Sensation Seeking and Reward Sensitivity are related to Poor Performance Monitoring (ERN) and Decision-making (IGT)

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Introduction

Background: Sensation seeking (SS) and sensitivity to reward (SR) have been theoretically linked to poor decision-making, disinhibition, and approach motivation. For example, disinhibited and substance abuse subjects make risky choices on the Iowa gambling task (IGT), which may reflect inefficient activity of the orbitofrontal and dorsolateral prefrontal cortices. No studies have examined SS and SR in relation to performance monitoring, necessary for evaluating and altering on-going behaviors. Performance monitoring has been measured using the error-related negativity (ERN), an ERP component thought to reflect activity of the anterior cingulate cortex. The ERN has been conceptualized as indexing error detection or response conflict but a number of recent studies have reported affective and motivational influences on the ERN, suggesting the ERN may be sensitive to goal states and affective responses to errors. For example, enhanced ERNs have been found in obsessive-compulsive subjects while reduced ERNs were related to low-socialization.

Purpose: To examine SS and SR in relation to IGT performance and the ERN.

Method

Participants:
• 50 unselected, 17- to 20-year-old males
• Right-handed, free of head injury

Self-report measures:
• Sensation Seeking Scale (SSS) a 40-item scale assessing thrill and adventure seeking, experience seeking, disinhibition and boredom susceptibility
• Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ) as a measure of Gray’s anxiety and impulsivity dimensions.
• Iowa Gambling Task (IGT) a 40-item scale assessing thrills and adventure seeking, experience seeking, disinhibition and boredom susceptibility.

Iowa Gambling Task (IGT):
• Participant selected card-by-card from 4 decks to maximize payoff for a total of 100 trials (decks A & B were disadvantageous, C & D were advantageous)

Participants:
50 individuals, including both high and low SS/SR groups. Participants were right-handed, free of head injury and completed the Sensation Seeking Scale (SSS) and Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ) to assess SS and SR.

ERP Flanker task:
• 4 computer generated visual displays of 5 letters, displayed 250 ms each with SOA of 1250 ms
• Target letter (S or H) flanked on each side by either congruent (SSSSS, HHHHH) or incongruent (SSHHSS, HHHSSH) letters, target letter required key press

Electrophysiological measurements:
• 4 midline scalp sites scored: Fz, FCz, Cz, Pz
• ERPs were averaged time-locked to error responses starting 600 ms prior and continuing 800 ms post response

Results

SS and SR were highly related (\( r = .45, p = .003 \)) and a composite (SS/SR) was constructed from the sum of the two indices. SS/SR was related to the ERN at Cz (\( r = .33, p = .02 \)) and net scores on the IGT (\( r = -.33, p = .02 \)).

Conclusions

1) SS and SR are sensitive to or affect functions of the ACC and PFC (OFC + DLPFC).
2) Results add to findings that personality factors have implications for performance monitoring as reflected in the ERN.
3) Poor decision-making and/or weak performance monitoring in combination with high sensation seeking and reward sensitivity may lead to risk-taking activities.

References

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