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Affective decision-making moderates the effects of automatic associations on alcohol use among drug offenders

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Abstract

Background: This study used a dual-process model of cognition in order to investigate the possible influence of automatic and deliberative processes on lifetime alcohol use in a sample of drug offenders.

Objective: The objective was to determine if automatic/implicit associations in memory can exert an influence over an individual's alcohol use, and if decision-making ability could potentially modify the influence of these associations.

Methods: 168 Participants completed a battery of cognitive tests measuring implicit alcohol associations in memory (verb generation) as well as their affective decision making ability (Iowa Gambling Task). Structural equation modeling procedures were used to test the relationship between implicit associations, decision making, and lifetime alcohol use.

Results: Results revealed that among participants with lower levels of decision-making, implicit alcohol associations more strongly predicted higher lifetime alcohol use.

Conclusion: These findings provide further support for the interaction between a specific decision function and its influence over automatic processes in regulating alcohol use behavior in a

risky population. Understanding the interaction between automatic associations and decision processes may aid in developing more effective intervention components.

Keywords

Dual Process; Implicit Associations; Alcohol Use; Decision-Making

1. Introduction

Alcohol continues to be the most commonly abused substance in the United States, despite knowledge that excessive use can result in a number of negative outcomes (1, 2). Engaging in risky behaviors, such as alcohol use, while being aware of the longer term negative consequences is a classic example of irrational decision-making that can be explained, in part, by dual process models of addiction (3, 4). This dual process approach to decision-making has been applied to behavioral research (5), and is supported across a wide range of health behaviors (6). Further, considerable evidence suggests that specific neurocognitive processes may moderate various habitual behaviors that are driven by implicit/automatic processes (7). To our knowledge no previous studies have examined the interplay of spontaneous associations and decision-making on alcohol behavior in a high-risk adult drug offender population.

1.1 Dual Process Interaction Model

The specific dual process model of decision making addressed in this work suggests that the choice to engage in a specific behavior is influenced by the interplay between fast or spontaneous processes guided by associations in memory and slower controlled processes guided by executive function (3, 5, 8–10). In other words, individuals may engage in various specific learned behaviors that occur without the need for much thought or introspection (11). Repetition of an appetitive behavior (eating, substance use, etc) can result in strengthening learned associations in memory (described below), allowing habitual behaviors to be triggered by environmental or internal stimuli without any need for deliberate recollection (9, 10). The effects of spontaneous memory associations are well documented in numerous studies on health behaviors, showing predictive utility across a range of populations and several drugs of abuse (7, 12, 13).

Executive control functions have been found to modify the effects of automatic/implicit processes on habitual behaviors, often dampening or diminishing their influence. This type of interaction is supported across a wide range of investigations, including HIV risk behavior (14, 15), risky sexual behaviors (16), eating behaviors (16–21), and alcohol and tobacco use (22–25). Executive control functions (described in detail below) require greater cognitive resources, and are thus slower to act and easier to overwhelm (7, 22). The present study evaluates a similar dual process interaction in a drug offender population at increased risk for engaging in excessive alcohol use.

1.2 Associative Processes and Alcohol Risk Behaviors

Associations in memory are essentially a learned relationship between two concepts or ideas that develop over time through experience. Once strengthened with continued exposure to

reinforcing/positive experiences, associations become highly accessible in memory (11, 26), and begin to affect behavior through a relatively spontaneous process that circumvents rational decision making processes (6, 26). Indeed, previous investigations into human behavior have found a relationship between the strength of a concept and the subsequent engaging of a behavior (6, 26). In other words, individuals with strong associations in memory between positive outcomes (feeling good) and a specific behavior (alcohol use) would be more likely to engage in that behavior compared to those with weaker memory associations.

Verb generation/word association tests (WATs) (11), have been used to measure associative memory due to their potential to assess memories of events and feelings that are spontaneously activated, without deep recollection of events or direct questioning (11, 26, 27). Basic research in memory has found WATs to be useful assessments of association (28, 29) across a wide range of experimental procedures (27, 30–32). Further, WATs have shown validity for detecting implicit conceptual memory in both amnesic and non-amnesic populations (33–36), and are among the best predictors of various risk behaviors across culturally diverse populations (12, 13, 27).

While there have been several studies that have assessed associative processes in research on alcohol-related risk behaviors (13, 37), a limited number have evaluated verb generation with alcohol associations in an adult high-risk population. For instance, an earlier study investigating the relationship between word associations and alcohol use in drug offenders found a higher number of alcohol-related responses to the WATs were predictive of higher levels of alcohol use (38). One of the first longitudinal studies found predictive effects of alcohol associations in memory among college students after controlling for previous drinking and alcohol expectancies (26). A more recent longitudinal study supported the relationship between alcohol associations and greater alcohol use after controlling for sensation seeking behavior, age, and gender (39). Further, recent neuroscience research on implicit associations has shown that heavier drinkers, when compared to lighter drinkers, show differing levels of activation in neural regions associated with decision-making, habit and inhibitory control (40).

1.3 Affective Decision Making

Executive functions include mental operations involving planning or inhibiting behavior, judgment, self-regulation of behavior, regulation of emotion, and working memory (41). Affective decision-making is a specific aspect of executive function that enables individuals to consciously choose a course of action by weighing short-term gains against the probability of long-term positive or negative outcomes (42). While this aspect of decision-making can show protective utility during high-risk situations, a combination of inadequate decision-making ability and strong habitual (associative) behaviors can lead to problems in the regulation of behavior (14). The stronger the association in memory, and the weaker the affective decision making, the more likely an individual will engage in a high-risk behavior.

In the present study participants' affective decision making ability was assessed with the Iowa Gambling Task (IGT) (43), one of the most frequently utilized neuropsychological tests of decision-making (44). A number of studies have demonstrated that populations with

behavioral regulation problems (i.e. substance abuse/dependence, pathological gambling, overweight/obesity, risky sex behavior) show poorer performance on the IGT compared to controls (44, 45). Interestingly, when compared to controls, decisions made by substance dependent individuals on the IGT are similar to those made by individuals with lesions of the ventral medial prefrontal cortex (VMPFC) (46–48). Patients with lesions in the VMPC are unable to properly weigh the long-term consequences to their short term actions (49).

This deficit in decision making may help explain continued heavy substance abuse; users may be highly focused on immediate short term rewards, they fail to realize the negative outcomes of their behaviors (46, 48, 49). Various investigations have utilized the IGT to discern a link between decision making deficits and substance use behaviors. For example, studies conducted among college students have found that compared to low-binge drinkers, heavy repeat (habituated) binge drinkers showed diminished decision-making performance as measured by the Iowa Gambling Task (50, 51). Among adults, reduced decision making ability was observed among clinically diagnosed alcohol dependent individuals (46), surprisingly even after a period of abstinence (52–55). Similar results were also observed in alcohol studies conducted with adolescents in China (56, 57).

1.4 Overview

This study was conducted as part of a larger investigation into the dual process model of decision-making and its effect on various health behaviors. While various substance use outcomes were assessed as part of the larger investigation, this work focuses only on the interaction between decision-making ability and spontaneously activated alcohol associations, and their effect on alcohol use behavior. Specifically, better affective decision-making (assessed with the IGT) is thought to moderate the effect of spontaneous alcohol associations (assessed using verb generation tests) have on alcohol use. Higher scores of decision-making should show a protective function against the influence of alcohol associations on drinking behavior among the study population. This effect may help explain why some individuals continue to engage in potentially hazardous behaviors despite serious short and long-term negative consequences.

2. Methods

2.1 Subjects

This study evaluated 168 adult drug offenders recruited from court mandated drug diversion programs located throughout the Los Angeles metropolitan area. Diversion programs are populated by first and second time drug offenders who have been mandated by the State of California to attend drug education classes in lieu of a prison sentence. The drug offenders included in this study were program attendees present on the day of data collection. In addition, program attendees had to be able to read and speak English and provide consent to participate. All program attendees are over the age of 18.

Study Coordinators contacted directors of various drug diversion programs to schedule data collections. Schedules of classes were provided to coordinators, who selected at random the class times to hold data collections. Participants who attended class on these data collection

days were invited to participate. Potential subjects were read a verbal consent form by data collectors that indicated 1) the study was voluntary, 2) all responses would be anonymous and protected by a Certificate of Confidentiality from the National Institutes of Health and 3) the study was related to health behaviors that may be considered personal/unlawful. All study protocol was approved by the Institutional Review Board

2.2 Procedure

Up to 15 participants were randomly selected at each diversion program and assigned to a computer in our mobile laboratory. Computerized assessments conducted in the field have shown high utility across a wide range of populations (58–60). Pre-recorded task instructions were broadcast over individual headphones to allow participants to complete each task at their own pace, and re-listen to instructions if necessary. All participants were assessed at a single time of measurement, at four different waves. Each participant had up to 90 minutes to complete the entire assessment, and was paid \$15 for participation.

Based on previous work done measuring memory associations, survey items were ordered so that indirect tests of association appeared early in the survey, while key concepts under study, such as alcohol and other drug use questions appeared later (61). Ordering items in this way has been shown to reduce priming of alcohol and other drug-related concepts.

2.3 Measures

2.3.1 Assessment of Alcohol Use—Frequency of alcohol and other drug use in the past 4 months, 12 months, and lifetime was assessed with a validated 11-point rating scale, ranging from 0 (None) to 11 (91+ times) (62). This measure has been utilized in previous studies of drug offender populations (27, 38), and has shown reliability (10-year retest for drugs, $r=0.63$ for daily use to 0.71 for abstinence) and validity among our subject population (63).

2.3.2 Neurocognitive Assessment of Affective Decision Making—Assessment of affective decision making was conducted using the Iowa Gambling Task (IGT). The IGT is a neuropsychological performance task that simulates real-life decision making by asking participants to choose a card from one of four decks of cards presented on a screen (43). The goal of the task is for participants to try to win as much money as possible. Participants are instructed that any time they pick a card, they will either win or lose some game money. At pre-determined intervals, choosing a card from a certain deck will result in a loss of money. Two of the decks are classified as “win decks” because choosing cards from these decks leads to an overall net gain of game money (while occasionally resulting in minimal loss of money), while the remaining two decks are “lose decks” because choosing from these decks leads to an overall loss of game money (while occasionally rewarding the participant with a large sum of money). A computer is used to track participants’ selections of cards, and compute scores by taking the number of times the participant chooses from the lose decks and subtracting that from the number of times they chose from the win decks (43). The longer it takes a participant to determine the ‘win decks’, the poorer the decision-making score.

2.3.3 Indirect Assessments of Spontaneous Associative Processes—*Word*

Association Tests (WAT) provide an indirect assessment of associations in memory by assessing content associated with risky behaviors that is spontaneously generated in response to a variety of cues. This study used a well-researched form of WAT in which participants produce the first action or behavior that pops to mind in response to various cues (34). Participants were instructed: “*For the next set of items, please type the very 1st behavior or action that comes to mind when you read a phrase on the screen. Behaviors, activities, or actions are ‘things to do’.*” The assessments were presented as a series of word association trials using the same verb generation instructions and format for all association items (27). The various WATs are described below.

On the *Outcome-Behavior Association Test (OBAT)*, participants provided responses to outcome association phrases (e.g. feeling good: ____). The phrase cues used to implicitly activate responses associated in memory were generated by at-risk populations who participated in previous studies (64–66). On the *Cue-Association Test (CAT)* participants responded to ambiguous situations (e.g., Friday night : ____). Similarly, the cues for this task were generated from at risk-populations in a previous study (65). The *Compound Cue task* combined different types of associations used in this study (OBAT, CAT). Participants responded to pairs of combined outcomes and situations (e.g., Friday night, feeling good : ____). Previous research has illustrated the utility of compound cues in yielding additional variability in association responses (61). *Neutral cues* were inter-mixed with the OBAT, CAT, and compound cues in order to reduce response chaining and priming (e.g., Thursday morning : ____).

Participants self-coded their responses on provided computers once the word association tests were finished. Self-coding of word association responses has been found to be effective in previous research (67, 68). The original WAT contained 22 target items. Using non-parametric IRT analysis, we randomly selected 12 target items, which were reliably unidimensional. In addition, 7 filler items were used to reduce response chaining. Association tests had a minimum of one neutral cue per three risk cues. The procedure resulted in the following code: 1= related to a specific category; 0 = not related to a category. This study focused on codes for alcohol-related association scores that were summed responses yielding indicators of associative strength in memory for alcohol.

2.3.4 Assessment of Acculturation—A scale adapted from Marin and colleagues (69) was used to assess the level of acculturation among participants. The scale was modified to apply to any native language group whose first or second language is in English, and has shown good reliability ($\alpha=.93$) (38). Acculturation questions included ‘In general, what language(s) do you most often read and speak’, ‘In what language(s) are the movies, TV, and radio shows you like to watch and listen to?’ and ‘What language(s) do you usually speak at home/with friends?’ Response options for all questions were: 1) only English, 2) English more than another language, 3) English and another language equally, 4) another language more than English, and 5) only another language (not English).

2.3.5 Analytical Procedure—Analyses followed structural equation modeling procedures. First, a confirmatory factor analysis (CFA) was conducted to determine if the

hypothesized measurement model adequately fit the data. The measurement model consisted of 1) alcohol associations and affective decision making latent factors, each of which consisted of three parceled indicators, and 2) lifetime alcohol use, which consisted of a single manifest variable.

The Affective decision-making factor (Z) was assessed with three IGT parceled indicators (Z1, Z2, Z3). Three indicators were each composed of 33 IGT trials randomly selected and scored. Each IGT trial consists of the overall sum of the ‘good deck’ selections minus the sum of the ‘bad deck’ selections that results in a score across trials (see method section for description of IGT protocol). The Implicit Alcohol Association factor (X) was assessed with three parcels (X1, X2, X3) comprised of 1) compound cues, 2) cue behavior associations, and 3) outcome-behavior association items. These parcels were used as indicators because of the large number of items in each measure and concerns about model stability (70). Further, cues were selected in order to construct a reliable unidimensional scale aligning with non-parametric item response theory (71). Correlations between factors were estimated among all factors, however all non-significant correlations between factors were excluded from the final model.

A latent variable interaction model was estimated using an “unconstrained” latent interaction approach (72, 73), which has been shown to provide one of the most consistently validated tests of latent interaction (73, 74). The interaction latent factor (XZ) was formed by multiplying the product indicators for alcohol associations (i.e. X1, X2, X3) and affective decision-making (i.e. Z1, Z2, Z3). The interaction model included covariates: age, gender, ethnicity (Hispanic or not), and acculturation level.

The CFA and latent variable interaction models were evaluated using Mplus software (74). The full information maximum likelihood (FIML) estimation method was utilized to adjust for uncertainty associated with incomplete data (75). Following appropriate guidelines (76), the overall goodness of fit was evaluated with the use of the Chi-square goodness-of-fit test, comparative fit index (CFI), root mean square error of approximation (RMSEA) and its confidence interval (77).

3. Results

3.1. Demographics

Participants were aged 18 to 66, with a mean age of 30 (see Table 1). Twenty-six percent of participants were female and 52% were Hispanic. Ninety-seven percent of study participants reported lifetime alcohol use, and 81% reported alcohol use within the past 4 months.

3.2. Analytical Results

A confirmatory factor analysis (CFA) model was run to test if the latent variable indicators sufficiently loaded on their respective factors; implicit alcohol associations (X) and affective decision-making (Z). Results of the CFA indicated that the measurement model fit the data well: $\chi^2(12) = 7.38$, $p = .83$, CFI = 1.00, RMSEA = .000 (90% CI = [.000, .047]). All factor loadings were significant ($p < .001$), ranging from .76 to .82 on the WAT and from .78 to .90 on the IGT. The correlation between the two latent factors was small and not significant (r

= .12, $p = .24$), providing discriminant evidence of the two types of tasks (WAT and IGT). The standard for adequate fit in covariance structure analysis is a CFI of 0.9; however a cutoff that is slightly greater (CFI > 0.96 and RMSEA < 0.06) is recommended (76).

3.3 Latent Variable Interaction Analysis

In the latent variable interaction analysis, lifetime alcohol use was regressed on the implicit alcohol association factor (X), the affective decision-making (Z) factor, and the interaction between X and Z. The interaction latent factor (XZ) was produced by multiplying indicators of alcohol associations and affective decision-making, forming three indicators with factor loadings ranging from 0.67 to 0.98. Covariates in the analysis included gender, age, ethnicity (Hispanic), and language acculturation. The interaction model fit the data well, $\chi^2(93) = 108.45$, $p = .13$, CFI = .97, RMSEA = .031, 90% CI = [.000, .054] (see Figure 1). The hypothesized affective decision-making and implicit alcohol association interaction term (XZ) was significant in the prediction of lifetime alcohol use ($b = -0.06$, $p < 0.05$). The number of alcohol-related associations was more predictive of lifetime use of alcohol for those with poorer decision making capacity than for those with higher capacity, consistent with a buffer hypothesis. In supplemental analyses, no significant interactions between implicit associations and decision making were found for past four months alcohol use ($b = 0.02$, $p = .567$), or past 12 months alcohol use ($b = -0.03$, $p = .547$).

Spontaneous implicit alcohol associations (X) and affective decision-making (Z) were both significant predictors of lifetime alcohol use ($b = 0.921$, $p = 0.001$; and $b = 0.08$, $p < 0.04$, respectively). Further, acculturation ($b = .206$, $p = .04$) was significant in predicting lifetime alcohol use. However, the covariates gender ($b = 0.220$, $p = 0.71$), age ($b = -1.62$ to -0.71 , $p = 0.08$ to $p = 0.27$), and ethnicity ($b = 0.33$, $p = 0.51$) were not found to be significant predictors of lifetime alcohol use.

In a structural model analyzed without the interaction term, the structural coefficient between implicit alcohol associations and lifetime alcohol use was significant ($b = .763$, $p = .002$). The structural coefficient between decision-making and lifetime alcohol use was not significant ($b = .063$, $p = .058$).

4. Discussion

The current study adds to the growing number of dual-process investigations that address the influence of executive control on spontaneous associative processes strongly linked to appetitive behaviors. To our knowledge, no other studies have evaluated the interaction between affective decision making and implicit alcohol associations with the WAT in an effort to predict unsafe alcohol behavior among a drug offender population. Consistent with previous investigations of dual process approaches into appetitive behaviors in risky populations (14, 15, 22, 23, 25), our findings indicated that higher decision-making ability moderated the effect of spontaneous alcohol associations on lifetime alcohol use. Specifically, alcohol associations more strongly predicted increased lifetime alcohol use among drug offenders with lower levels of executive decision-making ability. Latent variable interaction results suggest that these executive processes may serve a critical protective function regulating spontaneous processes implicated in certain appetitive behaviors. While

no significant interaction was detected between implicit associations and decision making for past 4-month and past-year alcohol use, previous methodological publications have described difficulty in detecting continuous variable interactions (78, 79). One possibility is that more recent alcohol use typically has less variability, which reduces the power to detect interaction effects.

Our model also showed that spontaneously generated alcohol associations were a significant independent predictor of lifetime alcohol use, when analyzed independently of the interaction term. These findings are in line with previous investigations into human cognition that revealed an important link between associations in memory and their corresponding appetitive behaviors (6, 12, 13, 80). As described by Stacy, Ames & Grenard (27), the association tests used to elicit responses never mentioned the target behavior in order to minimize the effects of self-reflective confounders. Thus, participants were allowed to freely generate any top-of-mind response to a wide range of vague contextual cues (e.g., ambiguous affective outcomes and situational cues). These findings further clarify the influence that fast neurocognitive processes exert over human behavior, and the importance of adapting this information for use in public health and related fields.

Results from the latent variable models also indicated a significant correlation between level of acculturation and lifetime alcohol use; that is, the more acculturated the individuals in the study, the greater the alcohol use. This corresponds to a body of evidence that suggests acculturation status has an important influence over alcohol use (81–85) that occurs across ethnicity (86), age (87), and gender (82, 88, 89). The effects of culture on implicit associations and various health behaviors were outside the scope of the present study. However, in a prior study, Ames and Stacy (38) investigated the influence of acculturation on implicit associations in the prediction of alcohol use among drug offenders and found no significant effects. Nevertheless, future research might further investigate this relationship and various health behaviors.

The results of this study help further our understanding of the interplay between spontaneous associative processes and executive control processes in drinking behavior in a high-risk sample. The population under study engages in unsafe alcohol behaviors that put them at greater risk of developing negative health outcomes, such as alcohol dependence (90) and mental health issues (91). Further, previous findings have demonstrated chronic alcohol use can lead to cognitive impairments (92–94) and a lowered ability to regulate the influence of implicit associations on behavior (9, 10). A goal of future interventions might be to train individuals with lower decision-making ability with alternative means of regulating behavior in order to combat cue-induced spontaneously activated behaviors. Indeed, a few interventions have demonstrated that adequate decision-making training has been key to reducing risky behaviors (41, 95, 96). Future interventions might also attempt to focus on enhancing cognitive components such as attention, memory, and health literacy (97).

A secondary approach to decision-making training could be an effort to exchange the original cued behavior and replace it with an alternative or healthier behavior (7). That is, programs could potentially work toward replacing negative and unsafe associations in memory with safer or protective associations that are spontaneously activated in risky

situations. For example, when a participant is confronted with an environmental, social, or affective cue that would have triggered them to engage in risky drinking behaviors, they would instead experience competing cognitions compatible with a safer alternative (7). There is a possibility that any health intervention will not be as effective in modifying behavior if it does not include components that address implicit/automatic processes since some researchers view implicit associations as the 'default' system guiding behavior (5). New health interventions are beginning to include implicit association modification in their programming with some promising results (98, 99).

4.1 Limitations

Due to the population studied, the findings of this research are limited to at-risk current and former drug users. Nevertheless, this population is a prime target for future health education campaigns as they engage in many behaviors that put them at increased risk for developing alcohol (and other substance use) problems. Further, the data is cross-sectional which limits our ability to infer causality (i.e. if strong associations override executive control or if alcohol use affects deficits in executive control). However, findings showed a protective effect for individuals with higher decision-making ability, consistent with the growing body of evidence for the form of the dual-process model studied here.

The present work was part of a larger study investigating decision-making on a number of health behaviors, including drug use and sexual behaviors in a high-risk population. This manuscript only addresses questions related to frequency of lifetime alcohol use, and while this does not allow for an extensive analysis of alcohol use among drug users, the alcohol-related questions demonstrate high reliability (62), and have been successfully used in other research in at-risk populations (14, 15, 27, 38).

Consistent with other dual process investigations, this study suggests that spontaneous associations may have an impact on behavior, specifically for those with lower levels of executive control. These findings could potentially help guide the development of future intervention components that address associations in memory and executive control processes.

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Figure 1:

Latent Interaction Model with alcohol use regressed on implicit alcohol associations and affective decision making. Model fit: $\chi^2=108.45$, $df=93$, $p=.13$; CFI=0.97, RMSEA=.031 (95% CI: .000, .054). Estimates for non-significant covariates are not shown.

Nonstandardized estimates; one-tailed p-values on regression coefficient estimates: * $p<0.05$;

** $p<0.01$; *** $P<0.001$.

Note: Due to nature of structural equation modeling, only the regression coefficient of XZ is interpreted; individual coefficients for X and Z are ignored.

Figure 2:

Nature of the interaction found was when lifetime alcohol use was regressed on scores of decision making on the IGT and spontaneous alcohol associations. NOTE: Lower decision ability equates to poorer decision scores (i.e., card choices) on the IGT.

Table 1.**Participant Characteristics (N=168)**

Gender	
Male % (N)	73% (122)
Female % (N)	26% (44)
Not Reported % (N)	1% (2)
Ethnicity	
Hispanic % (N)	52% (87)
Not Hispanic % (N)	46% (77)
Not reported % (N)	2% (4)
Age M (SD)	
30.3 (9.93)	
Acculturation M (SD) *	
3.43 (0.75)	
Lifetime Alcohol Use M (SD) **	
8.05 (3.21)	
Word Association Test ***	
Parcel 1 M (SD)	1.07 (1.2)
Parcel 2 M (SD)	0.55 (.88)
Parcel 3 M (SD)	0.73 (.99)
Fillers M (SD)	0.06 (.12)
Iowa Gambling Task ****	
Parcel 1 M (SD)	-2.26 (8.45)
Parcel 2 M (SD)	0.2 Fillers M9 (12.48)
Parcel 3 M (SD)	-1.08 (10.32)

* Note: Scale scoring: 4=only English, 3=English more than another language, 2=English and another language equally, 1=another language more than English, 0=only another language (not English).

** 11-point rating scale: (0) None, (1) 1–10 times, (2) 11–20 times, (10) 91+ times (Higher scores indicate more frequent use). Scale: 0=0, 1=1–10 times, 2=11–20 times...10=91 or more times.

*** Each WAT parcel score is the mean of four WAT items (Range 0 to 4). WAT filler score is the mean of seven WAT filler items.

**** IGT parcel scores are the mean of total good card deck selection minus bad card deck selection, based on 33 IGT trials (Positive scores indicate that the participants tended to select from good decks).