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Psychopaths are impaired in social exchange and precautionary reasoning

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Abstract

Psychopaths show a profound lack of morality and behavioral controls in the presence of intact general intellectual functioning. Two hallmarks of psychopathy are the persistent violation of social contracts (i.e., cheating) and chronic, impulsive risk-taking. These behaviors present a puzzle: can psychopaths understand and reason about what counts as cheating or risky behavior in a particular situation? We tested incarcerated psychopaths' and non-psychopaths' reasoning about social exchange, precautionary, and descriptive rules using the Wason selection task. Consistent with hypotheses, psychopaths, compared to matched non-psychopaths, showed significant impairment on social exchange and precautionary rules, but not descriptive rules. These results cannot be accounted for by differences in intelligence, motivation, or general antisocial tendency. These findings suggest that examination of evolutionarily-identified reasoning processes can be a fruitful research approach for identifying which specific mechanisms are impaired in psychopathy.

Psychopathy presents a fascinating paradox: a profound lack of morality and poor behavioral controls in the presence of intact general intellectual functioning and the absence of delusional or psychotic symptoms (Cleckley, 1976). Psychopathy is a complex personality disorder characterized by glibness, grandiosity, lack of moral emotions (e.g., guilt, remorse, empathy), irresponsibility, and impulsivity. Although psychopaths can articulate right from wrong (see review in Cima, Tonnaer, & Hauser, 2010), they persistently violate social, moral, and legal norms, cheating family, friends, and strangers alike. In addition, psychopaths frequently engage in impulsive, reactive behaviors that have destructive consequences for themselves and others, despite acknowledgement of, and professed desire to avoid, such outcomes.

The presence of these behaviors in otherwise intellectually-intact individuals presents a puzzle: can psychopaths understand and reason about what counts as cheating or risky behavior in a particular situation? One hypothesis is that two hallmarks of psychopathy—persistent violation of social contracts and chronic, impulsive risk-taking—are a consequence of malfunctions of neurocognitive specializations designed for reasoning about domains that have been long-standing adaptive problems for humans: engaging in social exchange and taking precautions to mitigate hazards.

A large body of evidence indicates that normal humans are adept at reasoning about such situations (see review in Cosmides & Tooby, 2005). Frequent and extensive cooperation was a pervasive part of normal social life throughout humans' evolutionary history. Evolutionary analyses have identified several cognitive abilities necessary for cooperation to evolve, including reasoning about cheaters, individuals who illicitly take benefits (Cosmides & Tooby, 2005).

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Exposure to myriad hazards during activities of daily life was another pervasive feature of human ancestral environments. Often hazards can be mitigated or eliminated by taking appropriate precautions, suggesting that natural selection would have favored the evolution of inferential mechanisms to manage risk (Fiddick, Cosmides, & Tooby, 2000; Boyer & Lienard, 2006).

These situations can be expressed as conditional rules (“If P, then Q”). Conditional reasoning is frequently investigated using the Wason selection task (Wason, 1966). In this task, participants read a story that describes any rule of the form “If P, then Q” (e.g., “If a person is from California, then that person will be patient”; Figure 1). Participants are then shown four cards containing information about P on one side of the card and information about Q on the other (e.g., “Mary is from California” or “John was patient”), representing the four possible logical categories (P, not-P, Q, not-Q). Only one side of each card is visible. Participants are asked to indicate which card(s) they would definitely need to turn over to check if the rule is violated. The logically correct answer is to select only the P and not-Q cards.

Social contracts can be expressed as rules of the form: “If you take the benefit(P), then you must meet the requirement(Q)” (e.g., “If you borrow my motorcycle, then you have to wash it”). They are violated when individuals take the benefit(P) without meeting the requirement(not-Q). Precautions can be expressed as rules of the form: “If you engage in the hazardous activity(P), then you must take the precaution(Q)” (e.g., “If you work with tuberculosis patients, then you must wear a surgical mask”). They are violated when individuals engage in the hazardous activity(P) without taking the precaution(not-Q). Thus, social contracts and precautions in these forms have the same logical structure as more general descriptive rules (“If P, then Q”), and the correct answer is the same in all cases (selecting only P and not-Q). They differ only in content (i.e., what P and Q stand for).

Normal individuals reason well about social contract and precautionary rules (65-85% correct), but perform poorly on descriptive rules (10-30%; Cosmides & Tooby, 2005). We used the selection task to investigate whether or not psychopaths show the same reasoning patterns as non-psychopathic individuals do.

Psychopaths exhibit traits, including being conning and manipulative, lacking remorse and guilt, pathological lying, and living parasitic lifestyles (Cleckley, 1976; Hare, 2003), that suggest they are insensitive to cues that govern normal humans’ conditional cooperative relationships, and they tend to exploit the cooperation of others (Mealey, 1995; Book & Quinsey, 2004). Psychopaths also fail to show normal distinctions between conventional rules (a form of social contract) and moral ones; in particular, psychopaths may fail to appreciate the *conditional* nature of conventional rules (Blair, 1997). These patterns may reflect difficulty understanding and reasoning about the grammar of social contracts, suggesting:

Hypothesis 1. Psychopaths, relative to non-psychopaths, are impaired on social exchange reasoning.

Psychopaths also exhibit traits, including poor behavioral controls and impulsivity, that suggest they may be insensitive to cues for when to enact appropriate precautions. Psychopaths have shown abnormalities in orienting (Kiehl, Hare, McDonald, & Liddle, 1999; Kiehl, Bates, Laurens, Hare, & Liddle, 2006), response inhibition (Kiehl, Smith, Hare, & Liddle, 2000), and responsiveness to threats (Blair, Peschardt, Budhani, Mitchell, & Pine, 2006), potential components of a hazard management system (Boyer & Lienard, 2006). Abnormality in processing inferred threats may reflect impaired hazard management, suggesting:

Hypothesis 2. Psychopaths, relative to non-psychopaths, are impaired on precautionary reasoning.

Descriptive rules are more general than social contracts or precautions. Reasoning about these rules relies on domain-general logical and intellectual abilities, on which psychopaths do not show impairment (Hare, 2003). These findings suggest:

Hypothesis 3. Psychopaths, relative to non-psychopaths, are not impaired on descriptive reasoning.

Method

Subjects

Sixty-seven incarcerated adult male volunteers from a medium-security North American correctional facility participated in this research as part of a larger study. The average age was 35.2 years ($SD=9.28$, Range:20-56). Inmates were compensated for their participation at the rate of \$1/hour, comparable to institutional wages for labor.

Psychopathy

Psychopathy was assessed using the Psychopathy Checklist-Revised (PCL-R; Hare, 2003), the most widely accepted diagnostic instrument for psychopathy. The assessment includes a review of institutional records and a semi-structured interview that reviews individuals' school, family, work, and criminal history, and their interpersonal and emotional skills. Individuals are scored on 20 items that measure personality traits and behaviors characteristic of psychopathy (Table S1). Scores range from 0-40; the accepted diagnostic cutoff for psychopathy is 30 (Hare, 1991). Interviews were conducted by trained researchers and videotaped for reliability assessment ($ICC=.96$, 10.4% of interviews double-rated).

Wason Selection Task

Ten social contract, ten precaution, and ten social descriptive rule problems were selected from a larger set previously normed on undergraduates ($n=64$, 14 males, age range:18-24, $M=18.4$, $SD=0.99$; supplementary material). All problems involved familiar content drawn from everyday life. Social contracts and precautions were equated on performance in undergraduates (social contracts: $M=70.0$, $SD=33.95$; precautions: $M=70.0$, $SD=34.36$).

For each problem, a story was presented on a computer screen, one section at a time, followed by the cards (one for each of the four logical categories), presented individually (Figure 1). Participants responded "yes" or "no" to whether each card was a possible violation of the rule.¹ Order of the problems and order of the cards within each problem were randomized for each participant. Inmates completed three practice problems to ensure they understood the task. Due to power interruptions, three inmates completed a subset of the problems (16-28 total problems); none were psychopaths.

Other measures

Total IQ was estimated from the vocabulary and matrix reasoning sub-tests of the Wechsler Adult Intelligence Scale (Wechsler, 1997; Ryan, Lopez, & Werth, 1999). Trained researchers administered the Structured Clinical Interview for DSM-IV (First, Spitzer, Gibbon, & Williams, 1997) and a post-head injury symptoms questionnaire (adapted from

¹Although in the original selection task all cards were presented simultaneously, the decisions about each card are logically independent, and performance does not differ between these two presentation methods (Ermer et al., 2006; Fiddick et al., 2005).

King, Crawford, Wenden, Moss, & Wade, 1995); individuals with history of psychosis or traumatic brain injury were excluded.

Results

Inmates were classified as psychopaths (PCL-R ≥ 30 , $n=10$), non-psychopaths (PCL-R ≤ 20 , $n=30$), or middle scorers (PCL-R $20 < x < 30$, $n=27$; Table S2). We report two-tailed p -values and point-biserial r s as effect sizes in the group comparisons.

Are psychopaths impaired on social exchange reasoning (Hypothesis 1)?

Yes. Psychopaths performed significantly worse on social contracts (35.0%, $SD=42.23$) than non-psychopaths did (66.8%, $SD=32.60$; $t(38)=2.48$, $p=.02$, $r=.37$; Figure 2).

Are psychopaths impaired on precautionary reasoning (Hypothesis 2)?

Yes. Psychopaths performed significantly worse on precautions (42.0%, $SD=40.22$) than non-psychopaths did (73.3%, $SD=31.53$; $t(38)=2.54$, $p=.02$, $r=.38$; Figure 2).

Reasoning performance did not differ significantly across social contracts and precautions for either psychopaths ($t(9)=1.66$, $p=.13$, $r=.48$) or non-psychopaths ($t(29)=1.44$, $p=.16$, $r=.26$).

Are psychopaths impaired on descriptive reasoning (Hypothesis 3)?

No. Psychopaths did not perform significantly worse on descriptives (18.0%, $SD=22.51$) than non-psychopaths did (19.6%, $SD=17.32$; $t(38)=0.23$, $p=.82$, $r=.04$).

Overall, there was a significant psychopathy*problem-type interaction ($F(4,128)=3.22$, $p=.02$, $\eta^2=.09$). Middle scorers (PCL-R: 20.1-29.9) showed reasoning performance in between that of non-psychopaths and psychopaths on social contracts (53.3%, $SD=36.27$) and precautions (58.5%, $SD=35.16$) and performance similar to the other inmate groups on descriptives (14.1%, $SD=16.47$; Figure 2).

Do these results hold treating psychopathy as a continuous measure?

Yes. Total psychopathy scores across all inmates ($n=67$) were significantly negatively correlated with social exchange ($r=-.32$, $p=.008$) and precautionary ($r=-.31$, $p=.01$), but not descriptive ($r=-.02$, $p=.86$) reasoning performance. The correlation with descriptive reasoning was significantly different from the correlations with social exchange ($p=.006$) and precautionary ($p=.02$) reasoning.

Can these results be accounted for by general intelligence differences?

No. None of the IQ measures differed significantly between psychopaths and non-psychopaths (total IQ: $t(38)=1.09$, $p=.28$, $r=.17$; vocabulary: $t(38)=0.59$, $p=.56$, $r=.10$; matrix reasoning: $t(38)=0.50$, $p=.62$, $r=.08$; Table S2).

IQ was significantly positively correlated with social exchange ($r=.31$, $p=.01$) and descriptive ($r=.32$, $p=.009$), but not precautionary ($r=.15$, $p=.24$), reasoning performance. Zero-order correlations and regression analyses indicated that this effect was due to variation in vocabulary scores, not matrix reasoning scores (Tables S3-S4). Thus, we ran regression analyses predicting reasoning performance from vocabulary scores and psychopathy (Table 1, Regression 1). After controlling for verbal ability, psychopathy remained a strong, significant negative predictor of social exchange reasoning performance. Furthermore, the similarity in the beta coefficients and semipartial correlations indicates that

psychopathy and verbal ability were essentially independent predictors of reasoning performance (supplementary material).

Can these results be accounted for by motivational differences?

One way to perform poorly on reasoning problems is to not read them carefully. Were psychopaths simply less motivated to do the task than non-psychopaths were? If psychopaths are not reading the problems carefully, we would expect significantly faster reaction times among psychopaths. This was not the case: there were no significant reaction time differences between psychopaths and non-psychopaths on any components of the social exchange and precautionary problems (supplementary material).

Additional evidence against this explanation comes from analysis of psychopaths' errors. Although psychopaths performed quite poorly on social contracts (35%) and precautions (42%), their performance was above chance (6.25%), and their errors were non-random (Tables S5-S7): 67.7% of psychopaths' incorrect responses on social contracts and 60.4% of their incorrect responses on precautions involved only one incorrect card choice, again above chance (26.7%). These results suggest that psychopaths were not unmotivated during the task and responding randomly; rather, their efforts failed to produce the high performance seen in non-psychopaths.

Are these results specific to psychopathy?

The Diagnostic and Statistical Manual of Mental Disorders-IV (APA, 1994) does not include psychopathy as a personality disorder, only antisocial personality disorder, a diagnosis intended to be closely related to psychopathy. However, the diagnosis of antisocial personality disorder relies mainly on the assessment of antisocial behaviors, to the exclusion of many interpersonal and affective traits central to psychopathy (Hart & Hare, 1996).

There was no difference in reasoning performance among individuals with ($n=45$) and without ($n=22$) antisocial personality disorder (social contracts: $t(65)=0.22$, $p=.83$, $r=.03$; precautions: $t(65)=0.43$, $p=.67$, $r=.05$; descriptives: $t(65)=0.44$, $p=.66$, $r=.05$), and the number of antisocial symptoms present was uncorrelated with reasoning performance (social contracts: $r=-.01$, $p=.94$; precautions: $r=.03$, $p=.82$; descriptives: $r=.04$, $p=.72$). These results indicate that the impairments in reasoning performance reported here are specific to psychopathy and cannot be explained by antisocial personality disorder.

Do these results stem from a particular component of psychopathy?

Interpersonal/affective traits (PCL-R Factor 1) were significantly correlated with social exchange ($r=-.32$, $p=.007$) and precautionary ($r=-.30$, $p=.01$), but not descriptive ($r=-.04$, $p=.74$), reasoning performance. Lifestyle/antisocial traits (PCL-R Factor 2) were not significantly correlated with reasoning performance (social contracts: $r=-.17$, $p=.16$; precautions: $r=-.16$, $p=.21$; descriptives: $r=-.01$, $p=.93$). Regression models confirmed this pattern: only Factor 1 was a significant, unique negative predictor of social contract and precautionary reasoning performance (Table 1, Regression 2). Controlling for verbal ability does not change these results (Tables S8-S9).

Discussion

Incarcerated psychopaths have substantial impairments in reasoning about social exchange and precautionary rules, but not descriptive rules, compared to incarcerated, matched non-psychopaths. Incarcerated non-psychopaths' reasoning performance on social exchange and precautionary rules was comparable to performance in undergraduates (see Method; Cosmides & Tooby, 2005). This result demonstrates that the selection task was not too

difficult for this population. Furthermore, our analyses show that the differences between psychopaths and non-psychopaths cannot be accounted for by differences in intelligence, motivation, or general antisocial tendency. Psychopaths' impairments could stem from two separate, but parallel, deficits in these specialized reasoning mechanisms or a more general reasoning deficit. We favor the first interpretation for several reasons.

First, although our results alone do not distinguish social exchange and precautionary reasoning as two separate specialized mechanisms, accumulating evidence supports this idea. Social contracts and precautions can be dissociated experimentally (Fiddick et al., 2000), show dissociation due to brain damage (Stone, Cosmides, Tooby, Kroll, & Knight, 2002), elicit different emotional responses (Fiddick, 2004), and produce distinct patterns of neural activation (Fiddick, Spampinato, & Grafman, 2005; Ermer, Guerin, Cosmides, Tooby, & Miller, 2006; Reis, et al., 2007).

Second, psychopaths do not show general intellectual impairment (Hare, 2003), nor did they show unusual difficulty with descriptive reasoning. They also perform normally on many other reasoning and judgment tasks (Cima et al., 2010; Richell et al., 2003), suggesting that a generalized deficit cannot explain the pattern of abilities and impairments in psychopathy.

These results are particularly striking given evidence that individuals with schizophrenia, who have substantial logical difficulties, show normal reasoning performance on social contracts and precautions (Sullivan et al., 2009). Thus, impairment in social exchange or precautionary reasoning is not a general feature of psychopathology. Indeed, our analyses show that these impairments were specific to psychopathy, not antisocial behavior more generally. Comparison of the main components of psychopathy supports this conclusion. Social exchange and precautionary reasoning were related to interpersonal/affective traits (Factor 1), characteristics central to the conceptualization of psychopathy, but not lifestyle/antisocial traits (Factor 2), behaviors common with antisocial personality disorder.

We used a strict criterion for classifying inmates as psychopaths ($PCL-R \geq 30$). Although our sample of psychopaths was thus modest ($n=10$), we find the same pattern of results across the entire sample using PCL-R scores as a continuous measure of psychopathy. These results suggest that psychopaths have specific reasoning impairments that may contribute to their chronic cheating and impulsive risky behaviors.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
 Example Social Contract Problem. Stories were presented on the screen one section at a time. Cards were presented individually on the screen as illustrated, in a random order for each problem.

Figure 2. Reasoning performance (percent correct) on social contract, precaution, and descriptive rule problems for inmate groups. Bars represent standard errors.

Table 1

Standardized regression coefficients for the prediction of reasoning performance from psychopathy and verbal ability (Regression 1) and from psychopathy factors (Regression 2)

		β	p	Semipartial r
Social Contracts				
Regression 1	Psychopathy	-.30	.01	-.29
	Verbal Ability	.24	.04	.24
Regression 2	Interpersonal/affective traits (Factor 1)	-.32	.02	-.28
	Lifestyle/antisocial traits (Factor 2)	-.01	.95	-.01
Precautions				
Regression 1	Psychopathy	-.30	.01	-.30
	Verbal Ability	.05	.68	.05
Regression 2	Interpersonal/affective traits (Factor 1)	-.30	.03	.26
	Lifestyle/antisocial traits (Factor 2)	10^{-4}	.999	10^{-4}
Descriptives				
Regression 1	Psychopathy	.02	.88	.02
	Verbal Ability	.37	.002	.37
Regression 2	Interpersonal/affective traits (Factor 1)	-.05	.74	-.04
	Lifestyle/antisocial traits (Factor 2)	.01	.93	.01

Note. N = 67. Zero-order correlation between Factor 1 and Factor 2 is $r=.51$, $p=10^{-6}$. For Regression 2, Tolerance=.74; Variance Inflation Factor (VIF)=1.35.