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Reward and punishment sensitivity in shy and non-shy adults: Relations between social and motivated behavior

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Abstract

Few studies have examined underlying mechanisms linking social behavior, motivated behavior, and reward and punishment systems. The current study was designed to investigate these mechanisms by examining responses to both rewarding and punishing non-social stimuli in shy and non-shy adults. Ninety-three participants, comprising three social behavior groups (Shy, Non-shy, Control) completed the Monetary Incentive Delay task. Consistent with previous research, all participants were sensitive to incentive manipulations. There were also significant individual differences in response. Non-shy participants demonstrated sensitivity to both reward and punishment stimuli, and behavior indicative of high levels of arousal in approach motivation. Shy individuals demonstrated a large discrepancy in sensitivity to reward compared to punishment, with this discrepancy being driven by enhanced sensitivity to reward. Their behavior suggested conflict generated by increased arousal in both approach and withdrawal motivation systems. Current findings contribute to theoretical accounts of relations between social behavior and behavior modulated by reward and punishment. These findings carry implications for the study of psychopathology and neuroimaging research designed to examine relationships between social behavior, motivated behavior, and underlying reward and punishment systems.

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1. Introduction

Converging evidence from many disciplines suggests relations between social behavior and behavior modulation by reward or punishment. While different terminology is used across disciplines to describe individuals who exhibit individual differences in social behavior (i.e., extraversion or exuberance versus introversion, shyness, or social anxiety), these individuals generally demonstrate different patterns of sensitivity to potentially rewarding or punishing stimuli. Personality theories suggest that socially outgoing individuals (extraverts) and socially withdrawn individuals (introverts) differ in conditionability and reward sensitivity, reflecting reward dependence effects on social behavior (Cloninger, 1987; Eysenck, 1967; Gray, 1970). Reward expectancy is typically high in extraverts and low in introverts, while individuals scoring high in Neuroticism manifest anxiety and sensitivity to punishment (Zuckerman, 1991; Zuckerman, Joireman, Kraft, & Kuhlman, 1999).

Behavioral studies demonstrate that introverts and extraverts differ in response to appetitive compared to aversive stimuli (Corr, 2004). For example, extraverts and introverts demonstrate different patterns of responsivity in the contexts of reward compared to punishment (Nichols & Newman, 1986; Patterson, Kosson, & Newman, 1987). Individuals with social anxiety show both attention and memory biases for threatening, potentially punishing stimuli, particularly when stimuli are social in nature (Monk & Pine, 2004). Similarly, extraverts show biased attention toward rewarding stimuli, while introverts show biases toward punishing stimuli (Derryberry, 1987; Derryberry & Reed, 1994).

Cognitive neuroscience research implicates a number of neural structures that overlap in processing socially relevant, and potentially rewarding and/or punishing stimuli. Human neuroimaging, lesion, and animal studies recognize the amygdala (Baxter & Murray, 2002), ventromedial cortex (Adolphs, 1999), orbitofrontal cortex (Kringelbach & Rolls, 2004), and ventral striatum (Ernst et al., 2004; Knutson, Adams, Fong, & Hommer, 2001; Robbins & Everitt, 1996) as playing roles in processing both reward and social stimuli, and generating behavior in response to these stimuli.

Most neural structures implicated in processing both socially relevant and potentially rewarding or punishing stimuli are likewise implicated in models of neural systems regulating approach or withdrawal motivated behavior in response to appetitive or aversive stimuli (Davidson, Jackson, & Kalin, 2000). The presentation of salient appetitive or aversive stimuli modulate activation of these systems, which subsequently results in approach or withdrawal motivated behavior (Lang, Bradley, & Cuthbert, 1998). Appetitive stimuli will activate approach motivation systems and facilitate approach behavior, whereas aversive stimuli will activate withdrawal motivation systems and facilitate withdrawal behavior. Anxiety and inhibited behavior occur when conflict exists between motivational incentive (i.e., appetitive or aversive) of salient stimuli and behavioral output (i.e., approach or withdrawal) required by the stimuli (McNaughton & Corr, 2004). For example, a stimulus that is interpreted as potentially punishing/threatening (thus energizing the

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