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Brief Report

Personality and behavioral outcomes associated with risk-taking are accurately inferred from faces

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ABSTRACT

Growing evidence suggests that people are able to accurately infer some personality traits and behavioral outcomes from facial photographs. However, little research has examined whether people are able to accurately infer personality traits or behavioral outcomes associated with risk-taking. In this study, we examined whether people were able to accurately infer, on average, others' personality traits associated with risk-taking from facial photographs. We further examined whether such first impressions were associated with relevant and important behavioral outcomes—specifically, future discounting and gambling and problem gambling tendencies. Results suggest that people are able to accurately infer, on average, some personality traits and behavioral outcomes associated with risk-taking from faces.

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1. Introduction

First impressions play an important role in guiding future social interactions with others, and a growing body of evidence suggests that first impressions allow for accurate judgments of others' personality traits (e.g., the Big Five; Naumann, Vazire, Rentfrow, & Gosling, 2009) and behavioral outcomes (e.g., CEO pay; Rule & Ambady, 2008). Facial inferences have also been associated with some laboratory-measured behavioral outcomes and tendencies (e.g., cooperation, trustworthiness; Stirrat & Perrett, 2010). These results provide some evidence suggesting that people are able to infer some personality traits and behavioral outcomes from facial photographs. However, little research has examined whether people can accurately infer personality and behavioral outcomes associated with risk-taking from faces.

The ability to infer degree of risk-propensity in others has substantial potential benefit in social interactions (e.g., avoiding costly encounters with others; Stillman, Maner, & Baumeister, 2010). Almost every decision people make involves some degree of risk, and risk-propensity is a key trait that underlies behavior in a wide array of domains involved in social life, including aggression, cooperation, conflict, sexual behavior, violence, and other forms of social decision-making (reviewed in Zuckerman (2007)). Furthermore, individual differences in personality traits associated with risk-propensity have been significantly associated with such measurable negative health outcomes as delinquency, teenage pregnancy, and problem and pathological gambling (reviewed in Mishra & Lalumière (2009)).

A few previous studies have examined the degree to which people are able to infer some behavioral outcomes associated with risk-propensity from faces, including drug use history, arrest history, physical violence, criminality, and aggression (Olivola & Todorov, 2010; Stillman et al., 2010; Valla, Ceci, & Williams, 2011; Carré, McCormick, & Mondloch, 2009). This research provides some initial evidence suggesting that people are able to infer behavioral outcomes associated with risk-propensity from faces. To our knowledge, however, no research has examined whether people can infer from faces personality traits that are directly relevant to risk-taking (e.g., impulsivity, sensation-seeking, self-control). Furthermore, no research has examined whether people's inferences of riskiness from faces are associated with laboratory-measured tendencies associated with general risk-propensity (e.g., future discounting), or with important non-criminal outcomes of risk-taking (e.g., gambling and problem gambling tendencies, which have large health and economic consequences).

An important behavioral outcome associated with elevated risk-propensity is future discounting. Future discounting describes a preference for smaller, immediate rewards over larger, distal rewards (e.g., a preference for $45 available immediately over $75 available in 30 days; Kirby, Petry, & Bickel, 1999). Laboratory measured rates of future discounting have been shown to be

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significantly elevated in populations exhibiting persistent levels of real-world risk-taking (e.g., drug addicts, problem gamblers; reviewed in Reynolds (2006)). People's inferences of the riskiness of target faces may be therefore be associated with targets' tendency to discount the future.

In the present study, we examined whether first impressions derived from facial photographs were associated, on average, with measured (1) personality traits associated with risk-taking, (2) future discounting tendencies, and (3) outcomes associated with persistent risk-taking, specifically, gambling and problem gambling tendencies. This study extends previous research in two important ways: First, although some research has examined inferences of specific instantiations of risk-propensity (e.g., aggression, criminality), no research has examined whether naïve raters can accurately infer risky personality traits of others from faces. Second, no research has examined whether facial inferences are associated with non-criminal behavioral outcomes linked with risk-taking, including future discounting and gambling.

2. Method

A first set of target participants comprised of 58 men and 57 women (age: $M = 20.0$, $SD = 2.0$) were recruited from undergraduate psychology classes at the University of Lethbridge. The same participants were also used in Mishra and Lalumière (2011). Participants received course credit for their participation. All target participants completed (1) self-report measures of personality traits associated with risk-taking, (2) a behavioral measure of future discounting, and (3) measures of problem gambling severity and general gambling tendencies, as described below.

2.1. Personality traits associated with risk

Zuckerman's Sensation-Seeking Scale (SSS). The SSS consists of 40 choices between paired statements regarding preferences for varied, stimulating experiences and disinhibited behavior (Zuckerman, 1994). A total score was obtained by summing the number of high sensation-seeking choices.

Eysenck's Impulsivity Scale (EIS). The EIS (Eysenck, Pearson, Easting, & Allsopp, 1985) consists of 19 yes/no statements about impulsive behaviors. A total score was obtained by summing the number of responses indicating impulsive tendencies.

Retrospective Behavioral Self-Control Scale (RBS). The RBS (Marcus, 2003) measures behaviors across the lifespan that are associated with low self-control. It consists of 67 items, measuring the frequency of behaviors associated with low self-control in childhood, adolescence, and adulthood. Frequency of engagement in the various behaviors was rated on a scale from 1 (*never*) to 7 (*always*). A total score was obtained by summing ratings of frequency of engagement in risky behaviors; higher scores indicated lower self-control.

Domain-Specific Risk Taking Scale (DOSPERT). The DOSPERT (Weber, Blais, & Betz, 2002) is a self-report measure of the likelihood of engaging in risky behavior in five domains: financial (investing and gambling), health/safety, recreational, ethical, and social. Participants rated the likelihood of engagement in each behavior on a scale of 1 (*extremely unlikely*) to 5 (*extremely likely*). A total score was obtained by summing all of the items.

2.2. Future discounting

Participants were presented with 27 choices between an amount of money available today, and an amount of money available in the future on a computer (e.g. "Would you rather have $40 or $70 in 20 days?"; Kirby et al., 1999). Choices were either for small, medium, or large amounts of money (seven in each category; for a complete list of options, see Kirby et al., 1999). At the end of this task, one of the 21 options was chosen at random, and participants earned the amount of their choice in the form of a cheque (either immediately cashable, or post-dated to the relevant date in the future). The dependent measure was a discounting parameter (k) calculated for each of the subsets of small (FD_S), medium (FD_M), or large rewards (FD_L) (as described in Kirby et al. (1999)). Higher discounting parameters indicated a greater preference for immediate over later rewards.

2.3. Gambling and problem gambling tendencies

Problem Gambling Severity Index (PGSI). The PGSI (Ferris & Wynne, 2001) is a nine-item self-report measure of problem and pathological gambling behavior based on behavior in the last 12 months. Engagement in various gambling behaviors was rated on a scale from 0 (*never*) to 3 (*almost always*). A total score was computed by summing all of the items.

Gambling Involvement. Self-reports of (1) the total number of different gambling activities engaged in, and (2) monthly frequency of gambling (both over the past year) were obtained.

2.4. Face ratings

After completing the measures described above, a color photograph of each participant was taken using a Canon PowerShot A530 digital camera. Photographs were taken at maximum resolution (2592×1944). Participants were seated on a chair in front of a white backdrop, and were instructed to look directly at the camera and maintain a neutral expression.

A second set of participants comprising 19 men and 23 women (age: $M = 20.2$, $SD = 2.3$) were shown photographs of the first set of target participants, one at a time, in random order on a computer screen. Each participant was asked, "How risky do you think this person is?" for each photograph. This question was phrased as such in an attempt to capture raters' own conceptions of riskiness in others as generally as possible. Responses were rated on a scale of 1 (*not at all risky*) to 10 (*very risky*). A pooled average measure of rated risky personality was obtained by taking the mean of all participants' ratings for each target photo. Participants indicated if any of the people in the target photographs were known to them (after each rating). All ratings of familiar faces were not used in the pooled average rated risky personality computation.

Previous research has demonstrated that attractiveness can affect or moderate personality judgment from faces (Langlois et al., 2000). Consequently, a third set of participants comprised of 12 men and 19 women (age: $M = 19.4$, $SD = 1.6$) rated photographs for attractiveness on a scale from 1 (*not attractive*) to 10 (*very attractive*).

3. Results

3.1. Data preparation

The two non-problem gambling involvement measures were significantly correlated ($\rho = .82$, $p < .001$), and so subsequent analyses were simplified by computing a composite score of *general gambling involvement* by summing the z-scores of the scales. The three future discounting parameters were also significantly intercorrelated (all $\rho s > .77$, $ps < .001$), so we conducted a PCA on these variables. A single component labeled *future discounting* explained 87.0% of the variance.

The future discounting component and the gambling measures were not normally distributed (all Shapiro–Wilk $Ws < .98$, $ps < .05$); non-parametric statistics were used where possible. All

Table 1
Descriptive statistics and zero-order correlations between rated risky personality and measured personality and behavioral measures associated with risk-taking.

	RRP	RPC	FD	GGI	PGSI	*M* (*SD*)
RRP	–	–	–	–	–	4.65 (.86)
RPC	.29***	–	–	–	–	0.0 (1.0)
FD	.19*	.01	–	–	–	−.08 (.71)
GGI	.18+	.30***	.17+	–	–	−.05 (1.55)
PGSI	.18*	.32***	.00	.40***	–	.93 (1.33)

Notes: All correlations are two-tailed Pearson *r*, except for correlations involving FD, GGI, and PGSI, which are Spearman ρ.
RRP = rated risky personality; RPC = risky personality component; FD = future discounting; GGI = general gambling tendencies; PGSI = problem gambling tendencies.
+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

other variables were normally distributed (all Shapiro–Wilk *W*s > .98, *p*s > .05). Outliers were detected (*z*s > 3 or *z*s < −3) for the future discounting component ($n = 5$), the general gambling involvement composite score ($n = 3$), and problem gambling ($n = 2$). These outliers were winsorized.

3.2. Preliminary analyses

The inter-rater reliability of attractiveness (Cronbach $\alpha = .93$) and ratings of risky personality derived from faces (subsequently, *rated risky personality*; Cronbach $\alpha = .91$) were high.

All of the risky personality measures (SSS, EIS, RBS, DOSPERT) were significantly correlated (all *r*s > .43, *p*s < .001). To determine whether a single underlying component accounted for common variance in the personality measures of risk, a principal components analysis (PCA) without rotation was conducted on the total personality scores. A single component labeled *risky personality* explained 64.1% of the variance. All variables loaded highly and positively (>.75). Descriptive statistics and reliability (Cronbach's *alpha*) for the risky personality measures were as follows: EIS ($M = 7.4$, $SD = 4.0$, $\alpha = .78$); SSS ($M = 21.0$, $SD = 6.4$, $\alpha = .84$); RBS ($M = 145.8$, $SD = 50.9$, $\alpha = .95$); DOSPERT ($M = 111.6$, $SD = 20.7$, $\alpha = .89$).

Male and female raters did not significantly differ in their ratings of faces overall, $t(228) = .261$, $p = .80$, or in their ratings of male target faces, $t(114) = .04$, $p = .97$, or female target faces, $t(112) = .44$, $p = .66$. We therefore combined face ratings obtained from men and women for all subsequent analyses.

3.3. Inferences of personality and behavioral outcomes

Correlations between rated risky personality and measured personality and behavioral outcomes associated with risk-taking are presented in Table 1, and shown graphically in Fig. 1. Rated risky personality was, on average, significantly correlated with measured risky personality, future discounting, and problem gambling, and marginally correlated with general gambling tendencies.[1] The same pattern of results was observed after controlling for attractiveness: risky personality, $r = .32$, $p = .001$; future discounting, $r = .23$, $p = .01$; problem gambling, $r = .20$, $p = .04$; general gambling involvement, $r = .18$, $p = .06$ (all partial correlations with rated risky personality, controlling for attractiveness).

3.4. Target gender and face ratings

Substantial evidence suggests that men exhibit higher levels of risk-taking compared to women, and possess higher levels of personality traits associated with risk (e.g., Stinchfield, 2004). In the present study, we found that target men scored higher than women on the risky personality component, $t(113) = 4.55$, $p < .001$. Furthermore, target men scored higher than women on general gambling involvement and problem gambling (both Mann–Whitney *Z*s > 2.34, *p*s < .019), and higher on future discounting ($Z = .23$, $p = .82$), although the latter comparison was not significant. It is possible that the correlations between rated risky personality and personality and behavioral measures associated with risk were driven by the "maleness" of targets.

We examined whether rated risky personality could account for variance in personality and behavioral traits associated with risk-taking above and beyond target sex and attractiveness using hierarchical regression analyses. Two blocks of variables were regressed onto measured risky personality, future discounting, general gambling involvement, and problem gambling. Block one consisted of target sex and rated attractiveness. Block two consisted solely of rated risky personality.

3.4.1. Risky Personality

Target gender and rated attractiveness accounted for significant variance in risky personality, adjusted $R^2 = .15$, $p < .001$. Rated risky personality accounted for significant variance above and beyond target gender and rated attractiveness, $sr = .18$, R^2 change = .03, $p = .038$.

3.4.2. Future Discounting

Target gender and rated attractiveness did not account for significant variance in the future discounting component, adjusted $R^2 = .010$, $p = .64$. Rated risky personality, however, accounted for significant variance in future discounting above and beyond target gender and rated attractiveness, $sr = .22$, R^2 change = .05, $p = .02$.

3.4.3. Gambling

For both general gambling involvement and problem gambling, target gender and attractiveness accounted for significant variance; for both, adjusted $R^2 = .08$, $p = .004$. However, rated risky personality did not account for additional variance in either of the gambling measures (for both, $sr = .10$, R^2 change = .009, $p = .28$). In both regressions, gender was the only significant predictor.

4. Discussion

Average rated risk-propensity of photographed targets was significantly associated with measured personality traits associated with risk-taking, future discounting, and problem gambling tendencies, and marginally associated with general gambling tendencies. These associations were not significantly accounted for by individual differences in rated attractiveness or target gender for risky personality or for future discounting. Regression analyses indicated that target gender was the only variable to significantly account for variance in gambling and problem gambling behavior. Overall, the results suggest that on average, people are able to accurately perceive some information regarding personality traits and behavioral outcomes associated with risk-taking from faces.

People may be particularly sensitive to traits that have significant and general behavioral implications, such as risk-propensity, and faces may serve as an honest signal to potential social partners. Alternatively, people who possess certain facial features may be prone to a self-fulfilling prophecy effect, whereby certain characteristics lead to biased treatment from others (Olivola & Todorov, 2010). If this hypothesis is true, perceived risk-proneness may not necessarily be an honest advertisement of actual risk-propensity, but rather, a product of being treated by others as risk-prone based on perceptual bias.

[1] Significant bivariate correlations were also observed between rated risky personality and the four individual measures of risky personality, all *r*s > .20, *p*s < .04.

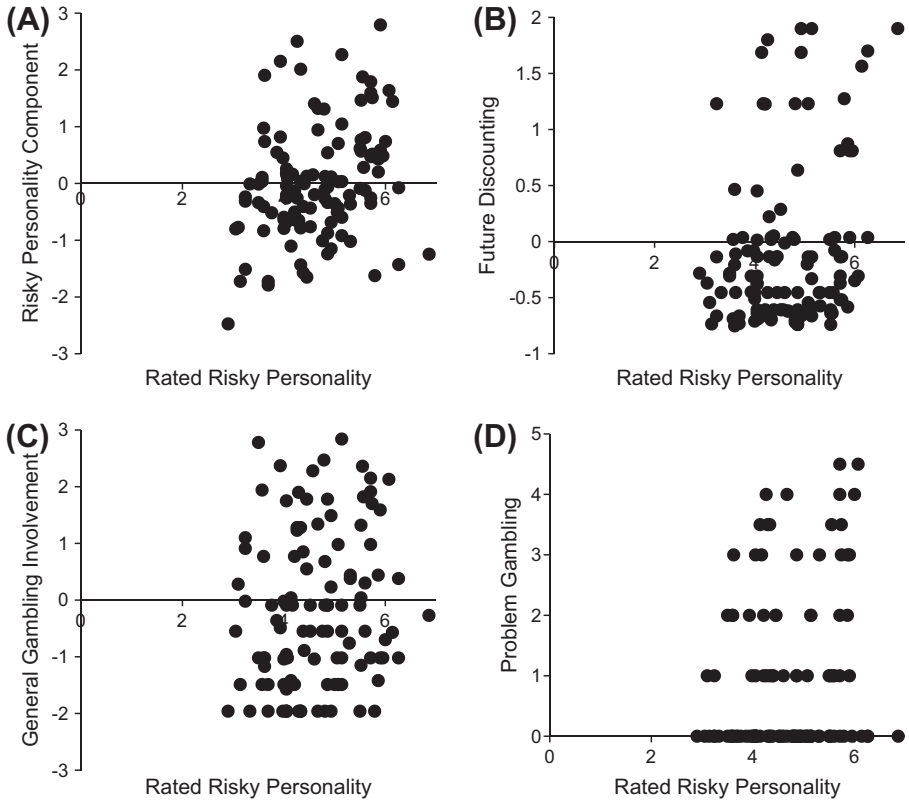

Fig. 1. Scatterplots between rated risky personality and (A) the risky personality component, (B) future discounting, (C) general gambling involvement (GGI), and (D) problem gambling (PGSI).

Although the results of this study indicate that people on average are able to perceive some variation in risk-propensity in faces, it is unclear what morphological characteristics of faces give rise to these impressions. Future research into the structural characteristics of faces that contribute to the perception of variance in risk-propensity would be illuminating (e.g., face width to height ratio; Carré et al., 2009). Some previous research has examined the proximate characteristics that give rise to facial trustworthiness and facial competence (Olivola & Todorov, 2010), providing some direction for future work.

This study examined the degree to which pooled average ratings of risk-propensity were associated with personality traits and behavioral outcomes associated with risk. Future research utilizing larger rater sample sizes would allow for investigation of the degree to which individual raters accurately perceive personality traits and behavioral outcomes associated with risk from faces. Furthermore, such larger sample sizes would also allow for the examination of the interaction of rater characteristics with target characteristics (e.g., through structural equation modeling). It would be interesting to examine whether certain raters are particularly adept at perceiving risk-propensity in faces, and whether this accuracy extends to the inference of other personality traits.

Despite the results of this study, some limitations must be noted. Rated risky personality was only marginally correlated with general gambling tendencies. Furthermore, regression analyses indicated that accounting for target gender eliminated the ability of rated risky personality to account for variance in gambling and problem gambling. Substantial evidence suggests that men are much more likely to engage in gambling than women (e.g., Stinchfield, 2004). Because of the size of this gender difference, it is unsurprising that target gender so effectively predicted gambling and problem gambling. Larger sample sizes may reveal the ability of risk inferences to predict gambling and problem gambling above and beyond gender.

Rated risky personality was associated with both risk-propensity and future discounting, but future discounting was not significantly correlated with any of the other measures associated with risk. Substantial research has linked future discounting to risky behavior in risk-persistent samples (e.g., gamblers, drug addicts; reviewed in Reynolds (2006)). However, in student populations, measures of future discounting have been inconsistently correlated with other measures of risk-taking (e.g., Mishra & Lalumière, 2011). Student populations may exhibit less variation in personality traits and behavioral tendencies associated with risk-propensity compared to more general populations. As a result, our relatively low effect sizes and inconsistent correlations may be a byproduct of a smaller, limited sample.

Risky personality was rated using a single, general question. This approach was used to capture participants' general conceptions of riskiness as generally as possible. However, participants may have varied in their conceptions of riskiness; for example, risk-taking may be considered positive (e.g., stock trading, extreme sports participation), or negative (e.g., criminal behavior). Future research would benefit from more specific questions posed to raters that specify the nature of risk to be rated in target individuals.

Such real-world behaviors as gambling and problem gambling, antisocial and delinquent conduct, dangerous driving, accidents, substance use, and risky sexual behavior have been associated with individual differences in risk-propensity. The ability to accurately infer risk-propensity in social partners may have important implications for successfully negotiating interactions with others. The results of this study provide additional support for the hypothesis that personality can, on average, be accurately inferred from faces,

and demonstrate that these inferences are linked with some behavioral tendencies and outcomes associated with risk-taking.

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