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# Impulsiveness and lack of inhibitory control in eating disorders

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## Abstract

Eating disorders are considered to lie on a spectrum of disorders with varying degrees of obsessive–compulsive and impulsive traits. Restrictive anorexia nervosa patients (AN-R) are thought to belong to the obsessive pole of the spectrum, and purging-anorexia (AN-P) and bulimia nervosa (BN) patients to the impulsive pole. In this study we have compared impulsive traits in three groups of eating disordered patients (total  $N=56$ ) and a control group of 83 female students. Information about impulsive traits and lack of inhibitory control was gathered by means of standardized rating scales (Eysenck's Impulsiveness Scale, Barrett's Impulsiveness Scale, and Carver and White's BIS/BAS scale) and a behavioral measure of impulsiveness (stop–go task). On the questionnaires AN-R patients reported to be less impulsive than controls, AN-P and BN patients. In the stop–go task, we did not find significant differences between the different groups. Correlations between self-reported measures of impulsiveness and behavioral measures were not significant. In conclusion: Our results from the self-report measures are at odds with the behavioral measures certainly in the AN-R group. Perhaps the latter patients' distorted self-perception and/or self-description may explain this discrepancy.

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*Keywords:* Impulsiveness; Lack of inhibitory control; Stop–go task; Anorexia nervosa; Bulimia nervosa

## 1. Introduction

It has been suggested that anorexia nervosa of the restrictive type (AN-R), anorexia nervosa of the bingeing/purging type (AN-P) and bulimia nervosa (BN) all belong to a spectrum of disorders that present with varying degrees of obsessive–compulsive and impulsive traits (McElroy, Phillips, & Keck, 1994). According to Hollander (1998), obsessive individuals may be hypervigilant and attempt to avoid harm and reduce anxiety or discomfort; in contrast, impulsive individuals are risk seekers who try to maximize pleasure, arousal or gratification and who may exhibit antisocial behaviors. Much has been written on obsessive–compulsive features in AN versus more impulsive traits in BN (for reviews see Dawe & Loxton, 2004; Kaye, Bulik, Thornton, Barbarich, & Masters, 2004). However, several authors have also recognized impulsive traits in AN subjects (particularly the bingeing–purging subtype) and obsessive–compulsive symptoms in BN subjects (e.g., Aragona & Vella, 1998). Understanding the obsessive–compulsive and impulsive aspects in individuals with eating disorders may help guide treatment or allow for better prediction of outcome (Raymond et al., 1999).

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Empirical studies of impulsiveness and lack of inhibitory control in general have used both self-report questionnaires and more objective behavioral measures (e.g., reaction time tasks), as indices of different aspects of the multi-dimensional impulsiveness construct (Malle & Neubauer, 1991, see in Butler & Montgomery, 2005). However, research on impulsiveness in eating disordered patients has mostly used self-report measures. Only a few authors have made use of behavioral measures to investigate impulsiveness and lack of inhibitory control in eating disordered patients (especially AN-R). Using a continuous performance task (CPT), Seed, Dixon, McCluskey, and Young (2000) found that women with AN responded to more non-targets (errors of commission, indicating impulsiveness) and missed more target stimuli (errors of omission, indicating inattention) than controls, without any differences in response latencies. Butler and Montgomery (2005) assessed impulsiveness in women with AN using the Impulsiveness Questionnaire of Eysenck ( $I_7$ ; Eysenck & Eysenck, 1978) and two behavioral measures (a continuous performance task and a risk-taking measure). The AN group had lower self-reported impulsiveness and venturesomeness scores than controls, but they also displayed impulsive behavior on the CPT (more errors of commission with faster reaction times). The authors concluded that the coexistence of self-reported self-control and behavioral impulsiveness in AN indicate that the relationship between impulsiveness and disordered eating in AN is more complex than previously recognized. Finally, Nederkoorn, Van Eijs, and Jansen (2004) used a stop-go task in 34 restrained eaters — who are expected to serve as an analogue of BN (Lowe et al., 1996) — and 29 control women: The former were significantly worse in inhibiting their motor responses than the unrestrained eaters. Food exposure during the task did not affect motor performance. The authors concluded that a fundamental lack of general response inhibition might play a role in the development of a specific eating disinhibition. This notion implies that the authors consider impulsivity to be a potential antecedent risk factor for AN. It would seem, however, that the starvation related implications of AN may have a significant effect on such behavioral measures of impulsivity. Fessler (2002) noted the possibility that “lack of response inhibition” might be an epiphenomena related to starvation. Increased impulsivity in association with dietary restriction is described in diverse literatures (see in Fessler, 2002). It appears that, via a reduction in serotonergic activity, fasting inherently increases levels of impulsivity in general, and impulsive aggressive in particular (Fessler, 2003).

The stop-go task used in the study by Nederkoorn et al. (2004) assesses the integrity of suppressing prepotent motor responses (inhibitory motor control). Inhibitory motor control is a hidden process. The main advantage of the stop task is that it can reveal this covert stop process by estimating the speed of stopping (SSRT). In the go task subjects are instructed to respond as quickly as possible to a particular stimulus (go stimulus). In some trials a second stimulus (stop stimulus) is presented closely in time to the go stimulus, with the indication to stop the response initiated by the go stimulus, assessing Stop-Signal Reaction Time (SSRT). According to Avila and Parcet (2001), the stop-go task is a valid and reliable measure of the inhibition process.

Lijffijt et al. (2004) investigated whether there is an association between trait impulsiveness in the normal population (as measured by questionnaires) and inhibitory motor control (as measured by the stop-go task). Low and high impulsive participants (as assessed by the  $I_7$  questionnaire, total of both groups  $N=31$ ) performed the stop-go task. The low and high impulsive groups did not differ on the speed to stop the response (SSRT). Furthermore a short meta-analysis was performed on this study and three previous studies with a similar aim [Logan, Schachar, & Tannock, 1997; Marsh, Dougherty, Mathias, Moeller, & Hicks, 2002; Rodriguez-Fornells, Lorenzo-Seva, & Andres-Pueyo, 2002]. However, the meta-analysis revealed that high-impulsive people are marginally slower in stopping than low-impulsives (effect-size =  $-0.26$ ;  $p=0.06$ ). Lijffijt et al. (2004) concluded that there is only minor evidence that impulsiveness in the common population is associated with inhibitory motor control. However, the stop-signal task has also been used in several studies with children with different psychiatric disorders (Avila & Parcet, 2001). The results of a recent meta-analysis of eight studies in which response inhibition was assessed with the stop-signal task revealed that response inhibition deficits were more present in children with ADHD compared with controls, but also in those with Conduct Disorder (Oosterlaan, Logan, & Sergeant, 2002). Another relevant result of the meta-analytic study was that anxious children did not show enhanced levels of response inhibition.

The goal of the present study was to find out whether the various types of eating disordered patients (AN-R, AN-P, BN) and normal controls differ from each other with respect to impulsiveness and lack of inhibitory control measured with subjective self-report measures of impulsiveness and a behavior measure of (lack of) inhibitory control (stop-go task). We hypothesized a gradual increase in self-reported (e.g. Claes, Vandereycken, & Vertommen, 2005) impulsiveness from AN-R, over AN-P to BN, and NC taken a position between AN-R and AN-P/BN patients. Formulating hypotheses concerning the results of the stop-go task in different ED groups is more difficult, due to a lack of literature concerning this topic. The available literature (e.g., Butler & Montgomery, 2005; Nederkoorn et al., 2004; Seed et al., 2000) suggests that AN patients make more mistakes, react faster and have less inhibitory control than NC, but no literature is available concerning the comparison of AN and BN patients on inhibitory control tasks. Based on literature on personality traits (Dawe & Loxton,

2004; Kaye et al., 2004), one would expect that BN patients have less inhibitory control than AN patients; but due to starvation AN patients can also display problems in inhibitory control. Finally, we are interested in the association between the self-reported measures of impulsivity and the lack of inhibitory control in the stop-go task.

## 2. Method

### 2.1. Subjects

We gathered data from 56 female eating disordered (ED) in/outpatients and 83 female healthy controls. By means of a clinical interview conducted by an experienced psychiatrist (third author) supplemented with the Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 1994; Mond, Hay, Rodgers, Owen, & Beumont, 2004) patients were diagnosed according to the DSM-IV criteria (American Psychiatric Association, 1994): 35.7% ( $N=20$ ) as anorexia nervosa restrictive type (AN-R), 25% ( $N=14$ ) as anorexia nervosa bingeing/purging type (AN-P), and 39.3% ( $N=22$ ) as bulimia nervosa purging type (BN). The results of the EDE-Q showed significant differences between the four groups (Wilks'  $\lambda=0.53$ ,  $p<0.001$ ); the different types of ED patients scored significantly higher on the four EDE-Q subscales compared to NC, but did not significantly differ from each other with respect to Restraint, Eating Concern, Weight Concern and Shape Concern. The mean age of the AN-R, AN-P, BN and NCs (NC) was 23.0 (SD=6.6), 21.7 (SD=6.8), 22.7 (SD=5.8) and 20.1 (SD=3.1) and were not significantly different from each other.

### 2.2. Measures

#### 2.2.1. Self-reported measures of impulsiveness

**2.2.1.1. Eysenck impulsiveness questionnaire ( $I_7$ ).** The  $I_7$  is a self-report inventory that consists of 54 items to be answered with a yes/no format. According to its authors (Eysenck & Eysenck, 1978) the  $I_7$  is an adequate measure of three factors: Narrow Impulsiveness (N-Imp, 19 items,  $\alpha=0.83$ ;  $\alpha_{\text{our sample}}=0.81$ ), Venturesomeness (Vent, 16 items,  $\alpha=0.84$ ;  $\alpha_{\text{our sample}}=0.79$ ), and Empathy (Emp, 19 filler items,  $\alpha=0.69$ ;  $\alpha_{\text{our sample}}=0.60$ ). Impulsiveness — as measured by this instrument — is related to decision making without an awareness of risk, whereas venturesomeness describes decision making with due consideration of risks and consequences. Impulsiveness and venturesomeness are positively correlated ( $r=0.38$ ). The instrument is known to have good reliability and derived age norms (Eysenck, Pearson, Easting, & Allsopp, 1985).

**2.2.1.2. Barrett impulsiveness scale (BIS-11).** The BIS-11 assesses different aspects of impulsiveness as a personality trait. The questionnaire consists of 30 statements to which participants respond by choosing one of the following responses: Rarely/never, occasionally, often, and almost always. An analysis of the factor structure of the BIS-11 (Patton, Stanford, & Barratt, 1995) revealed six first-order and three second-order factors. The first-order factors were labeled as follows: Attention (focusing on the task at hand); Motor Impulsiveness (acting on the spur of the moment); Self-control (planning and thinking carefully); Cognitive Complexity (enjoy challenging mental tasks), Perseverance (a consistent life style) and Cognitive Instability (thought insertions and racing thoughts). The three second-order factors are: Attentional Impulsiveness ( $\alpha_{\text{our sample}}=0.59$ ), combining Non-Attention and Cognitive Instability; Motor Impulsiveness ( $\alpha_{\text{our sample}}=0.64$ ), combining Motor Impulsiveness and Non-Perseverance; and Non-planning Impulsiveness ( $\alpha_{\text{our sample}}=0.71$ ) combining Self-control and Cognitive Complexity. Alpha coefficients for the total BIS were within acceptable limits for use in applied studies across different groups (e.g., General psychiatric patients:  $\alpha=0.83$ ;  $\alpha_{\text{our sample}}=0.79$ ).

**2.2.1.3. BIS-BAS measures.** The BIS-BAS Scales (Carver & White, 1994) are presented as a 20 item questionnaire. They have been designed specifically to measure the sensitivity of Gray's (1990) Behavioral Inhibition System (BIS) and Behavioral Activation System (BAS) at the personality level. In relation to behavior, this theory suggests that the BIS (trait anxiety) is sensitive to signals of punishment, frustrative non-reward and novelty, and when it is activated by such signals, it inhibits behavior that will lead to further negative or painful outcomes. In contrast, the BAS (trait impulsiveness) is believed to be sensitive to signals of reward and non-punishment, and when it is activated by such signals it causes or increases behavior toward more rewards or goals. Respondents are asked to endorse items on a 4-point

Likert scale ranging from 1 = strongly agree to 4 = strongly disagree. The measure yields four scales: One for BIS and three BAS scales entitled Reward Responsiveness (items measuring anticipation and positive response towards reward), Drive (items tapping persistence in obtaining desired goals) and Fun Seeking (statements indicative of a willingness to seek out and spontaneously approach potentially rewarding experiences). Cronbach alpha coefficients were reported for the original sample. For the BIS scale  $\alpha=0.74$  ( $\alpha_{\text{our sample}}=0.82$ ); for Reward Responsiveness  $\alpha=0.73$  ( $\alpha_{\text{our sample}}=0.68$ ); for Drive  $\alpha=0.76$  ( $\alpha_{\text{our sample}}=0.76$ ); and for Fun Seeking  $\alpha=0.66$  ( $\alpha_{\text{our sample}}=0.56$ ) (Heubeck, Wilkinson, & Cologon, 1998).

### 2.2.2. The stop-go task

The stop-go task was copied from Logan et al. (1997). It involves two concurrent tasks, a go task, which is a choice reaction time task, and a stop task, occurring on 25% of the go-trial, and involving a stop-signal that tells subjects to inhibit their responses to the go task. During the go task, the letters O or X were presented for 1000 ms on the center of a PC computer screen, preceded by a 500 ms fixation point. The subjects had to press a right button on a board with their right hand when an X was on the screen and a left button with their left hand when an O was on the screen. Between trials, the screen was blank for 1000 ms. The subjects were asked to press the buttons as fast as possible. In the go task subjects are instructed to respond as quickly as possible to a particular stimulus (go stimulus), generating measures such as the % correct answers on the Go Task (% of go trials on which one pressed left when O appeared and right when X appeared on the screen), the Mean Reaction Time ( $M_{RT}$ ), and Within-Subject Standard Deviation of the Reaction Time ( $SD_{RT}$ ), that possibly reflect lapses of attention (Castellanos & Tannock, 2002). The stop-signal was a 100 ms, 1000 Hz tone, produced by the computer. Initially, the stop-signal delay was set at 250 ms after the presentation of the go signal (the O or the X) and then adjusted dynamically depending on the responses of the subject (tracking procedure designed to allow subject to inhibit on 50% of the stop-signal trials). When the subject failed to inhibit the response, the delay was decreased by 50 ms, thereby making it easier to inhibit the next stop-signal trial. When the subject succeeded in inhibiting the response, the delay was increased by 50 ms, thereby making it more difficult to inhibit the next stop-signal trial. The variables measured in this task are the % No Inhibition (referring to the % of stop trials on which one did not inhibit one's response when the stop-signal was generated), the Reaction Time (RT) and the Stop Delay. The Stop-Signal Reaction Time (SSRT) is calculated by subtracting the Stop Delay from the Reaction Time. Higher SSRTs indicate poorer response inhibition. The task consists of four blocks, each containing 128 trials. There were an equal number of Xs and Os in a block and stop-signals were presented on 25% of the trials, balanced over X and O trials. The order of trials was randomized. Between blocks, the subject was allowed to take a break of a few minutes (Nederkooorn et al., 2004).

### 2.3. Procedure

The participants were tested individually. They signed an informed consent prior to participation. Approval was given by the ethical board of the university. The participants started with the stop-signal task. They were explicitly told that their first priority was to respond as fast as possible to the choice reaction task and not to wait for the tone. When the computer task was completed, the patient filled out the questionnaires.

### 2.4. Analyses

The data of the stop-go task were analyzed with 4 (group)  $\times$  4 (blocks) analyses of variance (ANOVA) for repeated measures. Data of the questionnaires were analyzed with multivariate analyses of variance (MANOVAs), followed by univariate analyses of variance (ANOVAs) and Scheffe's post-hoc tests to find the significant differences between the four groups (SPSS, version 11). To calculate the relationship between the interval-scaled variables, we used the zero-order correlation coefficient.

## 3. Results

### 3.1. Associations between self-reported measures of impulsiveness and the stop-go task measures

Within the self-reported measures of impulsiveness, Motor Impulsiveness ( $I_7$ , BIS), Venturesomeness ( $I_7$ ), Non-Planning Impulsiveness (BIS), Drive and Fun Seeking (BIS/BAS) are positively correlated with each other ( $r$  ranging

Table 1

Means (standard deviations) of self-reported measures of impulsiveness and stop-go task measures in the different types of ED and controls

	(A) AN-R (N=20)		(B) AN-P (N=14)		(C) BN (N=22)		(D) Controls (N=83)		F	Post-hoc tests
	M	(SD)	M	(SD)	M	(SD)	M	(SD)		
<i>Self-reported measures of impulsiveness</i>										
<i>Eysenk Impulsiveness Questionnaire</i>										
Impulsiveness	4.05	(2.2)	8.00	(3.8)	7.77	(4.5)	7.00	(4.2)	3.96**	B,C,D>A
Venturesomeness	6.00	(3.9)	9.46	(3.7)	9.22	(4.3)	8.88	(3.3)	4.00***	B,C,D>A
Empathy	15.8	(2.3)	15.6	(2.0)	15.3	(3.3)	15.4	(2.1)	0.16	n.s.
<i>Barrett Impulsiveness Scale</i>										
Attentional imp.	17.5	(4.4)	19.3	(3.7)	18.8	(3.7)	16.8	(3.2)	2.96*	B,C>D
Motor imp.	17.5	(3.3)	21.4	(2.9)	21.9	(4.1)	22.6	(4.3)	8.28***	B,C,D>A
Non-planning imp.	23.9	(5.0)	27.4	(5.6)	27.7	(5.2)	27.2	(4.3)	2.89*	C,D>A
<i>BIS/BAS Scale</i>										
BIS	25.3	(3.2)	21.7	(6.8)	24.3	(4.0)	22.5	(3.1)	4.03**	A>B,D
BAS–Total	36.0	(4.7)	35.7	(6.6)	37.8	(5.9)	39.4	(4.5)	3.69*	D>A
Reward respons.	16.2	(3.2)	15.4	(3.5)	16.3	(2.7)	17.1	(1.8)	2.48	n.s.
Drive	10.2	(2.8)	9.8	(2.2)	10.30	(2.6)	10.2	(2.2)	0.11	n.s.
Fun seeking	9.5	(2.2)	10.5	(2.5)	11.1	(2.0)	12.0	(1.9)	8.28***	C,D>A
<i>Stop-go task measures (results aggregated over blocks 1–4)</i>										
<i>Go task</i>										
Mean RT (in ms)	529.5	96.7	521.0	83.4	475.1	103.7	538.9	132.3	1.65	n.s.
SD of RT (in ms)	105.2	17.5	107.3	20.0	96.7	22.4	107.5	25.7	1.24	n.s.
% correct	93.6	2.2	93.8	2.2	94.4	1.4	92.1	8.8	0.86	n.s.
<i>Stop-signal delay</i>										
(in ms)	351.7	119.0	350.0	114.0	309.7	122.4	378.0	164.0	1.29	n.s.
<i>Stop task</i>										
% no inhibition	0.49	0.02	0.50	0.03	0.49	0.01	0.49	0.05	0.17	n.s.
SSRT (in ms)	177.8	53.2	171.0	56.9	165.4	34.4	160.8	44.4	0.81	n.s.

$p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

from 0.23 to 0.68;  $p < 0.01$ ); and negatively with Empathy ( $I_7$ ) and Behavioral Inhibition (BIS/BAS), which are positively ( $r = 0.46$ ,  $p < 0.001$ ) associated with each other.

Within the stop-go task, the Mean Reaction Time is positively correlated to the Stop-Signal Delay ( $r = 0.96$ ,  $p < 0.001$ ) and negatively to the Percentage of No Inhibition in the Stop Task ( $r = -0.62$ ,  $p < 0.001$ ) and the SSRT ( $r = -0.49$ ,  $p < 0.001$ ). The faster the person reacts to the go stimulus, the shorter the stop-signal delay needs to be set, the more disinhibition errors occur and the longer the SSRT (indicating a lack of inhibitory control). Furthermore, the Stop-Signal Delay is consistently negatively correlated with Percentage No Inhibition ( $r = -0.71$ ,  $p < 0.001$ ) and SSRT ( $r = -0.71$ ,  $p < 0.001$ ), indicating that persons who need a short Stop-Signal Delay make more disinhibition errors and have a longer SSRT (indicating a lack of inhibitory control). Finally, persons with a longer SSRT make more disinhibition errors, as can be seen in the positive correlation between SSRT and Percentage No Inhibition ( $r = 0.67$ ,  $p < 0.001$ ).

Finally, we calculated the correlations between the self-reported measures and behavioral measures of impulsiveness/lack of inhibitory control. Overall, we did not find significant correlations between the self-reported measures of impulsiveness and the behavioral measures of lack of inhibitory control.

### 3.2. Differences in self-reported measures of impulsiveness and stop-go task measures in ED and NC

#### 3.2.1. Self-reported measures of impulsiveness

To find out whether the ED patients and NC significantly differ from each other with respect to the self-reported measure of impulsiveness, we performed three MANOVA's with the types of ED/NC as independent variable and the subscales of the BIS (Wilks'  $\lambda = 0.71$ ,  $p < 0.001$ ), the  $I_7$  (Wilks'  $\lambda = 0.87$ ,  $p < 0.05$ ), and the BIS/BAS (Wilks'  $\lambda = 0.70$ ,  $p < 0.001$ ) as dependent variables (see Table 1). The different types of ED patients and the NC significantly differ from each other with respect to the self-reported measures of impulsiveness. With respect to Motor Impulsiveness ( $I_7$  Impulsiveness, BIS–Motor Impulsiveness, BIS–Non-Planning Impulsiveness), referring to acting on the spur of the moment and a lack of

self-control, AN-P, BN and NC are significantly more impulsive than AN-R patients. Comparable results are found for Venturesomeness ( $I_7$  Venturesomeness, BIS/BAS–Fun Seeking) referring to thrill and adventure-seeking behavior. Again, AN-P, BN, and NC are more fun-seeking than AN-R patients. In the same way, AN-R patients are more behaviorally inhibited (BIS/BAS–Behavioral inhibition) than BN-P and NC. Finally, the different types of ED patients (except for AN-R) have more attention problems (BIS–Attentional Impulsiveness) than NC.

### 3.2.2. Stop–go task measures

The data of the stop–go task were analyzed with 4 (groups)  $\times$  4 (blocks) ANOVA for repeated measures. We did not find significant group effects (AN-R, AN-P, BN and NC) for all the dependent variables (see Table 1). The decrease in Mean Reaction Time (gradually from NC over AN-R, AN-P, BN) and the decrease in Stop-Signal Delay (referring to a decrease in inhibitory control, gradually from NC over AN-R, AN-P and BN) were nearly significant (certainly the differences between the AN-R and the BN group). However, we did not find a gradual increase in SSRT (referring to lack of inhibitory control) from NC and AN-R over AN-P to BN. Furthermore, we did not find significant differences between the different groups with respect to Percentage Correct Answers on the go task and Percentage No-Inhibited Responses on the stop task. The stop–go task was after all designed to let participants be able to inhibit 50% of the stop trails (tracking procedure). The mean percentages of trials that were inhibited were 50%, 49%, 51%, and 51% respectively for the AN-R, AN-P, BN and NC, indicating that the task was well executed by the participants. Furthermore, we found significant block effects for  $M_{RT}$ ,  $SD_{RT}$ , Stop-Signal Delay, % No Inhibition and SSRT. This effect was due to the improvement of the four groups after the first block. Aside from the learning/habituating effect, no differences between blocks were found as analyses excluding the first block found no effect of blocks.

## 4. Discussion

Confirming the findings by other researchers (e.g., Sohlberg, 1991), we found *self-reported lack of impulsiveness (or increased self-control)* to be associated with AN-R. On the whole, the bingeing–purging anorexics seem to have more in common with BN patients than with restricting anorexics, a finding which is consistent with the results of other studies (e.g. De Silva & Eysenck, 1987; Toner, Garfinkel, & Garner, 1987). Even in comparison with NC, our AN-R patients reported less  $I_7$  Impulsiveness and Venturesomeness scores, results that are confirmed by other researchers (e.g., Butler & Montgomery, 2005). Also the correlational patterns of the self-reported impulsiveness measures were in line with the results of other researchers: (a)  $I_7$  Impulsiveness and Venturesomeness were positively correlated whereas the correlation between these two scales with empathy was notably lower and negative in the female group (e.g., Lijffijt, Caci, & Kenemans, 2005); (b) Barrett Impulsiveness Scales were all positively interrelated, and  $I_7$  Impulsiveness was most strongly related to the Barrett Motor Impulsiveness Scale (Luengo, Carrillo de la Pena, & Otero, 1991); (c) The BIS/BAS behavioral inhibition subscale was positively correlated with  $I_7$  Empathy, and for the most part negatively correlated with the other impulsiveness measures.

Unlike the self-reported measures of impulsiveness, the stop–go task (behavioral measure of lack of inhibitory control) failed to find differences between the different ED groups and NC. We found a — non significant — decrease in the Mean Reaction Time from NC over AN-R, AN-P and BN, and a decrease in the Stop-Signal Delay (referring to an increase in disinhibition) from NC over AN-R, AN-P and BN. We did not find an increase in SSRT (referring to a lack of inhibitory control) from NC and AN-R, over AN-P to BN. This apparent conflict may — according to Fessler (2002, 2003) — derive from a lack of inhibitory control in AN patients due to starvation or according to Butler and Montgomery (2005) — derive from the nature of self-reported assessments, which measure how participants view themselves, whereas objective measures reflect behavior. Future research, that makes use of larger samples of different ED subtypes and various measures of behavioral impulsiveness, will find out whether our results can be confirmed or rejected. However, the correlations between the different measures of the behavioral task were comparable with the results of other researchers (e.g., Avila & Parcet, 2001). The Mean Reaction Time was positively correlated to the Stop-Signal Delay and negatively to the Percentage of No Inhibition. Furthermore, the Stop-Signal Delay was negatively correlated to the Percentage of No Inhibition and SSRT.

Finally, the absence of significant correlations between the self-reported and behavioral measures of impulsiveness in our results, confirm the different nature of both types of measures. These findings are in line with the results of other researchers. Lijffijt et al. (2004) concluded that there is only minor evidence that self-reported impulsiveness is associated with inhibitory motor (behavioral) control.

According to [Butler and Montgomery \(2005\)](#) it seems appropriate to conclude that results from the self-report measure are at odds with the behavioral measures and probably reflect either a lack of self-awareness in AN-R, or a desire for self-control that is not evident in such tests. [Butler and Montgomery \(2005\)](#) also notice that research into the time-course of AN has indicated that although a small proportion of patients successfully manage to restrict their eating over protracted periods, for many the hypercontrol eventually breaks down ([Keel et al., 2005](#)) and they can move to the bingeing–purging type of AN and then to BN. This suggests that levels of self-control and impulsiveness can change over time and this may have important implications for theory (is impulsiveness more a trait than a state in ED patients?) and for treatment. [Butler and Montgomery \(2005\)](#) concluded that monitoring of changes to the impulsiveness profile over time might provide a basis for clinical interventions aimed at (a) addressing self-control/impulsiveness issues without necessarily having to directly confront eating behavior, thus possibly avoiding treatment resistance, and (b) interrupting the transition from AN to BN and the associated worsening of the prognosis ([Fichter, Quadflieg, & Rief, 1994](#)).

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