Research Article

Rejection Sensitivity and the Defensive Motivational System

Insights From the Startle Response to Rejection Cues

Geraldine Downey,[1] Vivian Mougios,[2] Ozlem Ayduk,[3] Bonita E. London,[1] and Yuichi Shoda[4]

[1]*Columbia University;* [2]*Long Island University;* [3]*University of California, Berkeley; and* [4]*University of Washington*

ABSTRACT—*Rejection sensitivity (RS) is the disposition to anxiously expect, readily perceive, and intensely react to rejection. This study used the startle probe paradigm to test whether the affect-based defensive motivational system is automatically activated by rejection cues in people who are high in RS. Stimuli were representational paintings depicting rejection (by Hopper) and acceptance (by Renoir), as well as nonrepresentational paintings of either negative or positive valence (by Rothko and Miro, respectively). Eyeblink startle magnitude was potentiated in people high in RS when they viewed rejection themes, compared with when they viewed nonrepresentational negative themes. Startle magnitude was not attenuated during viewing of acceptance themes in comparison with nonrepresentational positive themes. Overall, the results provide evidence that for people high in RS, rejection cues automatically activate the defensive motivational system, but acceptance cues do not automatically activate the appetitive motivational system.*

Everyone experiences rejection. Whereas some people respond with equanimity, others respond in ways that profoundly compromise their well-being and relationships. To help explain such maladaptive reactions to rejection, we have proposed a specific cognitive-affective processing disposition, rejection sensitivity (RS; Downey & Feldman, 1996). At the core of this disposition is the anxious expectation of being rejected by people who are important to the self, an expectation developed through exposure to severe and prolonged rejection. Our research has shown that individuals who anxiously expect rejection have a tendency to readily perceive it in other people's behavior and then react to it in ways that undermine their relationships; their behavior thus leads to the feared outcome (see Levy, Ayduk, & Downey, 2001). We have applied the term *high-rejection-sensitive* (HRS) to describe people who show a heightened tendency to anxiously expect, readily perceive, and intensely react to rejection (Downey & Feldman, 1996).

Address correspondence to Geraldine Downey, Department of Psychology, Columbia University, 1190 Amsterdam Ave., Mail Code 5501, New York, NY 10027; e-mail: gdowney@psych.columbia.edu.

Why do people who anxiously expect rejection behave in ways that lead to the realization of their worst fears? Our view is that the RS dynamic functions to defend the self against rejection by significant others and social groups. To the extent that the individual has experienced the pain of rejection, protecting the self from rejection while maintaining close relationships will become an important goal, and a self-defensive system such as RS will develop to serve it. However, this system becomes dysfunctional to the extent that it gets elicited automatically with minimal rejection cues and sets in motion the precise actions that ultimately lead to the fulfillment of expectations of rejection (Downey, Freitas, Michaelis, & Khouri, 1998).

The present study tested our guiding assumption that RS is a defensively motivated system that gets elicited by rejection-relevant stimuli and that this elicitation occurs automatically, at an early, nonverbal stage in the activation of the RS dynamic. We tested these hypotheses by assessing whether in the face of rejection-relevant cues, individuals high in RS show heightened potentiation of the startle response, a robust autonomic nervous system indicator of activation in the defensive motivational system (DMS; Lang, Bradley, & Cuthbert, 1990; see Dawson, Schell, & Boehmelt, 1999).

DEFENSIVE MOTIVATIONAL SYSTEM

The understanding of how organisms defend themselves against threats has increased tremendously as researchers have brought developments in cognitive, behavioral, and affective neuroscience to bear on the issue. Converging evidence from neurological and behavioral research suggests that two primary affective-motivational systems organize behavior—an appetitive system that responds to positive stimuli (i.e., rewards), motivating approach and consummatory behavior, and a defensive system that responds to negative, aversive stimuli (i.e., punishments, threat), disposing the individual toward active avoidance, and fight-or-flight (Gray, 1987; Lang, Davis, & Öhman, 2000; Metcalfe & Mischel, 1999).

Lang et al. (1990) proposed a model of human emotions that is consistent with this literature. In this model, human emotions are viewed as action dispositions that organize behavior along an appetitive-aversive dimension. Valence determines which system is activated (i.e., defensive vs. appetitive), but arousal determines the

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intensity with which the system is activated. According to this model, when negatively valenced and highly arousing stimuli are encountered, the DMS becomes activated to prepare for rapid execution of a set of automatic behaviors aimed at self-protection. What constitutes a threat can be biologically based (e.g., an instinctive threat reaction to seeing a snake) or socially learned (e.g., an expectation of rejection in certain social situations).

Research on both animals and humans suggests that when the DMS is activated by the potential of danger, physiological responses to newly encountered threat-congruent cues are amplified, and physiological responses to threat-incongruent cues are attenuated. That is, the organism is oriented to detect cues that are congruent with a state of threat and to act when confirmatory cues are detected (see Lang et al., 2000). The model also indicates that when the appetitive system is activated, there should be a relative dampening of physiological responses to threatening cues.

CONCEPTUALIZING RS AS A DEFENSIVE MOTIVATIONAL SYSTEM

Our phenomenological description of the operation of the RS system closely parallels the operation of the DMS. According to our conceptualization of RS, in situations in which rejection is a possibility (e.g., meeting a prospective dating partner, asking one's friend to do a favor), people who are high in RS are uncertain about whether they will be accepted or rejected, but the outcome is critical. Thus, for HRS individuals, such situations incorporate cognitive appraisals of threat under conditions of uncertainty—the specific conditions known to activate the DMS (Fanselow, 1994; Lang et al., 2000; Lazarus, 1999; LeDoux, 1996; Metcalfe & Mischel, 1999). Low-RS (LRS) individuals are less likely to experience heightened DMS activation in these same situations because they typically deem rejection less probable and of less concern.

As we have described, when the DMS is activated, it facilitates monitoring and detection of threat-relevant cues and prepares the individual for swift response once cues of danger are detected. We hypothesize that in rejection-relevant situations, this system is automatically activated in HRS individuals.

Given our assumption that RS develops specifically to defend the self against rejection, we hypothesize that the system is biased primarily toward dealing with threats of rejection. We do not expect acceptance to elicit the appetitive system in HRS people to a greater extent than in LRS individuals. Thus, RS should predict indicators of heightened DMS activation in the presence of rejection cues but should not predict heightened activation of the appetitive system in the presence of acceptance cues. We tested these predictions using the human startle probe paradigm.

ASSESSING ACTIVATION OF THE DMS USING THE HUMAN STARTLE PROBE

The magnitude of an individual's eyeblink response to a startling probe stimulus is a highly reliable indicator of DMS activation (Bradley, Cuthbert, & Lang, 1990, 1999; Lang et al., 1990). For example, when a loud burst of white noise is presented in the context of an unpleasant pictorial stimulus, the individual's naturally occurring startle response to the loud noise is significantly augmented relative to when the same noise is presented in the context of a pleasant pictorial stimulus (see Lang et al., 2000, for review). The electromyographic (EMG) response accompanying sudden closure of the eyelids (the eyeblink) is the first, fastest, and most stable component of the startle reflex (Lang et al., 1990). Although this reflex habituates over trials, it can nevertheless be repeatedly evoked within relatively short time periods over dozens of trials (Putnam & Roth, 1990).

The rationale underlying this paradigm is that when an organism is already in a high-arousal, negatively valenced state, independently evoked defensive responses such as the eyeblink response to an unexpected loud noise are augmented (Lang et al., 1990, 2000). For example, when individuals are viewing a picture depicting a gun pointing toward them, they show exaggerated startle (indexed by the magnitude of their eyeblink response) when disturbed by an unexpected loud noise. The eyeblink is a reflexive defensive response that follows unexpected and averse stimuli. Both the picture and the noise are unpleasant, and both evoke defensive responses. The magnitude of the startle response to the loud noise is potentiated, however, because the individual is already in a defensive state due to viewing the unpleasant, arousing picture. Conversely, when individuals are viewing a positively arousing pictorial stimulus, they are in an appetitive state and therefore their independently evoked defensive responses are attenuated. Thus, the magnitude of the startle reflex changes systematically with the valence of the psychological context (Lang et al., 1990).

Previous studies have used the startle probe paradigm to infer individual differences in the extent to which the DMS is activated in a particular psychological context. For example, people with a specific phobia are more responsive than nonphobics to a startle probe, such as a noise burst, that is presented in the presence of a phobia-relevant stimulus, but are not more responsive to the same probe when it is presented in the presence of a phobia-irrelevant negative stimulus (e.g., Hamm, Cuthbert, Globisch, & Vaitl, 1999).

THE PRESENT STUDY

Capitalizing on this research, we used the startle probe paradigm to examine individual differences in DMS activation in the presence of rejection cues as a function of RS. We hypothesized that the operation of the RS dynamic entails a context-dependent activation of the DMS, and thus expected HRS people, relative to LRS people, to show a greater relative increase in eyeblink magnitude following a startle probe presented in a rejection-relevant context (e.g., during viewing of pictures depicting rejecting themes). We expected no differences between HRS and LRS people in the magnitude of startle response in a negative but rejection-irrelevant context.

In contrast, we hypothesized that RS would not covary systematically with reactions to acceptance. Thus, we expected that HRS and LRS people would not differ in their eyeblink magnitude following a startle probe presented in an acceptance-relevant context (e.g., during viewing of pictures depicting acceptance themes). We also expected no differences between the responses of HRS people to acceptance-themed art and their responses to positively valenced but acceptance-irrelevant art.

METHOD

We conducted a pilot study to identify artists whose work depicts themes of acceptance and rejection. To select control paintings, we identified artists whose work is characterized by nonrepresentational

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depictions of positive and negative themes. Participants in a second study viewed slides of the selected paintings in a startle probe paradigm. The general procedures for the startle paradigm were adapted from those used by Lang and his colleagues (e.g., Bradley et al., 1990, 1999; Lang et al., 1990).

Pilot Study: Identification and Validation of Artwork to Be Used as Experimental Stimuli

Through consultation with art experts and examination of qualitative data obtained from 20 pilot participants, we identified the artwork of Edward Hopper, August Renoir, Mark Rothko, and Jean Miro as depicting rejection, acceptance, nonrepresentational negativity, and nonrepresentational positivity, respectively. A separate group of pilot participants ($N = 40$) rated four selected paintings from each artist along four dimensions: positivity-negativity, acceptance-rejection, interest, and arousal. These 16 paintings were the stimuli for the main study. (The stimuli are available on the Web at www.columbia.edu/cu/psychology/socialrelations.) Table 1 presents the mean ratings (on a scale from 1 to 7) for each artist's work, together with the F tests for the effect of artist (Hopper vs. Rothko vs. Renoir vs. Miro) and the pair-wise comparisons between the artists for each rating dimension.

The results confirmed that the Hopper paintings depicted rejection themes and were negative in valence, whereas the Renoir paintings depicted acceptance themes and were positive in valence. The Rothko paintings were highly negative but less related to rejection than were Hopper's works. The Miro paintings were highly positive but depicted acceptance less than did Renoir's paintings. Rothko's paintings were more negative than Hopper's paintings, but this difference should have worked against our hypothesis, providing a more conservative test of the prediction that Hopper's paintings would lead to a greater potentiation of the startle reflex than would Rothko's paintings for people high in RS. Finally, Hopper's and Rothko's paintings had similar arousal and interest ratings, indicating that any differences in startle potentiation in response to Hopper's works (compared with Rothko's) in HRS people cannot be attributed to differences between the artists on these two dimensions.

Blink Magnitude Study

Sample and Procedure

Participants were 43 undergraduates (60% males) recruited via advertisements posted around the Columbia University campus (M age = 23.6 years, $SD = 5.5$, range: 18–38 years). The ethnicity of the sample was 45% Caucasian, 29% Asian, 10% African American, 10% Latino, and 6% other. All participants received either $8 or course credit toward the university's introductory psychology requirement. Data from 3 subjects were dropped because of equipment failure.

Participants were tested individually in one experimental session lasting approximately 1 hr. Each participant first completed questionnaires measuring RS and general psychological distress (described in the Background Measures section) and was then led into a small sound-attenuated room with a one-way mirror. The experimenter attached sensors as described in the next paragraph. To facilitate adaptation to the laboratory setting, we had participants rest quietly while the experimenter monitored the physiological recording and sampled a 2-min baseline before proceeding with the startle probe experiment.

A customized program on a Gateway 2000 computer system controlled stimulus presentation and collection of physiological data. The eyeblink component of the startle response was measured by recording EMG activity from the *orbicularis oculi* muscle. Two miniature sensors were attached below the left eye, and a third sensor, serving as a ground, was attached to the participant's forehead. Eyeblink activity was amplified by a Coulbourn S75-01 high-gain bioamplifier. For each participant, the level of amplification needed to obtain a robust signal was determined by the experimenter in a practice session prior to the experimental session and held constant throughout the experimental session. The EMG signal was rectified and integrated by a Coulbourn contour-following integrator at a time constant of 20 ms, then sampled at a rate of 4000 Hz for 1,000 ms following each startle probe.

The slides of the 16 paintings were projected by a Kodak Ektagraphic III slide projector through a one-way mirror onto a 3- × 2.5-m white screen 1.5 m in front of the participant. Four presentation blocks consisting of 4 slides each were arranged so that a picture from each artist was included within each block. Each slide was shown for 6 s, followed by an interslide interval that varied randomly from 10 s to 20 s. During 3 slides in each block, a startling noise burst was presented at one of three probe positions, either 2.5 s, 4.0 s, or 5.0 s after slide onset; the 4th slide was not probed. Acoustic startle probes were generated by a Coulbourn noise generator, amplified by a stereo amplifier, and electronically relayed to a set of stereo speakers that were placed in front of the subject. The acoustic stimulus consisted of a 50-ms presentation of a 95-dB burst of white noise with an

TABLE 1
Mean Ratings of the Paintings in the Pilot Study

Dimension	Artist: Hopper (rejection)	Rothko (negativity)	Miro (positivity)	Renoir (acceptance)	$F(3, 123)$
Rejection	5.90_a (0.98)	4.17_b (0.75)	3.58_c (0.64)	2.12_d (0.61)	157.00**
Valence[a]	4.93_a (0.41)	5.56_b (0.84)	2.44_c (0.83)	2.67_c (0.48)	202.17**
Interest	$4.14_{a,b}$ (0.94)	3.89_a (0.55)	3.97_a (0.60)	4.20_b (0.88)	1.62
Arousal	$4.17_{a,b}$ (1.41)	3.93_a (0.73)	4.21_b (0.45)	3.88_a (0.70)	2.18

Note. Values in parentheses are standard deviations. Ratings were made on a scale from 1 to 7. Within each row, means with different subscripts differ from each other at $p < .05$.
[a]Higher ratings indicate greater negativity.
**$p \leq .001$.

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instantaneous rise time. To ensure that postprobe blinks were responses to the probe, we limited all analyses to eyeblink data that occurred within a response window of 20 to 200 ms following the probe onset.

On completion of the experiment, each participant was fully debriefed and compensated either monetarily or with course credit.

Background Measures

Rejection Sensitivity Questionnaire (RSQ). The RSQ assesses anxious expectations of rejection from significant others (Downey & Feldman, 1996; the measure is available on the Web at www.columbia.edu/cu/psychology/socialrelations). The measure consists of 18 items that depict hypothetical interpersonal interactions in which rejection by a significant other is a possibility (e.g., "You ask your friend to do you a big favor"). For each situation, the respondent indicates his or her degree of concern or anxiety about the outcome, as well as the perceived likelihood that the interactant (or interactants) would respond with rejection. Reflecting our adoption of an expectancy-value model (Bandura, 1986) of anxious expectations of rejection, RSQ scores are computed by first weighting the expected likelihood of rejection for each situation by the degree of anxiety and then averaging these weighted scores across the 18 situations. Downey and Feldman (1996) provided evidence that RS is not redundant, in terms of its predictive utility, with conceptually and empirically related personality constructs, including introversion, neuroticism, adult attachment style, social anxiety, social avoidance, and self-esteem. In this study, the mean RSQ score was 10.37 ($SD = 3.53$, $\alpha = .83$). There were no significant gender or age differences.

Symptom Checklist-90-R (SCL-90-R). The SCL-90-R (Derogatis, 1992) asks participants to indicate their level of discomfort with each of 90 psychiatric distress symptoms in the past week, using a scale ranging from *not at all* (0) to *extreme* (4). The scores on the total checklist, SCL-Total, and on the 9-item SCL-Anxiety subscale were used in this study (SCL-Total: $M = 0.71$, $SD = 0.58$, $\alpha = .97$; SCL-Anxiety: $M = 0.62$, $SD = 0.76$, $\alpha = .91$).

Hypotheses and Data Analyses

The data were analyzed using a mixed-linear-model approach with artist treated as a within-subjects factor and RS treated as a between-subjects factor. The results were adjusted for first-order autocorrelation in the within-subjects error terms. Including either SCL-Anxiety or SCL-Total as a between-subjects covariate did not change the significance of the findings reported here (neither SCL-Anxiety nor SCL-Total moderated any of the findings reported). We implemented the analysis using the SAS program PROC MIXED (Littell, Milliken, Stroup, & Wolfinger, 1996). To aid the interpretation of results, we centered RS on its mean by subtracting the mean value of RS (10.37) from each individual's value.

To test whether RS was related to an increase in the magnitude of the eyeblink startle reflex specifically during viewing of the Hopper slides, we examined whether the relation between RS and blink magnitude was different for Hopper compared with all other artists (Hopper = 1, other = 0), as well as specifically with each of the other artists. In all of the analyses, we expected the interaction term between RS and artist to be positive and significant and, thus, to indicate greater potentiation of the startle reflex in HRS people in response to Hopper's paintings. Finding the expected interaction term when comparing Hopper and Renoir would be consistent with the conclusion that HRS people were more responsive than LRS people to Hopper than to Renoir (Hopper = 1, Renoir = 0). However, the finding might reflect HRS people's greater responsivity to negative than to positive cues. Alternatively, it might reflect that HRS people show an attenuated response to acceptance cues, indicating heightened activation of the appetitive motivational system, rather than an accentuated response to rejection cues, indicating heightened activation of the DMS. The analyses comparing Hopper and Rothko (Hopper = 1, Rothko = 0) would help rule out the possibility that the effect of Hopper's paintings in potentiating the startle reflex in HRS people was due merely to the paintings' negative content (rather than to their rejection content).

To determine whether HRS people were more responsive to acceptance cues than were LRS people, we assessed whether RS was more negatively associated with the magnitude of blink response during viewing of Renoir's work than during viewing of Miro's. Finally, because of the equivalently high ratings of arousal for Miro's and Hopper's paintings, we examined whether the association between RS and blink magnitude differed for these two artists. If only arousal level mattered, then RS would not be associated with blink magnitude for either artist. However, if differences in valence are what mattered, we would expect RS to be more strongly associated with blink magnitude for the negatively valenced Hopper paintings than for the positively valenced Miro paintings.

RESULTS

Preliminary analyses showed that, as expected, there was a trend for startle blink magnitude to be higher for negatively valenced paintings (Rothko, Hopper) than for positively valenced ones (Miro, Renoir), $b = 2.76$, $t(39) = 1.71$, $p < .10$. There was no significant effect of stimulus type (representational vs. abstract) on eyeblink magnitude ($t < 1$). RS was unrelated to magnitude of baseline EMG level.

Mixed-models analyses yielded a significant interaction term between RS and artist both when Hopper was compared with all other artists combined, $b = 2.07$, $t(37) = 2.34$, $p < .05$, effect size $r = .42$, and when Hopper was compared with each artist, Renoir: $b = 1.95$, $t(37) = 2.09$, $p < .05$, effect size $r = .39$; Rothko: $b = 2.39$, $t(37) = 2.44$, $p < .02$, effect size $r = .42$; Miro: $b = 1.92$, $t(37) = 2.14$, $p < .05$, effect size $r = .42$. In contrast, the analyses comparing Renoir and Miro did not yield a significant RS × Artist interaction ($t < 1$).

Table 2 presents the parameter estimates from these analyses, and Figure 1 illustrates the results for the Hopper-versus-Rothko comparison for individuals 1 *SD* below and above the mean on RS (LRS and HRS, respectively). Simple slope analyses (Aiken & West, 1991) indicated that RS showed a marginally significant positive relation to blink magnitude for the Hopper slides, $b = 2.78$, $t(37) = 1.92$, $p = .06$, but not the Rothko slides, $b = 0.39$, $t < 1$. Furthermore, for HRS participants, Hopper slides (compared with Rothko slides) were related to an increase in blink magnitude, $b = 11.71$, $t(37) = 2.43$, $p = .02$, whereas for LRS participants, Hopper slides were not significantly related to an increase in blink magnitude, $b = -5.13$, $t(37) = 1.13$, n.s.

A possible explanation for the potentiated startle effect among HRS individuals when they viewed Hopper's pictures is that they might have disengaged their attention from visual stimuli that they found noxious and thus may have had more resources available to respond to

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TABLE 2

Unstandardized Parameter Estimates From Mixed-Models Analyses Predicting Blink Magnitude as a Function of Rejection Sensitivity (RS) and Artist

	Parameter estimate			
Pair-wise comparison	Intercept	Artist	RS	RS × Artist
Hopper (1) vs. other (0)	31.18**	4.03	0.74	2.07*
Hopper (1) vs. Rothko (0)	31.76**	3.29	0.39	2.39*
Hopper (1) vs. Renoir (0)	31.47**	4.05	0.82	1.95*
Hopper (1) vs. Miro (0)	35.06**	5.33†	2.85†	1.92*
Renoir (1) vs. Miro (0)	30.14**	1.49	1.12	−0.23

Note. RS scores have been centered.
†$p \leq .10$. *$p \leq .05$. **$p \leq .001$.

stimuli in another modality such as the acoustic probe (Anthony & Graham, 1985). To rule out this explanation, we conducted a separate study in which individuals could view each of the pictures used in this study for as long as they wished ($N = 86$; 37 males). Overall, people spent more time viewing positive paintings (Miro and Renoir: $M = 8.33$ s, $SD = 6.93$) than negative paintings (Rothko and Hopper: $M = 6.93$ s, $SD = 5.60$), $F(1, 85) = 9.28$, $p < .01$. However, length of viewing time was unrelated to RS (Pearson *r*s between .04 and .13). This finding is inconsistent with the hypothesis that HRS individuals consciously avoid rejection stimuli.

DISCUSSION

When viewing art depicting rejection themes (Hopper's paintings), people who were high in RS showed an amplified eyeblink following a loud noise, relative to their eyeblink response when viewing each of the other types of artwork, whereas people low in RS did not. This finding indicates that when HRS individuals are viewing rejection-related stimuli, they show heightened DMS activation.

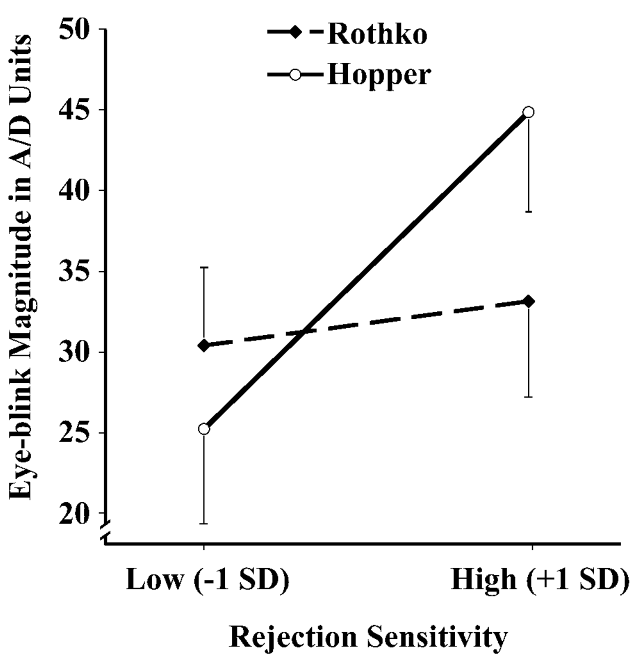

Fig. 1. Change in blink magnitude as a function of rejection sensitivity and artist (Hopper vs. Rothko). Error bars show standard deviations of the relevant point estimates. A/D = analog-to-digital conversion.

We propose that the activation of this system helps explain the readiness with which HRS individuals perceive rejection in other people's behavior and contributes to the intensity of their responses to the perceived rejection. The adaptive value of the DMS comes from its ability to trigger quick defensive responses under threat without the individual needing time to think (Lang et al., 2000; LeDoux, 1996; Metcalfe & Mischel, 1999). Such an emergency system can become maladaptive, however, if activated when reflective, strategic behavior is required, when the threat is minimal, or when efforts to prevent the realization of the threat occur at the expense of other personal goals.

We found no evidence that acceptance cues elicit a positive, appetitive motivational state to a greater extent in HRS individuals than in LRS individuals. These findings support our view that acceptance and rejection are not of equivalent importance for HRS individuals and that the RS system develops specifically to protect the self against the threat of rejection.

Although providing evidence of selective activation of the DMS in response to rejection themes among individuals high in RS, this study has several limitations. For example, the findings may not generalize beyond the specific stimuli selected. The findings should be replicated with a broader range of stimuli and a control condition in which participants view representational art that does not depict rejection or acceptance themes.

Moreover, it is important to extend the present study in several ways. One goal is to link peripheral evidence of DMS activation with more direct evidence of DMS activation using neuroimaging and neuromonitoring techniques, such as functional magnetic resonance imaging and event-related potential recording. Both animal research and human studies implicate the amygdala as a key site of DMS activation (Fanselow, 1994; Funayama, Grillon, Davis, & Phelps, 2001; Lang, Bradley, & Cuthbert, 1998, 2000). That research thus suggests that, compared with LRS individuals, HRS individuals should selectively show greater amygdala activation (most likely in the right hemisphere, given stimuli presented pictorially) to rejection stimuli. In addition, work with humans suggests that viewing unpleasant stimuli, compared with pleasant or neutral stimuli, is associated with increased activity in the visual cortex, which is indicative of increased attention and more processing at earlier stages (Lang et al., 1998). Thus, compared with LRS people, those high in RS should show greater activation of the visual cortex when viewing rejection stimuli.

It is also important to link evidence of DMS activation in response to rejection stimuli with behavior in HRS individuals. For example, estimates of individual differences in reactivity to rejection stimuli obtained in studies like the present one could be used to predict behavior in real-life situations deemed likely to activate rejection concerns. Such a study design exemplifies a way of linking biological with cognitive-affective and contextual variables to further the understanding of self-defeating and socially harmful responses to rejection.

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