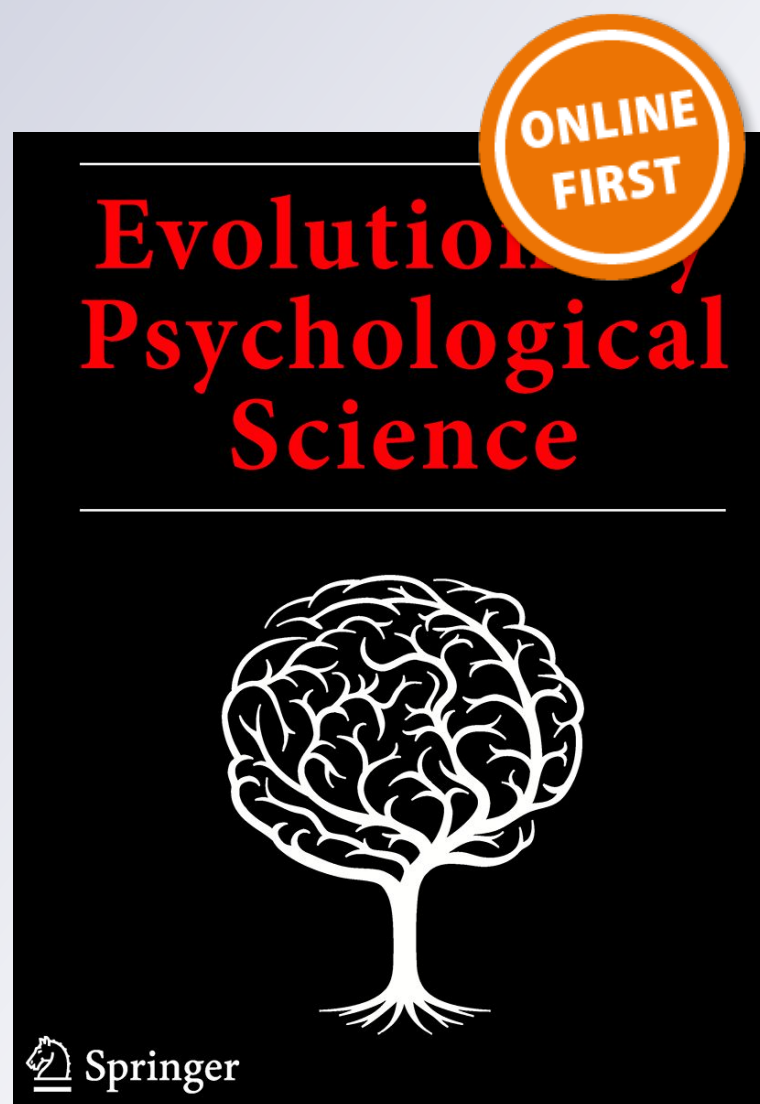# Preliminary Evidence for How the Behavioral Immune System Predicts Juror Decision-Making

## Mitch Brown, Dario N. Rodriguez, Alyssa P. Gretak & Melissa A. Berry

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# Preliminary Evidence for How the Behavioral Immune System Predicts Juror Decision-Making

Mitch Brown[1] · Dario N. Rodriguez[2] · Alyssa P. Gretak[3] · Melissa A. Berry[2]

**Abstract** The behavioral immune system (BIS) is comprised of a variety of psychological and behavioral defenses designed to protect against pathogenic threats. These processes predict various affective and behavioral responses in myriad human contexts, including putative decisions to mitigate exposure to environmental pathogens. We investigated whether the strength of BIS responses predicted jurors' verdicts in a sexual assault trial, wherein strength of the evidence against the defendant was manipulated (ambiguous vs. strong) to determine the extent to which chronic activation of BIS predicted derogation of the defendant. Subsequent mediation analyses indicated that dispositionally activated BIS (as indexed by perceived vulnerability to disease) predicted greater likelihood of conviction by way of affective experiences of disgust, which in turn influenced participants' cognitive appraisals of diagnostic evidence. Furthermore, such responses also elicited greater desire for social distance with the defendant. Evidence strength, however, did not moderate these effects. Findings provide preliminary evidence for how BIS responses may influence legal proceedings.

Human survival is contingent on identifying interpersonal threats—including threats of environmental pathogens—

✉ Mitch Brown
mitchellbrown@usm.edu

1 Department of Psychology, The University of Southern Mississippi, Owings-McQuagge Hall 226, Hattiesburg, MS 39401, USA

2 University of Dayton, Dayton, OH, USA

3 East Tennessee State University, Johnson City, TN, USA

and subsequently avoiding them (Neuberg et al. 2011). Because pathogens are microscopic, proximal disease cues assume an important role in guiding pathogen-avoidant behavior. Various physical attributes may signal pathogen load (e.g., facial disfigurement; Ackerman et al. 2009) and are associated with aversion to and stigmatization of those possessing them (e.g., Mortensen et al. 2010; Park et al. 2007). People perceive conspecifics engaging in non-normative behavior as pathogenic, resulting in derogation and repulsion ostensibly serving to prevent contamination (e.g., Brenner and Inbar 2015; Murray and Schaller 2012; Terrizzi et al. 2010), providing an interesting basis for applying these evolutionary principles. Jurors are tasked with evaluating a community member who may have engaged in a deviant behavior (i.e., cue to pathogen load) and must render a verdict—a decision that either removes that person from (conviction), or integrates that person back into the community (acquittal). We posited that chronically activated pathogen-avoidant motives may influence jurors' decisions, biasing them toward conviction as a means to isolate pathogenic conspecifics. Further, this study investigated whether these motives might be differentially influential depending on the strength of evidence presented against the defendant.

## Behavioral Immune System and Attitudes

Along with a biological immune system, evolutionary psychologists posit that humans have evolved a behavioral immune system (BIS) to further mitigate the threat of infectious disease (Schaller and Park 2011). The BIS is a suite of perceptual, affective, cognitive, and behavioral mechanisms in the service of detecting and avoiding potential disease vectors; these responses purportedly enable

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people to recognize potential threats and take preventive action to avoid contamination rather than having to utilize resources in a more metabolically costly immunological response after contamination occurs (Murray and Schaller 2016). BIS activation serves to recognize veridical cues of pathogenic threat from various disease vectors (e.g., disease-carrying animals, rotting food), which also includes conspecifics. Numerous physical cues appear to signal conspecifics' relative pathogen load, including facial disfigurement (e.g., Ackerman et al. 2009), obesity (e.g., Park et al. 2007), and old age (Duncan and Schaller 2009). Individuals with a more (vs. less) chronically activated BIS are more accurate at detecting such cues, yielding aversion to diseased targets (Miller and Maner 2012; Mortensen et al. 2010).

Just as physical features connote pathogen load, conspecifics' behavioral repertoires may also communicate potential disease threats. In particular, behaviors indicative of nonconformity and deviance frequently elicit aversive responses, and the strength of these responses may vary depending on the level of chronic BIS activation. For example, those with a more chronically activated BIS often derogate nonconformity and place stronger valuation on reticence than those whose BIS is less chronically activated (Brown and Sacco 2016; Murray and Schaller 2012). Terrizzi et al. (2010) also found experimental elicitations of disgust, a common BIS response, produced more negative attitudes toward homosexuals, people typically perceived as non-conforming. Such derogative attitudes are potentially related to the perceived association between nonconformity with infectious disease, as evident by the emphasis on rules adherence in cultures in pathogenic regions (Tybur et al. 2016). Furthermore, heightened BIS responses (e.g., disgust) predict greater endorsement of socially conservative values, including derogating homosexuals and immigrants (Brenner and Inbar 2015; Terrizzi et al. 2013; Terrizzi et al. 2010). Given the emphasis on rule adherence in such cultures, it would seem sensible for pathogen-avoidant motives to elicit derogation of conspecifics seen as having severely violated social rules. This mere association with perceived pathogenic behavior may also suffice in eliciting derogation, even without veridical cues.

## Disgust and Moral Decision-Making

A characteristic BIS response to potential pathogen threat is the affective experience of disgust. This response may have initially evolved to guide organisms away from potentially harmful foods, pathogen-bearing species, and infected members of our own species (Curtis et al. 2011). However, disgust is a ubiquitous response. Instead of only subverting

individuals from interacting with conspecifics who may have physical ailments, these responses may emerge in response to perceiving conspecifics as having violated norms of social conduct and moral codes (e.g., sexually deviant acts; Horberg et al. 2009; Tybur et al. 2013). This suggests disgust responses to moral violations serve to avert people from immoral behavior or prevent affiliation with those who violate rules.

The elicitation of disgust signals that a conspecific's norm-violating behavior could bear risk of infection for the individual, resulting in repulsive impulses that serve to distance oneself from the potential threat. Extensive research has shown that disgust (and, by extension, the BIS) is associated with many facets of moral judgment and behavior. Along with its mitigating roles with infection, moral transgressions also emote similar aversive responses (Tybur et al. 2013). Stronger feelings of disgust with respect to a target transgressor tend to predict more punitive behavioral intentions toward the offender (e.g., greater prejudice and ostracism; Schaller 2015). For example, thoughts of criminals often elicit feelings of disgust and "moral hypervigilance." In one study utilizing a juror decision-making scenario, participants experiencing higher (vs. lower) levels of disgust were more punitive toward hypothetical criminals (Jones and Fitness 2008). Thus, BIS sensitivity may predict a range of legal decisions.

## Implications of the BIS for Juror Decision-Making

Considerable overlap exists between legally sanctioned and morally acceptable behavior (though they are not completely redundant). Consequently, the criminal justice system frequently concerns itself with the disposition of those who purportedly engage in behaviors that are both legally forbidden and morally reprehensible (e.g., murder, sexual assault). A cornerstone of the American criminal justice system is the jury trial, wherein members of the community are selected to determine the guilt of someone who stands accused of committing a legally and morally impermissible behavior. These determinations are supposed to be made on the basis of a rational and dispassionate evaluation of evidence that the prosecution presents against the defendant. Despite numerous procedures designed to achieve that end (e.g., voir dire, judicial instructions), research consistently shows that jurors' evaluations of defendants and judgments of guilt are influenced by factors that, legally, should be irrelevant to the issue of determining guilt, such as racial prejudices (Sommers and Ellsworth 2001), community outrage (Zimmerman et al. 2016), and emotional responses to evidence (Bright and Goodman-Delahunty 2006).

In this context, understanding the downstream consequences of BIS strength takes on new urgency—jurors are faced with the task of determining a defendant's guilt of a moral transgression dispassionately, yet the mere exposure

to moral transgressions may set in motion a series of emotional processes that bias verdict decisions. Specifically, jurors with a more (vs. less) chronically activated BIS, may experience particularly strong feelings of disgust when evaluating a defendant, which may result in a tendency to convict (i.e., punitiveness of potential offender) as a means to remove an individual who has violated social rules and may pose a pathogenic risk (see Jones and Fitness 2008). It may behoove a juror to "err on the side of caution" and separate the potential disease threat from a group, as such an error would be of lower (pathogen-related) costs to conspecifics (Haselton and Nettle 2006). That is, convicting an innocent person would be less costly than acquitting someone guilty in terms of pathogenic risk. Interestingly, this bias may be particularly influential when there is reasonable likelihood of the defendant's innocence (vs. assured guilt). That is, when evidence is decisive and the correct judgment is clear—such as when the evidence against a defendant is strong—subtle and emotional biases may be constrained by cognitive appraisals, and all jurors, irrespective of BIS sensitivity, may vote to convict. When evidence is less clear, however—which is more likely to occur when the defendant may be innocent—then such subtle processes may hold greater sway over the evaluation and interpretation of the facts (cf. Nickerson 1998). Jurors with a more (vs. less) chronically activated BIS may perceive the defendant as a potential disease vector, with the BIS overwhelming the lack of credible evidence (i.e., reasonable doubt). Thus, a strong BIS response may, ironically, yield a strong conviction bias among jurors when the defendant's guilt is less assured, particularly if such a crime dually has strong disease implication (e.g., sexual assault).

## The Present Study

In the present study, we investigated the predictive relation between a chronically activated BIS and punitive decisions in a juror decision-making paradigm. Participants read a brief summary of a sexual assault trial wherein the strength of evidence against the defendant was manipulated. We assessed participants' perceived vulnerability to disease and tasked them with providing a verdict regarding the defendant. We also assessed emotional responses to the defendant (e.g., disgust) and cognitive appraisals of evidence to determine such variables' role in predicting conviction or acquittal. We predicted interactive effects such that chronic BIS activation would positively predict guilty verdicts—mediated by affective responses toward the defendant (disgust, desire for social distance) and cognitive appraisals of evidence strength—but only when evidence against the defendant was weak. When evidence was strong, we predicted this relation would be attenuated or null. All data exclusions, manipulations, and measures are reported with materials and data freely available at osf.io/7b58p.

## Method

### Participants and Design

We recruited 136 undergraduates (56.6% female; $M_{Age}$ = 19 years, $SD$ = 1 year; 84.6% Caucasian) from a mid-sized private university in southwest Ohio in exchange for credit in an introductory psychology course. Participants were randomly assigned to conditions in a 2 (Evidence: Strong vs. Ambiguous) × 2 (Disgust: High vs. Low) between-subjects design. We decided a priori to collect data until we reached $n$ = 30 in each condition. This sample size afforded us 0.80 power to detect medium-sized main effects ($r$ = 0.24) with $\alpha$ = 0.05.

### Materials

**Perceived Vulnerability to Disease** We assessed participants' level of chronic BIS activation using the Perceived Vulnerability to Disease Scale (PVD; Duncan et al. 2009). This 15-item scale assesses individual differences in BIS responses along two subscales: perceived infectability (PI) and germ aversion (GA). PI contains 7 items that assess perceptions of personal susceptibility to contagious disease (e.g., "If an illness is 'going around,' I will get it."). GA contains 8 items to assess disease-related emotional aversions (e.g., "It does not make me anxious to be around sick people."). In this version of the scale, participants rated their agreement using a 5-point scale (1 = *Strongly Disagree*; 5 = *Strongly Agree*) with higher scores indicating greater perceptions of vulnerability to disease (PI $\alpha$ = 0.83; GA $\alpha$ = 0.73). Both subscales produced virtually identical patterns of results; further, these patterns matched those obtained using the overall scale score. For ease of discussion and communication of results, we report all analyses using the single, overall scale score (PVD $\alpha$ = 0.79).

**Disgust** We assessed participants' state level of disgust toward the defendant using an English version of the *Ekel-State-Fragebogen* (Ihme and Mitte 2009). Participants responded to 15 statements (e.g., "I feel sick because of [the defendant]") on a 4-point scale (1 = *Not at all*; 4 = *Very*) with higher scores indicating higher levels of disgust toward the defendant ($\alpha$ = 0.88).

**Social Distance** We used a modified social distance scale (mSDS; Rodriguez et al. 2015; see also Thompson et al. 2011) to assess participants' desire to distance themselves from a criminal defendant. Participants rated their agreement (1 = *Strongly Disagree*; 7 = *Strongly Agree*) with 18 statements regarding actions they would be willing take with a defendant (e.g., "I would be willing to live next door to [the

defendant]"); higher scores indicated greater desire for social distance from the defendant (i.e., derogation; $\alpha = 0.90$).

**Group Interest** We used the Norm of Group Interest scale (NGI; Montoya and Pittinsky 2012) to assess participants' general adherence to the norm that group members should behave in accordance with group needs. Participants rated their agreement (1 = *Strongly Disagree*, 7 = *Strongly Agree*) with six statements regarding how group concerns relate to group members' behaviors (e.g., "Group members should 'pull strings' to help out fellow group members"); higher scores indicate greater adherence to the norm of group interest ($\alpha = 0.61$). We included this measure to explore whether the predicted relationships might be moderated by adherence to this norm.

**Crime Scenario** Participants read a brief crime scenario that describes a man who is accused of raping a young woman at a house party. The facts of the case were based on the general fact pattern in *People of California v. Haidl* (2010). Early in the evening, the defendant was seen flirting with the victim, who was obviously intoxicated. Later that evening, a witness entered an upstairs bedroom and saw a man raping the unconscious victim. The man fled the scene. Police later stopped the defendant on the street, asked for his whereabouts that evening, and took his picture for the purpose of obtaining a show-up identification from the witness.

We manipulated the strength of the evidence by altering the confidence with which the witness identified the defendant, the alignment between the defendant's alibi and the time of the assault, and the match between the witness's description and defendant's appearance. In the strong evidence condition, the defendant said he was at the party and left after the time at which the assault occurred; the police stopped the defendant because he "closely" matched the witness's description; and the witness identified the defendant saying "That's the man I saw raping [victim]." In the ambiguous condition, the defendant said he left the party before the time of the attack; the police stopped the defendant because he "somewhat" matched the witness's description; and when presented with the defendant's photo, the witness said, "I am not sure." The crime scenario also included non-diagnostic details of the crime that were consistent across conditions (i.e., defendant was seen flirting with the victim earlier in the evening; defendant had an unopened condom is his pocket when searched), and summarized the arguments presented by the prosecution and defense at trial.

The disgust manipulation entailed an alteration of some details surrounding a sexual assault and was designed to activate pathogen-avoidant motives, similar to a disease prime (e.g., Ackerman et al. 2009). In low disgust scenarios, the witnessed reported seeing a man having intercourse with the unconscious victim; in high disgust scenarios, the witness reported seeing a man using a wooden object to penetrate the unconscious victim. This manipulation was motivated by research indicating that sexual acts are considered more disgusting as they deviate from typical intercourse (Haidt and Hersh 2001).

**Evaluations of Evidence and Verdict** Participants completed seven attention check multiple-choice items to ensure they read the passage closely. We decided *a priori* to eliminate participants who answered three or more items incorrectly. None warranted exclusion, so we do not discuss these items further. Participants also evaluated the probative value of five pieces of evidence presented against the defendant (i.e., evidence strength) using 7-point scales (1 = *Extremely Weak*; 7 = *Extremely Strong*). Three items (Alibi, Description, Identification [ID]) assessed evaluations of the diagnostic evidence that varied across conditions; the remaining two items (Flirt, Condom) concerned the non-diagnostic details held constant between conditions. The ultimate decision-making measure was participants' dichotomous verdict decision: guilty or not guilty. We also assessed participants' perceptions of guilt using a continuous guilt scale—a composite verdict-confidence scale—and two questions concerning sentencing severity (if the participant found the defendant guilty); these measures yielded the same pattern of results as the dichotomous verdict measure. Because dichotomous verdict is the most ecologically valid measure (e.g., juries do not decide sentences for non-capital cases in the USA), we do not discuss the other outcome measures further.

### Procedure

Participants came to the lab in small groups of up to eight for what was described as a mock jury study. Although data were collected in groups, all tasks were completed individually. Following consent, participants completed PVD and NGI. Participants then read the crime summary and answered the attention check items, followed by ESF and mSDS, which were counterbalanced. Finally, participants completed the evidence evaluation questionnaire and provided a dichotomous verdict decision before completing demographic information. Afterward, they were debriefed and dismissed.

### Results

### Manipulation Checks and Data Preparation

We decided that measures needed to have reliabilities of at least $\alpha = 0.70$ to be used in our analyses. The Norm of Group Interest (NGI) scale was not sufficiently reliable. We therefore excluded it from all analyses and do not

discuss it further. An independent-samples $t$ test revealed no significant effect of our Disgust manipulation on participants' feelings of disgust (high: $M = 2.40$, $SD = 0.56$; low: $M = 2.28$, $SD = 0.55$), $t(134) = 1.27$, $p = 0.207$, $d = 0.21$, 95% CI [0.10, 0.37]. Further, an equivalence test using the two one-sided $t$ test procedure (see Lakens 2017) indicated that the observed effect size was significantly within the equivalence bounds of $d = 0.50$, $t(134) = 1.67$, and $p = 0.048$. That is, these data provide evidence for the null hypothesis of no effect (relative to that of an effect $d = 0.5$ or larger). The Disgust manipulation did not affect any outcome variable and it did not interact with any other variables, so we collapsed across this manipulation. This resulted in samples of $n = 69$ and $n = 67$ in the Strong and Ambiguous evidence conditions, respectively. We consider why this manipulation may have failed in the Discussion.

## Data Analysis Strategy

Table 1 displays descriptive statistics for the individual difference and dependent measures as a function of evidence strength condition. We tested our hypotheses using a series of logistic and multiple linear regression analyses, wherein Verdict (1 = guilty, 0 = not guilty) was regressed on evidence strength (Evidence; 1 = strong, −1 = ambiguous), perceived vulnerability to disease (PVD), and their residualized interaction term (see Lance 1988; Block 1), self-reported disgust and desire for social distance (mSDS; Block 2), and evaluations of evidence (Flirt, Condom, Alibi, Description, ID; Block 3). We then used Hayes' (2013) PROCESS macro to identify specific indirect effects from Block 1 to verdict.

**Table 1** Means (SDs) for measured variables as a function of evidence strength

|  | Evidence strength | |
| --- | --- | --- |
|  | Strong | Ambiguous |
| PVD | 2.67 (0.53) | 2.72 (0.54) |
| Disgust | 2.30 (0.55) | 2.38 (0.57) |
| mSDS | 4.93 (0.89) | 5.14 (1.02) |
| Flirt | 4.33 (1.44) | 4.52 (1.48) |
| Condom | 3.62 (1.66) | 3.90 (1.91) |
| Alibi | 4.06 (1.71) | 3.75 (1.80) |
| Description* | 4.62 (1.41) | 3.93 (1.53) |
| ID* | 4.87 (1.54) | 3.40 (1.63) |
| Conviction rate* | 70% | 52% |

*PVD* perceived vulnerability to disease, *mSDS* modified social distance scale, *ID* witness identification

*$p < 0.05$

## Preliminary Regression Analyses

**Predicting Disgust and Social Distance** Table 2 contains the total and direct effects from the regression analyses. PVD significantly predicted Disgust, $b = 0.39$, $t(132) = 4.68$, $p < 0.001$, 95% CI [0.23, 0.56], and mSDS, $b = 0.51$, $t(132) = 3.44$, $p = 0.001$, and 95% CI [0.22, 0.81]. Consistent with prior work, participants with a higher perceived vulnerability to disease were more disgusted by and desired more social distance from the defendant than those with a lower perceived vulnerability to disease. Neither the main effect of Evidence nor the Evidence × PVD interaction predicted Disgust or mSDS.

**Predicting Evaluations of Diagnostic Evidence** Evidence significantly predicted participants' evaluations of the match of the defendant to the witness's description, $b = 0.75$, $t(132) = 3.11$, and $p = 0.002$, 95% CI [0.27, 1.22], and the witness's identification of the defendant, $b = 1.52$, $t(132) = 5.82$, $p < 0.001$, and 95% CI [1.00, 2.04]. Those in the strong evidence conditions viewed these pieces of evidence as more incriminating than those in the Ambiguous condition. Evidence did not significantly predict participants' evaluations of the defendant's alibi, though the effect was in the predicted direction (see Table 1). PVD also predicted participants' Description, $b = 0.87$, $t(132) = 3.87$, $p < 0.001$, and 95% CI [0.43, 1.32], and ID ratings, $b = 0.93$, $t(132) = 3.78$, $p < 0.001$, and 95% CI [0.44, 1.41]. Participants higher in PVD viewed these pieces of evidence as more incriminating than those lower in PVD. The interaction between Evidence and PVD did not predict participant evaluations of diagnostic evidence. Disgust and mSDS did not significantly predict participants' evaluations of diagnostic evidence, and did not significantly improve the explanatory power of the models when added.

**Predicting Evaluations of Non-diagnostic Evidence** Appropriately, Evidence did not significantly predict participants' evaluations of non-diagnostic evidence (i.e., Flirt and Condom items; see Table 2). PVD significantly predicted participants' ratings of the Condom item, $b = 0.78$, $t(132) = 2.79$, $p = 0.006$, and 95% CI [0.23, 1.34]; as self-perceived susceptibility to disease increased, the defendant's possession of a condom was viewed as more incriminating. PVD did not, however, significantly predict participants' ratings on the Flirt item. The Evidence × PVD interaction did not predict either rating.

Adding Disgust and mSDS scores to the models greatly and statistically significantly increased their predictive power. Disgust predicted participants' ratings on both the Flirt, $b = 0.65$, $t(130) = 2.39$, $p = 0.018$, and 95% CI [0.11, 1.18], and Condom items, $b = 0.98$, $t(130) = 2.98$, $p = 0.003$, and 95% CI [0.33, 1.63]. As disgust increased, participants viewed

**Table 2** Regressions predicting verdict via disgust, social distance, and evidence evaluations

| | Disgust | mSDS | Flirt | | Condom | | Alibi | | Description | | ID | | Verdict | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Total | Total | Direct | Total | Direct | Total | Direct | Total | Direct | Total | Direct | Total | Direct |
| **Block 1** | | | | | | | | | | | | | | |
| Evidence | −0.06 | −0.18 | −0.17 | −0.07 | −0.23 | −0.13 | 0.34 | 0.36 | 0.75** | 0.82** | 1.52*** | 1.55*** | 1.06* | 1.36* |
| PVD | 0.39*** | 0.51*** | 0.33 | −0.10 | 0.78** | 0.30 | 0.52 | 0.42 | 0.87*** | 0.57* | 0.93*** | 0.78** | 1.95*** | 1.38* |
| E × PVD | 0.03 | 0.06 | 0.16 | 0.12 | 0.19 | 0.15 | 0.03 | 0.02 | −0.10 | −0.12 | 0.75 | 0.03 | 0.15 | -0.23 |
| $R^2$ | 0.15*** | 0.10** | 0.03 | – | 0.07* | – | 0.03 | – | 0.15*** | – | 0.26*** | – | 0.27*** | – |
| **Block 2** | | | | | | | | | | | | | | |
| Disgust | – | – | 0.65* | – | 0.98** | – | 0.28 | – | 0.48† | – | 0.22 | – | 1.64** | 1.18 |
| mSDS | – | – | 0.35* | – | 0.21 | – | 0.00 | – | 0.22 | – | 0.11 | – | 0.82** | 0.82* |
| $R^2$ | – | – | 0.18*** | – | 0.20*** | – | 0.04 | – | 0.22*** | – | 0.27*** | – | 0.50*** | – |
| **Block 3** | | | | | | | | | | | | | | |
| Flirt | – | – | – | – | – | – | – | – | – | – | – | – | 0.41† | – |
| Condom | – | – | – | – | – | – | – | – | – | – | – | – | 0.47* | – |
| Alibi | – | – | – | – | – | – | – | – | – | – | – | – | −0.18 | – |
| Description | – | – | – | – | – | – | – | – | – | – | – | – | 0.08 | – |
| ID | – | – | – | – | – | – | – | – | – | – | – | – | 0.43† | – |
| $R^2$ | – | – | – | – | – | – | – | – | – | – | – | – | 0.65*** | – |

Unstandardized coefficients shown. E × PVD = Evidence × PVD interaction. $R^2$ for effects on verdicts is Nagelkerke $R^2$.

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

the non-diagnostic evidence as more incriminating. Participants' mSDS scores predicted their Flirt ratings, $b = 0.35$, $t(130) = 2.28$, $p = 0.024$, and 95% CI [0.05, 0.65]; those who desired more social distance from the defendant tended to view his flirtatious behavior with the victim as more incriminating than those who desired less distance from him; mSDS scores did not significantly predict Condom ratings.

**Tests of Hypotheses**

**Predicting Verdicts** The total effects of Evidence, $b = 1.06$, Wald $\chi^2(1) = 6.36$, $p = 0.0127$, odds ratio = 2.88, and 95% CI [1.27, 6.54], and PVD, $b = 1.96$, Wald $\chi^2(1) = 19.72$, $p < 0.001$, odds ratio = 7.05, and 95% CI [2.98, 16.68], were both sizeable and statistically significant. Participants were more likely to convict the defendant when evidence was strong (vs. ambiguous) and when they perceived themselves has having a greater (vs. lesser) susceptibility to disease. The predicted Evidence × PVD interaction, however, was not significant.

Both Disgust, $b = 1.64$, Wald $\chi^2(1) = 8.61$, $p = 0.004$, odds ratio = 5.13, and 95% CI [1.67, 15.81], and mSDS, $b = 0.82$, Wald $\chi^2(1) = 6.79$, $p = 0.009$, odds ratio = 2.28, and 95% CI [1.23, 4.23], predicted verdicts when added to the model. Disgust and desire for social distance from the perpetrator were both positively associated with the likelihood of conviction. The explanatory power of the model was further increased when the evidence evaluation ratings were included

as predictors. Participants' Condom ratings significantly predicted verdicts, $b = 0.47$, Wald $\chi^2(1) = 5.69$, $p = 0.017$, odds ratio = 1.60, and 95% CI [1.09, 2.34], and their Flirt, $b = 0.40$, Wald $\chi^2(1) = 3.59$, $p = 0.058$, odds ratio = 1.50, and 95% CI [0.99, 2.28] and Identification ratings, $b = 0.43$, Wald $\chi^2(1) = 2.93$, $p = 0.087$, odds ratio = 1.53, and 95% CI [0.94, 2.49], marginally significantly predicted verdicts.

**Mediation Analyses** Examinations of specific indirect effects revealed several mediating pathways between the predictors (Evidence and PVD) and Verdict (see Table 3). In general, Evidence predicted verdicts via participants' appraisals of diagnostic pieces of evidence (specifically, the match of the defendant to the witness's description, and the witness's identification), but not via appraisals of non-diagnostic evidence, nor via emotional responses toward the defendant. PVD, however, exerted its effect on verdicts by influencing participants' emotional responses to the defendant (disgust and desire for social distance), which then affected their appraisals of non-diagnostic and diagnostic evidence against him and, ultimately, their verdict decisions.

**Discussion**

The present study provides preliminary evidence for how chronic BIS activation may predict jurors' emotional responses to crime, cognitive appraisals of evidence against a

**Table 3** Significant indirect paths from evidence and PVD to verdict

| Path | b | 95% CI |
| --- | --- | --- |
| Evidence > Description > Verdict | 0.24 | [0.08, 0.51] |
| Evidence > ID > Verdict | 0.48 | [0.22, 0.85] |
| PVD > Disgust > Verdict | 0.67 | [0.29, 1.31] |
| PVD > Disgust > Flirt > Verdict | 0.18 | [0.05, 0.46] |
| PVD > Disgust > Condom > Verdict | 0.23 | [0.09, 0.49] |
| PVD > Disgust > Description > Verdict | 0.16 | [0.03, 0.45] |
| PVD > mSDS > Verdict | 0.42 | [0.11, 0.95] |
| PVD > mSDS > Flirt > Verdict | 0.13 | [0.03, 0.36] |
| PVD > mSDS > Condom > Verdict | 0.14 | [0.04, 0.35] |
| PVD > mSDS > Description > Verdict | 0.12 | [0.01, 0.40] |
| PVD > Description > Verdict | 0.38 | [0.08, 0.85] |
| PVD > ID > Verdict | 0.49 | [0.08, 1.02] |

Unstandardized coefficients shown

potential offender, and ultimate verdict decision. Specifically, participants with more chronic BIS activation exhibited more strongly negative affective responses against the defendant, viewed undiagnostic evidence as more incriminating, and were more likely to convict the defendant than were those with less chronic BIS activation. These processes occurred even though participants were evaluating evidence "correctly"—the evidence strength manipulation predicted participants' verdicts by way of only their evaluations of diagnostic evidence, and not via emotional responses or evaluations of non-diagnostic evidence. The expected interaction between BIS strength and evidence strength, however, did not emerge.

**BIS Predicts Affective Response, Cognitive Appraisals, and Behavioral Intentions**

BIS activation directly predicts the strength and severity of emotional responses to moral transgressors. Such a response seems sensible, given the well-documented associations between pathogen-avoidant motives with both morality (i.e., disgust, repulsion; Tybur et al. 2013) and a similar perception of severity from more innocuous acts of non-normative behavior (Murray and Schaller 2012). Further, such affective responses are positively associated with punitive treatment of such transgressors (e.g., Jones and Fitness 2008). Our results are consistent with these findings, and expand on them in two important ways. First, many investigations of the relation between BIS strength and associated responses and judgments are relatively context-free. That is, previous research typically considers behavioral responses that would likely only occur in experimental settings (e.g., Mortensen et al. 2010). Our study, however, places these associations in a rather concrete context that many people in the USA (and other countries) will experience at some point in their lives: juror decisions in a criminal trial. Our method, while certainly lacking in ecological

validity in terms of sampling and task medium—though this likely does not limit the generalizability of our results (Bornstein et al. 2017)—nonetheless provides an example of the practical utility that can come from understanding how evolutionary principles predict human behavior.

Second, our study provides some evidence that BIS-related affective responses can have direct, as well as indirect, effects on behavioral intentions. Such results provide a laboratory analog to various cross-cultural studies demonstrating how BIS responses predict behaviors more broadly defined (e.g., engagement in pluralistic mating strategies; Schaller and Murray 2008). Although the correlational nature of the data prevent firm inferences of causation, our mediation analyses suggest that strong feelings of disgust and a strong desire for social distance, two of many BIS manifestations (Murray and Schaller 2016), can lead people to view evidence as more incriminating, which, naturally, makes conviction appear appropriate.

Immediate affective reactions to aversive targets can shape cognitive appraisals of those targets (Rodriguez et al. 2015). These data are consistent with this possibility. BIS predicted participants' verdicts via evaluations of non-diagnostic evidence—evidence that was unrelated to guilt and remained constant across evidence strength conditions (e.g., the defendant had an *unopened* condom in his pocket when searched by police)—as well as diagnostic evidence. Although the correlation between perceived vulnerability to disease (PVD) and the perceived probative value of the condom fits neatly with the associations among sexual behaviors, attributions of pathogenic threats, and derogative responses (e.g., Schaller and Murray 2008), the associations between PVD and the evaluations of less intrinsically disease-related pieces of evidence suggests that BIS activation may manifest as an overall conservative shift in evaluation and treatment of potential disease vectors. When confronted with a deviant target, those with a more chronically activated BIS may be inclined to "err on the side of caution" and move to prevent the target from rejoining the community (i.e., a conviction bias; see Haselton and Nettle 2006). This bias is consistent with and sensible from an evolutionary standpoint, but conflicts with more modern, societal-level concerns of procedural justice and the presumption of innocence (e.g., Blader and Tyler 2003; Friedman 1999). Future research might examine if and how competing concerns for and conceptions of "the greater good" might influence jurors' decisions in an individual case.

**Limitations and Future Directions**

**No Interaction Effect Materialized** We predicted the influence of BIS on verdicts would be moderated by evidence strength, such that responses would predict verdicts when evidence was ambiguous, but strong evidence would mitigate any influence of BIS or affect on verdicts. Despite an effective

evidence strength manipulation, this interaction did not emerge. Verdicts in the strong evidence condition were not at the ceiling (70% convictions). Given the "room" for variance in verdicts even in the strong evidence condition, one possible explanation is that our manipulation was not strong enough given the rather impoverished nature of our trial summary to produce the predicted interaction between evidence strength and perceived vulnerability to disease (i.e., essentially a ceiling effect). That is, though the evidence in the strong evidence condition was stronger than it was in the weak evidence condition, it still may not have been strong enough to overwhelm any affective or disease-relevant processes. To wit, the incriminating evidence essentially amounted to: one eyewitness, a resemblance of the defendant to the perpetrator, and one less-than-trustworthy alibi; all of which are fallible indicators of guilt (Garrett 2011). Further, evaluations of the defendant's alibi were unchanged across conditions, perhaps reflecting a general distrust of alibis—the idea that, if a defendant has made it to court, *something* must be awry with the alibi (Crozier et al. 2017). Future research might employ more elaborate trial scenarios and complex patterns of physical and witness evidence.

Another possibility is that strong evidence of guilt does not attenuate this relation. Instead, strong evidence of guilt may provide certainty that the defendant is rightfully the object of their affective responses (though the "strength" of the affective responses was similar between evidence conditions; see Table 1). Perhaps a better test of this hypothesis would be to include a condition in which the defendant is almost certainly *innocent*, the evidence against the defendant so flimsy as to leave jurors no choice but to acquit. Such a condition might more effectively pit the affective and cognitive processes against each other. This condition, though potentially theoretically illuminating, may suffer some defects in external validity, as in actuality such cases might be more likely to be adjudicated via plea bargaining (Bushway et al. 2014), if charges are brought against such a defendant at all.

**Failed Disgust Manipulation** We attempted to activate participants' BIS temporally by varying degrees of details in the case to elicit stronger disgust reactions. The current manipulation did not appear to alter reactions. One possibility for these null results could be related to insufficient power; although our sample size fares well in comparison to samples typically relied on in the recent past (see, e.g., Marszalek et al. 2011), it still offers limited ability to detect small effects. Nonetheless, our equivalence test indicates that the results are not merely uninformative, but provide positive evidence that, if a manipulation such as ours has an effect in this context, it is likely to be small. Future research looking to elicit disgust in this context would benefit from having larger samples to detect potentially smaller effects. Alternatively, following examination of the means in Table 1, participants appeared

to perceive the case as highly disgusting regardless of details. This may suggest that a more polarizing disgust manipulation for disgust would be ideal in future research (specifically one with a less disgusting control condition). This could include comparing verdicts in a case that is categorically pathogenically disgusting (e.g., sexual assault) vs. one that is not (e.g., insurance fraud), though this might necessitate some confounded comparisons (see Rodriguez et al. 2015). Future research should further consider other manifestations of BIS responses. Research typically relies on disease primes to activate pathogen concerns (e.g., Ackerman et al. 2009; Mortensen et al. 2010; Miller and Maner 2012; Murray and Schaller 2012), but it is difficult to incorporate such primes into a jury protocol in any ecologically valid manner. One potentially ecologically valid measure of BIS activation could be through considering juror decisions as a function of the most recent moment a person contracted an illness. Recency of illness has demonstrated similar vigilance and aversion to disease as experimental manipulations (Miller and Maner 2011). Knowing recency of illness could potentially predict jurors' sensitivity to certain types of evidence that may elicit BIS responses that would similarly bias attitudes toward a defendant. Such a method may also be relevant to voir dire (the questioning of prospective jurors) in certain types of civil trials (e.g., medical malpractice).

**Boundary Conditions of BIS Effects on Juror Decisions**
Sexual assault cases are complex constellations of situational factors (e.g., premeditation on the part of the perpetrator, harm committed against a victim). Although our data suggest that disease-relevant processes may be operative in juror decisions in such cases, they do not allow us to specify the activating source of these processes. As one reviewer noted, the implication of a cognitive component to a perpetrator's behavior (i.e., volition) may change the relevance or activation of these effects. On the one hand, our scenario described what can be considered a "crime of opportunity," but on the other hand, perpetrating sexual assault requires some degree of volition and willful action. It is unclear whether and how these considerations influenced our participants' responses. Future research might employ experimental manipulations of these aspects of criminal acts to more surgically identify the source of disease-related process as well as their boundary conditions.

Similarly, sexual assault necessitates some degree of harm to a victim. Future research might examine whether such "victim impact" information is necessary for the observed effects. Practically, however, crafting unconfounded yet realistic manipulations may be difficult given the correlations among these factors in real cases. Lastly, these effects may further depend on additional individual difference characteristics. We had intended to explore whether these processes were stronger for those higher in adherence to the norm of group interest, though the unreliable scale prevented any informative

analysis. There are numerous other individual differences that might plausibly interact with the effects observed here (e.g., conservativism) that future research could incorporate.

**Individual vs. Group Decisions** An important limitation of our study is that we focused on *juror* decision-making, whereas individual jurors do not make ultimate verdict decisions—juries as a whole do. Although individual verdicts can be powerful predictors of group verdicts (Simon 2012), the nature of the BIS-related associations observed here may change when the task shifts to one of group behavior. Nonetheless, the BIS is intimately linked to issues of conformity and treatment of non-conformers (Murray and Schaller 2012), which are acute in jury decision-making. The BIS may still exert non-trivial effects when such legal decisions are examined at the group level.

## Conclusion

The BIS plays an important role in guiding human behavior in myriad social circumstances beyond those superficially linked to disease avoidance. Our study shows that these associations may even influence human behavior in a legal decision-making context. We have identified some concrete paths on which to build our research and expand our understanding of both basic and applied BIS-related processes. An understanding of these processes may allow for a more complete understanding of the influence of evolutionary principles in real-world contexts.

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