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Testing helping behavior and its relationship to antisocial personality and psychopathic traits

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A B S T R A C T

When presented with decisions that require simultaneously weighing self-benefit and other harm, adolescents with callous-unemotional traits compared with controls engage in less Costly Helping (i.e., giving up a benefit to protect a beneficent other). Young adults completed questionnaires, played an online-administered game of Costly Helping, and viewed an Elevation stimulus video (when witnessing another's act of virtue, individuals may experience a positive or elevating response). Subjects were assigned to one of four study arms, which varied the order of presentation. Higher levels of Factor 1 (callousness) psychopathic trait scale scores (assessed using the Levenson Self-Report Psychopathy Scale) were associated with significantly less Costly Helping. Elevation associated positively with Costly Helping behaviors and negatively with psychopathic traits. Introducing Elevation as an independent variable in regression analyses attenuated the relationship between psychopathic traits and Costly Helping, suggesting mediation. Those viewing the Elevation stimulus video prior to playing the game, as opposed to after, trended toward more Costly Helping by taking less money for themselves ($3.28vs. $3.72). Results support that this simple game provides meaningful behavioral data associated with psychopathic traits. Differences in Elevation may, in part, explain the observed differences in prosocial behavior in those with high psychopathic traits.

1. Introduction

1.1. Costly helping, a behavioral paradigm of self: other consideration, associations with externalizing behavior in adolescence

In everyday life individuals make choices that require weighing the value of a benefit or cost to oneself against the value of harming or helping another (e.g., I'm feeling tired at the end of a long work week. I enter a subway with one seat remaining. An elderly woman enters behind me. Should I sit or offer the seat to her?) There are many examples of humans engaging in extreme self-benefitting other-harming behaviors, but humans also often engage in prosocial behaviors, giving up a benefit or endangering themselves to help or protect another, even when anonymity is assured and there is no possibility of reciprocity of an unselfish choice or punishment of a selfish choice (e.g., Sakai et al., 2012). These kinds of self: other decisions appear to be influenced by characteristics of the other. For example, in the Dictator Game players are often willing to give up a monetary gain to enforce a cost to someone who is viewed as a “bad actor,” a tendency previously termed Costly Punishment (Henrich et al., 2006; Knoch et al., 2010). And similarly, individuals appear to often be willing to give up a benefit to help or protect an individual who is viewed as a “good actor,” which we have previously termed Costly Helping (Sakai et al., 2016).

Building from the work of others (Moll et al., 2006; Sawyer, 1966), we developed a behavioral paradigm of Costly Helping, called the AlAn's (Altruism-Antisocial) Game, which asks subjects to repeatedly decide whether to accept or reject offers where they will benefit but a beneficent other (charity) will be harmed (charity donation is reduced). We have shown in two adolescent samples, that patients with substance use disorder(s) and conduct problems, especially those with callous-unemotional traits, on average take more money for themselves, leave less money in the charity donation and engage in less Costly Helping (Sakai et al., 2012, 2016). Thus, we have demonstrated a negative relationship between Costly Helping and externalizing psychopathology in adolescents (e.g., rho = −0.35 between Costly Helping on the game and levels of callousness; Sakai et al., 2016). However, it is unclear if this association exists in adults when considering antisocial behavior problems and especially, psychopathic traits.

1.2. Psychopathic traits: measurement as a dimensional construct in non-institutionalized populations, the Levenson self-report psychopathy scale (LSRPS)

Although not included in the DSM-5, psychopathy is a well-described (Cleckley, 1950) and well-studied (Hare and Neumann, 2008) construct. Its definition overlaps with, but is clearly separable, from the DSM-5′s antisocial personality disorder diagnosis, which has been criticized for emphasizing mainly behaviors, with little about personality

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(e.g., Hare et al., 1991). In contrast, definitions of psychopathy, in part guided by early clinical descriptions (Cleckley, 1950), include affective deficits (e.g., callousness and limited prosocial emotions), interpersonal problems (e.g., acting with arrogance, self-importance and selfishness, manipulating and deceiving others), along with a behavioral and lifestyle component (e.g., acting impulsively, irresponsibly, with considerable antisocial conduct; (Cleckley, 1950; Cooke and Michie, 2001; Hare and Neumann, 2008; Ross et al., 2007; Walters et al., 2008)). Though some controversies remain unresolved, including the number of factors underlying psychopathy (e.g., 2 vs. 3 vs. 4 Factor models; (Hare and Neumann, 2008; Mahmut et al., 2011; Walters et al., 2008)), psychopathy can be validly assessed (Hare et al., 2000). Psychopathy, although often assessed in practice as a taxon (yes vs. no), has good evidence supporting it is a dimensional construct (Edens et al., 2006; Hare and Neumann, 2008; Walters et al., 2008; Walters et al., 2007). As stated by Walters et al., (2008) "Existence of a psychopathy dimension implies that when researching psychopathy…it may be more prudent to employ the entire range of scores rather than group scores into categories." This has prompted interest in assessing psychopathic traits in non-institutionalized populations and motivated development of several measures of psychopathic traits, appropriate for general population samples.

The Levenson Self-Report Psychopathy Scale (LSRPS) is a 26 item self-report measure (Levenson et al., 1995), which intentionally excludes items related to criminality to improve utility in non-incarcerated populations (Sellbom, 2011). The LSRPS is quick, easy to administer without specialized training, is in the public domain and unlike the gold standard Psychopathy Checklist-Revised (PCL-R) does not require in-person interview nor institutional file review (unavailable in general population) nor synthesis of collateral information (Brinkley et al., 2001; Christian and Sellbom, 2016). The LSRPS as originally studied produces a Factor 1 score, which assesses selfishness, callousness and uncaringness, and a Factor 2 score, which assesses impulsiveness and poor behavioral control (Levenson et al., 1995). LSRPS has shown good test-retest reliability ($r = 0.83$; Lynam et al., 1999) and has been positively associated with antisocial behaviors (e.g., cheating on exams, plagarism, arrested for driving while intoxicated; $r = 0.44$; $p < 0.001$; Levenson et al., 1995), disinhibition ($r = 0.34$; $p < 0.001$) and boredome susceptibility ($r = 0.39$; $p < 0.001$; Lynam et al., 1999). Among male prisoners LSRPS correlates with PCL-R scores ($r = 0.30$; $p < 0.001$) and violent criminal acts ($r = 0.25$; $p < 0.001$) and those with higher scores commit significantly more passive avoidance errors (Brinkley et al., 2001). Levenson total score shows convergent and discriminative validity with other measures related to psychopathy (Sellbom, 2011, e.g., the Hare Self-Report Psychopathy Scale ($r = 0.64$, 0.66, 0.42 for total score, Factor 1, and Factor 2 respectively; Lynam et al., 1999). Here, we measure psychopathic traits in an unselected sample of young adults.

1.3. Etiological theories of Psychopathy, considering moral elevation and connectedness to others

Assuming an association between Costly Helping and psychopathic traits, one logical next question is what under-girds this relationship? Important work has been dedicated to describing and testing etiologic theories of psychopathy and callous-unemotional traits, with models focusing on acute threat response, reward sensitivity, processing of punishment, response inhibition, and problems of emotional processing, among other areas (Blair et al., 2016; Blair, 1995; Blair et al., 2001; Blair et al., 2014; Blair et al., 2018). Some early work posited that because those with psychopathy might not experience emotional reactivity to another's pain, they would lack essential information that would promote desisting from other-harming behaviors (Blair et al., 1997). Positive emotional responses and feelings of connectedness to others are also important motivators that may promote other-helping behaviors (Deci and Ryan, 2000; Pavey et al., 2011). Almost 70 years ago Cleckley noted that "…the general feebleness of affect [is] common to all" those with psychopathy, that those with psychopathy tend to have an "…incapacity for object love" as opposed to self-love (i.e., choices are driven by selfish motives), and raised "the possible interdependence of these faculties" (page 374; Cleckley, 1950). Such prior work suggests the question, could deficits in positive emotional responsiveness lead to less motivation toward Costly Helping?

One positive emotional response which can be elicited in the laboratory through stimulus stories/videos is Moral Elevation (Aquino et al., 2011; Englander et al., 2012; Lai et al., 2014). When one observes an act of generosity, kindness, uncommon goodness or moral beauty, even when not personally benefitting from the act, one can experience strong emotional (e.g., compassion, awe, admiration), physical (e.g., lump in throat, tearfulness, fullness in the chest), and cognitive (e.g., wanting to be a better person, having a more positive worldview) responses. Elevation appears to be an approach-related response (Van de Vyver and Abrams, 2017), which prompts prosocial and affiliative behaviors (Algoe and Haidt, 2009; Schnall et al., 2010; Silvers and Haidt, 2008).

We previously proposed that a blunted Moral Elevation response may, in part, explain the negative association between callous-unemotional traits and Costly Helping (Sakai et al., 2016), or in other words that those with high levels of callous-unemotional traits may lack emotional cues that prompt prosocial decision making. However, our design in that adolescent study was inadequate to fully address this hypothesis because participants watched the Elevation stimulus about a week prior to playing the game of Costly Helping. In this study we attempted to further explore this hypothesis and to test whether experiencing an Elevation response is related to greater levels of Costly Helping. In addition, because feeling connected to others has been proposed to be a basic psychological need (Deci and Ryan, 2000) and experimental enhancement of connectedness to others promotes prosocial behaviors (Pavey et al., 2011), we also assessed whether our Elevation stimulus increases feelings of connectedness to others and whether those feelings of connectedness are associated with Costly Helping behaviors.

1.4. Current study hypotheses

Subjects were assigned to one of four study arms: half viewed an Elevation stimulus prior to (and half after) playing a game of Costly Helping; and half completed measures of social connectedness before, and half after, the Elevation stimulus. We hypothesized that in young adults: Costly Helping behavior on the AlAn's Short Game would be related to LSRPS Factor 1 score (**hypothesis 1.1; primary outcome**), Elevation response (hypothesis 1.2a) and other characteristics (feelings of connectedness to others, and LSRPS Factor 2 scores - hypotheses 1.2b-c; **secondary outcomes**). We extended prior work by hypothesizing that viewing an Elevation stimulus video prior to playing the AlAn's Short game (vs. after) would be associated with differences in Costly Helping (**hypothesis 2**). Finally, we hypothesized that this Elevation stimulus presentation would be associated with differences in self-reported feelings of social connectedness to others (**hypothesis 3**). We also sought to confirm the relationship between psychopathic traits Factor 1 scores, Costly Helping and Elevation response reported in adolescents (Sakai et al., 2016).

2. Methods

The Colorado Multiple Institutional Review Board approved this protocol.

2.1. Study procedures

We recruited 120 young adults from the community via Craigslist. Inclusion/exclusion criteria were intentionally minimal, to recruit a

sample representative of the general young adult population and were: (1) age 18–25 years, and (2) refusal to provide informed consent, respectively. The study coordinator called individuals who responded to our online advertisement, verified that they met inclusion/exclusion criteria, and described the study procedures. Interested participants were provided with an online link to the Consent. After reading and clicking, "Yes, I agree to be in this study" subjects were directed to the study web address. Study data were collected and managed using REDCap data capture tools hosted at the University of Colorado (Harris et al., 2009). Participants were assigned to study arms to assure similarities in sex and age and were paid $25, plus earnings from playing the AlAn's Short Game.

2.2. Study instruments

2.2.1. AlAn's short game

The original AlAn's Game (Sakai et al., 2012) has some limitations, including that it (1) takes about 30 min, and (2) is played in-person after set-up on a laptop by a research assistant. Thus, our studies to date have used relatively modest sample sizes (Sakai et al., 2012; Sakai et al., 2016). To address these concerns, we developed a shortened version (AlAn's Short Game) programmed in REDCap (Harris et al., 2009), which can be played online (including smartphone). Subjects viewed game instructions and also a short presentation about good things that the Red Cross does. We then asked subjects to rate how much good they feel the Red Cross does on a 100 point visual analog scale anchored by "no good at all" and "lots of good" (hereafter referred to as Red Cross Visual Analog Scale). Subjects then played the AlAn's Short Game. Subjects started with no money and a real donation to the Red Cross of $5. Like the original AlAn's Game (Sakai et al., 2012), there were three trial types: Active Trials, Calculation Trials and Attention Control Trials and a running counter appeared after each decision, showing how much money the subject had earned and the remaining value of the Red Cross donation. **Active Trials** asked "Change both counters?" and presented a "You" amount and a separate "Red Cross" amount (see Supplemental Figure 1; Panels A-B). Subjects were asked to accept vs. reject the offer. This shortened game included 11 Active Trials which were each presented twice (see Panel A, Supplemental Figure 1). **Calculation Trials** asked "Is the You number bigger?" and tested subjects' understanding of the relative values used in the Active Trials (see Panel C, Supplemental Figure 1). Ten trials had You and Red Cross numbers identical to those in the Active Trials (excluding trials with equal You and Red Cross values). **Attention control trials** aimed to keep subjects from simply falling into a pattern of always accepting (or rejecting) during the game**;** in 2 trials both You and the Red Cross gain 8 cents (logically accept) and in 2 trials both You and the Red Cross lose 8 cents (logically reject; see Panel D, Supplemental Figure 1).

2.2.2. Elevation stimulus and measurement

Participants (1) completed a pre-stimulus Elevation questionnaire, (2) viewed a short video about an uncommon act of selflessness that has been used as a stimulus to elicit Elevation (Englander et al., 2012; Sakai et al., 2016), and (3) completed the post-stimulus Elevation questionnaire. Elevation measures were adapted from prior work (Aquino et al., 2011; Freeman et al., 2009) and have been previously used by our group (Sakai et al., 2016). Questions are binned into four domains: (1) Emotional reaction, (2) Physical reaction, (3) View of humanity, and (4) Desire to be a better person. Following our prior procedures (Sakai et al., 2016), we calculated a 0–4 score (weighting questions equally) for each domain and summed the domain scores (0–16 range) to create an overall Elevation score. Pre and post questions for domains 1 and 2 are identical. Some questions for domains 3 and 4 are only asked in the post-stimulus questionnaire (Supplemental Materials, Appendix). The Elevation stimulus video can be accessed at (https://www.youtube.com/watch?v=e9JcX2×7XnM) and depicts a man risking his life to save an individual who, was experiencing a seizure and fell onto the New York subway tracks.

2.2.3. Measure of psychopathic traits

Subjects completed the Levenson Self-Report Psychopathy Scale. *A priori* we specified the LSRPS Factor 1 score (e.g., callous, uncaring, selfish) as our primary outcome. Seven positively worded items were reverse scored and Factor 1 scores were calculated by summing 16 questions (range of scores 16–64) and Factor 2 by summing 10 questions (range of scores 10–40; see Supplemental Table 1 in Levenson et al., 1995). This original two-factor structure has been replicated by others (Lynam et al., 1999) and used by the majority of prior studies (see Section 1.2).

2.2.4. Measures of social connectedness

Social Connectedness: The relatedness subscale of the Basic Psychological Needs Scale (Deci and Ryan, 2000) has 8 items such as "People are generally pretty friendly towards me" and "There are not many people I am close to". All item responses range from "not at all true" to "very true." After appropriate reverse scoring and averaging, possible scores range from 1–7.

2.3. Study arms (orders of administration)

We assigned subjects to one of four arms, i.e. orders of administration (Supplemental Figure 2). Subjects receiving order 1 (1A,1B) viewed the Elevation stimulus before playing the AlAn's Short Game while those receiving order 2 (2A, 2B) played the AlAn's Short Game before viewing the Elevation stimulus (allowing testing of whether experiencing Elevation is subsequently associated with increased prosocial behavior; hypothesis 2). Subjects receiving order A (1A,2A) completed the social connectedness survey before viewing the Elevation stimulus while those receiving order B (1B, 2B) viewed the Elevation stimulus before completing the social connectedness survey (allowing testing of whether experiencing Elevation is subsequently associated with increased reports of social connectedness; hypothesis 3).

2.4. Sample descriptives and data analyses

2.4.1. Sample characteristics

Including demographics, AlAn's Short Game behavior, psychopathic traits, and social connectedness were evaluated for differences by study arm using chi-square, ANOVA, and Kruskall Wallis tests as appropriate. AlAn's Short Game: We calculated percent of correctly answered Calculation Trials and Attentional Control Trials. In addition, we graphed the rates of acceptance by Active Trial content (ratio of the absolute value of the Red Cross donation divided by the You Gain amount). Elevation response**:** We tested for within-subject change in pre-to-post stimulus Elevation scores using the Wilcoxon Signed Rank Test. A multiple linear regression that adjusted for age, sex, and race (Caucasian, non-Caucasian) evaluated the relationship between the outcome and predictor variable of interest specified by each hypothesis. For Hypothesis 1, the outcome Costly Helping was regressed on the primary predictor LSRPS Factor 1 (**hypothesis 1.1**) and then separate regression models similarly compared Costly Helping to three **secondary** predictor variables in hypotheses 1.2.a-c. Regression analyses were repeated adjusting for arm (1A,2A,1B,2B) and Red Cross Visual Analog Scale score to determine if results changed. For **Hypothesis 2**, Costly Helping was regressed on game order (1A/1B vs. 2A/2B). For **Hypothesis 3**, the Relatedness subscale of the Basic Psychological Needs Scale was regressed on game order (1A/2A vs. 1B/2B). **Additional analyses:** Additional analyses are described in Supplemental Section S.1.

Table 1
Hypotheses 1.1, 1.2A-C: Results from separate regressions of Costly Helping (dependent variable) on variables of interest controlling for demographic characteristics. Each row represents a separate regression analysis.

Hypothesis Sample size	Total R^2	Variable of Interest Regression coefficient (SE); t-value; *p*
Hypothesis 1.1: Costly Helping behavior on the AlAn's Short Game would be related to LSRPS Factor 1 score (**hypothesis 1.1; primary outcome**).		
1.1	R^2= 0.09	LSRPS Factor 1 score (selfishness, callousness and uncaringness)[b]
n = 115[a]		−0.14 (0.06); t = −2.33; p = 0.02
Hypothesis 1.2: Costly Helping behavior on the AlAn's Short Game would be related to Elevation response (hypothesis 1.2a) and other characteristics (feelings of connectedness to others, and LSRPS Factor 2 scores - hypotheses 1.2b-c; **secondary outcomes**).		
1.2.a	R^2= 0.10	Post-stimulus Elevation score[d]
n = 90[c]		0.45 (0.22); t = 2.06; p = 0.04
1.2.b	R^2= 0.06	Relatedness scale[e]
n = 115[a]		0.78 (0.61); t = 1.27; p = 0.21
1.2.c	R^2= 0.08	LSRPS Factor 2 score (impulsiveness, poor behavioral control)[f]
n = 115[a]		−0.27 (0.13); t=-2.09; p = 0.04

R^2 = R squared (variance explained).

[a] Three subjects did not complete the AlAn's short game and 2 additional subjects did not report on their race, leaving n = 115 for this regression analysis.

[b] After additionally controlling for Red Cross Visual Analog Scale and study arm, LSRPS Factor 1 score remained significantly related to Costly Helping (p = 0.006).

[c] Excluding subjects who (1) did not complete the AlAn's short game, (2) did not completely watch the videos, and (3) did not report on their race (leaving n = 90).

[d] After additionally controlling for Red Cross Visual Analog Scale and study arm, Post-stimulus Elevation score remained significantly related to Costly Helping (p = 0.02).

[e] After additionally controlling for Red Cross Visual Analog Scale and study arm, Social connectedness remained not significantly related to Costly Helping (p = 0.36).

[f] After additionally controlling for Red Cross Visual Analog Scale and study arm, LSRPS Factor 2 score remained significantly related to Costly Helping (p = 0.03).

3. Results

No sample characteristics (e.g., sex, race, age, Factor 1 and Factor scores) differed significantly by study arm. Results for AlAn's Short Game and Elevation Response (analyses described in Section 2.4.1) are reviewed in Supplemental Sections S.2 and S.3.

3.1. Hypothesis 1

Regression analyses of Costly Helping (number of "No" responses to Active Trials) on independent variables of interest adjusting for age, sex, and race evaluated the 4 components of **hypothesis 1** (Table 1): 1.1) LSRPS Factor 1 score was negatively related to levels of Costly Helping (t = −2.33; p = 0.02). 1.2a) Self-reported Elevation score taken just after watching the stimulus video was positively related to Costly Helping (t = 2.06; p = 0.04). Costly Helping was not related to 1.2.b) social connectedness (t = 1.27; p = 0.21) but was negatively related to 1.2.c) LSRPS Factor 2 score (t = −2.09; p = 0.04) and LSRPS total score (t = −2.49; p = 0.01). It is important to note that Factor 1 and 2 LSRPS scores were significantly correlated in this sample (*rho* = 0.51; p < 0.001; n = 117). Results were similar after we repeated analyses additionally adjusting for study arm and Red Cross Visual Analog Score.

3.2. Hypothesis 2

Those who watched the Elevation stimulus video before (arms 1A, 1B; n = 47) vs. after (arms 2A, 2B; n = 45) playing the AlAn's Short Game differed in their game behavior. Those watching the Elevation stimulus first (Group 1A/1B) on average declined 11.5 Active Trials, left $4.11 in the donation and took $3.28 for themselves. Those watching the Elevation stimulus after playing the game (Group 2A/2B) on average declined 10.1 Active Trials, left $3.97 in the donation and took $3.72 for themselves. After adjusting for demographics, this difference in Costly Helping by Elevation stimulus viewing order (1 vs 2) trended toward significance (t = 1.93; p = 0.057; see Supplemental Table 1).

3.3. Hypothesis 3

We compared those who completed the social connectedness measure before (1A/2A; n = 45) versus after (1B/2B; n = 47) watching the Elevation stimulus video. Feelings of social connectedness were similar for Group 1A/2A (mean = 5.41, SD = 0.84) and Group 1B/2B (mean = 5.30, SD = 0.81). Regression analyses adjusting for demographics showed that social connectedness did not differ based on completion order (A vs. B; t=-0.51; p = 0.61; see Supplemental Table 1).

Results of additional analyses (see end of Section 2.4.1, Supplemental Section S.1) are reviewed in Supplemental Section S.5 and Supplemental Table 1.

4. Discussion

Although previous studies have examined psychopathy in relation to moral processing, in many past studies, the focus on emotionality and processing has been on negatively-valenced emotions and aggressive behaviors (e.g., see the important model previously proposed by Blair et al., 1997). Those models provide great insight into the understanding of why individuals with psychopathy may behave violently. But relatively limited work has focused on problems of positively-valenced emotions, prosocial behavior and social connectedness (O'Nions et al., 2017).

The central model underlying our ongoing work, is that individuals with high levels of callousness experience a world relatively lacking in positive emotional responses (e.g., in response to the strongly prosocial behaviors of others). Because they lack such emotional motivators, they engage in less prosocial and affiliative behaviors (Carlo et al., 2011; Carlo et al., 2014). While they may be glib, charming and attractive in early stages of a relationship (e.g., see Cleckley, 1950), in longer term interactions, this blunting of prosocial emotions and lower levels of prosocial behaviors reduce feelings of social connectedness, and increase their likelihood of experiencing peer rejection and in turn, further feelings of social isolation (Hosseinbor et al., 2014; McArdle et al., 2000). But social connectedness has been proposed to be a fundamental psychological need (Deci and Ryan, 2000) and of course social isolation has many deleterious effects for humans (e.g., House et al., 1988). Our results lend some support to this conceptualization as outlined below.

4.1. Self: other decision making and psychopathic traits

As shown in Fig. 1, our results suggest that those with higher levels of psychopathic traits have similar choice patterns (e.g., shape of the curve) but exhibit less prosocial behavior when compared to other subjects. Regression analyses confirmed that psychopathic traits (Factor 1, Factor 2 and total scores from LSRPS) were negatively related to Costly Helping behaviors on AlAn's Short Game (i.e., higher psychopathic traits were related to lower levels of prosocial behaviors; See Table 1) even while controlling for multiple covariates. This result is consistent with our prior findings in adolescents examining callous-

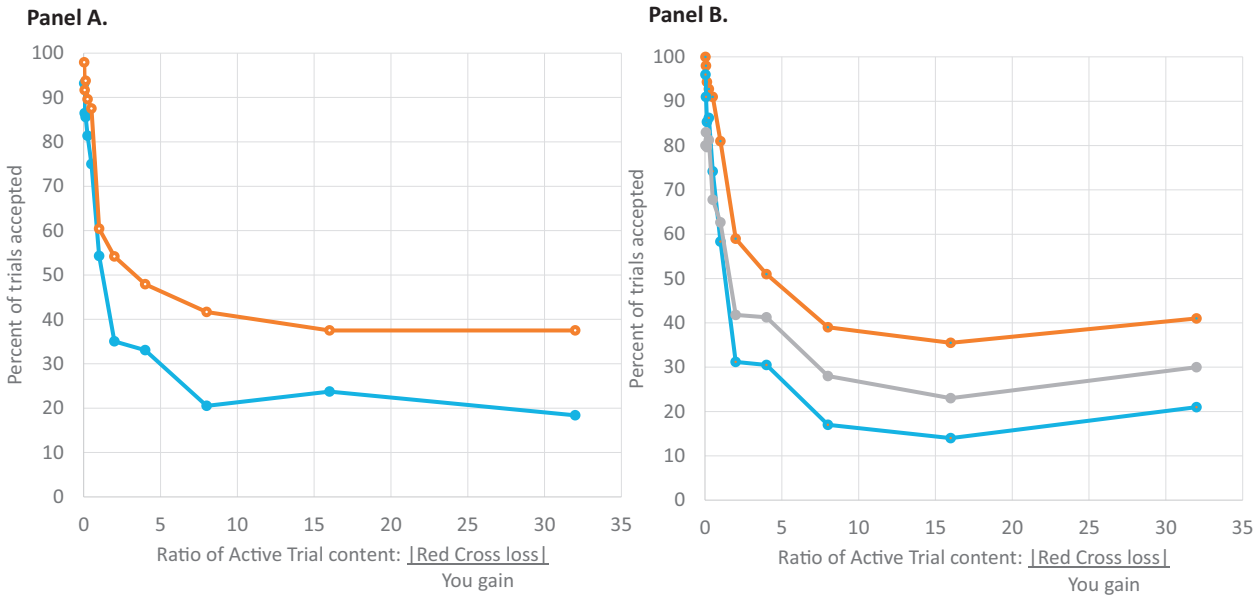

Fig. 1. Data from the current study (Panel A; AlAn's Short Game) and redrawn from a prior study (Panel B; AlAn's game; supplemental Figure 1 from Sakai et al., 2016). Y-Axis indicates how frequently subjects accepted these Active Trials (percent). X-Axis is organized by Active Trial information (ratio of absolute value of Red Cross loss divided by the amount the subject will gain). For example, for an Active Trial where you will receive 64 cents but the Red Cross will lose 2 cents the ratio is $|-2|/64 = 0.03125$ (near zero on the X-Axis). In this study (left panel) subjects accepted trials with this ratio 93.16% of the time. Alternatively, for an Active Trial where you will receive 2 cents and the Red Cross will lose 64 cents the ratio is $|-64|/2 = 32$ (rightward on X-Axis). In this study, subjects accepted Active Trials with this ratio 18.38% of the time. Note: Left panel shows all young adult subjects (blue) and 24 subjects with the highest LSRPS Factor 1 scores (top ~20%; red). Right panel shows 3 adolescent groups: blue = controls; gray = patients with substance use disorder (SUD) and conduct problems who did not meet the limited prosocial emotions specifier; and red = patients with SUD and conduct problems with limited prosocial emotions.

unemotional traits and conduct problems (Sakai et al., 2012; Sakai et al., 2016) and supports that these behavioral tendencies can be demonstrated under controlled conditions, using a simple paradigm. Thus across two different measures (Inventory of Callous-Unemotional Traits and Levenson Self Report Psychopathy Scale) and across two age groups (adolescents and young adults), we see a consistent association.

4.2. The mediating role of positive emotions

One important next step is to better understand what differences in those with high levels of psychopathic traits may lead to lower levels of prosocial behaviors. Based on prior work (e.g., Blair et al., 2016; Blair, 1995; Blair et al., 2001; Blair et al., 2014; Blair et al., 2018; Cleckley, 1950), emotional differences are one possible target. Here we examined Moral Elevation response, which we can experimentally induce (see Supplemental Section S.3) and which we have shown to be blunted in youth with callous-unemotional traits (Sakai et al., 2016). Similar to our prior findings, psychopathic traits (Factor 1 scores) were negatively associated with post-stimulus Elevation scores and pre-to-post change in Elevation, but not pre-stimulus Elevation scores (see Supplemental Section S.5). Thus, those with higher psychopathic traits (Factor 1 scores) report a blunted Elevation response. Next we tested the relationships between Elevation and Costly Helping. As shown in Table 1 (see row 1.2.a), amount of Elevation after watching the stimulus video positively related to levels of Costly Helping. Additionally, the group who watched the Elevation stimulus before playing AlAn's Short Game trended toward more Costly Helping ($p = 0.06$; Study Hypothesis 2), suggesting that experiencing Elevation may, at least for a brief period, increase prosocial decision making. Finally, we completed mediation analyses (last paragraph of Supplemental Materials S.5) suggesting that magnitude of Elevation response may partly mediate this relationship.

4.3. Mixed results regarding social connectedness

We had speculated that Costly Helping behaviors might be motivated by intrinsic feelings of connectedness to others (Deci and Ryan, 2000). However, social connectedness was not associated with Costly Helping behaviors (see Table 1). We had also speculated that experiencing an Elevation response might increase feelings of connectedness to others but viewing the Elevation stimulus video was not associated with differences in self-reported social connectedness to others (hypothesis 3). However, we did demonstrate that individuals with higher levels of psychopathic traits, report feeling less social connectedness (Supplemental Section S.5). In addition, the level of Elevation response was positively predictive of feelings of social connectedness (Supplemental Section S.5). Therefore, while the immediate experience of Elevation may not impact feelings of social connectedness (at least as measured here; hypothesis 3) the capacity for an Elevation response (e.g., how big of a response you experience; Supplemental Table 1) is predictive of social connectedness. The chronology of this association is unclear. For example, it may be that early difficult rearing environments lead to limited feelings of social connectedness which, in turn, limits Elevation response. In addition, we did not measure satisfaction with social connectedness and cannot determine how these problems of social connectedness are experienced by those with high levels of psychopathic traits. Thus, our findings regarding the role of social connectedness are relatively mixed and will require further work to disentangle these relationships.

4.4. Limitations

Our findings must be viewed in the context of several study limitations. First, unlike our prior studies, Costly Helping behavior was evaluated here with an online administration. Some subjects, without in-person direction and oversight, did not follow instructions and did not properly view videos (See Supplemental Section S.4). Unfortunately, the likelihood of not following such directions appears to be greater among individuals with higher LSRPS Factor 1 scores. Thus an important portion of our sample was excluded from several Elevation-related analyses in this manuscript. In future work, we will

need to develop methods for providing feedback for not viewing the full Elevation stimulus video.

Second, based on population prevalence rates of psychopathy (e.g., <1%; (Coid et al., 2009)) our selection strategy was unlikely to include many individuals with psychopathy. Here instead we studied psychopathic traits, utilizing an unselected sampling approach. Though accumulating prior research has supported studying psychopathic traits as a dimensional construct rather than a taxon (see Section 1.2), our results must be considered relevant to psychopathic traits and not necessarily psychopathy.

Third, because this is the first study utilizing the AlAn's Short Game, we did not have prior estimates from which to calculate *a priori* sample size estimates. Data collected here will provide improved sample size calculations for future studies.

Fourth, by design we addressed three main study hypotheses. But we also completed a number of additional secondary or exploratory analyses. The possibility of false positive results increases with additional analyses and if we enforced a Bonferroni correction for all analyses conducted, most of our results would become non-significant. However, our results generally follow those of our prior publications (Sakai et al., 2012; Sakai et al., 2016). Future attempts at replication are needed to assure consistency of results.

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Disclosures

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2019.02.022.

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