**Supplementary Material**

**Altered social and non-social decision-making in recreational and dependent cocaine users**

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**Methods**

*Participants*

Subjects were recruited in Zurich via advertisements in widely read local newspapers, different drug prevention and treatment centers, psychiatric hospitals, Internet platforms, and word-of-mouth communication. The recruiting period took place between January 2010 and January 2012. Eight-hundred-four prospective participants completed an initial telephone screening, whereof 240 subjects participated in the actual study. Forty-six participants had to be excluded afterwards because hair analyses revealed illegal drug use not declared in the interviews (e.g., opioids, excessive MDMA use) or lack of cocaine use. Twenty-eight participants (18 controls, 10 cocaine users) were excluded to achieve adequate matching across the three groups (i.e., controls with particularly high verbal IQ, older dependent cocaine users [DCU]), very young recreational cocaine users [RCU]), resulting in a final sample size of 166 participants.

*Study Procedure*

Participants completed a large test battery comprising clinical interviews and questionnaires, neuropsychological, electrophysiological, and social and non-social decision-making measures. The time used to complete the test battery ranged from 4 to 6 hours with breaks after every 1.5 h. Participants were allowed to take additional breaks as needed and smoking was permitted ad libitum. The longitudinal data and results from neuropsychological (Vonmoos *et al.*, 2013) and psychophysiological assessments will be published elsewhere (Preller *et al.*, 2013).

*Behavioral Tasks*

*Social decision-making*: In the social interaction tasks, participants were told that they would interact with two other study participants in a randomly assigned role of either player A or B. In order to warrant anonymity of the drug users, which was necessary for ethical reasons and for professional secrecy, a cover story was used where players were told that they would interact with the other subjects via Internet connection. For the purpose of this study, we were solely interested in the role of player A, wherefore player B was simulated by the computer and always responded in the same manner. The instructions specify that both players are informed about the other player’s possibilities of action and that the points will be converted into real money (Swiss Francs, CHF) at the end of the study. The plausibility of the cover story was controlled by the following question at the end of the test battery: “For reasons of anonymity you did not meet your interaction partner personally. Did you have any doubts that you interacted with someone?” Subjects responded on a five-point scale ranging from 1=*not at all* to 5=*very much*.

*Non-Social Decision-Making:* The IGT tests the ability to choose between favorable card decks with lower gains but also a lower risk for losses eventually resulting in long-term benefit and unfavorable card decks with higher gains but also higher losses resulting in long-term loss. In this study, a computerized version of Grasman and Wagenmakers (University of Amsterdam, Netherlands) was used (http://purl.oclc.org/NET/rgrasman/jscript/IowaGamblingTask). In total, participants had to draw 100 cards, whereby each card deck contained 50 cards. Dependent variables were the net score of favorable and unfavorable cards drawn, the total number of points gained, and quartiles (the 100 cards were summed in 4 quartiles each containing 25 cards). At the end of the task, points were converted by the factor .002 and paid out in real money. All participants started out with 4000 points, with the maximum number of points that could be gained at 8000, equaling 16 CHF.

In theDD, subjects were presented with 27 choices between immediately available lower monetary rewards and higher rewards available with a temporal delay. The discounting rate can be calculated with the Formula *V=A/(1+ kD)(V* is the present value of the delayed reward *A* at delay *D*, and *k* is a free parameter that determines the discount rate) (Mazur, 1987). In this study, we used a computerized version (implemented in Presentation®) of the DD paradigm according to Kirby et al. (Kirby *et al.*, 1999). This version not only makes it possible to investigate the steepness of discounting of delayed rewards (expressed as *k*; the larger the parameter *k*, the stronger the discounting of larger delayed rewards), but also distinguishes between large, medium, and small rewards.

*Methodology of the Urine Analysis*

Urine toxicology analyses comprised the compounds/substances tetrahydrocannabinol, cocaine, amphetamines, benzodiazepines, opioids, and methadone and were assessed by a semi-quantitative Enzyme Multiplied Immunoassay method (Dimension RXL Max, Siemens, Erlangen, Germany)(SAMHSA, 2008).

*Methodology of the Hair Analysis*

If participants’ hair was long enough, one sample of six cm hair (from the scalp) was taken and subsequently divided into two subsamples of three cm length. Hair samples from 163 subjects were successfully analyzed. Due to an insufficient amount of hair, the samples from two controls, and one cocaine user could not be analyzed properly. The following compounds were assessed: cocaine, benzoylecgonine, ethylcocaine, norcocaine, amphetamine, methamphetamine, MDMA, MDEA, MDA, morphine, codeine, methadone EDDP (primary methadone metabolite), tramadol, and methylphenidate.

For our routine protocol for drugs of abuse analysis a three step washing procedure with water (2 minutes shaking, 15ml), acetone (2min., 10ml) and finally hexane (2min., 10ml) of hair was performed. Then the hair samples were dried at ambient temperatures, cut into small snippets and extracted in two steps, first with methanol (5ml, 16hours, ultrasonication) and a second step with 3 ml MeOH acidified with 50 µL hydrochloric acid 33 % (3 hours, ultrasonication). The extracts were dried and the residue reconstituted with 50 µL MeOH and 500 µL 0.2 mM ammonium formate (analytical grade) in water. As internal standards deuterated standards of the following compounds were used, added as mixture of the following compounds: cocaine-d3, benzoylecgonine-d3, ethylcocaine-d3, morphine-d3, MAM-d3, codeine-d3, dihydrocodeine-d3, amphetamine-d6, methamphetamine-d9, MDMA-d5. MDEA-d6, MDA-d5, methadone-d9, EDDP-d3, methylphenidate-d9, tramadol-d3, oxycodone-d3, and ephedrine-d3. All deuterated standards were from ReseaChem (Burgdorf, Switzerland), the solvents for washing and extraction were of analysis grade and obtained from Merck (Darmstadt, Germany); LC-solvents were of HPLC grade and were obtained from Sigma Aldrich (Buchs, Switzerland).

The LC-MS/MS apparatus was an ABSciex QTrap 3200 (Analyst software Version 1.5, Turbo V ion source operated in the ESI mode, gas 1, nitrogen (50 psi); gas 2, nitrogen (60 psi); ion spray voltage, 3500V; ion source temperature, 450°C; curtain gas, nitrogen (20 psi) collision gas, medium), with a Shimadzu Prominence LC-system (Shimadzu CBM 20 A controller, two Shimadzu LC 20 AD pumps including a degasser, a Shimadzu SIL 20 AC autosampler and a Shimadzu CTO 20 AC column oven, Shimadzu, Duisburg, Germany). Gradient elution was performed on a separation column (Synergi 4µ POLAR-RP 80A, 150x2.0 with a POLAR-RP 4x2.0 Security Guard Cartridge, (Phenomenex, Aschaffenburg, Germany). The mobile phase consisted of 1mM ammonium formate buffer adjusted to pH 3,5 with formic acid (eluent A) and acetonitrile containing 1mM ammonium formate and 1 mM formic acid (eluent B). The Analysis was performed in MRM mode with two transitions per analyte and one transition for each deuterated internal standard, respectively.

**Results**

*Legal and Illegal Drug Use*

DCU smoked significantly more cigarettes (*F*(2, 163)=4.59, *p*<.05) and consumed more alcohol (*F*(2, 163)=4.28, *p*<.05) per week compared to controls. Both RCU and DCU had a significantly longer duration of cannabis use and RCU had a higher cumulative dose of hallucinogens in comparison to controls. DCU had a higher cumulative dose of cannabis in comparison to controls and RCU. Moreover, DCU reported to use cocaine more frequently, for a longer duration than RCU, and had higher cocaine and 3,4-Methylendioxy-N-methylamphetamin (MDMA) cumulative doses than RCU, while amphetamine and 4-hydroxybutanoic acid (GHB) consumption was comparable among the cocaine user groups. Stimulant-naïve controls were allowed to have recreational cannabis use and limited (<15 times) experiences with other illegal drugs.

*Subanalyses of Potential Co-factors*

Because both RCU and DCU scored substantially higher in a questionnaire assessing symptoms of ADHD and depression we sought to investigate how strongly these symptoms impact SDM and NSDM. In addition, as strong cocaine craving and acute drug intoxication are likely to influence task performance, we examined whether the degree of craving and whether participants tested positive for cocaine in the urine toxicology influenced the decision-making performance (**Fig. S4**). For these analyses the two cocaine users groups were merged. As summarized in **Table S5**, multiple regression analyses were calculated with the common variables of age, sex, and years of education included in the model and dummy coded group variables.

With regard to SDM, both cocaine users without (n=76, *ß*=-.18, *t*=-2.20, *p*<.05) and with clinically relevant ADHD symptoms (n=22, *ß*=-.17, *t*=-2.10, *p*<.05) exhibited more selfish SDM compared to controls without diagnosed ADHD. Moreover, cocaine users with high cocaine craving scores (n=46, *ß*=-.26, *t*=-3.13, *p*<.01) but not cocaine users with low craving scores (n=52), acted in a more selfish manner in the SDM tasks compared to controls. Both cocaine users who tested negative for cocaine in the urine toxicology (n=74, *ß*=-.17, *t*=-2.09, *p*<.05) and cocaine users who tested positive (n=23, *ß*=-.17, *t*=-2.02, *p*<.05) exhibited more selfish behavior in the SDM tasks than controls. The same pattern was found for analyses regarding cannabis urine toxicology. Accordingly, cocaine users with negative (n=76, *ß*=-.17, *t*=-1.96, *p*<.05) and positive cannabis urine toxicology (n=21, *ß*=-.20, *t*=-2.28, *p*<.05) were more self-serving in the SDM tasks. Lastly, cocaine users with low (BDI score < 11) (n=69, ß=-.17, t=-1.99, p<.05) and high depression scores (n=29, ß=-.19, t=-2.20, p<.05) acted more selfishly in the SDM tasks. Therefore, ADHD symptoms, acute cocaine and cannabis use (positive urine toxicology), and symptoms of depression alone cannot explain the more self-serving performance in SDM tasks. However, stronger cocaine craving seems to be associated with a more self-serving money allocation behavior in the SDM tasks.

None of the regression models regarding the IGT explained a significant amount of variance, indicating that the examined co-factors were not significantly associated with the decision-making performance in the IGT.

With regard to the DD, cocaine users with high (n=29, *ß*=.28, *t*=3.26, *p*<.01) but not low depression scores (n=69, *ß*=.11, *t*=1.32, *p*=.19) discounted delayed rewards more strongly than controls with low BDI scores. None of the other regression models explained a significant amount of variance, indicating that the DD preferences were significantly associated with symptoms of ADHD, cocaine craving, and recent cocaine and cannabis consumption.

**References**

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**Table S1.** *Socioeconomic status (number of subjects and percent)*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Stimulant-naïve controls (n=68) | Recreational cocaine users (n=68) | Dependent cocaine users (n=30) | Value | *P* | *df* |
| 0 - 15'000 CHF | 26 (38.20 %) | 18 (26.50 %) | 12 (40.00 %) | 2.75 | 0.25 | 2 |
| 15'000 - 30'000 CHF | 15 (22.10 %) | 11 (16.20 %) | 10 (33.30 %) | 3.62 | 0.16 | 2 |
| 30'000 - 60'000 CHF | 12 (17.60 %) | 20 (29.40 %) | 4 (13.30 %) | 4.28 | 0.12 | 2 |
| 60'000 - 90'000 CHF | 10 (14.70 %) | 16 (23.50 %) | 2 (6.70 %) | 4.61 | 0.10 | 2 |
| 90'000 - 120'000 CHF | 2 (2.90 %) | 2 (2.90 %) | 1 (3.30 %) | 0.01 | 0.99 | 2 |
| 120'000 CHF and more | 3 (4.40 %) | 1 (1.50 %) | 1 (3.30 %) | 1.02 | 0.60 | 2 |

Participants were asked how much money they had available over the past year. Chi2-test.

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| **Table S2.** *Multiple regression analyses for demographic variables and group contrasts predicting task parameters* | | | | | | | | | | | | | | | | | | | |
|  | *B* | *SE B* | *β* |  | *B* | *SE B* | *β* |  | *B* | *SE B* | *β* |  | *B* | *SE B* | *β* |  | *B* | *SE B* | *β* |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | **SDM (composite score)** | | |  | **Distribution Game** | | |  | **Dictator Game** | | |  | **Iowa Gambling Task** | | |  | **Delay Discounting** | | |
| Constant | 0.39 | 0.64 |  |  | 21.94 | 5.40 |  |  | 7.04 | 7.09 |  |  | 35.17 | 17.10 |  |  | 0.00 | 0.02 |  |
| Age | -0.02 | 0.01 | -0.20\* |  | 0.17 | 0.08 | 0.17\* |  | 0.26 | 0.10 | 0.20\* |  | -0.44 | 0.25 | -0.14 |  | 0.00 | 0.00 | 0.10 |
| Sex | 0.07 | 0.17 | 0.03 |  | -1.36 | 1.40 | -0.07 |  | 0.65 | 1.84 | 0.03 |  | -0.20 | 4.43 | 0.00 |  | 0.00 | 0.01 | -0.02 |
| Years of education | 0.02 | 0.04 | 0.04 |  | -0.43 | 0.37 | -0.09 |  | 0.23 | 0.48 | 0.04 |  | -0.28 | 1.15 | -0.02 |  | 0.00 | 0.00 | 0.01 |
| Controls vs. Recreational cocaine users | 0.34 | 0.17 | 0.17\* |  | -2.51 | 1.41 | -0.15 |  | -3.43 | 1.85 | -0.16 |  | -5.05 | 4.47 | -0.10 |  | 0.01 | 0.01 | 0.10 |
| Controls vs. Dependent cocaine users | 0.51 | 0.22 | 0.20\* |  | -4.41 | 1.84 | -0.20\* |  | -4.17 | 2.41 | -0.15 |  | -10.75 | 5.82 | -0.16 |  | 0.02 | 0.01 | 0.26\*\* |
| R*2* |  | 0.08 |  |  |  | 0.08 |  |  |  | 0.07 |  |  |  | 0.04 |  |  |  | 0.07 |  |
| F |  | 2.91\* |  |  |  | 2.70\* |  |  |  | 2.39\* |  |  |  | 1.43 |  |  |  | 2.39\* |  |

SDM = Social Decision-Making, *B* = unstandardized regression coefficient *B*, *SE* = unstandardized standard error, *β* = standardized beta. \**p*<.05, \*\**p*<.01.

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| **Table S3.** *Drug use patterns predicting social decision-making* | | | | |  |  |  |  |  |  |  |
|  | Social Decision-Making | | |  | Social Decision-Making | | |  | Social Decision-Making | | |
|  | Model 1: | | |  | Model 2: | | |  | Model 3: | | |
| Cumulative dose | | | Weekly consumption | | | Years of use | | |
|  | *B* | *SE* | *β* |  | *B* | *SE* | *β* |  | *B* | *SE* | *β* |
| Constant | -0.43 | 0.77 |  |  | -0.74 | 0.74 |  |  | -0.57 | 0.57 |  |
| Age at cocaine use onset (years) | 0.01 | 0.02 | 0.055 |  | 0.02 | 0.02 | 0.11 |  | 0.01 | 0.02 | 0.07 |
| Cocaine craving (CCQ) | -0.02 | 0.01 | -0.21\* |  | -0.02 | 0.01 | -0.20 |  | -0.02 | 0.01 | -0.17 |
| Urine toxicology (pos./neg.) | -0.11 | 0.25 | -0.04 |  | -0.20 | 0.29 | -0.08 |  | -0.10 | 0.26 | -0.04 |
| Cocaine cum. dose (g) | 0.21 | 0.16 | 0.14 |  |  |  |  |  |  |  |  |
| Amphetamine cum. dose (g) | 0.04 | 0.16 | 0.02 |  |  |  |  |  |  |  |  |
| MDMA cum. dose (pills) | -0.16 | 0.14 | -0.13 |  |  |  |  |  |  |  |  |
| Cannabis cum. dose (g) | -0.07 | 0.09 | -0.09 |  |  |  |  |  |  |  |  |
| Cocaine (g/week) |  |  |  |  | 0.26 | 0.39 | 0.08 |  |  |  |  |
| Amphetamine (g/week) |  |  |  |  | 0.39 | 1.91 | 0.02 |  |  |  |  |
| MDMA (pills/week) |  |  |  |  | 0.15 | 0.97 | 0.02 |  |  |  |  |
| Cannabis (g/week) |  |  |  |  | -0.07 | 0.40 | -0.02 |  |  |  |  |
| Alcohol (g/week) |  |  |  |  | -0.01 | 0.21 | -0.00 |  |  |  |  |
| Nicotine (cigarettes/week) |  |  |  |  | 0.16 | 0.15 | 0.12 |  |  |  |  |
| Cocaine (years of use) |  |  |  |  |  |  |  |  | 0.04 | 0.03 | 0.19 |
| Amphetamine (years of use) |  |  |  |  |  |  |  |  | 0.01 | 0.04 | 0.03 |
| MDMA (years of use) |  |  |  |  |  |  |  |  | -0.03 | 0.03 | -0.10 |
| Cannabis (years of use) |  |  |  |  |  |  |  |  | -0.01 | 0.02 | -0.05 |
| Alcohol (years of use) |  |  |  |  |  |  |  |  | 0.01 | 0.03 | 0.06 |
| Nicotine (years of use) |  |  |  |  |  |  |  |  | -0.00 | 0.02 | -0.00 |
| *R*2 |  | 0.09 |  |  |  | 0.07 |  |  |  | 0.10 |  |
| *F* |  | 1.31 |  |  |  | 0.78 |  |  |  | 1.10 |  |

N = 98 (only cocaine users are included). *B* = unstandardized regression coefficient *B*, *SE* = unstandardized standard error, *β* = standardised beta, CCQ = cocaine craving questionnaire, pos./neg. = positive/negative, g = grams, cum. dose = cumulative dose. \**p*<.05.

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| **Table S4.** *Drug use patterns predicting performance in the Iowa Gambling and Delay Discounting Task* | | | | | | | | | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Iowa Gambling Task | | |  | Iowa Gambling Task | | |  | Iowa Gambling Task | | |  | Delay Discounting | | |  | Delay Discounting | | |  | Delay Discounting | | |
|  | Model 1: | | |  | Model 2: | | |  | Model 3: | | | Model 1: | | |  | Model 2: | | |  | Model 3: | | |
| Cumulative dose | | | Weekly consumption | | | Years of use | | |  | Cumulative dose | | | Weekly consumption | | | Years of use | | |
|  | *B* | *SE* | *β* |  | *B* | *SE* | *β* |  | *B* | *SE* | *β* |  | *B* | *SE* | *β* |  | *B* | *SE* | *β* |  | *B* | *SE* | *β* |
| Constant | 58.88 | 18.88 |  |  | 15.19 | 17.29 |  |  | 38.45 | 13.36 |  |  | 0.02 | 0.02 |  |  | 0.01 | 0.03 |  |  | 0.01 | 0.02 |  |
| Age at cocaine use onset (years) | -0.56 | 0.49 | -0.13 |  | -0.33 | 0.46 | -0.08 |  | -0.01 | 0.57 | -0.00 |  | 0.00 | 0.00 | -0.03 |  | 0.00 | 0.00 | 0.07 |  | 0.00 | 0.00 | 0.14 |
| Cocaine craving (CCQ) | -0.27 | 0.27 | -0.10 |  | -0.33 | 0.27 | -0.13 |  | -0.26 | 0.25 | -0.10 |  | 0.00 | 0.00 | -0.04 |  | 0.00 | 0.00 | -0.03 |  | 0.00 | 0.00 | -0.02 |
| Urine toxicology (pos./neg.) | 0.29 | 6.18 | 0.00 |  | -2.58 | 6.70 | -0.04 |  | -3.36 | 5.98 | -0.06 |  | -0.01 | 0.01 | -0.06 |  | -0.00 | 0.01 | -0.05 |  | -0.01 | 0.01 | -0.09 |
| Cocaine cum. dose (g) | -9.36 | 3.93 | -0.25\* |  |  |  |  |  |  |  |  |  | 0.02 | 0.01 | 0.28\*\* |  |  |  |  |  |  |  |  |
| Amphetamine cum. dose (g) | 3.83 | 3.90 | 0.11 |  |  |  |  |  |  |  |  |  | 0.01 | 0.01 | 0.14 |  |  |  |  |  |  |  |  |
| MDMA cum. dose (pills) | -1.04 | 3.32 | -0.03 |  |  |  |  |  |  |  |  |  | -0.01 | 0.00 | -0.17 |  |  |  |  |  |  |  |  |
| Cannabis cum. dose (g) | -2.21 | 2.18 | -0.11 |  |  |  |  |  |  |  |  |  | -0.01 | 0.00 | -0.37\*\* |  |  |  |  |  |  |  |  |
| Cocaine (g/week) |  |  |  |  | -4.50 | 9.21 | -0.06 |  |  |  |  |  |  |  |  |  | 0.01 | 0.01 | 0.06 |  |  |  |  |
| Amphetamine (g/week) |  |  |  |  | 128.16 | 44.76 | 0.30\*\* |  |  |  |  |  |  |  |  |  | 0.03 | 0.07 | 0.05 |  |  |  |  |
| MDMA (pills/week) |  |  |  |  | 18.34 | 22.64 | 0.09 |  |  |  |  |  |  |  |  |  | -0.01 | 0.03 | -0.03 |  |  |  |  |
| Cannabis (g/week) |  |  |  |  | -10.16 | 9.27 | -0.11 |  |  |  |  |  |  |  |  |  | -0.01 | 0.01 | -0.11 |  |  |  |  |
| Alcohol (g/week) |  |  |  |  | 2.93 | 4.82 | 0.06 |  |  |  |  |  |  |  |  |  | 0.00 | 0.01 | 0.06 |  |  |  |  |
| Nicotine (cigarettes/week) |  |  |  |  | 3.44 | 3.63 | 0.10 |  |  |  |  |  |  |  |  |  | 0.00 | 0.01 | -0.00 |  |  |  |  |
| Cocaine (years of use) |  |  |  |  |  |  |  |  | -1.11 | 0.73 | -0.22 |  |  |  |  |  |  |  |  |  | 0.00 | 0.00 | 0.40\*\* |
| Amphetamine (years of use) |  |  |  |  |  |  |  |  | 0.58 | 0.86 | 0.07 |  |  |  |  |  |  |  |  |  | 0.00 | 0.00 | 0.01 |
| MDMA (years of use) |  |  |  |  |  |  |  |  | -0.81 | 0.61 | -0.14 |  |  |  |  |  |  |  |  |  | 0.00 | 0.00 | -0.03 |
| Cannabis (years of use) |  |  |  |  |  |  |  |  | -0.20 | 0.45 | -0.06 |  |  |  |  |  |  |  |  |  | 0.00 | 0.00 | -0.45\*\*\* |
| Alcohol (years of use) |  |  |  |  |  |  |  |  | -1.22 | 0.63 | -0.31 |  |  |  |  |  |  |  |  |  | 0.00 | 0.00 | -0.25 |
| Nicotine (years of use) |  |  |  |  |  |  |  |  | 0.52 | 0.50 | 0.15 |  |  |  |  |  |  |  |  |  | 0.00 | 0.00 | 0.22 |
| R2 |  | 0.10 |  |  |  | 0.15 |  |  |  | 0.20 |  |  |  | 0.22 |  |  |  | 0.03 |  |  |  | 0.21 |  |
| F |  | 1.43 |  |  |  | 1.71 |  |  |  | 2.32\* |  |  |  | 3.55\*\* |  |  |  | 0.32 |  |  |  | 2.57\* |  |

N = 98 (only cocaine users are included). *B* = unstandardized regression coefficient *B*, *SE* = unstandardized standard error, *β* = standardized beta, CCQ = cocaine craving questionnaire, pos./neg. = positive/negative, g = grams, cum. dose = cumulative dose. \**p*<.05, \*\**p*<.01, \*\*\**p*<.001.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table S5.** *Multiple regression analyses for demographic variables and group contrasts predicting task parameters* | | | | | | | | | |  |  |
|  | *B* | *SE B* | *β* |  | *B* | *SE B* | *β* |  | *B* | *SE B* | *β* |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  | **Social Decision-Making** | | |  | **Iowa Gambling Task** | | |  | **Delay Discounting** | | |
| Constant | -0.42 | 0.64 |  |  | 34.35 | 17.00 |  |  | 0.01 | 0.02 |  |
| Age | 0.02 | 0.01 | 0.19\* |  | -0.50 | 0.25 | -0.16\* |  | 0.00 | 0.00 | 0.12 |
| Sex | -0.06 | 0.17 | -0.03 |  | 0.37 | 4.43 | 0.01 |  | -0.00 | 0.01 | -0.02 |
| Years of schooling | -0.02 | 0.04 | -0.03 |  | -0.10 | 1.13 | -0.01 |  | 0.00 | 0.00 | -0.02 |
| Controls vs. CU users without ADHD | -0.36 | 0.16 | -0.18\* |  | -4.73 | 4.32 | -0.09 |  | 0.01 | 0.01 | 0.18\* |
| Controls vs. CU with ADHD | -0.50 | 0.24 | -0.17\* |  | -13.93 | 6.39 | -0.18\* |  | 0.01 | 0.01 | 0.09 |
| *R2* |  | 0.08 |  |  |  | 0.05 |  |  |  | 0.04 |  |
| F |  | 2.86\* |  |  |  | 1.68 |  |  |  | 1.49 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Constant | -0.44 | 0.63 |  |  | 33.97 | 17.10 |  |  | 0.01 | 0.02 |  |
| Age | 0.02 | 0.01 | 0.19\* |  | -0.48 | 0.25 | -0.15 |  | 0.00 | 0.00 | 0.12 |
| Sex | -0.08 | 0.16 | -0.04 |  | -0.20 | 4.45 | -0.00 |  | -0.00 | 0.01 | -0.03 |
| Years of schooling | -0.01 | 0.04 | -0.02 |  | -0.06 | 1.14 | -0.00 |  | 0.00 | 0.00 | -0.01 |
| Controls vs. CU with low craving | -0.22 | 0.18 | -0.10 |  | -5.70 | 4.82 | -0.10 |  | 0.01 | 0.01 | 0.18\* |
| Controls vs. CU with high craving | -0.57 | 0.18 | -0.26\*\* |  | -7.91 | 4.96 | -0.14 |  | 0.01 | 0.01 | 0.13 |
| *R2* |  | 0.10 |  |  |  | 0.04 |  |  |  | 0.05 |  |
| F |  | 3.49\*\* |  |  |  | 1.27 |  |  |  | 1.49 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Constant | -0.41 | 0.64 |  |  | 34.18 | 17.23 |  |  | 0.01 | 0.02 |  |
| Age | 0.02 | 0.01 | 0.19\* |  | -0.47 | 0.25 | -0.15 |  | 0.00 | 0.00 | 0.13 |
| Sex | -0.12 | 0.17 | -0.05 |  | -0.19 | 4.47 | -0.00 |  | -0.00 | 0.01 | -0.03 |
| Years of schooling | -0.01 | 0.04 | -0.02 |  | -0.12 | 1.15 | -0.01 |  | 0.00 | 0.00 | -0.02 |
| Controls vs. CU with neg. cocaine UT | -0.33 | 0.16 | -0.17\* |  | -7.92 | 6.34 | -0.11 |  | 0.01 | 0.01 | 0.10 |
| Controls vs. CU with pos. cocaine UT | -0.47 | 0.24 | -0.17\* |  | -5.87 | 4.39 | -0.11 |  | 0.01 | 0.01 | 0.19\* |
| *R2* |  | 0.08 |  |  |  | 0.04 |  |  |  | 0.05 |  |
| F |  | 2.82\* |  |  |  | 1.19 |  |  |  | 1.52 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Constant | -0.35 | 0.65 |  |  | 36.18 | 17.32 |  |  | 0.01 | 0.02 |  |
| Age | 0.02 | 0.01 | 0.18\* |  | -0.48 | 0.26 | -0.15 |  | 0.00 | 0.00 | 0.14 |
| Sex | -0.05 | 0.17 | -0.02 |  | 0.12 | 4.55 | 0.00 |  | -0.00 | 0.01 | -0.04 |
| Years of schooling | -0.02 | 0.04 | -0.04 |  | -0.34 | 1.16 | -0.02 |  | -0.00 | 0.00 | -0.03 |
| Controls with neg. vs. Controls with pos. cannabis UT | -0.07 | 0.36 | -0.02 |  | 1.53 | 9.67 | 0.01 |  | 0.01 | 0.01 | 0.10 |
| Controls with neg. vs. CU with neg. cannabis UT | -0.33 | 0.17 | -0.17\* |  | -4.37 | 4.54 | -0.08 |  | 0.02 | 0.01 | 0.24\*\* |
| Controls with neg. vs. CU with pos. cannabis UT | -0.58 | 0.25 | -0.20\* |  | -13.16 | 6.79 | -0.17 |  | 0.00 | 0.01 | 0.05 |
| *R2* |  | 0.08 |  |  |  | 0.05 |  |  |  | 0.06 |  |
| F |  | 2.38\* |  |  |  | 1.29 |  |  |  | 1.81 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Constant | -0.5 | 0.65 |  |  | 35.51 | 17.03 |  |  | 0.00 | 0.02 |  |
| Age | 0.02 | 0.01 | 0.20\* |  | -0.44 | 0.25 | -0.14 |  | 0.00 | 0.00 | 0.13 |
| Sex | -0.09 | 0.17 | -0.04 |  | -1.29 | 4.42 | -0.02 |  | -0.00 | 0.01 | -0.03 |
| Years of schooling | -0.01 | 0.04 | -0.01 |  | -0.08 | 1.13 | -0.01 |  | 0.00 | 0.00 | -0.02 |
| Controls with low BDI vs. CU with low BDI | -0.34 | 0.17 | -0.17\* |  | -2.78 | 4.46 | -0.05 |  | 0.01 | 0.01 | 0.10 |
| Controls with low BDI vs. CU with high BDI | -0.48 | 0.22 | -0.19\* |  | -18.41 | 5.69 | -0.27\*\* |  | 0.02 | 0.01 | 0.19\*\* |
| *R2* |  | 0.08 |  |  |  | 0.04 |  |  |  | 0.08 |  |
| F |  | 2.65\* |  |  |  | 1.19 |  |  |  | 2.65\* |  |

CU = cocaine users, UT = Urine toxicology, ADHD = Attention Deficit Hyperactivity Disorder, BDI = Beck Depression Inventory (low BDI<11). *B* = unstandardized regression coefficient *B*, *SE* = unstandardized standard error, *β* = standardized beta. \**p*<.05, \*\**p*<.01.

**SI Figures**



**Fig. S1.** Depicts the point values of the payoffs for participant A and B, and the total payoffs for the ten distributions in the Distribution Game. Participants can be classified into three categories according to their preferences for efficiency. Participants are *fair* when choosing distribution 1 where participant A and B both receive 25 points each; *unfair efficient* when choosing distributions 2-5, yielding the highest total payoffs; and *unfair inefficient when* choosing distributions 6-10, resulting in the destruction of money.



**Fig. S2.** *(A)* Depicts the frequency in percent of the ten distributions of the Distribution Game chosen by controls, RCU and DCU. *(B)* Displays the frequency in percent of the categories *fair*, *unfair efficient*, and *unfair inefficient* chosen by the three groups. DCU were less frequently classified as unfair efficient and more frequently as unfair inefficient.



**Fig. S3.** *(A)* Means and standard errors for quartiles and the net score (advantageous minus disadvantageous cards) in the Iowa Gambling Task. Particularly DCU exhibited a decreased learning curve and chose more unfavorable cards than controls. *(B)* Means and standard errors for large, medium, and small *k* parameters. DCU discounted delayed rewards more steeply than controls. Sidak-corrected post hoc analyses: \*\**p*<.01.



**Fig. S4.** Mean scores and standard errors subdivided in cocaine user groups without and with clinically significant ADHD symptoms, low and high cocaine craving, negative and positive cocaine urine toxicology (UT), and low and high depression scores (BDI). *(A)* the social decision-making domain (SDM) and *(B)* the non-social decision-making domain (NSDM). Multiple regression analyses with age, sex, years of education, and dummy coded group contrasts (controls vs. RCU, controls vs. DCU): \**p*<.05, \*\**p*<.01.