0 (2.8)	0.7 (2.3)	0.1 (1.9)	0.3 (1.1)
Sadness	0.3 (1.1)	0.3 (0.9)	0.6 (1.7)	0.3 (1.1)	0.3 (0.7)	0.7 (1.7)
Facial emotion						
Happiness	–0.3 (0.8)	0.1 (0.8)	0.3 (0.7)	0.1 (1.2)	–0.3 (1.5)	–0.1 (1.0)
Pleasantness	–0.8 (0.5)	–0.7 (0.5)	–0.7 (0.5)	–0.8 (0.7)	–0.8 (0.7)	–0.9 (0.6)
Intensity	–0.4 (1.0)	0.0 (1.2)	–0.2 (1.2)	0.1 (1.1)	–0.3 (1.4)	–0.3 (1.1)
Surprise	–0.3 (0.9)	0.1 (1.0)	–0.5 (1.1)	0.1 (0.9)	0.0 (1.0)	–0.1 (0.8)
Smiles	–0.2 (0.5)	0.3 (1.0)	0.1 (0.5)	0.1 (0.8)	–0.1 (0.7)	0.0 (0.7)
Blinks	2.2 (8.1)	2.6 (6.7)	3.1 (7.7)	–0.1 (7.2)	0.5 (8.9)	0.9 (6.1)
Psychophysiological responses						
nSCRs	3.4 (4.7)	3.7 (4.6)	3.3 (5.0)	3.5 (4.6)	2.5 (5.5)	2.9 (3.7)
ISCR	13.3 (13.1)	15.3 (18.3)	15.0 (24.1)	11.4 (18.9)	4.7 (36.0)	18.3 (21.7)
HR	–0.6 (5.3)	1.3 (3.9)	–0.8 (2.7)	0.4 (3.8)	–0.5 (3.8)	–0.4 (3.8)
SDNN	6.5 (23.6)	12.3 (21.4)	–3.1 (18.5)	–0.7 (25.6)	–2.4 (17.3)	2.2 (19.0)
RMSDD	2.6 (13.7)	0.2 (16.8)	1.7 (17.0	–1.1 (20.3)	3.4 (23.7)	–2.9 (14.4)

Note. nSCRs = number of skin conductance responses per minute; ISCR = integrated skin conductance response (time integral of phasic driver during film clip); HR = heart rate in beats per minute; SDNN = standard deviation of the normal-to-normal interval; RMSDD = square root of the mean squared differences of successive normal-to-normal intervals. Responses are expressed in change scores (raw score minus score on the preceding neutral baseline clip).

TABLE S6. Mean (*SD*) Responses (Change Scores) to the Happy Film Type by Condition and Group (*N* = 110)

	Nonoffender controls (*n* = 26)		Nonpsychopathic offenders (*n* = 42)		Psychopathic offenders (*n* = 42)	
	Inhibit	Express	Inhibit	Express	Inhibit	Express
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Self-reported emotion						
Fear	–0.1 (0.6)	0.0 (0.3)	–0.1 (0.6)	–0.1 (1.0)	–0.1 (0.9)	0.1 (1.1)
Happiness	3.2 (2.7)	2.4 (2.6)	2.7 (2.3)	3.5 (2.4)	2.7 (2.3)	3.3 (2.7)
Disgust	–0.2 (0.6)	0.2 (1.3)	0.1 (1.0)	–0.1 (1.3)	–0.1 (1.5)	0.2 (1.2)
Surprise	0.7 (2.4)	0.8 (1.6)	1.0 (2.5)	1.3 (3.0)	0.7 (2.3)	1.5 (2.3)
Amused	2.7 (2.2)	2.4 (2.7)	2.0 (2.6)	3.2 (2.2)	1.9 (2.3)	2.7 (2.6)
Content	2.0 (2.4)	1.5 (2.8)	1.5 (2.8)	2.5 (2.8)	1.4 (2.4)	2.6 (3.0)
Sympathy	0.3 (1.0)	–0.1 (0.6)	0.1 (1.2)	0.4 (1.2)	0.6 (1.6)	0.6 (1.6)
Anger	0.0 (0.2)	0.0 (0.9)	–0.1 (1.0)	–0.3 (1.0)	–0.2 (1.3)	0.0 (1.2)
Sadness	0.1 (0.7)	0.0 (0.6)	0.2 (1.2)	0.0 (0.5)	0.1 (1.5)	0.3 (1.6)
Facial emotion						
Happiness	0.1 (1.7)	0.9 (1.5)	0.5 (1.0)	1.2 (2.0)	0.1 (1.8)	1.2 (1.7)
Pleasantness	0.9 (1.7)	0.7 (1.7)	0.7 (1.4)	1.2 (1.9)	0.7 (1.5)	1.1 (2.0)
Intensity	–0.1 (2.3)	0.9 (2.0)	0.1 (1.7)	1.4 (2.4)	0.0 (1.9)	1.9 (3.2)
Surprise	–0.3 (0.9)	0.1 (0.6)	–0.3 (1.1)	0.5 (1.6)	0.2 (1.4)	0.6 (2.2)
Smiles	0.0 (1.0)	1.2 (2.3)	0.3 (0.8)	1.5 (2.0)	0.3 (1.1)	1.5 (2.3)
Blinks	–2.7 (7.9)	–0.5 (9.1)	–2.3 (10.1)	–5.7 (9.0)	–5.0 (8.3)	–3.6 (10.3)
Psychophysiological responses						
nSCRs	5.0 (5.5)	3.8 (4.8)	3.5 (4.8)	4.7 (7.8)	2.5 (5.9)	4.4 (6.1)
ISCR	2.7 (12.6)	4.7 (15.2)	2.0 (15.2)	3.4 (18.1)	0.8 (26.6)	6.8 (16.7)
HR	0.2 (5.1)	1.2 (4.5)	–0.1 (5.0)	0.0 (4.2)	–1.2 (2.9)	0.6 (3.9)
SDNN	0.2 (28.8)	3.2 (19.6)	–1.6 (25.7)	0.7 (29.7)	–2.8 (20.6)	0.6 (18.4)
RMSDD	0.4 (18.3)	–8.1 (20.3)	3.1 (27.8)	4.5 (27.7)	2.4 (19.4)	–0.5 (21.3)

Note. nSCRs = number of skin conductance responses per minute; ISCR = integrated skin conductance response (time integral of phasic driver during film clip); HR = heart rate in beats per minute; SDNN = standard deviation of the normal-to-normal interval; RMSDD = square root of the mean squared differences of successive normal-to-normal intervals. Responses are expressed in change scores (raw score minus score on the preceding neutral baseline clip).

TABLE S7. Mean (*SD*) Responses (Change Scores) to the Sad Film Type by Condition and Group (*N* = 110)

	Nonoffender controls (*n* = 26)		Nonpsychopathic offenders (*n* = 42)		Psychopathic offenders (*n* = 42)	
	Inhibit	Express	Inhibit	Express	Inhibit	Express
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Self-reported emotion						
Fear	0.7 (1.6)	0.6 (0.9)	0.9 (2.1)	1.2 (2.1)	1.0 (1.9)	0.9 (2.0)
Happiness	0.2 (2.1)	0.0 (1.8)	0.6 (2.2)	0.6 (1.9)	0.0 (2.2)	1.3 (2.6)
Disgust	0.4 (0.9)	0.4 (1.7)	0.8 (2.1)	0.7 (2.3)	0.3 (1.9)	1.2 (2.0)
Surprise	1.9 (2.9)	1.6 (2.3)	1.6 (2.6)	1.6 (2.7)	1.0 (2.2)	2.0 (3.1)
Amused	0.9 (1.9)	1.1 (1.9)	0.3 (2.7)	1.2 (2.6)	1.1 (2.1)	1.4 (3.2)
Content	–0.2 (1.9)	0.1 (2.2)	–0.5 (2.4)	–0.1 (2.4)	0.1 (2.4)	0.2 (2.5)
Sympathy	4.5 (2.2)	4.6 (2.8)	5.4 (2.4)	5.5 (2.5)	4.9 (2.4)	5.1 (2.6)
Anger	0.9 (1.4)	0.8 (1.7)	1.6 (2.9)	1.6 (2.8)	1.3 (2.6)	2.1 (3.0)
Sadness	3.7 (2.0)	3.8 (2.7)	4.6 (2.7)	4.5 (2.6)	4.7 (2.5)	4.9 (2.7)
Facial emotion						
Confusion	–0.5 (0.9)	0.0 (0.5)	–0.5 (1.0)	–0.3 (1.0)	–0.4 (0.8)	–0.2 (0.8)
Happiness	–0.3 (0.8)	0.1 (0.5)	0.1 (0.5)	–0.2 (0.9)	–0.5 (1.2)	–0.1 (0.9)
Pleasantness	–1.2 (0.3)	–1.0 (0.3)	–1.1 (0.3)	–1.2 (0.4)	–1.3 (0.5)	–1.3 (0.4)
Intensity	–0.5 (1.0)	0.0 (1.0)	–0.4 (1.1)	–0.2 (0.9)	–0.6 (1.2)	–0.1 (1.0)
Surprise	–0.4 (0.8)	-0.1 (0.8)	–0.6 (1.0)	–0.2 (0.7)	–0.2 (0.9)	–0.2 (0.8)
Smiles	–0.2 (0.5)	0.3 (0.9)	0.0 (0.4)	–0.1 (0.6)	–0.2 (0.5)	0.0 (0.6)
Blinks	0.4 (7.0)	3.5 (7.0)	2.2 (11.0)	1.4 (9.7)	–1.0 (9.1)	2.1 (7.4)
Psychophysiological responses						
nSCRs	2.3 (4.5)	3.2 (3.6)	3.3 (4.7)	2.9 (4.3)	2.3 (6.0)	2.8 (5.4)
ISCR	12.5 (16.2)	21.9 (15.2)	22.9 (36.1)	24.0 (30.4)	9.1 (27.1)	22.0 (34.6)
HR	–1.5 (3.9)	0.6 (4.4)	–1.1 (4.6)	–0.4 (3.2)	–1.2 (2.5)	–1.1 (3.9)
SDNN	–2.5 (28.2)	0.5 (24.0)	–9.3 (24.1)	–6.0 (20.5)	–3.6 (21.9)	2.1 (24.1)
RMSDD	–0.9 (16.6)	–0.3 (21.2)	2.0 (22.5)	–1.9 (22.5)	1.3 (17.1)	4.9 (23.9)

Note. nSCRs = number of skin conductance responses per minute; ISCR = integrated skin conductance response (time integral of phasic driver during film clip); HR = heart rate in beats per minute; SDNN = standard deviation of the normal-to-normal interval; RMSDD = square root of the mean squared differences of successive normal-to-normal intervals. Responses are expressed in change scores (raw score minus score on the preceding neutral baseline clip).