

Passive avoidance learning as a function of behavioral inhibition and activation among female inmates

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Abstract

This study examined the association between temperament and behavioral disinhibition among incarcerated females ($N = 128$) within a passive avoidance learning (PAL) paradigm. Participants completed measures of temperament dimensions associated with behavioral inhibition (BI) and behavioral activation (BA) as well as one of two PAL tasks. Task 1 allowed participants to reflect on their response feedback for up to 7 s, whereas Task 2 involved a fixed duration (3 s) of response feedback. For Caucasian participants, those high in both BA and BI committed more passive avoidance errors (PAEs) in Tasks 1 and 2, and reflected less on punishment feedback in Task 1 than other participant groups. For Task 1, reflection on punishment was negatively associated with PAEs.

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1. Introduction

Passive avoidance learning (PAL) refers to the learned inhibition of behavior in order to avoid punishment (Newman, 1987). Research on PAL has been useful in clarifying the association of personality and temperament characteristics with disinhibited behavior. Psychopathy, extraversion, low anxiety, and/or impulsivity are typically associated with PAL deficits among Caucasian males. These findings, however, have not generalized to different ethnic groups (Kosson, Smith, & Newman, 1990; Newman & Schmitt, 1998; Thornquist & Zuckerman, 1995), and few studies have examined behavioral disinhibition among females, particularly female prisoners (Vitale & Newman, 2001).

Several theories have proposed that hyposensitivity to punishment underlies behavioral disinhibition and poor PAL (Cloninger, 1987; Gray, 1987). For example, Cloninger (1987) has proposed that *Harm Avoidance* (HA) is associated with trait anxiety, inhibition in response to punishment cues (passive avoidance), and avoidance of punishing stimuli. In contrast, *Novelty Seeking* (NS) is associated with behavioral activation, including impulsivity and responsivity to reward. Similarly, Gray (1987) has described a *Behavioral Inhibition System* (BIS) associated with anxiety and behavioral inhibition to punishment cues. In contrast, Gray's *Behavioral Activation System* (BAS) is activated by cues that signal reward or relief from punishment and promotes approach behavior. In both Gray's and Cloninger's theories, behavioral activation is associated with impulsivity and extraversion, whereas weak behavioral inhibition is associated with lower anxiety and poor PAL. Cloninger (1987), however, has argued that NS may further contribute to poor PAL.

Alternatively, Newman has proposed that poor PAL is associated with heightened behavioral activation (Newman, 1987; Patterson & Newman, 1993). In response to reward cues, individuals with strong BASs show increased intensity of behavioral responding and a narrowed attentional focus; consequently, reward cues are more salient than punishment cues. Therefore, when persons with strong BASs seek rewards, they fail to attend to punishment cues or punishing consequences that suggest the need to modify this response set.

According to Newman's theory, strong behavioral activation underlies disinhibited behavior under conditions that involve both reward and punishment contingencies, when, theoretically, both BIS and BAS systems are activated (Newman, Widom, & Nathan, 1985). This theory suggests that poor reflection on punishment and a resulting lack of inhibitory associations to punishment cues contribute to disinhibited behavior in impulsive persons. In support of this view, studies have demonstrated PAL deficits among males with features associated with behavioral activation or impulsivity, including psychopathy (Newman & Schmitt, 1998), juvenile delinquency (Newman et al., 1985), and extraversion (Patterson, Kosson, & Newman, 1987).

Although studies have produced reliable findings in Caucasian male samples, the generalizability of these findings to other populations has not been established (i.e., African-Americans in Kosson et al., 1990; Newman & Schmitt, 1998; Latin Americans in Thornquist & Zuckerman, 1995). In addition, two published studies that examined the association between PAL and temperament among females (Farmer et al., 2003; Segarra, Molto', & Torrubia, 2000) have produced inconsistent findings. Segarra et al. found that neurotic extraverts committed fewer passive avoidance errors (PAEs, or responses to S— stimuli that result in punishment) than neurotic introverts. In contrast, Farmer et al. reported that NS was positively associated with PAEs only among women

who were low in HA. Furthermore, a recent study (Vitale & Newman, 2001) found that psychopathy was not associated with behavioral disinhibition among female inmates.

The primary purpose of this study was to extend the research on temperament and PAL to incarcerated females. We sought to clarify some of the inconsistent findings on the association of PAL with temperament among women, and consequently contribute to the development and refinement of theoretical models of disinhibited behavior. Additionally, this study sought to evaluate the degree to which findings based on male samples generalize to incarcerated females, particularly in light of research that suggests differing findings between female and male offenders. Although not the central feature of this research, the present study also examined whether ethnic differences in the association between temperament and disinhibition noted in other studies also are present among female inmates.

Several measures of the constructs of *behavioral inhibition* (BI) and *behavioral activation* (BA) were employed. Consistent with Patterson and Newman's (1993) theory, we hypothesized that BI and BA would interact to predict PAEs. Given research that suggests weaker associations between PAL and personality among non-Caucasians, we examined the primary hypotheses with an ethnically diverse sample as well as a restricted sub-sample of Caucasian participants.

This study also explored the relationship between reflection on contingent feedback and PAL. Compared to temperament or personality variables, reflection on punishment feedback has consistently accounted for more variance in PAEs, and may mediate the link between temperament and PAEs (Chapman, Mayer, Specht, Farmer, & Field, 2003b; Farmer et al., 2003; Patterson et al., 1987). Similar to Patterson et al., this study used two different PAL tasks that differed according to whether participants viewed feedback for a variable interval (up to 7 s; Task 1) or for a fixed interval (3 s; Task 2) of time. We hypothesized that the duration of reflection on feedback would account for any differences in PAEs related to the task manipulation. For instance, if individuals in Task 1 reflected on feedback for a longer duration, we hypothesized that Task 1 participants would commit fewer PAEs. In contrast, if Task 1 participants reflected for a shorter duration, we hypothesized that they would commit more PAEs.

2. Method

2.1. Participants

Participants initially consisted of 156 female inmates ($M_{\text{age}} = 33.60$, S.D. = 8.53) randomly selected from a multilevel women's prison in Idaho. Participants' data were excluded from analyses if they were (a) 50 years or older; (b) below the fourth grade reading level, or (c) taking psychotropic medication that impact performance on conditioning tasks (see Gray, 1987). Eight participants were excluded based on these criteria or because they provided ambiguous or missing questionnaire responses. Of the remaining 148 participants, 127 individuals (85.8%) participated in the PAL task. The ethnic composition was Caucasian (71.7%), Native-American (8.7%), Hispanic (8.7%), African-American (3.1%), declined to indicate (7.1%), and other (0.8%). While the ethnic distribution of inmates in this sample departs from that observed in US forensic institutions, it does reflect the ethnic make-up of Idaho's female incarcerated population, where the citizenry of Idaho is predominantly Caucasian. The primary reasons for non-participation were

unavailability (e.g., had left the prison) or refusal to participate. Usable data from the participants were retained for multivariate investigations of questionnaire response patterns.

2.2. Procedure

Prospective participants were given a brief description of the project (described as a study on personality and learning), invited to participate, and provided with an informed consent form that explicitly stated that their decision to participate (or to refuse) would not affect prison status. Following completion of questionnaires, participants underwent a computerized PAL task in a private room.

2.3. Questionnaire measures

Questionnaire packets contained six randomly ordered measures. Each measure assessed temperament constructs theoretically or empirically associated with behavioral inhibition (BI) or behavioral activation (BA). BI measures included the Welsh Anxiety Scale (WAS; Welsh, 1956), the Behavioral Inhibition System scale (BIS; Carver & White, 1994), the Harm Avoidance scale of the Temperament and Character Inventory (TCI-HA; Cloninger, 1992), and the Neuroticism scale from the Eysenck Personality Inventory (EPI) (EPI-N; Eysenck & Eysenck, 1968). BA measures included the Eysenck Impulsivity Narrow subscale of the Eysenck I₇ Impulsiveness Questionnaire (EIN; Eysenck, Pearson, Easting, & Allsopp, 1985), the TCI Novelty Seeking scale (TCI-NS), the Behavioral Activation System scale (BAS; Carver & White, 1994), the Extraversion scale from the EPI (EPI-E; Eysenck & Eysenck, 1968), and the Psychopathic Personality Inventory (PPI; Lilienfeld & Andrews, 1996).

The PPI contains three validity scales that assess response distortion tendencies: socially desirable impression management, deviant responding, and response inconsistency. Prior to testing study hypotheses, these validity scales were used to remove the variance in BI and BA that was attributable to response distortion (see Chapman, Gremore, & Farmer, 2003a).

2.4. Apparatus and tasks

Each participant completed one of two different PAL tasks (fixed or variable feedback) administered with a laptop computer. Task 1 (*variable feedback*; $n = 57$) was similar to the “go/no-go task” employed by Patterson et al. (1987, Experiment 2). For this task, participants were allowed to choose how long (up to 7 s) they reflected on punishment or reward feedback. In contrast, Task 2 (*fixed feedback*; $n = 70$), previously utilized in Newman and Schmitt (1998), involved the presentation of feedback for a fixed period (3 s). These two tasks originally were administered in the context of separate studies. Resultant data were combined to allow sufficient statistical power for multivariate analyses and tests of the generalizability of study findings across experimental procedures.

2.4.1. Task 1

Stimuli were presented on the computer screen and participants were instructed to learn by trial and error when to respond (by pressing the space bar on the computer) and when not to respond.

Stimuli consisted of 12 two-digit numbers: six positive discriminative stimuli (S+) were signals to respond; six negative discriminative stimuli (S–) were signals to withhold responding. The stimulus properties (e.g., specific numbers used, position of odd or even digits, magnitude of numbers used) did not systematically differentiate S+ or S–. The computer program randomly assigned participants to one of two number sets. Participants underwent 114 trials that included 18 pre-treatment and 96 treatment trials. The pre-treatment trials were designed to establish a dominant approach response set for reward (67% of trials were S+ trials) and were not included in data analyses. During the treatment trials, each S+ and S– appeared with equal frequency, with the constraint that neither three S+ nor three S– stimuli were presented sequentially. Each numerical stimulus was presented for 3 s or until the subject responded. The inter-trial interval was 1 s.

If a participant responded to either an S+ or S– by pressing the space bar, feedback was presented for a maximum of 7 s or until terminated by the subject. Following a correct response, the number remained on the screen, the word “Correct” appeared under the number; the experimenter said “Correct” in a natural tone, and 1 plastic chip was placed in a dish next to the subject. Following an incorrect response, the number remained on the screen, the word “Wrong” appeared under the number, the experimenter said “Wrong” in a natural tone, and 1 chip was removed from the dish. No feedback was provided when a subject did not respond to a S+ or S– within the 3-s interval. Because prison restrictions precluded monetary rewards, we used plastic chips that were redeemable for food items following completion of the task. Participants began the task with five chips.

2.4.2. Task 2 (*fixed feedback condition*)

As with Task 1, experimenters instructed participants in Task 2 to learn by trial and error, and the task stimuli were randomly presented two-digit numbers. Ten two-digit numbers were utilized: five positive discriminative stimuli (S+) were signals to respond and five negative discriminative stimuli (S–) were signals to withhold responding. Participants received 95 trials of number presentations, 15 of which were pretreatment trials. As with Task 1, pretreatment trials were designed to establish a dominant response set for reward (67% were S+ trials). Following a correct response, the number remained on the screen, the words “You have won 1 chip” appeared under the number, a high-pitched tone sounded (400 Hz), and a chip was placed in to a dish next to the participant. Following an incorrect response, the number remained on the screen, the words “You have lost 1 chip” appeared under the number, a low tone sounded (100 Hz), and a chip was removed from the dish. No feedback was provided when a subject did not respond to a S+ or S– within the 3-s interval. Chips were redeemed in the same manner as in Task 1. In contrast with Task 1, however, the length of the feedback interval was fixed at 3 s, after which the computer automatically initiated the next trial.

3. Results

3.1. Preliminary analyses

3.1.1. Descriptive statistics

Descriptive statistics for questionnaire measures are displayed in [Table 1](#).

Table 1
Descriptive statistics and internal consistencies of personality variables

Variable	Number of items	<i>M</i>	S.D.	Range	α
EPI Extraversion	24	13.06	4.84	1–23	.81
TCI Novelty Seeking	40	22.60	6.96	5–37	.85
EIN Impulsivity	19	10.81	5.27	0–19	.89
Behavioral Activation System	13	41.81	5.51	24–52	.80
PPI Psychopathy	163	369.02	48.06	262–492	.94
WAS Anxiety	39	17.50	10.04	0–39	.93
EPI Neuroticism	24	12.85	6.06	0–23	.88
TCI Harm Avoidance	35	14.59	8.09	0–33	.89
Behavioral Inhibition System	7	21.03	3.82	8–28	.71

Note: EPI = Eysenck Personality Inventory; TCI = Temperament and Character Inventory; EIN = Eysenck Impulsiveness Narrow sub-scale; PPI = Psychopathic Personality Inventory; WAS = Welsh Anxiety Scale.

3.1.2. Correction for response distortion

Preliminary analyses were conducted with the three PPI validity scales to examine the influence of deviant response sets on questionnaire scores. Regression analyses were performed with each temperament score as the dependent variable and the 3 response distortion indicators as predictors. Response distortion indicators significantly and positively predicted participants' scores on all measures except for the BIS scale, accounting for 5% (BAS) to 25% (EIN) of the variance in scores. Consequently, the unstandardized residuals from these analyses were used in place of participants' raw scores for all analyses that follow.

3.1.3. Factor analysis of temperament measures

An exploratory factor analysis with principal components extraction (eigenvalues > 1.0) and varimax rotation was performed with the unstandardized residuals from the above regressions (Table 2). Factor 1 (eigenvalue = 3.41) included high positive loadings for BA scales. Factor 2 (eigenvalue = 2.93) included high positive loadings for BI scales. Factor scores based on these two dimensions were computed using the regression method and employed in the main data analyses that follow.

Table 2
Rotated component matrix for exploratory factor analysis of temperament measures

Variables	Factor 1	Factor 2
EPI Extraversion	.84	
TCI Novelty Seeking	.84	
PPI Psychopathy	.81	
Behavioral Activation System	.76	
EIN Impulsivity	.74	
WAS Anxiety		.91
EPI Neuroticism		.88
TCI Harm Avoidance	–.44	.79
Behavioral Inhibition System		.67

Note: All loadings $\leq -.40$ or $\geq .40$ are presented. See Table 1 description of scale abbreviations.

Two additional data transformations were performed. First, consistent with past PAL research (e.g., Newman & Schmitt, 1998), median splits were performed to delineate groups. This procedure was performed separately for both factors in order to define two variables (BI and BA) each at two levels (low and high). Second, to examine the effect of the type of PAL task used, response frequencies were converted into proportions that represented the percentage of possible PAEs made during non-baseline computer task trials.

3.1.4. Comparison between computer task participants and non-participants

When compared with computer task non-participants, participants scored significantly higher on the WAS ($M_s = 11.17$ and 17.54 , respectively), $F(1, 144) = 7.60$, $p < .01$, and on the EPI-N ($M_s = 9.19$ and 12.85 , respectively), $F(1, 147) = 6.98$, $p < .01$. No additional differences were observed.

3.1.5. Comparison between Caucasian and non-Caucasian participants

The associations between ethnicity and the study IVs and DVs were examined. As there were few participants within each non-Caucasian ethnic group, these groups were collapsed into a single group. A one-way ANOVA revealed a non-significant association between ethnicity (Caucasian vs. non-Caucasian) and the proportion of PAEs, $F(1, 126) = .02$, ns.¹ Two additional ANOVAs ($N = 119$, due to incomplete questionnaire data for nine participants) revealed no significant associations between ethnicity and BA, $F(1, 118) = 2.46$, ns, or BI, $F(1, 118) = .49$, ns.

3.2. PAL as a function of temperament

The following analyses examined the effects of BI, BA, and Task type (fixed vs. variable reflection time) on the proportion of PAEs committed during non-baseline trials. For reasons noted above, $N = 119$ for these analyses. First, a 2 (BI: low/high) $\times 2$ (BA: low/high) $\times 2$ (Task: variable/fixed) between subjects ANOVA was performed. The main effect of task was non-significant, $F(1, 111) = .39$, ns, as were all two and three-way interactions involving task; consequently, subsequent analyses were collapsed across Tasks, resulting in a 2 (BI: low/high) $\times 2$ (BA: low/high) ANOVA. The main effects of BA ($F[1, 115] = .03$, ns), BI ($F[1, 115] = .01$, ns), and the BI $\times$ BA interaction ($F[1, 115] = 1.77$, ns) also were non-significant.

Caucasian sample. The ANOVAs described above were repeated using only the data from Caucasian participants who produced usable factor scores ($n = 87$). The main effects of BI and BA were non-significant; however, the BI $\times$ BA interaction was significant, $F(1, 83) = 3.97$, $p < .05$, $\eta^2 = .05$. Planned orthogonal contrasts revealed a trend (Fig. 1) for the high-BA/high-BI group to commit more PAEs ($M = .51$) than the low-BA/high-BI group ($M = .37$), $t(39) = 1.78$, $p < .08$, $d = .59$. In contrast, the high-BA/low-BI group did not differ from the low BA/low-BI group, $t(44) = .33$, ns.

¹ Because we only had usable ethnicity data on 127 of the 128 computer task participants, the df for this analysis is 126.

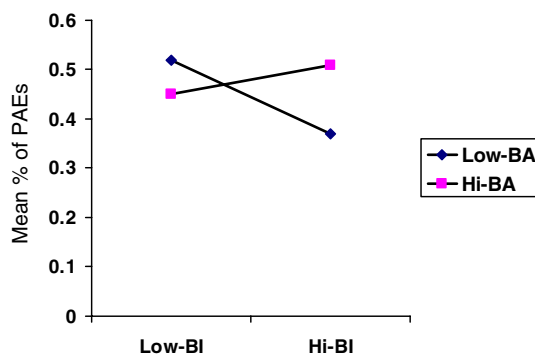


Fig. 1. Interaction of behavioral inhibition (BI) and behavioral activation (BA), with PAE frequency as the dependent variable. Hi-BI = group scoring above the median for BI; Low-BI = group scoring below the median for BI; Hi-BA = group scoring above the median for BA; Low-BA = group scoring below the median for BA.

3.3. PAL as a function of reflection on punishment feedback

Analyses were performed with data from participants who completed the variable-feedback task (Task 1; $n = 52$).² First, a 2 (low vs. high BA) $\times$ 2 (low vs. high BI) ANOVA found no significant main effects of BI or BA on reflection on punishment; however, the BI $\times$ BA interaction was significant, $F(1, 4) = 4.72$, $p < .04$, $\eta^2 = .09$. Planned comparisons revealed that high-BA/high-BI participants spent less time reflecting on punishment feedback ($M = 2226.41$ ms) than the low-BA/high-BI participants ($M = 4287.97$), $t(26) = 2.34$, $p < .03$, $d = .92$. In contrast, the high-BA/low BI group did not spend less time reflecting on punishment feedback than the low-BA/low-BI group, $t(22) = .42$, ns.

When these analyses were repeated for the Caucasian sub-sample of participants who participated in Task 1 and produced usable factor scores ($n = 32$), the pattern of findings was similar (Fig. 2). Main effects were non-significant, and a significant BI $\times$ BA interaction was observed, $F(1, 28) = 5.25$, $p < .03$, $\eta^2 = .16$. High-BI/high-BA participants spent less time reflecting on punishment feedback ($M = 1654.80$ milliseconds) than high-BI/low-BA participants ($M = 3952.95$), $t(13) = 2.15$, $p < .05$, $d = 1.19$. In addition, high-BA/low-BI participants did not spend less time reflecting on punishment than low-BA/low-BI participants, $t(15) = 1.15$, ns.

We further examined the linear association between reflectivity and PAEs with the Task 1 group. There was a significant negative association between reflection on punishment and PAEs ($r = -.24$, $p < .04$). Following Farmer et al. (2003), hierarchical regressions were performed with reflectivity on punishment as the predictor and PAEs as the dependent variable. Analyses controlled for the effects of overall response speed by entering reflection on reward in the first step, followed by reflection on punishment in the second step. Reflection on punishment was significantly negatively associated with PAEs, $\beta = -.37$, $p < .01$.

² Due to excessive missing data on questionnaires, only 52 of 57 Task 1 participants produced usable factor scores.

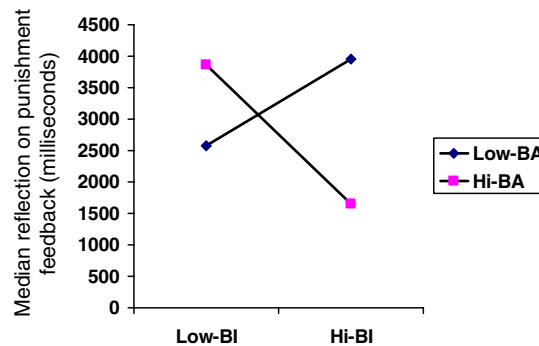


Fig. 2. Interaction of behavioral inhibition and behavioral activation, with reflectivity on punishment among Caucasian participants as the dependent variable. See Fig. 1 for description of group labels.

4. Discussion

The primary purpose of this study was to examine the generalizability of research on the association between temperament and PAL to incarcerated females. A factor analysis of temperament measures yielded two dimensions: behavioral inhibition (BI) and behavioral activation (BA), offering one of the first assessments of the latent structure of temperament among female offenders. Theoretically, these dimensions represent conditionability to reward (BA) and punishment stimuli (BI). Findings based on the association of these dimensions with PAL in Caucasian participants in this study were largely consistent with those of past research with males (Patterson et al., 1987). The interaction of BI and BA suggested that the features associated with BA (i.e., reward sensitivity) might have led to poorer PAL among highly inhibited persons. This pattern of findings is also consistent with aspects of Patterson and Newman's (1993) theory that high levels of BAS may paradoxically contribute to disinhibited behavior among individuals high in BIS. Gray's theory also posits that persons who are high in BIS and BAS are highly anxious and impulsive. High-anxious/high-impulsive persons should theoretically exhibit strong activity in the non-specific arousal system (NAS). Given that NAS activity has been associated with greater speed and force of behavioral responses (Wallace, Bachorowski, & Newman, 1991), punishment may have enhanced NAS activity and facilitated the continuation of reward-driven behavior. This finding is less consistent with theories that predict elevated PAEs among persons who are unresponsive to punishment and very responsive to reward (Cloninger, 1987; Gray, 1987). It should be noted, however, that the planned comparisons on which our findings are based did not reach conventional significance levels ($p < .08$).

Findings were weaker or non-existent when the entire sample (including non-Caucasians) was considered. These findings, along with those with males (Kosson et al., 1990; Newman & Schmitt, 1998; Thornquist & Zuckerman, 1995), suggest that temperament constructs may be weakly related to PAL among non-Caucasians. Such findings are puzzling given that these constructs presumably reflect the influence of biologically based traits that, theoretically, should not operate differently among ethnic groups. Dissimilar patterns of temperament among Caucasian and non-Caucasian participants do not appear to account for these divergent findings, as ethnicity was not associated with the predictors or the dependent measures. Other methodological factors

cannot be ruled out, however (e.g., representativeness of samples), nor can the potential mediating or moderating influences of environmental events or experiences that covary with ethnicity. There is a clear need for future studies to elucidate the role of ethnicity in PAL.

Findings from this study indicate a role for reflection on punishment in the regulation of goal-directed behavior and evidence for a disinhibitory effect of BA among inhibited persons. For Caucasian participants, high-BI/high-BA group reflected less on punishment than the high-BI/low-BA group. Consistent with [Patterson and Newman \(1993\)](#), high levels BA may have led to decreased reflection on consequences among persons who were higher in BI; consequently, these individuals may have formed fewer inhibitory associations to punishment cues. In addition, regression analyses revealed a negative association between reflection on punishment and PAEs, both before and after controlling for response speed. Consistent with past research ([Chapman et al., 2003a, 2003b](#); [Farmer et al., 2003](#); [Patterson et al., 1987](#)), reflection on consequences may play a critical role in the regulation of goal directed behavior. Interestingly, when the relationship between temperament and reflection on punishment was examined with the entire (ethnically heterogeneous) sample, the pattern of findings was identical, but the effects were weaker, further suggesting limits to the generalizability of PAL research to non-Caucasian individuals.

Some limitations of this study warrant consideration. First, as this study was not explicitly designed to test the generalizability of research across ethnicities, ethnic differences should be interpreted cautiously. This sample contained individuals from several ethnic groups, thus “non-Caucasians” represented a heterogeneous group. However, findings were consistent with those of other studies that compared ethnic groups ([Kosson et al., 1990](#); [Newman & Schmitt, 1998](#); [Thornquist & Zuckerman, 1995](#)). Second, slight differences between Task 1 and Task 2 complicate the interpretation of the non-significant task manipulation. For instance, Task 2 involved fewer trials (95 vs. 96) and different audio and visual feedback. Although these differences are small and not theoretically meaningful, resulting error variance may have obscured task effects. However, data from this study do suggest that the main findings are not artifacts of the specific PAL procedures employed.

In sum, this study partially supported the generalizability of PAL research to incarcerated females and suggested future directions. Given the findings on reflectivity, future research on reflection on punishment as an important individual difference variable is indicated. Findings from this study may have relevance for theoretical models of recidivism among women, particularly if high recidivism is associated with difficulties in regulating behavior and learning from negative consequences. Other studies have indicated that the types of individuals who demonstrate PAL deficits (i.e., psychopathic males; [Newman & Schmitt, 1998](#)) are also at heightened risk for interpersonal violence ([Hill, Rogers, & Bickford, 1996](#)) and recidivism ([Hemphill, Hare, & Wong, 1998](#)). Practically, this research may have implications for the development of treatment programs to reduce impulsivity among prisoners. For instance, treatment might teach individuals to reflect on negative consequences, thus enhancing discrimination of when a given response may lead to punishment.

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