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Relationships between functional and dysfunctional impulsivity, delay discounting and cognitive distortions

Sirous Mobini [a,*], Alec Grant [b], Andrea E. Kass [a], Martin R. Yeomans [a]

[a] *Department of Psychology, School of Life Sciences, University of Sussex, Brighton, BN1 9QH, UK*
[b] *Faculty of Health, INaM, 59 Darley Road, University of Brighton, Eastbourne, BN20 7UR, UK*

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Abstract

Impulsivity is a multidimensional construct assessed by a variety of behavioural and self-report measures. Each measure is thought to assess a separate component, but the inter-relationship between these measures in relation to the functional and dysfunctional nature of this psychological construct remains unclear. In addition, cognitive attributes of functional and dysfunctional impulsivity have not yet been identified. The present study addressed these issues by examining the inter-relationships between impulsivity measured using the delay discounting task and self-report questionnaires, alongside a measure of cognitive distortions. The results showed that delay discount rates were positively correlated with both functional and dysfunctional impulsivity measures, non-planning-impulsiveness and total scores of the Barratt Impulsiveness Scale (BIS-11). These findings are consistent with the idea that discounting the value of delayed rewards may be related to some, not necessarily dysfunctional, forms of impulsive behaviour. Furthermore, the present study suggests that negative cognitive attributes may operate as cognitive processing associated with some subtypes of impulsivity, i.e., dysfunctional impulsivity, non-planning and cognitive impulsiveness.

Keywords: Functional and dysfunctional impulsivity; Delay discounting; Cognitive distortions; Barratt Impulsiveness Scale

* Corresponding author. Tel.: +44 1273 877031; fax: +44 1273 678058.
E-mail address: S.Mobini@sussex.ac.uk (S. Mobini).

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1. Introduction

Impulsivity is viewed as a prominent feature of many psychiatric disorders and has been assessed using a variety of behavioural and personality measures (e.g., Evenden, 1999; Mathias et al., 2002; Webster & Jackson, 1997). These measures have helped us to consider impulsiveness as a personality construct encompassing behavioural, cognitive, emotional, and motor components that can vary across individuals.

Most studies have focused on impulsiveness as a personality construct or behaviour which can be defined as an inability to wait, insensitivity to consequences, the tendency to act without forethought, an inability to inhibit inappropriate behaviours, and deficient tolerance of delay of gratification (e.g., Ainslie, 1975; Eysenck, 1993; Logue, 1995; McCown & DeSimone, 1993). However, there are situations where such impulsive behaviours may have adaptive functions and others where impulsivity would be counter-productive. These definitions either fail to clearly distinguish between functional and dysfunctional aspects of impulsivity or only consider impulsivity as an abnormal personality trait. Dickman (1990) distinguished between two distinct and independent forms of impulsivity, i.e., functional impulsivity and dysfunctional impulsivity. According to Dickman's model (Dickman, 1990), functional impulsivity is related to the tendency to take quick decisions when doing so is beneficial. In contrast, dysfunctional impulsivity is related to the tendency towards speedy and non-reflective decision-making despite the negative consequences of such actions. Accordingly, Dickman (1990) developed an inventory to discriminate these two forms of impulsive behaviour. Similarly, Eysenck (1997) distinguished between two distinct aspects of impulsiveness, one aligning with extraversion, i.e., extraverted impulsivity and the other with psychoticism, i.e., psychotic impulsivity. The former is the process of taking decisions with a calculated risk and a full awareness of the danger, while the latter is the process of taking decisions without any considerations of the associated risks or consequences of the action (Eysenck, 1997). Furthermore, Barratt and colleagues (Patton, Stanford, & Barratt, 1995) have developed a measure of impulsivity, which appears to measure impulsivity as an abnormal personality trait. The Barratt Impulsiveness Scale (BIS-11, Patton et al., 1995) has been validated in general psychiatric and normal populations as well as a group of male inmates from a maximum security prison unit. It measures three subtypes of impulsiveness: cognitive (attentional) impulsiveness (inattention and cognitive instability), motor impulsiveness (motor disinhibition), and non-planning impulsiveness (lack of self-control and intolerance of cognitive complexity) (Patton et al., 1995). Furthermore, Gray's personality theory (1987) suggests that high impulsivity is associated with sensitivity to signals of reward due to the activity of the behavioural approach system (BAS) when such cues are encountered. One of the possible implications of this model is that individuals with high impulsivity may exhibit a lower tolerance for delayed rewards.

In addition to self-report questionnaires, some studies have used behavioural measures to quantify a single index of impulsive behaviour. One of the most commonly used behavioural tasks to measure impulsive decision-making is Delay Discounting, which provides a valid and reliable measure of the value of delayed, relative to immediate rewards in both animal and human studies (Ainslie, 1974; Herrnstein, 1981; Logue, 1988; Mobini, Body, Ho, Bradshaw, &

Szabadi, 2002; Richards, Zhang, Mitchell, & De Wit, 1999). In delay discounting studies a key assumption is that the value of a reward is discounted as a function of the delay which precedes its delivery. Thus, delay discounting procedure often requires the subject to choose between a small immediate reward and a large delayed reward; in this case preference for the former is often considered as 'impulsive' and preference for the latter as 'self-controlled' (Logue, 1995; Mazur, 1987; Monterosso & Ainslie, 1999; Rachlin, 1974). Some studies have examined the relationships between delay discounting as a behavioural measure and self-report questionnaires as personality measures of impulsivity and reported no such relationships (e.g., Lane, Cherek, Rhoades, Pietras, & Tcheremissine, 2003; Mitchell, 1999; Reynolds, Ortengren, Richards, & De Wit, 2006; White et al., 1994), whereas, some other studies have reported a positive correlation (e.g., Cherek, Moeller, Dougherty, & Rhoades, 1997; de Wit, Flory, Acheson, McCloskey, & Manuck, 2007; Kirby, Petry, & Bickel, 1999). A possible explanation for these discrepancies is that different self-report measures tap into different aspects of impulsivity in general, and that some of these components are captured by the delay-discounting task, while others do not. The present study therefore investigated the inter-relationship between delay discounting and different forms of impulsiveness measured both by the BIS-11 and Dickman's measures of functional and dysfunctional impulsivity. An important further question would be whether people with high dysfunctional impulsivity discount the value of the delayed reward more rapidly than people with high functional impulsivity. To our knowledge no study has yet examined this question. This latter component of the study allows us to assess whether delay discounting represents a general feature of impulsivity, or better reflects an aspect of dysfunctional impulsivity.

A second shortcoming in our understanding of the nature of impulsivity is the lack of information on the cognitive attributes which may contribute to impulsive behaviour. Hutchinson and colleagues (Hutchinson, Patock-Peckham, Cheong, & Nagoshi, 1998) found that measures of irrational beliefs and impulsiveness were moderately correlated in a group of students abusing alcohol. In another recent study, it was reported that 'core beliefs' related to 'abandonment' were positively associated with high levels of impulsive self-harming behaviour in a psychiatric population (Dench, Murray, & Waller, 2005). However, in these studies impulsivity was investigated alongside other psychological disorders, therefore, making it difficult to attribute the findings to impulsive behaviour. From a cognitive perspective, one of the questions open to more investigation is how individuals who score high on dysfunctional impulsivity relative to functional impulsivity interpret the events preceding such actions. Previously we reported that people with high impulsivity measured by the BIS-11 scored high on cognitive distortions suggesting that there might be some general and specific cognitive distortions associated with impulsive behaviour (see Mobini, Pearce, Grant, Mills, & Yeomans, 2006). More specifically, in the present study we aimed to investigate whether cognitive attributes of dysfunctional impulsivity differ from those of functional impulsivity.

Taken together, the present study was designed to investigate (1) the inter-relationships between delay discounting with functional and dysfunctional impulsivity and also with cognitive, motor and non-planning impulsiveness; and (2) cognitive attributes associated with dysfunctional impulsivity vs. functional impulsivity, and discounting the value of the delayed rewards.

2. Methods

2.1. Participants

Participants in this study were 214 undergraduate volunteer students (male = 79 female = 135) recruited from the University of Sussex. Age of the participants averaged 21.5 (SD = 5). Participants were given a written information sheet which outlined the details of the study.

2.2. Measures

2.2.1. Computerized delay discounting procedure

Discounting the value of delayed rewards was measured using a computerized version of the adjusting amount procedure (Mitchell, 1999). The delay discounting procedure used in this study was designed to measure the subjective value of a 'standard' £10 reward at several delays relative to an 'alternative' variable immediate reward. The choices were presented randomly on a computer screen as two coloured boxes, and participants indicated which of the two items they preferred by pressing one of two coloured keys on a button box. The programme was run using Psyscope software.

2.2.2. Barratt Impulsiveness Scale (BIS-11, Patton et al., 1995)

The BIS-11 is a self-rating questionnaire with 30 questions. The scale is based on a tri-factor model of impulsivity measuring (a) "motor impulsiveness"; (b) "cognitive (attentional) impulsiveness"; and (c) "non-planning impulsiveness".

2.2.3. Dickman impulsivity inventory (DII, Dickman, 1990)

The DII-short is a self-report questionnaire developed to measure two forms of impulsivity, namely functional and dysfunctional impulsivity. This consists of 11 items designed to measure functional impulsivity and 12 items designed to measure dysfunctional impulsivity.

2.2.4. Cognitive distortions scale (CDS, Mobini et al., 2006)

The CDS is a 20-item scale designed to measure 20 cognitive distortions relevant to cognitive models of psychopathology. The CDS used in this study was a modified version of cognitive distortions originally introduced by Beck (1976) and expanded by Leahy (2003) and Najavits and colleagues (Najavits, Gotthardt, Weiss, & Epstein, 2004).

2.3. Procedure

On arrival to the laboratory, participants were given an instruction sheet, which briefly described the procedure involved in the study. They completed a computerised version of the delay-discounting task of impulsivity along with the three self-report questionnaires (BIS-11, DII and CDS) measuring impulsivity and cognitive distortions.

3. Data analysis

3.1. Indifference points

To determine the ''indifference points'', i.e., the point at which the probabilities of the subject choosing both rewards are equal, for each standard item in each task, the alternative items were arranged in ascending order of value (£0.01–£10.50). Generally, the value of the alternative at which preference reversed (switched) was discrete and the median between two values was determined as the ''indifference point'' (see Green, Fisher, Perlow, & Sherman, 1981).

3.2. Statistical analyses

Correlational analyses (Pearson) were performed to assess the associations between delay discounting, functional and dysfunctional impulsivity, cognitive, motor, and non-planning impulsiveness, and cognitive distortions. Furthermore, the indifference points were analysed using a mixed analysis of variance (ANOVA). To determine the overall rate of discounting for delay, a hyperbolic equation was fit to the six indifference points obtained for each participant and subsequently for each group using a nonlinear curve-fitting plot (Sigma Plot). For delay discounting the following hyperbolic function was used:

$$V = A/1 + kD$$

In this equation, V is the discounted value of a delayed reward, A is the amount of the reward, k is an empirically derived parameter representing delay discounting, and D is the delay duration. Larger k values indicate that the delayed rewards are being devaluated more rapidly (a steeper function) and consequently that the participant is more impulsive. A non-parametric statistics (Mann–Whitney U) was used to compare the discounting parameter (k) between two groups i.e., dysfunctional impulsivity > functional impulsivity and functional impulsivity > dysfunctional impulsivity and also between low- and high-impulsive groups based on the BIS-11. The means and standard deviations were calculated on each cognitive distortion and the total scores of the CDS for the participants who scored higher on dysfunctional impulsivity vs. functional impulsivity and vice versa. A one-way ANOVA was used to compare means of the CDS total scores and means of each cognitive distortion scores between the two groups.

4. Results

4.1. Delay discounting and self-report measures of impulsivity

Table 1 shows Pearson's correlation coefficients (r) between delay discounting (k), different subtypes of impulsivity measured by the self-report personality measures and cognitive distortions. The delay discounting (k) values were significantly correlated with both functional ($r = 0.19$, $p < 0.05$) and dysfunctional impulsivity scores ($r = 0.21$, $p < 0.01$) as well as the total impulsivity scores of the DII ($r = 0.20$, $p < 0.05$). Also, the results showed that k values were positively

Table 1
Pearson's correlation matrix comparing measures of impulsivity and the CDS

	k	Np-Imp	Co-Imp	Mo-Imp	BIS-t	Fun-Imp	Dys-Imp	DII-t
Np-Imp	0.32**							
Co-Imp	−0.08	0.42***						
Mo-Imp	0.11	0.51***	0.35**					
BIS-t	0.22*	0.84***	0.73**	0.79***				
Fun-Imp	0.19*	0.22*	0.09	0.32**	0.24**			
Dys-Imp	0.21*	0.43***	0.34**	0.45***	0.50***	0.08		
DII-t	0.20*	0.43***	0.28**	0.52***	0.49***	0.77***	0.70***	
CDS	0.07	0.23**	0.35**	0.09	0.26**	–	0.27**	−0.07

k, Delay discounting; NP-Imp, non-planning impulsiveness; Co-Imp, cognitive impulsiveness; Mo-Imp, motor impulsiveness; BIS-t, BIS-11 total score; Fun-Imp, functional impulsivity; Dys-Imp, dysfunctional impulsivity; DII-t, DII total score; CDS, cognitive distortion scale.
All two-tailed, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

correlated with non-planning impulsiveness subscale ($r = 0.32$, $p < 0.01$) of the BIS-11 and total impulsivity scores on this scale ($r = 0.22$, $p < 0.01$).

As shown in Fig. 1, both groups of participants with dysfunctional impulsivity > functional impulsivity ($n = 82$) and with functional impulsivity > dysfunctional impulsivity ($n = 108$) exhibited a steeper delay discounting function. Mann–Whitney *U* test revealed no significant differences in the *k* values between these two groups (two-tailed, $Z = 0.68$, $p = 0.50$). Twenty-four participants were not included in this data analysis as their scores on both dysfunctional and functional subscales of the DII were equivalent. In addition, ANOVA comparing the indifference points between these two groups revealed no group × delay interaction ($F < 1$).

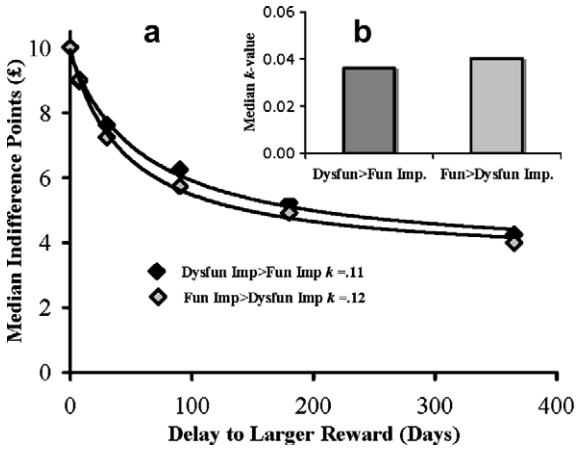

Fig. 1. (a) Median indifference points on delay discounting for participants with dysfunctional impulsivity > functional impulsivity and functional impulsivity > dysfunctional impulsivity. Lines represent the hyperbolic functions fitted to these data points for each group. The *y*-axis represents the subjective value (''indifference points'') of the delayed reward (£10) and the *x*-axis represents the delays to the reward. (b) Median *k* (discount parameter) values for both groups.

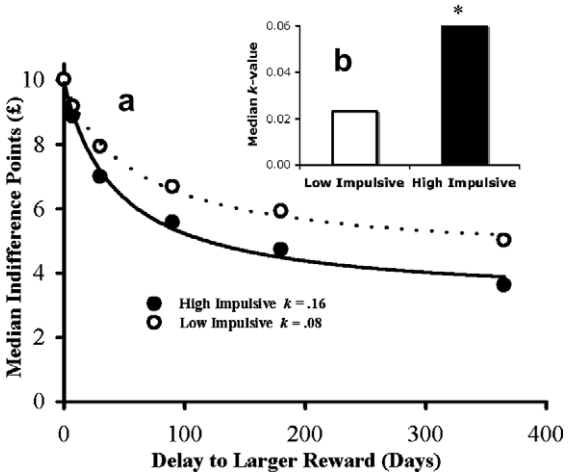

Fig. 2. (a) Median indifference points on delay discounting for high-impulsive and low-impulsive groups. Lines represent the hyperbolic functions fitted to these data points for each group. The discounting parameter, k, for each function is also shown. The y-axis represents the subjective value (''indifference points'') of the delayed reward (£10) and the x-axis represents the delays to the reward. (b) Median k (discount parameter) values for both groups. $^{*}p < 0.05$.

As shown in Fig. 2, both low-impulsive (scores $\leqslant 60$ on BIS-11) and high impulsive (scores > 60 on BIS-11) groups exhibited discounting of the delayed reward, but the high-impulsive group exhibited a steeper delay discount function (i.e., valued delayed rewards less than the low impulsives). ANOVA conducted with the indifference points revealed that participants with higher overall scores on the BIS-11 ($n = 113$) exhibited significantly greater delay discounting than did participants with lower scores ($n = 101$) [group $\times$ delay interaction, $F(5, 895) = 3.37$, $p < 0.005$], as indicated by the higher k-value of the high-impulsive group than that of the low impulsive group (Mann–Whitney U test, two-tailed, $Z = 2.39$, $p < 0.02$).

4.2. Cognitive distortions, dysfunctional/functional impulsivity and delay discounting

The correlation coefficients revealed a significant positive relation between cognitive distortions (CDS) and dysfunctional impulsivity ($r = 0.27$, $p < 0.01$). Conversely, the CDS was negatively correlated with functional impulsivity ($r = -0.32$, $p < 0.01$). ANOVA revealed participants who scored higher on the dysfunctional impulsivity than functional impulsivity scale of the DII scored significantly higher on the CDS total score and on 18 of 20 cognitive distortions, in contrast to participants who scored higher on functional impulsivity than dysfunctional impulsivity (Table 2). Furthermore, the CDS scores were positively correlated with the total scores of the BIS-11 ($r = 0.26$, $p < 0.01$) and more specifically with non-planning impulsiveness ($r = 0.23$, $p < 0.01$) and cognitive impulsiveness ($r = 0.35$, $p < 0.01$) (Table 1). However, delay discounting rates (k) were not significantly correlated with the CDS total scores, although these values showed small positive correlations with three cognitive attributes of the CDS, i.e., ''instant satisfaction'', $r = 0.16$; ''mind reading'', $r = 0.17$, and ''short-term thinking'', $r = 0.13$. Table 3 reports descriptions of all cognitive distortions measured by the CDS.

Table 2
Means and standard deviations (SD) of the cognitive distortions scale for participants with dysfunctional impulsivity > functional impulsivity and vice versa

Measure	Dysfunctional > functional ($n = 82$) Mean (SD)	Functional > dysfunctional ($n = 108$) Mean (SD)	$F(1, 188)$
Cognitive distortions			
Instant satisfaction	42 (27)	31 (24)	4.6*
Mind reading	49 (22)	44 (24)	0.8 NS
Shoulds	45 (30)	34 (26)	3.9*
Fooling yourself	46 (28)	30 (24)	8.8**
Overreacting	54 (29)	29 (24)	22.5***
Jumping to conclusion	57 (23)	35 (23)	19.3***
Fortune-telling	38 (27)	18 (19)	20.5***
Confusing needs and wants	49 (27)	30 (25)	11.9***
Focusing on the negatives	56 (30)	33 (26)	17.8***
All or none thinking	42 (29)	21 (22)	16.8***
Catastrophizing	45 (32)	22 (22)	21.2***
Discounting positives	41 (26)	25 (21)	11.5***
Overgeneralizing	44 (26)	25 (23)	14.1***
Personalizing	47 (27)	30 (24)	11.9***
Regret orientation	60 (22)	38 (26)	19.6***
Short-term thinking	37 (23)	21 (21)	13.1***
Emotional reasoning	51 (23)	37 (24)	7.5**
Negative filtering	47 (28)	21 (21)	30.0***
Labelling	38 (24)	24 (21)	10.1**
Blaming	25 (18)	19 (19)	0.1 NS
CDS-total	46 (17)	28 (15)	29.4***

NS, non-significant.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

5. Discussion

There were four major findings in the present study. First, the delay discount rates were positively correlated with both functional and dysfunctional impulsivity measures. Second, participants who scored high on a self-report measure of impulsivity (BIS-11) were found to discount hypothetical monetary outcomes to a greater extent than did participants scoring low on this scale. Delay discount rates were positively correlated with non-planning impulsiveness and the total scores of BIS-11. Third, the scores of CDS were positively correlated with dysfunctional impulsivity, non-planning impulsiveness, and cognitive impulsiveness. Finally, the delay discounting values (k) did not correlate with the total scores of the CDS, but showed positive correlations with three cognitive distortions i.e. ''instant satisfaction'', ''mind reading'' and ''short-term thinking''.

The present research is the first study of this kind that indicates the tendency to prefer more immediate rewards on the delay discounting task is associated with both functional and dysfunctional features of impulsivity. This finding suggests that discounting the value of the delayed reward may be a general feature of impulsivity rather than a function only related to dysfunctional

Table 3
Descriptions of cognitive distortions measured by the CDS

Cognitive distortions	Definition
Instant satisfaction	Having a right to immediate satisfaction
Mind reading	Knowing what other people are thinking
Shoulds	Having a list of rules of how the world should work
Fooling yourself	Holding a belief that something is OK when it is not
Overreacting	Making a mountain out of a mole hill
Jumping to conclusions	Drawing a conclusion in the absence of evidence
Fortune-telling	Thinking you know what the future will bring
Confusing needs and wants	Wanting something very badly
Focusing on the negatives	Magnifying all the negatives in a situation
All or none thinking	Seeing things as black or white, good or bad
Catastrophizing	Believing that events will be so awful and unbearable
Discounting positives	Believing the positive things you do are trivial
Overgeneralizing	Perceiving a global pattern of negatives
Personalizing	Attributing blames to yourself
Regret orientation	Focusing on the idea that you could have done better in the past
Short-term thinking	Focusing only on the short-term consequences
Emotional reasoning	Letting your feelings guide your interpretation of reality
Negative filtering	Focusing almost on the negatives
Labelling	You assign global negative traits to yourself
Blaming	Focusing on the other person as the source of your negative feeling

impulsivity. This finding seems to be consistent with the Gray's (1987) model suggesting that individuals with high impulsivity generally show higher sensitivity to rewards delivered immediately. This is an important finding as previous studies mainly used self-report measures of impulsivity which either do not distinguish between functional and dysfunctional components or measure impulsivity as an abnormal personality trait. According to Dickman's theory, a common feature of impulsivity is "the tendency to deliberate less than most people of equal ability before taking action" (Dickman, 1990). This lack of deliberation seems to have two opposing outcomes, one of which is positive and the other negative, but in both cases the lack of deliberation may be associated with a rapid discounting of delayed rewards.

As mentioned earlier, the findings of the relationship between delay discounting and impulsivity are controversial, with some studies suggesting a positive relationship (Cherek et al., 1997; de Wit et al., 2007; Kirby et al., 1999) and some others failing to report such a relation (e.g., Lane et al., 2003; Mitchell, 1999; Reynolds et al., 2006; White et al., 1994). These inconsistencies in findings may be a result of using different discounting procedures or sample populations. Consistent with two previous studies (de Wit et al., 2007; Swann, Bjork, Moeller, & Dougherty, 2002), we found a positive correlation between delay discounting and non-planning impulsiveness. In line with de Wit et al.'s (2007) findings, we found a negative but non-significant correlation between delay discounting and cognitive impulsiveness. We also found that participants with high total scores on the BIS exhibited a greater discount rate of monetary rewards as compared with those with low scores. Unlike motor and cognitive impulsiveness, non-planning impulsiveness characterised as a "present orientation" or a lack of "futuring" and measured by such items as "I plan task carefully" and "I plan for future" (Patton et al., 1995) appears conceptually related to the

delay-of-gratification model. Accordingly, having a ''present orientation'' and a lack of ''futuring'' can undermine human ability to tolerate delay of gratification, possibly causing the tendency to select the small immediate rewarding outcomes in preference for larger delayed rewarding outcomes.

The other novel finding from the present study was the identification of several cognitive distortions, which might operate as predisposing cognitive processes contributing to dysfunctional impulsivity, non-planning impulsiveness and cognitive impulsiveness. This is consistent with our previous findings that those participants with high scores on the BIS-11 scored higher on the CDS as compared with low-impulsive individuals (Mobini et al., 2006). The finding that scores on the CDS were positively correlated with dysfunctional impulsivity and negatively with functional impulsivity strongly suggests that maladaptive cognitive attributes are involved in dysfunctional impulsivity. In line with Beck's cognitive theory (Beck, 1976), this finding suggests that high dysfunctional impulsive individuals have maladaptive interpretations of events around them that may contribute to their tendency to act rapidly with little or no forethought. These dysfunctional beliefs may play an important role in the impulsive individuals' inability to think carefully and to take into account the long-term negative consequences of their behaviour. Moreover, consistent with some cognitive research (e.g., Dickman, 1985; Gorlyne, Keilp, Tryon, & Mann, 2005), this distorted thinking may cause difficulties in integrating information and formulating appropriate responses so that behaviour appears to be unplanned and irrelevant to consequences. For example, maladaptive cognitive attributes concerned with having a right to immediate satisfaction (*instant satisfaction*), focusing on short-term rather than long-term consequences (*short-term thinking*), having something at all costs (*confusing needs and wants*), holding rigid rules stated by ''shoulds'', and absolutistic thinking (*all/none thinking*) could undermine people's ability to tolerate delay of gratification along with their ability to plan ahead and think carefully about the consequences of their actions.

The finding that the delay discounting values were not correlated with CDS suggests that unlike dysfunctional impulsivity, negative cognitive attributes were not related to discounting values of delayed rewards. However, discounting rates were positively correlated with scores of three cognitive distortions i.e., ''instant satisfaction'', ''mind reading'' and ''short-term thinking''. These three cognitive attributes seem to be related most to the deficient tolerance of delay of gratification or ''impulsive choice''.

It is worth noting the primary limitations in this study as well as some suggestions for further investigations. First, although the analogue sample used in this study was relatively large, future studies with a more balanced gender and education distribution and using clinical samples are needed. Use of clinical samples would be particularly beneficial for further clarifying the relationships between impulsivity subtypes and cognitive distortions. Second, although the present study suggests some cognitive attributes contributing to impulsivity, it would be interesting to examine more distant underlying cognitive factors (e.g., schemas or maladaptive assumptions) predisposing dysfunctional impulsive behaviour. Third, as Gray's BAS construct is associated with impulsivity, it would be interesting to examine the inter-relationship between the sensitivity to reward function (BAS) and different forms of impulsivity, particularly functional and dysfunctional impulsivity. Finally, a more direct relationship between Gray's BAS system and sensitivity to delayed reward remains to be seen.

In conclusion, the findings of the present study are consistent with the idea that impulsivity is a multidimensional construct and discounting the value of delayed reward may be related to some, not necessarily dysfunctional, subtypes of impulsive behaviour. Furthermore, negative cognitive attributes may operate as underlying cognitive processing of some types of impulsivity, i.e. dysfunctional impulsivity, non-planning and cognitive impulsiveness.

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