Innocence and Resisting Confession During Interrogation: Effects on Physiologic Activity

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Innocent suspects may not adequately protect themselves during interrogation because they fail to fully appreciate the danger of the situation. This experiment tested whether innocent suspects experience less stress during interrogation than guilty suspects, and whether refusing to confess expends physiologic resources. After experimentally manipulating innocence and guilt, 132 participants were accused and interrogated for misconduct, and then pressured to confess. Systolic and diastolic blood pressure (SBP, DBP), heart rate (HR), respiratory sinus arrhythmia (RSA), and pre-ejection period (PEP) responses quantified stress reactions. As hypothesized, the innocent evidenced smaller stress responses to interrogation for SBP, DBP, HR, and RSA than did the guilty. Furthermore, innocents who refused to confess exhibited greater sympathetic nervous system activation, as evidenced by shorter PEPs, than did innocent or guilty confessors. These findings suggest that innocent suspects underestimate the threat of interrogation and that resisting pressures to confess can diminish suspects’ physiologic resources and lead to false confessions.

Keywords: innocence, guilt, interrogation, confession, stress

During police interrogation, innocent suspects will sometimes confess to crimes they did not commit. Case reviews of the first 250 individuals who were initially convicted of a crime but later exonerated by DNA evidence, revealed that 40 of them, or 16%, had provided a false confession (Garrett, 2011; Innocence Project, 2012). Furthermore, scholars point out that this is likely a conservative estimate, inasmuch as it does not include confessions that were disproven prior to trial, pertained to crimes that lacked biological evidence, were too minor to receive close examination following conviction, or were made by juveniles whose proceedings entailed provisions of confidentiality (Kassin, 2008). Although these considerations make it difficult to estimate the true prevalence of false confessions within the legal system, there is consensus that a confession—even a false one—stands as compelling evidence of guilt, strongly influences juror decisions, and biases the interpretation of other evidence toward supporting a guilty verdict (Hasel & Kassin, 2009; Leo & Davis, 2010). Because of their potential for causing a miscarriage of justice, it is essential to understand the processes that can produce a false confession.

Phenomenology of Innocence

Though the guilty are more likely to confess than are the innocent (Leo, Costanzo, & Shaked-Shroer, 2009; Russano, Meissner, Narchet, & Kassin, 2005), the innocent are more likely to make behavioral choices that increase their risk of self-incrimination. For example, the innocent are more likely than the guilty to waive their rights and to cooperate and speak freely with investigators (Kassin & Norwick, 2004). These choices, which are made at the outset of questioning and interrogation, can set in motion a cascade of effects that can ultimately result in a coerced false confession; that is, one that is extracted via interrogation techniques (Kassin & Wrightsman, 1985). In seeking to understand why the innocent make these choices, Kassin (2005) has proposed that innocents are susceptible to a psychological state referred to as the phenomenology of innocence. According to this theoretical perspective, innocent suspects are of the mindset that the truth of their innocence will protect them from experiencing negative outcomes. We propose here that innocent suspects, bolstered by this mindset, experience less stress at the point of accusation and interrogation than do guilty suspects. Therefore, one aim of this research was to examine the physiologic stress responses that accompany accusation and interrogation among both innocent and guilty suspects. Accordingly, it is helpful to conceptualize the relevant issues within a stress and coping framework.

Stress is a psychological state in which people perceive their circumstances as threatening and likely to tax or exceed their abilities to cope (Lazarus & Folkman, 1984). Although the expe-
perience of stress is often considered negative, it is an adaptive reaction that signals the presence of threat and supports the mobilization of a coping response. Thus, if the innocent have too little appreciation for the peril inherent in their status as suspects, and too much faith in either their ability to convince interrogators of their innocence or the infallibility of the judicial process in preventing convictions of the truly innocent, then they should experience less stress at the start of an interrogation than do the guilty, ultimately setting themselves up to make choices that increase their risk of self-incrimination. Therefore, integrating the tenets of the phenomenology of innocence with theoretical conceptualizations of stress, we hypothesized that innocent suspects experience less stress than guilty suspects in response to accusation and interrogation.

Depletion of Resources

Despite the possibility that innocents might feel less stress than the guilty at the outset of an interrogation, the task of maintaining and defending one’s innocence throughout an interrogation can require great fortitude. Although innocents might initially assert their innocence with vigor, continuing to do so for hours while simultaneously resisting coercive interrogation techniques likely entails the expenditure of significant physical and psychological resources (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Davis & Leo, 2012). Over time, innocent suspects might become exhausted and confess as a means to escape from the interrogation. Consistent with this possibility, prior research has shown that lengthy interrogations are associated with increased false confession rates (Drizin & Leo, 2004) and reduce the diagnostic value of confession evidence (Madon, Yang, Smalarz, Guyll, & Scherr, 2013). However, no prior research has examined whether resisting confession pressure is associated with reduced physiologic activity indicative of stress.

Research Overview

This study tested two hypotheses regarding stress responses to accusation and interrogation. First, it tested whether innocence is associated with reduced physiologic activity indicative of stress. Second, it examined whether resisting confession pressure is associated with greater stress-related physiologic activity, consistent with a pattern of resource depletion. Adapting the paradigm of Russano et al. (2005), participants were induced (or not) to help a confederate “cheat” on a problem solving task and subsequently accused and interrogated by an experimenter while physiologic indices of stress were simultaneously measured. To examine how the decision to confess or maintain one’s innocence influenced physiologic activity, participants were later pressured to sign a confession, and—after having made their confession decisions—their physiologic responses were assessed.

The current study’s use of physiologic outcomes is novel in the context of interrogation and confession research and offers two advantages. First, because physiologic responses occur largely beyond conscious control, they are less susceptible to the biases that can affect self-reports or other behaviors that are subject to voluntary control. Second, because we assessed physiologic outcomes while participants were accused and interrogated, the measures were contemporaneous with these events, thereby avoiding the shortcomings associated with retrospective accounts.

Method

Participants

Participants (N = 141) from a large Midwestern university participated in the experiment to satisfy a course requirement. Data from 9 participants were excluded from the analyses for several reasons, including being suspicious of the study’s true purpose (n = 1), refusal to help the confederate cheat (n = 6), withdrawing prior to the study’s completion (n = 1), and physiologic data acquisition failure (n = 1). The final sample consisted of 132 participants (74 women, 58 men), including 6 African Americans, 2 Asian Americans, 109 European Americans, 1 Native American, 1 Asian-Indian American, 6 participants who self-described as multietnic, and 7 participants who self-described as “other.” The average age of the sample was 19.4 years (SD = 1.6). All participants were native English speakers.

Design

Participants were randomly assigned to either an innocent (n = 74) or guilty (n = 58) experimental condition. Participants were paired with a confederate and instructed to solve six logic problems, three independently and three jointly. In the guilty (but not the innocent) condition the confederate solicited and received the participant’s help in solving one of the individual logic problems, thus constituting being guilty of cheating in the experiment.

Measures

Physiologic activity was assessed three times during each of three phases of the experiment: prior to the experimental manipulation (baseline phase), during accusation and interrogation (interrogation phase), and after participants had either confessed or refused to confess (postconfession phase). The term “postconfession” is used for conciseness, though strictly speaking it is a misnomer because not all participants confessed. Rather, the postconfession phase actually corresponds to the time after which the participant had been pressured to confess and had ultimately confessed or refused to confess.

Blood pressure and heart rate. Systolic and diastolic blood pressure (SBP, DBP; mmHg) and heart rate (HR) in beats per minute (bpm) were assessed with the WelchAllyn Spot Vital Signs LXi blood pressure machine. Because approximately 20 s were required to obtain a reading, the 1st, 2nd, and 3rd readings in each phase were initiated at 30, 120, and 230 s after the start of each 5-min physiologic assessment phase. The timing of these three readings provided values at equally spaced intervals throughout the phase, specifically at 50, 150, and 250 s. In addition, it caused the three blood pressure and heart rate values within each 5-min phase to be obtained in the middle of each of the three consecutive
100 second periods across which the continuous data for the assessment of respiratory sinus arrhythmia and pre-ejection period were acquired, as described below.

Respiratory sinus arrhythmia (RSA). RSA is the effect of respiration on heart rate variability. Because RSA predominantly reflects vagal influences on the heart, it provides an index of parasympathetic nervous system activity (PNS; Berntson, Quigley & Lozano, 2007). Because psychological stress can elicit reductions in PNS activity, RSA is an informative outcome variable for assessing stress reactivity. (e.g., Berntson et al., 1994). RSA was measured through electrocardiograms (ECGs), which were acquired using a lead II configuration and digitized at 1,000 Hz using Mindware Technologies’ BioLab software and Bionex impedance module and chassis. Postacquisition processing entailed inspection of every heartbeat for artifacts using Mindware’s HRV application, the latter of which performed spectral analysis of the ECG signal to calculate RSA as the log-transformed power in the high frequency range (.12–.40 Hz), yielding values with the units log of milliseconds-squared (ln(ms²)). In each 5-min physiologic assessment phase, RSA values were based on data collected across three consecutive 100-s periods.

Pre-ejection period (PEP). PEP is the length of time in milliseconds from the onset of ventricular stimulation to the ejection of blood through the aortic valve, and inversely indexes sympathetic nervous system (SNS) activity, with shorter times corresponding to greater SNS activation (Berntson et al., 2007). Increased SNS activity mobilizes the individual for action, and increases in response to psychological stressors, particularly those requiring an effortful response as in active coping (Berntson et al., 1994; Obrist, 1981). PEP values were based on thoracic impedance data acquired via four spot electrodes applied in the configuration of Qu, Zhang, Webster, and Tomkins (1986) and digitized at 1,000 Hz using the Mindware BioLab software and Bionex hardware. Postacquisition processing entailed inspection of every heartbeat for artifact removal using Mindware’s IMP application, the latter of which performed ensemble averaging across the assessment period to yield PEP. Each 5-min physiologic assessment phase yielded three PEP values based on data collected across three consecutive 100-s periods.

Confession statement. Participants were presented with the confession statement “I admit to having cheated on the triangle problem,” beneath which a signature line was drawn. Participants either confessed or refused to confess by signing or not signing the statement.

Sex, height, and body shape. Participants self-reported their sex. The experimenter measured the participant’s height and privately recorded the participant’s body shape utilizing the Figure Rating Scale, with possible scores ranging from 1 to 9, in order of increasing largeness (Stunkard, Sorenson, & Schulsing, 1983).

Consent Process

To prevent the participation of vulnerable individuals, the consent form confirmed that participants met eligibility requirements that had been posted at the time of sign-up. Participants were not permitted to participate if they reported any of the following: being less than 18 years old, being hypertensive, taking antihypertensive medication, having a history of heart problems, fainting, having low blood pressure, being pregnant, or possibly being pregnant.

Procedures

Each session required approximately 75 min to complete and commenced with the experimenter partnering the participant with a confederate, the latter of whom posed as another participant. Across two semesters of data collection, eight undergraduate research assistants served as experimenters, five of whom were women. To justify the physiologic measures and reduce suspicion, the experimenter described the study as an investigation into the effect of stress on physiologic activity, an effect that would ostensibly be investigated by having the pair solve logic problems of various difficulties. Following the cover story, the pair engaged in a 3-min get-acquainted exercise that enabled the confederate to build rapport with the participant so as to increase the likelihood that participants in the guilty condition would comply with the confederate’s later request to cheat. Shortly thereafter, a rigged procedure identified the participant as the member of the pair whose physiologic activity would be assessed, at which point the confederate exited the room and the experimenter applied electrodes and a blood pressure cuff to the participant. An unseen technician in an adjacent room remotely acquired physiologic measures from the participant who relaxed while alone for the 5-min baseline period.

Upon completion of the baseline period, the experimenter explained the logic problem task, making it clear that the pair should work alone on problems designated as individual problems, and jointly on problems designated as team problems. The experimenter then left the pair in private to work on the logic problems, which required approximately 15 to 20 min to complete. The technician remotely inflated the blood pressure cuff at predetermined times throughout the logic problem task to create the appearance that physiologic data were being collected, though this was not actually the case. Also during the logic problem task, the confederate delivered the experimental manipulation, thus keeping the experimenter blind to condition. In the guilty (but not the innocent) condition the confederate requested and received the participant’s help in solving the final individual problem. After completing the logic problem task, the pair notified the experimenter who returned, collected the logic problem materials, distributed filler surveys, and then left the room again for the supposed purpose of scoring the logic problems.

Upon returning to collect the filler surveys, the experimenter stated that there was a problem with the pair’s answers to the logic problems, after which the experimenter escorted the confederate out of the room, ostensibly for questioning. The experimenter returned 5 min later and recited a script adapted from Russano et al. (2005). The 5-min interrogation phase assessment of the participant’s physiologic activity began 75 s after the experimenter began reciting the script, at which point participants would be clearly aware that they were being accused of having shared answers with the confederate on one of the individual problems. As part of this script, the experimenter explained that the professor in charge of the study had been notified about the incident and was annoyed and upset about what had happened. The experimenter expressed uncertainty regarding how the professor would handle the situation, whether it might be necessary for him to involve other university offices, and noted that he might even consider the incident to be a case of cheating. The experimenter questioned
the participant about what had happened during the logic problem task, supposedly to provide the professor with detailed information about the incident. After completing the questioning of the participant, the experimenter exited the room under the guise of needing to contact the professor for further instructions, thus leaving the participant alone for approximately the final 2 min of interrogation phase physiologic recording.

Upon returning several minutes later, the experimenter pressured the participant to sign a confession statement using a script adapted fromRussano et al. (2005). Specifically, the experimenter explained that the professor wanted the situation documented by having the participant sign a statement confessing to having cheated on one of the individual logic problems. The experimenter then proceeded to write the confession statement on a blank piece of paper. Just prior to passing the confession statement to the participant, the experimenter employed a minimization procedure (Russano et al., 2005), stating that it was in the participant’s best interests to sign the statement because it would indicate cooperation and make the professor less upset about the incident. If the participant refused to sign the statement, the experimenter pressured the participant up to two additional times. The length of time that a participant was pressured to confess, therefore, differed depending on the participant’s confession behavior. Participants who confessed at the first prompt were pressured for approximately 1 minute, whereas those who confessed at the last prompt or who never confessed were pressured for approximately 1 min 20 s. After the participant had either confessed or thrice refused to confess, the experimenter left the room, ostensibly to provide a status report to the professor. This marked the start of the post-confession phase during which time physiologic data were collected for the third and final time across a 5-min period. Thus, the time from the cessation of confession pressure to the physiologic assessments of the post-confession phase was the same for all participants.

Upon completion of the post-confession period, the experimenter returned to begin the funnel debriefing, which included opportunities for the participant to report suspiciousness. Prior to revealing the true nature of the study the experimenter asked the participant, “How anxious were you when I accused you of cheating on the triangle problem?” After the participant’s free response, the experimenter responded with the query, “So, would you say you were not at all anxious, a little anxious, moderately anxious, quite anxious, or very anxious?” and assigned the participant’s answer a score of 1 through 5, with greater values indicating greater anxiety.

The participant was then fully informed regarding the true nature of the study and the deception used in the research, and explained the differences associated with experimenters for any physiologic dependent variable (ps > .15). At the time of debriefing, on average participants reported being moderately anxious at being accused of cheating (M = 2.98, SE = 0.10), with the innocent reporting less anxiety than the guilty (M = 2.66, SE = 0.13 vs. M = 3.39, SE = 0.15; 95% confidence interval [CI] [−1.12, −0.33]), \( t(129) = 3.64, p < .001, d = 0.64 \).

Effect of Innocence Versus Guilt on Physiologic Reactivity to Interrogation

Repeated-measures regression analyses tested the effect of innocence versus guilt on physiologic reactivity to the accusation and interrogation. The dependent variables were three change-score values created by subtracting the average baseline value from each of the three interrogation phase values for a particular physiologic measure. Separate analyses were conducted for SBP, DBP, HR, RSA, and PEP. In addition to controlling for sex, height, and body shape, the predictive model included the average baseline value for the corresponding measure, the reading number, which corresponded to the 1st, 2nd, or 3rd reading in the phase, and the experimental condition (innocent vs. guilty). Continuous predictors were mean centered and analyses included all main effect terms. The interaction between the experimental condition and reading number was included in the final model only if significant.

Ancillary tests pertaining to the first interrogation-phase readings revealed that participants responded physiologically to the accusation and interrogation in the expected direction for all five physiologic outcomes (ps < .001). This corresponded to a manipulation check of the stressfulness of the procedure, indicating that accusation and interrogation produced stress-related physiologic changes. With respect to the experimental manipulation, Table 2 presents detailed results from analyses of physiologic reactivity during the interrogation phase. Consistent with study hypotheses, innocence was associated with less SBP (\( b = −4.66 \text{ mmHg}, 95\% \text{ CI } [−7.36, −1.96] \)), \( t(123) = 3.41, p < .001 \), and DBP (\( b = −1.60 \text{ mmHg}, 95\% \text{ CI } [−3.02, −0.17] \)), \( t(123) = 2.22, p = .028 \), reactivity, as shown in Figure 1. For HR and RSA, the effect of being innocent as opposed to guilty differed across readings for both HR (\( b = 5.83 \text{ bpm}, 95\% \text{ CI } [2.92, 8.74] \)), \( t(253) = 3.94, p < .001 \), and RSA (\( b = −0.42 \text{ ln}(\text{ms}^2), 95\% \text{ CI } [−0.65, −0.19] \)), \( t(246) = 3.64, p < .001 \). The innocent initially demonstrated less HR reactivity and RSA reduction (i.e., less PNS withdrawal) than the guilty, with these between-groups differences fading across subsequent readings, as depicted in Figure 2. No significant manipulation effects emerged for PEP (\( p = .19 \)). Overall, these results show that the innocent exhibited less physiologic reactivity to being accused and interrogated than did the guilty, thereby suggesting that they perceived less threat and potential harm in the situation.

Confession

Results of a logistic regression analysis determined that innocent participants were less likely to confess than were guilty participants (\( b = −1.44, \text{ OR } = 0.06, 95\% \text{ CI } [0.02, 0.17] \)), \( \chi^2(1, N = 132) = 25.54, p < .001, d = 0.98 \).
of SNS activity, the guilt-confession group was significant only for PEP, the indicator for any outcome. The predictors included sex, height, body-shape, baseline physiologic values, guilt-confession group, and reading number. With continuous predictors being mean centered, the interaction between guilt-confession group and reading number was not feasible to fully cross the innocent versus guilty manipulation. We created three guilt-confession groups that corresponded to guilty participants who confessed (guilty-confessed), innocent participants who refused to confess (innocent-refused), and innocent participants who confessed (innocent-confessed). In repeated measures regression analyses similar to those described above, the dependent variables were the three postconfession physiologic reactivity values relative to baseline. The predictors included sex, height, body-shape, baseline physiologic values, guilt-confession group, and reading number, with continuous predictors being mean centered. The interaction of the guilt-confession group with reading number was not included in the final models because it did not attain significance for any outcome.

Results presented in Table 3 show that the main effect of the guilt-confession group was significant only for PEP, the indicator of SNS activation, $F(2, 111) = 3.82, p = .025, d = 0.34$. As shown in Figure 3, the innocent-refused group demonstrated the greatest decrease in PEP, corresponding to the greatest amount of SNS activation. Further tests revealed that the innocent-refused group’s postconfession PEP values were significantly less than baseline, $M = -13.9$ ms, $SE = 4.5$, 95% CI $[-22.8, -5.0]$, $t(235) = -3.07, p = .002, d = 0.40$, whereas values were not different from baseline for either the guilty-confessed, $M = 0.3$ ms, $SE = 4.2$, 95% CI $[-8.0, 8.5]$, $t(235) = 0.06, p = .95, d = .01$, or innocent-confessed groups, $M = -4.5$ ms, $SE = 4.9$, 95% CI $[-14.2, 5.2]$, $t(235) = -0.92, p = .359, d = .12$.

Though this analysis presents refusal to confess as a cause of greater SNS activity, we also evaluated the feasibility of alternative interpretations. Specifically, it is conceivable that greater SNS activity caused participants to more vigorously defend their innocence, or that an individual difference factor might have produced both greater SNS reactivity and resistance to confession pressure. To address these possibilities, we tested whether the main effect of the guilt-confession group predicted PEP reactivity during the interrogation phase, prior to confession. However, no relationship existed between the guilt-confession group and prior PEP reactivity, $F(2, 114) = 1.11, p = .332$, thus not supporting a reversed direction of causality, nor the possibility that an individual difference variable caused both greater PEP reactivity and refusal. Accordingly, the results pertaining to PEP values obtained subsequent to confession decisions are consistent with the hypothesis that resisting confession pressure caused elevated SNS activity. These results further suggest a process of resource depletion, wherein resisting confession pressure comes at a physiologic cost that, if continued throughout a lengthy interro-

### Table 1

<table>
<thead>
<tr>
<th>Experimental condition</th>
<th>Innocent ($n = 74$)</th>
<th>Guilty ($n = 58$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
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<tr>
<td>Demographic characteristics</td>
<td></td>
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</tr>
<tr>
<td>Sex (% female)</td>
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<tr>
<td>Height (in)</td>
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<td>Body shape</td>
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<td>Baseline phase physiology</td>
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<td></td>
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<tr>
<td>SBP</td>
<td>116.1</td>
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</tr>
<tr>
<td>DBP</td>
<td>74.1</td>
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</tr>
<tr>
<td>HR</td>
<td>69.9</td>
<td>10.9</td>
</tr>
<tr>
<td>RSA</td>
<td>6.7</td>
<td>1.0</td>
</tr>
<tr>
<td>PEP</td>
<td>136.9</td>
<td>22.6</td>
</tr>
<tr>
<td>Interrogation phase physiology</td>
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<td></td>
</tr>
<tr>
<td>SBP</td>
<td>124.4</td>
<td>13.6</td>
</tr>
<tr>
<td>DBP</td>
<td>78.9</td>
<td>6.3</td>
</tr>
<tr>
<td>HR</td>
<td>77.7</td>
<td>15.2</td>
</tr>
<tr>
<td>RSA</td>
<td>6.8</td>
<td>1.1</td>
</tr>
<tr>
<td>PEP</td>
<td>125.3</td>
<td>27.3</td>
</tr>
<tr>
<td>Confession decisions</td>
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<td></td>
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<tr>
<td>Percent confessed</td>
<td>43.2%</td>
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<tr>
<td>Post-confession phase physiology</td>
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<td></td>
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<tr>
<td>SBP</td>
<td>124.0</td>
<td>13.9</td>
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<tr>
<td>DBP</td>
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<tr>
<td>HR</td>
<td>75.3</td>
<td>13.8</td>
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<tr>
<td>RSA</td>
<td>6.8</td>
<td>1.0</td>
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<tr>
<td>PEP</td>
<td>125.1</td>
<td>24.5</td>
</tr>
<tr>
<td>Anxiety felt in response to cheating (retrospective self-report)</td>
<td>2.66</td>
<td>1.12</td>
</tr>
</tbody>
</table>

Note. SBP = systolic blood pressure (mmHg); DBP = diastolic blood pressure (mmHg); HR = heart rate (bpm); RSA = respiratory sinus arrhythmia (ln(ms²)); PEP = preejection period (ms).

### Relationship of Confession to Subsequent Physiologic Reactivity

Because only four guilty participants refused to confess, it was not feasible to fully cross the innocent versus guilty manipulation with participants’ confession decisions in predicting postconfession physiologic activity. Therefore, we created three guilt-confession groups that corresponded to guilty participants who confessed (guilty-confessed), innocent participants who confessed (innocent-confessed), and innocent participants who refused to confess (innocent-refused). In repeated measures regression analyses similar to those described above, the dependent variables were the three postconfession physiologic reactivity values relative to baseline. The predictors included sex, height, body-shape, baseline physiologic values, guilt-confession group, and reading number, with continuous predictors being mean centered. The interaction of the guilt-confession group with reading number was not included in the final models because it did not attain significance for any outcome.

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respiratory sinus arrhythmia reactivity (\ln{ms^2}); PEP manipulation; coefficients reflect effect of being innocent compared with guilty. Interaction term only included in final model if significant.

Table 2
Prediction of Physiologic Reactivity During Accusation and Interrogation

<table>
<thead>
<tr>
<th></th>
<th>SBP</th>
<th>DBP</th>
<th>HR</th>
<th>RSA</th>
<th>PEP</th>
</tr>
</thead>
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<tr>
<td>Intercept</td>
<td>21.40</td>
<td>11.20</td>
<td>21.09</td>
<td>−0.30</td>
<td>−19.63</td>
</tr>
<tr>
<td>Baseline</td>
<td>0.05 (0.05)</td>
<td>−0.10 (−0.10)</td>
<td>−0.08 (−0.05)</td>
<td>−0.52 (−0.42)**</td>
<td>−0.04 (−0.05)</td>
</tr>
<tr>
<td>Sex</td>
<td>−1.57 (−0.15)</td>
<td>−0.14 (−0.02)</td>
<td>1.04 (0.06)</td>
<td>−0.15 (−0.12)</td>
<td>−1.13 (−0.05)</td>
</tr>
<tr>
<td>Height</td>
<td>−0.01 (−0.00)</td>
<td>0.10 (0.06)</td>
<td>0.07 (0.02)</td>
<td>−0.03 (−0.09)</td>
<td>−0.24 (−0.04)</td>
</tr>
<tr>
<td>Body shape</td>
<td>−1.24 (−0.18)*</td>
<td>−0.35 (−0.08)</td>
<td>−0.77 (−0.07)</td>
<td>−0.01 (−0.01)</td>
<td>−1.12 (−0.08)</td>
</tr>
<tr>
<td>Reading (R)</td>
<td>−6.11 (−0.59)**</td>
<td>−3.08 (−0.50)**</td>
<td>−6.91 (−0.41)**</td>
<td>0.21 (0.16)**</td>
<td>4.23 (0.20)**</td>
</tr>
<tr>
<td>Innocent (I)</td>
<td>−4.66 (0.45)**</td>
<td>−1.60 (0.26)*</td>
<td>−16.86 (1.00)**</td>
<td>1.20 (−0.92)**</td>
<td>−4.25 (0.20)</td>
</tr>
<tr>
<td>R × I*</td>
<td>5.83 (−0.35)**</td>
<td>−0.42 (0.32)**</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. SBP = systolic blood pressure reactivity (mmHg); DBP = diastolic blood pressure reactivity (mmHg); HR = heart rate reactivity (bpm); RSA = respiratory sinus arrhythmia reactivity (\ln{ms^2}); PEP = pre-ejection period reactivity (ms); baseline = average baseline value for corresponding physiologic measure; sex = coefficients reflect effect of being female vs. male; reading = reading number during phase (1, 2, 3); innocent = experimental manipulation; coefficients reflect effect of being innocent compared with guilty. Interaction term only included in final model if significant.

* p ≤ .05. ** p ≤ .01. *** p ≤ .001.

gation, could progressively degrade suspects’ ability to maintain their innocence.

Discussion

This research examined how accusation and interrogation, as well as continued denials of guilt, influence suspects’ physiologic responses. Participants were led to engage in either innocent or guilty behavior, were then accused and interrogated for misconduct, and were subsequently pressured to confess. Physiologic indices of stress were assessed during accusation and interrogation, and after participants had been pressured to confess and had ultimately either confessed or refused to confess. Two primary findings characterized the present research. First, innocent participants exhibited less physiologic reactivity to accusation and interrogation than did guilty participants. Second, innocent participants who denied guilt despite being pressured to confess exhibited elevated SNS activity relative to baseline, whereas the innocent and guilty participants who confessed under the same pressure did not.

These results are important for several reasons. First, they provide evidence that innocent suspects initially experience less stress in response to accusation and interrogation than do guilty suspects. The fact that stress emerges from the perception that one is threatened and may be unable to cope with that threat (Lazarus & Folkman, 1984) suggests that, in comparison to their guilty counterparts, the innocent participants in our research perceived themselves to be less imperiled by the accusation, and perhaps more capable of successfully managing their predicament. This interpretation is consistent with the phenomenology of innocence, which holds that innocent suspects believe themselves to be pro-

Figure 1. Systolic and diastolic blood pressure reactivity during interrogation as a function of innocence and guilt. Values generated by regression model results.

Figure 2. Heart rate and respiratory sinus arrhythmia reactivity during interrogation as a function of innocence and guilt. Values generated by regression model results.
tacted from negative outcomes (Kassin, 2005), a misperception
that can lead them to make choices that have the unintended effect
of increasing their risk of self-incrimination. The current findings
show that the state of being actually innocent produces an imme-
diate and fundamental difference in suspects that could set in
motion an array of ill-advised decisions and behaviors that could
put innocent suspects’ long-term outcomes in jeopardy.

It should be noted that the initial physiologic differences asso-
ciated with innocence and guilt are not necessarily important in
and of themselves, but rather are significant because they reflect
critical initial differences between the innocent and the guilty in
how they differently construe the same situation. The smaller
physiologic reactions of the innocent occurring in response to
being accused and interrogated signal the experience of less stress,
ingerating that they perceive themselves to be at less risk—a
perception that would discourage taking strong self-protective
actions, such as invoking one’s rights to silence and counsel. It
should further be noted that the cardiovascular system exists to
respond to the body’s physical needs for oxygen, nutrients, and the
removal of metabolic wastes. When confronted with purely psy-
chological stress—such as was the case in the current study—the
cardiovascular system responds to regulate the body for physical
activity, as part of the classic fight or flight response. However,
this physical activity never occurred in the current study. Because
the cardiovascular system is regulated by feedback mechanisms,
it will not continue to excessively pump blood through the body in
the absence of a physical need. Therefore, it is not surprising that
initial differences between the innocent and the guilty might
quickly narrow, as was observed for HR and RSA, because the
actual metabolic needs of the innocent and the guilty were quite
similar, leading feedback mechanisms to regulate their cardiovas-
cular activity to similar levels after a relatively short period of
time.

The physiologic differences reported in the current study should
distinguish from those associated with lie detection. Lie
detection makes use of marked physiologic responses to specific
questions to identify when an individual answers untruthfully. By
contrast, in the current study both the innocent and the guilty were
characterized by conspicuous physiologic responses when particip-
ants grasped that they were being accused of wrongdoing. Thus,
the differences between the innocent and the guilty were not
categorical in nature, but a matter of degree. For this reason, the
results are not useful for establishing the innocence or guilt of any
particular individual, but instead reflect average differences based
on responses aggregated across many individuals. Furthermore,
there were many cases in which innocent participants evidenced
greater physiologic reactions than guilty participants, thus demon-
strating that the responses that constitute the current results are of
little probative value.

The findings of the present research are also important because
they suggest that innocent suspects who continue to deny guilt
during an interrogation may experience a gradual decline in their
psychological and emotional resources. In comparison to the in-
ocent and guilty participants who had yielded to interrogation
pressure and confessed, innocent participants who resisted that

Table 3
Prediction of Physiologic Reactivity after being Pressured to Confess

<table>
<thead>
<tr>
<th>Group</th>
<th>SBP (β)</th>
<th>DBP (β)</th>
<th>HR (β)</th>
<th>RSA (β)</th>
<th>PEP (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>10.28</td>
<td>4.98</td>
<td>3.44</td>
<td>0.41</td>
<td>4.59</td>
</tr>
<tr>
<td>Baseline</td>
<td>0.00 (0.00)</td>
<td>-0.11 (-0.12)</td>
<td>-0.12 (-0.13)</td>
<td>-0.52 (-0.42)**</td>
<td>-0.46 (-0.36)**</td>
</tr>
<tr>
<td>Sex</td>
<td>-0.33 (-0.04)</td>
<td>1.27 (0.25)</td>
<td>0.22 (0.02)</td>
<td>-0.06 (-0.05)</td>
<td>-8.28 (-0.27)</td>
</tr>
<tr>
<td>Height</td>
<td>0.24 (0.10)</td>
<td>0.19 (0.14)</td>
<td>0.31 (0.11)</td>
<td>-0.01 (-0.04)</td>
<td>-0.05 (0.01)</td>
</tr>
<tr>
<td>Body shape</td>
<td>-0.55 (-0.09)</td>
<td>-0.20 (-0.06)</td>
<td>-0.59 (-0.08)</td>
<td>-0.07 (-0.07)</td>
<td>0.06 (-0.03)</td>
</tr>
<tr>
<td>Reading</td>
<td>-0.54 (-0.06)</td>
<td>-0.26 (-0.05)</td>
<td>1.52 (0.15)**</td>
<td>-0.16 (-0.12)**</td>
<td>0.45 (-0.01)</td>
</tr>
<tr>
<td>Group</td>
<td>F = 0.25</td>
<td>F = 0.78</td>
<td>F = 0.32</td>
<td>F = 0.02</td>
<td>F = 3.82**</td>
</tr>
</tbody>
</table>

Note. SBP = systolic blood pressure reactivity (mmHg); DBP = diastolic blood pressure reactivity (mmHg); HR = heart rate reactivity (bpm); RSA = respiratory sinus arrhythmia reactivity (ln[ms²]); PEP = preejection period reactivity (ms); baseline = average baseline value for corresponding physiologic measure; sex = coefficients reflect effect of being female vs. male; reading = reading number during phase (1, 2, 3); group = guilt-confession group (guilty-confessed, innocent-confessed, and innocent-refused).

*p ≤ .05. **p ≤ .01. ***p ≤ .001.

Figure 3. Preejection period reactivity during postconfession phase as a function of guilt-confession group. Values generated by regression model results.
pressure and maintained their innocence demonstrated elevated SNS reactivity, as indicated by shorter PEP values. The experience of greater SNS activity among nonconfessing innocent participants could reflect engagement in active coping, wherein they mobilized their psychological resources and sought an outcome they believed to be under their control, namely resisting the unjust accusation and the pressure to confess (e.g., Obrist, 1981). The physiologic effect associated with confession refusal is particularly noteworthy because protracted SNS activation has been linked to mental fatigue and reduced motivation (Mizuno et al., 2011)—the very types of responses that characterize suspects subjected to unusually long and coercive interrogations (Warden & Drizin, 2009). Therefore, results of the present study suggest that even though innocent suspects may initially experience less stress than guilty suspects, subsequently resisting interrogation pressures could activate a stress-related physiologic mechanism that promotes fatigue and despair, thereby eroding will-power and contributing to false confessions.

In considering the relationship between confession decisions and subsequent physiologic activity it is worthwhile to discuss the possibility that participants confessed to escape unbearable physiologic stress caused by being pressured to confess, as theorists have proposed can sometimes occur (Kassin et al., 2010; Leo, 2008). Applying this idea to the current research raises the possibility that confessors initially experienced a greater stress response to confession pressure than did nonconfessors, confessed as a way to escape that stress, and then—having achieved the short-term gains that a confession can provide—exhibited reduced physiologic activity. In considering this possibility, it is important to note three points. First, because it was not the purpose of the current investigation to study whether unbearable stress could produce confessions, the procedures were not designed to produce intense stress. Participants were only pressured to confess for a short period of time, and the procedure included a minimization tactic that both diminished the seriousness of the offense and presented the experimenter as a sympathetic figure. For these reasons, it is improbable that participants confessed because they found themselves unable to bear the situational stress. Instead, it seems more likely that participants confessed because they perceived it to be in their best interest to do so.

Second, because the current study was not intended to determine whether intense physiologic stress could trigger confessions, the data collection procedures were not crafted to test such a process. Specifically, stress-related physiologic activity was not assessed while participants were being pressured to confess. Rather, because a key aim of this research was to examine whether confession decisions might predict a physiologic response suggestive of resource depletion, physiologic activity was assessed after the participant had ultimately confessed or not confessed. As a result, this study does not allow a test of whether antecedent stress predicted subsequent confessions.

Third, it is important to realize that even if participants did confess because they could no longer endure the physiologic stress of the procedures, that possibility does not constitute an alternative interpretation of the reported results. That is, even if confessors reduced their physiologic activity by confessing, it necessarily follows that those who refused to confess continued to experience elevated physiologic activity precisely because they did not confess. Regardless of what factor led some participants to confess and some to refuse, successfully resisting confession pressure nonetheless predicted subsequently greater physiologic activity, consistent with a process of resource depletion.

Finally, even though the time from the point at which confession pressure ended to when the postconfession physiologic assessments began was the same for all participants, participants who refused to confess were subjected to confession pressure for approximately 20 s longer than those who confessed immediately. This raises the possibility that this additional time during which nonconfessing participants had previously experienced confession pressure produced the subsequent differences observed in SNS activity. However, it should be recognized that this possibility does not threaten the interpretation that refusal to confess produced the physiologic differences. Resisting confession pressure is inextricably tied to being exposed to that pressure for a longer period of time; when one refuses to confess, confession pressure continues to be applied. Indeed, false confessions tend to occur after the suspect has refused to confess for an extended period of time, with one study finding that half of all interrogations that produced documented false confessions lasted more than 12 hr (Drizin & Leo, 2004). Nonetheless, it is the case that the current study does not enable a disentanglement of the potential proximal causes of the physiologic outcomes associated with confession refusal, an issue that requires additional study.

**Strengths and Limitations**

There are several strengths of this research that serve to increase confidence in the conclusions. First, the experimental manipulation provided ground truth with respect to participants’ true innocence or guilt, and removed potential confounding between the states of being actually innocent or guilty with any individual differences that characterize individuals who have freely chosen to engage in either innocent or guilty behavior. Second, the procedures produced a situation high in experimental realism in that participants—aware of their own objective innocence or guilt—truly believed that they were being accused of misconduct, and that they were in jeopardy of experiencing real and meaningful consequences. Thus, participants’ responses are likely to correspond to those that would be experienced by suspects of crimes, though probably weaker in magnitude. Third, the use of physiologic measures to assess stress reactions minimized the potential influence of factors that can affect self-report. In addition, the physiologic measurements enabled us to assess participants’ reactions simultaneously with the transpiration of critical events, thereby avoiding any potential influences associated with the passage of time that might have otherwise affected the observed relationships.

The results of the current study should also be considered in light of several limitations. First, even though our procedures were psychologically coercive in the sense that participants were pressured to confess and subjected to a minimization tactic that reduced the apparent seriousness of signing the confession statement, ethical concerns precluded us from employing other, harsher coercive tactics such as the threat of severe punishment, confrontational questioning, or sleep deprivation. Accordingly, we cannot know whether the relationships observed in the current study would arise in the course of actual police interrogations that utilize such tactics. Nonetheless, the procedures we used did create a context reasonably analogous to a police interrogation, and were
effective at psychologically engaging participants who felt significant stress as evidenced by their physiologic responses. Therefore, it seems reasonable to presume that the patterns observed in the current study would also be likely to emerge in actual police interrogations.

Second, the relatively brief time that participants were interrogated did not permit examination of physiologic responses that arise in the course of prolonged interrogation. For example, mental stress is first characterized by increased cortisol secretion for energy mobilization, whereas protracted stress leads to cortisol down-regulation and decreased motivation (Boksem & Tops, 2008). Such physiologic effects may encourage confession because even suspects who can vigorously resist confession at first may, after many hours, become exhausted, and lose their will to resist (Davis & Leo, 2012). Third, participants were not criminal suspects, but university undergraduates. However, because college students are likely more intelligent and less prone to suffer cognitive deficits and mental illness than are criminal suspects, the current sample was probably less susceptible to coercion (Gudjonsson, 2003), suggesting that the present results may underestimate the effects that would be observed in a more vulnerable population. Finally, it merits noting that neither the innocence-guilt manipulation nor the guilt-confession group predicted all of the physiologic outcomes considered. However, this is not surprising, considering that different physiologic systems control each of the dependent variables, and the systems’ effects on the measured variables are complex and dynamic. The particular response pattern of these more fundamental physiologic systems is likewise multiply determined by not only the demands of the situation, but also by individual differences pertaining to construals of the situation, coping responses, and physical condition (Brownley, Hurwitz, & Schneiderman, 2000). For these reasons it is not unexpected that the various physiologic outcomes did not respond in perfect uniformity.

Conclusion

Results showed that the innocent exhibited smaller stress-related physiologic reactions in response to being accused and interrogated. Thus, findings supported the hypothesis that the innocent perceive less danger in their status as suspects, but university undergraduates. However, because college students are likely more intelligent and less prone to suffer cognitive deficits and mental illness than are criminal suspects, the current sample was probably less susceptible to coercion (Gudjonsson, 2003), suggesting that the present results may underestimate the effects that would be observed in a more vulnerable population. Finally, it merits noting that neither the innocence-guilt manipulation nor the guilt-confession group predicted all of the physiologic outcomes considered. However, this is not surprising, considering that different physiologic systems control each of the dependent variables, and the systems’ effects on the measured variables are complex and dynamic. The particular response pattern of these more fundamental physiologic systems is likewise multiply determined by not only the demands of the situation, but also by individual differences pertaining to construals of the situation, coping responses, and physical condition (Brownley, Hurwitz, & Schneiderman, 2000). For these reasons it is not unexpected that the various physiologic outcomes did not respond in perfect uniformity.

References


Received October 23, 2012
Revision received April 23, 2013
Accepted May 16, 2013