

# Adolescent risk-taking is reward driven rather than impulsive

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The presented study was designed to test the main prediction of the Dual Systems Model: that reward sensitivity and cognitive control contribute to risk-taking in additive manner. We tested it separately on behavioral level and self-report level. The behavioral level included a driving task measuring risk-taking in the rewarded and non-rewarded conditions (top fig.). We also used a new incentivized task to measure reward sensitivity, a task measuring cognitive control and a task measuring impulsivity. We considered whether the increase in risk-taking between the rewarded and non-rewarded driving task was caused by high sensitivity to rewards and/or weak control abilities. The self-reported level included questionnaires of reward sensitivity and self-control as possible predictors of everyday risk-taking. We were hoping to determine whether adolescent risk-taking is impulsive (due to weak cognitive control and heightened reward sensitivity), or reward driven (due to heightened reward sensitivity only).

## Method

The sample contained two groups: adolescents ( $N = 90$ , mean age = 14.4,  $SD = 0.68$ , range = [13, 16], 40 boys) and young adults ( $N = 95$ , mean age = 23.05,  $SD = 1.51$ , range = [20, 28], 39 men). Participation was rewarded with vouchers valued from \$5 to \$15, depending on the level of individual performance in two rewarded tasks. Participants performed a set of tasks measuring risk-taking (Spaceride task, in rewarded and non-rewarded condition), reward sensitivity (Incentivized Visual Search Task), cognitive control (Go/Nogo task), and impulsivity (Matching Familiar Figure Test). They also completed three questionnaires measuring everyday risk-taking (Risk Behavior Questionnaire), reward sensitivity (SPSRQ-SF) and self-control (NAS-50).

## Results

There were 59 participants who risked more in the rewarded than in the non-rewarded condition; 74 participants who risked less, and 52 participants who did not risked at all in both conditions. The additive effects of reward sensitivity and cognitive control on risk-taking were similar on two levels: in behavioral tasks and in self-report measures. The effect of reward sensitivity on risk-taking was stronger in adolescents than in adults. Participants who risked more in the rewarded than in the non-rewarded Spaceride were more sensitive to rewards in the IVS task. Similarly, everyday risk-taking was related to reward sensitivity in SPSRQ-SF (bottom fig, top panels). The effects of cognitive control on risk-taking were different in adolescents than in adults. In adults, an increase of risk-taking in the rewarded Spaceride was predicted by weak cognitive control. In adolescents, it was predicted by highly efficient control. Similarly, in adults everyday risk-taking was related to weak self-control, while in adolescents it was related to high self-control (bottom fig., bottom panels).

## Conclusions

Adolescent risk-taking was predicted by reward sensitivity and highly efficient control. It seems that adolescents took risks because they strove to win and were excited by the task, not because they could not control their impulses. Possibly, impulsive risk-taking characterizes a small subset of youth. The rest of adolescents may perceive risk-taking as an advantageous strategy and, consequently, not engage cognitive control to reduce it.

