



Contents lists available at ScienceDirect

# Personality and Individual Differences

journal homepage: [www.elsevier.com/locate/paid](http://www.elsevier.com/locate/paid)



## Review

## Fifty years of the Barratt Impulsiveness Scale: An update and review

Matthew S. Stanford<sup>a,\*</sup>, Charles W. Mathias<sup>b</sup>, Donald M. Dougherty<sup>b</sup>, Sarah L. Lake<sup>a</sup>,  
Nathaniel E. Anderson<sup>a</sup>, Jim H. Patton<sup>a</sup>

<sup>a</sup> Baylor University, Department of Psychology and Neuroscience, One Bear Place #97334, Waco, TX 76798-7334, United States

<sup>b</sup> University of Texas Health Science Center at San Antonio, Department of Psychiatry, San Antonio, TX 78229-3900, United States

### ARTICLE INFO

#### Article history:

Received 12 January 2009

Received in revised form 25 March 2009

Accepted 6 April 2009

Available online 1 May 2009

#### Keywords:

Impulsiveness  
Impulse control  
BIS-11

### ABSTRACT

The Barratt Impulsiveness Scale (BIS-11) is a 30 item self-report instrument designed to assess the personality/behavioral construct of impulsiveness. Originally developed as part of a larger attempt to relate anxiety and impulsiveness to psychomotor efficiency, the BIS is arguably the most commonly administered self-report measure for the assessment of impulsiveness in both research and clinical settings. Over the last 50 years the BIS has significantly influenced the way that impulsivity is conceptualized in psychology and psychiatry. On its golden anniversary we thought it important to update the literature in relation to this influential psychometric instrument. The goal of this paper is threefold: (1) describe the history and development of the BIS-11; (2) present new data supporting the psychometric properties of the subscales; and to (3) review the clinical and personality literature that has reported on the BIS-11 subscales.

© 2009 Elsevier Ltd. All rights reserved.

## 1. Introduction

Impulsiveness is a construct relevant to explaining both normal individual differences in personality and more extreme personality pathology among clinical populations. Impulsiveness has long been viewed as a complex construct (Barratt & Patton, 1983), which is reflected in one of the more popular definitions of impulsiveness “as a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions to the impulsive individuals or to others” (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001).

The question of whether a person is capable of modulating their cognition and behavior to fit the demands of a given environment is imperative in almost any conceivable situation. Because of this there is wide spread interest in understanding the role of impulsiveness among healthy populations in activities ranging from employment behaviors (Everton, Mastrangelo, & Jolton, 2005) to educational performance (Diamantopoulou, Rydell, Thorell, & Bohlin, 2007). Generally though, impulsive behavior is viewed as counterproductive by society, and individual differences in impulsivity have been found to be related to a number of socially deviant behaviors like aggression (Houston, Stanford, Villemarette-Pittman, Conklin, & Helfritz, 2003) and substance abuse (Swann, Dougherty, Pazzaglia, Pham, & Moeller, 2004). Finally, impulsivity is a symptom of several disorders including attention-deficit/

hyperactivity disorder, borderline personality disorder, and antisocial personality disorder (American Psychiatric Association, 2000), as well as the basis for a separate section in the DSM-IV-TR entitled *Impulsive Control Disorders not Elsewhere Classified* (which includes intermittent explosive disorder, kleptomania, pyromania, and pathological gambling; American Psychiatric Association, 2000). Given its relevance to both healthy and harmful behaviors, the accurate assessment of impulsiveness has been of wide interest in the scientific literature.

## 2. Development of the instrument

### 2.1. History of the Barratt Impulsiveness Scale

This year (2009) will mark the 50th anniversary of the Barratt Impulsiveness Scale (BIS; Barratt, 1959). The BIS, currently in its 11th revision (Patton, Stanford, & Barratt, 1995), is a 30 item self-report instrument designed to assess the personality/behavioral construct of impulsiveness (see Appendix). It is arguably the most commonly administered self-report measure specifically designed for the assessment of impulsiveness in both research and clinical settings. As of March 2009 there have been 551 citations of the BIS-11, building on the large number of publications using the preceding versions of the instrument (ISI, 2009). With its widespread application, the BIS has significantly influenced the way that impulsivity is conceptualized in psychology and psychiatry. The goal of this paper is threefold: (1) describe the history and development of the BIS-11; (2) present new data supporting the

\* Corresponding author. Tel.: +1 (254) 710 2236; fax: +1 (254) 710 3033.  
E-mail address: [matthew\\_stanford@baylor.edu](mailto:matthew_stanford@baylor.edu) (M.S. Stanford).

psychometric properties of the first and second-order subscales; and to (3) review the clinical and personality literature that has reported on the BIS-11 subscales.

The original BIS was developed by Ernest S. Barratt, Ph.D. in his attempt to relate impulsiveness, along with anxiety, to psychomotor efficiency (Barratt, 1959). Recognizing that impulsiveness and anxiety subscales from a number of self-report inventories such as the Thurstone Temperament Schedule (Thurstone, 1953) and the Guilford–Zimmerman Temperament Survey (Guilford & Zimmerman, 1949), usually had non-significant, correlations with each other, Barratt hypothesized that these two constructs were orthogonal. This hypothesis was supported by early studies that showed the Taylor Manifest Anxiety Scale (MAS; Taylor, 1953) and the Institute for Personality and Ability Testing Anxiety Scale (Cattell, 1957) were not significantly correlated with the BIS (Barratt, 1959, 1965, 1967). Barratt theorized that since anxiety, as measured by the MAS, had been related to “habit strength” within the Hull–Spence learning theory (Hull, 1943; Spence, 1956) then impulsiveness might be related to the construct of “oscillation”, defined as momentary fluctuations in an organism’s propensity to respond to a stimulus, within the same theory. The hypothesized orthogonal nature of impulsiveness and anxiety strongly influenced Barratt’s early work on the BIS such that many of the initial item analyses (both published and unpublished) were done not only to arrive at internal consistency within the BIS, but also to eliminate items that correlated with measures of anxiety. A second and equally significant influence on the development of the BIS was Barratt’s view that impulsiveness was not a uni-dimensional construct.

## 2.2. Subtraits of impulsiveness

A review of several factor analytic studies (Barratt, 1965; Eysenck & Eysenck, 1977; Twain, 1957) convinced Barratt that impulsiveness was not uni-dimensional, as he had originally conceptualized. After a long series of analyses (Barratt, 1965, 1972; Barratt & Patton, 1983) aimed at developing not only a scale orthogonal to anxiety but also an item pool that more specifically measured impulsiveness in contrast to other “action-oriented” traits such as sensation seeking, extraversion, and risk taking, Barratt proposed that impulsiveness was composed of three subtraits. Thus, the BIS (version 10) was redesigned to measure the theoretical subtraits of Cognitive Impulsiveness, Motor Impulsiveness, and Non-Planning Impulsiveness (Barratt, 1985). Within this three component conceptualization, Cognitive Impulsiveness involved making quick decisions, Motor Impulsiveness involved acting without thinking, and Non-Planning Impulsiveness involved a lack of “futuring” or forethought (Barratt, 1985). Subsequently, this three subtrait structure of impulsiveness has been consistently demonstrated in the literature (Gerbing, Ahadi, & Patton, 1987; Luengo, Carrillo-de-la-Pena, & Otero, 1991; Miller, Joseph, & Tudway, 2004; Parker, Bagby, & Webster, 1993; Patton et al., 1995).

The BIS-11 came about as Barratt’s final attempt to more specifically define the subtraits of impulsiveness. Principal components analysis (PCA) was conducted on BIS-10 data gathered from a sample of 412 university students. The PCA produced six first-order factors; attention, motor, self-control, cognitive complexity, perseverance, and cognitive instability. This was consistent with previous work that had shown impulsiveness to have a broad first-order factor structure (Gerbing et al., 1987). An oblique rotation of the first-order factors showed the expected three second-order factors, with one important difference. While subtraits of Motor Impulsiveness (first-order factors motor and perseverance) and Non-planning Impulsiveness (first-order factors self-control and cognitive complexity) were clearly identified, the third factor had a heavy load of cognitive items and was not exactly the

Cognitive Impulsiveness subtrait Barratt had originally conceptualized (Barratt, 1985). Another published study also reported difficulties identifying the Cognitive Impulsiveness subtrait when using the BIS-10 (Luengo et al., 1991). As a result, this third factor was labeled Attentional Impulsiveness (first-order factors attention and cognitive instability) and defined as an inability to focus attention or concentrate. While many researchers agree with Barratt’s conclusion that impulsivity is a multi-faceted construct, the majority of studies using the BIS-11 have reported only the total score, ignoring both the first- and second-order subscales. Because impulsiveness is such a complex construct, understanding the relative contribution of each of the subscales is critical for accurately characterizing an individual’s general level of impulsiveness. What we have attempted to do in this paper is to summarize in one document the findings from the existing literature on the BIS-11 subscale scores as well as add new psychometric data.

## 3. New BIS-11 psychometric data

Patton et al. (1995) stated that “the [BIS-11] subfactors are of primary value in helping define impulsiveness in general and exploring more subtle relationships between impulsiveness and different clinical syndromes.” While interest in the second-order subscales has steadily increased since the publication of the BIS-11; few studies have attempted to look at the reliability and validity of these scores. Further, no study has published psychometric data on the first-order subscales, even though there is continued interest as demonstrated by the number of requests for information by other researchers to the present authors. To remedy this we present new psychometric data on the subscale scores in this section.

To obtain the present sample of adults ( $N = 1577$  [m 393, f 1184]; age  $M = 21.6$  [5.3], range 17–45; years of education  $M = 13.2$  [1.5], range 6–23) data from two separate ongoing, unpublished studies of the BIS-11 were combined. This was done to create a larger and more diverse sample with the goal of obtaining psychometric data reflective of the general population. In the first study, college students ( $N = 1178$  [m 266, f 912]; age  $M = 19.4$  [1.3], range 17–25; years of education  $M = 13.0$  [1.1], range 12–15) were asked to complete an online battery of self-report measures of impulsivity. One month after completion of the initial battery participants were asked to complete the BIS-11 online a second time so that test–retest reliability could be determined. Participants were given extra credit in a course for completion of the online battery which took approximately 2 h.

In the second study, healthy adults ( $N = 399$  [m 127, f 272]; age  $M = 28.2$  [7.0], range 18–45; years of education  $M = 13.7$  [2.2], range 6–23) were recruited between 2001 and 2007 from the community to participate in a study of self-reported impulsivity and behavioral assessment. Participants were recruited via various media outlets and in two settings, one urban (Houston, TX;  $n = 151$ ) and one rural (Winston-Salem, NC;  $n = 248$ ). To be included in the study, participants could not have any DSM-IV-TR Axis I psychiatric disorder or a positive drug urine test, alcohol test, or pregnancy test.

In the combined sample, all participants completed the BIS-11 while subsets of the participants completed other self-report measures of impulsivity and risk-taking that included the Eysenck Impulsiveness Questionnaire (I<sub>7</sub>; Eysenck, Pearson, Easting, & Allsopp, 1985), Zuckerman Sensation-Seeking Scale (SSS-V; Zuckerman, Eysenck, & Eysenck, 1978) and the Behavioral Inhibition/Activation Scales (BIS/BAS; Carver & White, 1994). In addition, a subset of the participants also completed a battery of laboratory behavioral measures of impulsivity (Dougherty, Marsh, & Mathias, 2002; Dougherty, Mathias, Marsh, & Jagar, 2005) that included, a

continuous performance test (Immediate and Delayed Memory Tasks [IMT/DMT]), a stop task (GoStop Impulsivity Paradigm), delay-discounting measure (Two Choice Impulsivity Paradigm [TCIP]), and a delay-of-gratification type procedure (Single Key Impulsivity Paradigm [SKIP]).

Table 1 presents descriptive statistics for the BIS-11 arranged by gender. Consistent with Patton et al. (1995), analysis of variance showed no significant gender differences for either the total score or the second-order subscales. A significant gender difference was found for the first-order subscale perseverance ( $F(1, 1575) = 12.5$ ,  $p < 0.01$ ). Table 2 presents measures of internal consistency (Cronbach's  $\alpha$ ) and test–retest reliability at one month for the BIS-11. Intercorrelations between the BIS-11 total score and subscales are presented in Table 3. Correlations between the BIS-11 and other behavioral and self-report measures of impulsivity are shown in Table 4. Consistent with previous research, the BIS-11 is highly correlated with similar self-report measures (convergent validity) but not significantly correlated with behavioral measures of impulsiveness (Barratt & Patton, 1983; Lane, Cherek, Rhoades, Pietras, & Tcheremissine, 2003). This is a common finding since self-report measures like the BIS-11 assess personality traits occurring over extended periods of time and reflect an individual's subjective experience, while behavioral procedures assess more state-dependent aspects of impulsivity (Dougherty, Mathias, & Marsh, 2003).

A common question asked concerning the BIS-11 is what score can be used to designate an individual as highly impulsive? Several previous studies have used a BIS-11 total score of 74, one standard deviation above the mean reported in Patton et al. (1995), to designate high impulsiveness. Individuals with this level of impulsiveness show more aggression, a greater variability of

performance, faster cognitive tempo (Lawrence & Stanford, 1999) and physiological differences suggestive of low baseline arousal (Houston & Stanford, 2005; Mathias & Stanford, 2003). Review of the present data suggests that a total score of 72 or above should be used to classify an individual as highly impulsive. In the college sample reported here individuals scoring 72 or higher were more than twice as likely to have shoplifted an item over \$10 (2.54 odds ratio, 95% CI 1.33–4.86) and more than twice as likely to have been involved in self-mutilation (2.23 odds ratio, 95% CI 1.25–3.97). This result suggests that the scale has good concurrent validity. BIS-11 total scores between 52 and 71 should be thought of as within normal limits for impulsiveness. Scores lower than 52 usually are representative of an individual that is either extremely over-controlled (Knyazev & Slobodskaya, 2006) or who has not honestly completed the questionnaire (Helfritz et al., 2006).

## 4. Review of the literature utilizing the BIS-11 subscales

### 4.1. Clinical populations

While the BIS-11 has been used in a diverse set of clinical samples, the predominance of studies have tended to focus on Substance Use Disorders, Axis I disorders other than substance abuse/dependence specifically: Depression, Bipolar Disorder, and Attention-Deficit/Hyperactivity Disorder (AD/HD), as well as suicide attempters and criminal offenders. In this section we will briefly review BIS-11 results from studies in these four clinical populations that have reported meaningful differences in the BIS-11 subscale scores. Table 5 presents descriptive statistics for the BIS-11 total score and second-order subscales in a variety of adult clinical samples. The studies reported here were obtained using the ISI Web of Science citation search.

#### 4.1.1. Substance use disorders

Substance users are known to be highly impulsive and this is reflected in their BIS-11 scores. For instance, higher BIS-11 scores are found for cocaine dependent adults (Lane, Moeller, Steinberg, Buzby, & Kosten, 2007) and Ecstasy users (Bond, Verheyden, Wingrove, & Curran, 2004) relative to controls. While it is not completely surprising that substance abusers would score higher on the BIS-11, the instrument's sensitivity to distinctions within substance use disorder is impressive. Early-onset alcoholics score higher on the BIS-11 than late-onset alcoholics, which are generally thought to be less severe cases (Dom, D'haene, Hulstijn, & Sabbe, 2006a). Also, among alcohol-dependent subjects, the number of daily cigarettes smoked correlates with the Non-planning subscale (Dom, Hulstijn, & Sabbe, 2006c; Skinner, Aubin, & Berlin, 2004). Finally, BIS-11 scores are predictive of the level of an individual's crack/cocaine use (Lejuez, Bornovalova, Reynolds, Daughters, & Curtin, 2007).

#### 4.1.2. Other Axis I disorders

A number of studies have shown that the presence of a mood disorder is correlated with a significantly high level of impulsiveness (Peluso et al., 2007; Swann, Steinberg, Lijffijt, & Moeller, 2008; Swann et al., 2004; van den Eynde et al., 2008). In comparison to patients with unipolar depression, bipolar disordered patients tend to show higher levels of impulsiveness (Peluso et al., 2007; Swann et al., 2008; van den Eynde et al., 2008). In bipolar disorder, the three subtraits of impulsiveness are differentially related to the affective states of the disorder with Motor Impulsiveness related to the manic episodes, Non-planning Impulsiveness related to the depressive episodes, and Attentional Impulsiveness related to both manic and depressive episodes (Swann et al., 2008). Consistent with these findings Peluso and colleagues (2007) have hypothesized that Non-planning Impulsiveness is a state-dependent symptom of unipolar depression.

**Table 1**  
Descriptive statistics for the BIS-11 by gender.

Scale	Male <i>M</i> ( <i>SD</i> )	Female <i>M</i> ( <i>SD</i> )	Total <i>M</i> ( <i>SD</i> )
Total score	62.8 (9.2)	62.1 (10.6)	62.3 (10.3)
<i>Second-order subscales</i>			
Attentional	16.8 (3.9)	16.7 (4.1)	16.7 (4.1)
Motor	22.4 (3.4)	21.8 (4.1)	22.0 (4.0)
Non-planning	23.6 (4.5)	23.6 (5.0)	23.6 (4.9)
<i>First-order subscales</i>			
Attention	10.3 (2.8)	10.4 (2.9)	10.4 (2.9)
Motor	15.2 (2.8)	15.0 (3.4)	15.0 (3.2)
Self-control	12.4 (3.1)	12.0 (3.3)	12.1 (3.3)
Cognitive complexity	11.3 (2.4)	11.6 (2.6)	11.5 (2.6)
Perseverance	7.2 (1.8)	6.8 (1.7)**	6.9 (1.8)
Cognitive instability	6.4 (1.8)	6.3 (1.9)	6.4 (1.9)

Note: Adult sample ( $N = 1577$ ;  $m$  393,  $f$  1184); differs significantly from males.

\*\*  $p < 0.01$ .

**Table 2**  
Internal consistency and test–retest reliability at one month for the BIS-11.

Scale	No. of items	Cronbach's $\alpha$	Spearman's Rho
Total score	30	0.83	0.83
<i>Second-order subscales</i>			
Attentional	8	0.74	0.61
Motor	11	0.59	0.67
Non-planning	11	0.72	0.72
<i>First-order subscales</i>			
Attention	5	0.72	0.74
Motor	7	0.64	0.67
Self-control	6	0.72	0.73
Cognitive complexity	5	0.48	0.50
Perseverance	4	0.27	0.35
Cognitive instability	3	0.55	0.23

Note: Cronbach's  $\alpha$  calculated using adult sample ( $N = 1577$ ;  $m$  393,  $f$  1184); test–retest reliability at one month calculated using  $N = 153$  ( $m$  33,  $f$  120), all correlation coefficients statistically significant at  $p < 0.01$ .

**Table 3**  
Intercorrelations among BIS-11 subscales.

	ATT	MOT	NP	att	mot	sc	cc	per	ci	TOT
<i>Second-order subscales</i>										
Attentional	–									
Motor	0.39	–								
Non-planning	0.45	0.50	–							
<i>First-order subscales</i>										
Attention	0.91	0.38	0.53	–						
Motor	0.37	0.90	0.42	0.34	–					
Self-control	0.47	0.47	0.88	0.51	0.41	–				
Cognitive complexity	0.27	0.35	0.79	0.36	0.27	0.39	–			
Perseverance	0.21	0.60	0.36	0.25	0.19	0.31	0.30	–		
Cognitive instability	0.76	0.26	0.16	0.41	0.27	0.22	0.02 <sup>a</sup>	0.08	–	
Total score	0.76	0.78	0.85	0.76	0.69	0.78	0.61	0.49	0.47	–

Note: Adult sample  $N = 1577$  (m 393, f 1184).

<sup>a</sup> All correlation coefficients statistically significant at  $p < 0.01$  except.

**Table 4**  
Correlations of BIS-11 with other self-report and behavioral measures of impulsiveness.

	ATT	MOT	NP	att	mot	sc	cc	per	ci	TOT
<i>Zuckerman Sensation-Seeking Scale (SSS-V)<sup>a</sup></i>										
Thrill-adventure seeking	0.06	0.17**	0.05	0.07	0.16**	0.12	–0.05	0.09	0.02	0.11
Experience seeking	0.19**	0.29**	0.13	0.13	0.30**	0.26**	–0.07	0.11	0.21**	0.24**
Disinhibition	0.25**	0.39**	0.31**	0.30**	0.37**	0.30**	0.22**	0.20**	0.07	0.39**
Boredom susceptibility	0.34**	0.31**	0.26**	0.32**	0.27**	0.30**	0.11	0.23**	0.21**	0.36**
<i>Eysenck Impulsiveness Scale (I<sub>7</sub>)<sup>b</sup></i>										
Impulsiveness	0.44**	0.57**	0.50**	0.40**	0.59**	0.53**	0.28**	0.22**	0.33**	0.63**
Venturesomeness	0.11**	0.19**	0.04	0.08	0.19**	0.10**	–0.06	0.10**	0.12**	0.14**
Empathy	0.22**	–0.01	0.06	0.16**	0.03	0.06	0.03	–0.07	0.23**	0.11**
<i>Behavioral Inhibition/Activation Scales (BIS/BAS)<sup>c</sup></i>										
Inhibition	0.07	0.16**	0.13**	0.08	0.17**	0.16**	0.05	0.06	0.15	0.15**
Reward responsiveness	–0.14**	–0.05	0.07	–0.08	–0.16**	0.09	0.02	0.17**	–0.17**	–0.04
Drive	–0.15**	–0.21**	0.01	–0.13**	–0.27**	0.02	–0.01	0.01	–0.11	–0.13**
Fun-seeking	–0.30**	–0.29**	–0.18**	–0.27**	–0.33**	–0.19**	–0.11	–0.05	0.23**	–0.31**
<i>Behavioral Measures of Impulsiveness<sup>d</sup></i>										
IMT ratio	0.06	0.07	0.14	0.08	0.03	0.10	0.14	0.09	0.00	0.12
DMT ratio	0.07	0.05	0.09	0.10	0.03	0.07	0.09	0.05	–0.02	0.09
GoStop 150 ms ratio	0.00	0.08	0.05	0.03	0.12	0.02	0.06	–0.02	–0.06	0.06
TCIP-% short	–0.02	–0.06	–0.06	–0.08	–0.06	–0.02	–0.07	–0.03	0.08	–0.05
SKIP response interval	0.04	0.10	–0.01	0.01	0.04	0.06	–0.10	0.14	0.07	0.05

<sup>a</sup>  $n = 336$  (m 88, f 248; college students only).

<sup>b</sup>  $n = 712$  (m 212, f 500; 336 college students, 376 healthy adults [233 Winston-Salem sample, 143 Houston sample]).

<sup>c</sup>  $n = 442$  (m 88, f 354; 336 college students, 106 healthy adults [Houston sample only]).

<sup>d</sup>  $n = 315$  (m 126, f 189; healthy adults only [227 Winston-Salem sample, 88 Houston sample]).

\*\*  $p < 0.01$ .

Similar to mood disordered patients, adults diagnosed with AD/HD also show significantly higher levels of impulsivity when compared to healthy controls. Malloy-Diniz and colleagues (Malloy-Diniz, Fuentes, Leite, Correa, & Bechara, 2007) in discussing these results theorized that due to the uniformly higher subtrait scores among adults diagnosed with AD/HD, deficits must exist in the underlying mechanisms of all the subtraits of impulsiveness (Motor, Non-planning, and Attentional) in this population. Rodriguez-Jimenez et al. (2006) found similar results in pathological gamblers with a childhood history of AD/HD using the Spanish version of the BIS-11 (Oquendo et al., 2001). In this study pathological gamblers with a history of AD/HD had significantly higher BIS-11 total scores and less capacity to delay gratification on a stop signal task than pathological gamblers without a history of AD/HD or controls.

#### 4.1.3. Suicide attempters

Impulsiveness is often a problem for individuals who exhibit suicidal behaviors. Adults with a past history of suicide attempt(s) tend to score higher on the BIS-11 Motor (Dougherty et al., 2004) or Attentional subscales (Quednow et al., 2006) than those without attempts. Among psychiatric patients with a recent suicide at-

tempt, all BIS-11 subscale scores were higher than orthopedic patients, and these differences were stable from hospitalization to 1-week after discharge (Jallade, Sarfati, & Hardy-Bayle, 2005).

#### 4.1.4. Forensic populations

Impulsivity and aggression are associated constructs and as a result, the BIS-11 has been utilized a great deal in criminal populations. The BIS-11 is sensitive to differences in levels of aggression; for instance, violent offenders score higher on the BIS-11 than those convicted of non-violent offenses (Smith, Waterman, & Ward, 2006). Among female prisoners, those who met criteria for Antisocial Personality Disorder (ASPD) demonstrated significantly higher scores on all BIS-11 subscales compared to those who met criteria for psychopathy or control subjects (Warren & South, 2006). This finding has been extended to male prisoners as well (Dolan & Fullam, 2004).

#### 4.2. Normal populations

There have been over 60 published studies that have reported the BIS-11 subscales in normal populations. Topics have ranged



**Table 5**

BIS-11 descriptive statistics for published adult clinical samples.

Sample	n	M Age	F/M	ATT M (SD)	MOT M (SD)	NP M (SD)	TOT M (SD)	Source
<i>Substance use disorders</i>								
Substance abusers	35			17.4 (5.0)	25.8 (4.9)	24.7 (5.4)	?	Swann et al. (2004)
Substance users								Bond et al. (2004)
Current users	32	25.2		13.9 (5.0)*	19.2 (5.1)	26.8 (5.6)	59.8 (13.8)	
Former users	32	27.8		15.7 (5.3)*	19.1 (5.9)	22.9 (7.5)	57.6 (14.5)	
Mixed Sub. dependence	18	38.9	0/18	18.4 (3.4)	26.7 (5.3)	28.7 (6.3)	73.8 (11.8)	Conklin & Stanford (2008)
Substance dependent								Lejuez et al. (2007)
Females	56	41.9	56/0	31.3 (4.6)	23.4 (4.6)	27.4 (5.3)	79.9 (11.4)	
Males	96	41.9	0/96	29.6 (5.4)	20.7 (5.1)	26.0 (5.0)	74.2 (12.6)	
Alcoholic								Dom et al. (2006c)
Early onset	62	37.5	14/48	18.0 (5.5)*	19.3 (7.8)	23.8 (7.3)	61.1 (15.4)	
Late onset	68	45.5	26/42	14.8 (5.9)*	13.2 (5.8)	17.9 (8.1)	45.9 (14.7)	
Alcoholic								Dom et al. (2006a)
Early onset	42	38.1		18.0 (5.5)*	18.6 (7.5)	24.4 (7.2)	60.9 (15.7)	
Late onset	46	45.6		14.1 (6.0)*	13.2 (5.7)	19.2 (7.9)	47.2 (14.3)	
Alcohol dependent	130	39.8	96/34	17.7 (3.7)	25.7 (4.5)	27.2 (5.0)	70.6 (11.7)	Bjork, Hommer, Grant, & Danube (2004)
Cocaine dependent	17	37.3	5/12	17.0 (3.8)	25.9 (4.8)	27.4 (6.5)	68.6 (13.1)	Moeller et al. (2004)
Cocaine dependent	18	33.1	4/14	16.1 (4.4)	24.7 (4.2)	25.4 (4.7)	65.9 (10.6)	Moeller et al. (2005)
Cocaine dependent	18	39.2	5/13	14.9 (.86)	23.2 (1.3)	27.5 (1.1)	65.6 (2.68)	Lane et al. (2007)
Cocaine dependent	50	39.3	11/39	17.6 (4.2)	21.5 (5.2)	30.6 (5.1)	69.7 (12.4)	Moeller, Dougherty et al. (2001)
MDMA (Ecstasy) users	32	25.2	0/32	13.9 (5.0)	19.2 (5.1)	26.8 (6.6)	59.8 (13.8)	Bond et al. (2004)
Stimulant dependent	15	42.3	0/15	17.9	28.6	28.4	?	Wittmann, Leland, Churan, & Paulus (2007)
Stimulant users	19	18.4	14/5	17.6 (3.7)	23.2 (3.5)	27.4 (3.1)	68.2 (7.7)	Leland & Paulus, 2005
Substance users								Clark, Robbins, Ersche, & Sahakian (2006)
Amphetamine User	24	37.3	11/13	18.5 (3.8)	26.4 (5.7)	27.9 (6.1)	72.7 (13.6)	
Opiate user	40	34.0	8/32	14.9 (3.0)	24.6 (3.0)	27.9 (4.2)	67.4 (7.1)	
Exdrug users	24	38.5	11/13	17.9 (3.8)	25.3 (4.2)	27.1 (4.8)	70.3 (11.2)	
<i>Other Axis I disorders</i>								
Conduct disorder	5	28.5	0/5	21.6 (2.2)	26.8 (2.9)	28.0 (0.8)	76.4 (5.2)	Cherek & Lane (2000)
Obese binge eaters	11	29.0	11/0	17.3 (3.5)	26.2 (6.8)	27.4 (4.2)	70.9 (12.0)	Nasser, Gluck, & Geliebter (2004)
AD/HD	50	33.7	22/28	22.2 (3.7)	26.9 (5.6)	28.2 (5.8)	77.3 (10.8)	Malloy-Diniz et al. (2007)
AD/HD	30	33.8	10/20	21.5 (3.8)	23.9 (3.5)	29.5 (4.7)	74.9 (8.9)	Muller et al. (2007)
Pathological gamblers								Rodriguez-Jimenez et al. (2006)
–AD/HD	39		0/39	20.9 (5.6)*	15.4 (6.2)	23.9 (5.1)	60.2 (15.5)	
+AD/HD	16		0/16	25.1 (5.2)*	26.9 (8.8)	27.0 (3.8)	79.1 (14.2)	
Depression	15	45.1	0/15	15.4 (3.0)	20.3 (4.6)	25.7 (4.4)	62.1 (9.7)	Westheide et al. (2007)
Depression								Peluso et al. (2007)
Unipolar	24	37.0	15/9	21.1 (3.4)	23.0 (6.3)	30.3 (5.5)	74.5 (11.7)	
Bipolar	24	36.2	18/6	21.5 (3.5)	25.5 (5.9)	30.7 (4.3)	77.7 (11.3)	
Euthymic								
Unipolar	10	46.0	7/3	17.8 (4.8)	23.8 (3.7)	22.8 (5.6)	64.4 (12.5)	
Bipolar	12	36.8	8/4	19.6 (4.7)	24.3 (6.7)	31.2 (6.8)	75.0 (15.1)	
Bipolar disorder	32	28.4	25/7	23.9 (3.0)	29.6 (4.8)	30.4 (5.5)	84.0 (11.0)	van den Eynde et al. (2008)
Bipolar disorder								Swann et al. (2004)
Without sub. abuse	15			18.5 (4.3)	23.5 (3.9)	26.8 (5.8)	?	
With sub. abuse	12			20.5 (4.9)	26.5 (5.2)	27.5 (5.6)	?	
Bipolar disorder		33.0	20/19					Swann, Pazzaglia, Nicholls, Dougherty, & Moeller (2003)
Euthymic	22			20.7 (4.7)	27.7 (4.8)	29.0 (6.2)	77.1 (13.8)	
Manic	12			20.5 (4.6)	28.5 (3.7)	28.1 (7.0)	77.6 (11.6)	
Bipolar disorder + SUD	74							Swann et al. (2008)
Interepisode	24			20.0 (4.3)	27.7 (4.3)	27.0 (6.6)	74.5 (15.2)	
Depressed	17			21.6 (3.7)	27.5 (5.2)	31.0 (4.1)	80.1 (10.1)	
Manic	16			21.6 (4.6)	30.9 (6.5)	29.2 (6.5)	82.4 (14.5)	
Mixed	17			24.8 (4.0)	31.3 (5.3)	32.6 (4.8)	88.7 (13.0)	
<i>Suicide attempters</i>								
Bipolar + suicide attempts								Swann et al. (2005)
No attempts	20	35.0	15/9	19.6 (5.3)	27.1 (6.7)	27.6 (7.1)	73.9 (17.5)	
Not severe attempt	13	35.1	11/5	22.8 (5.3)	28.9 (7.0)	29.6 (7.2)	81.4 (18.3)	
Medically severe	8	34.3	5/3	22.3 (6.9)	28.5 (6.4)	31.4 (6.2)	82.1 (18.6)	
Suicide attempters								Dougherty et al. (2004)
Single	20	31.2	14/6	17.1 (3.1)	24.8 (3.5)	26.4 (4.2)	68.3 (9.3)	
Multiple	10	28.0	7/3	18.0 (4.9)	28.7 (5.6)	25.2 (6.2)	71.9 (20.6)	
Attempt + depression	20	35.7	8/12	18.0 (3.5)	22.7 (6.6)	26.1 (5.8)	66.7 (13.5)	Quednow et al. (2006)
Single suicide attempt	26	30.6	17/9	19.3 (4.6)*	26.4 (8.3)	27.4 (5.2)	71.6 (13.2)	Jallade et al. (2005)
<i>Forensic populations</i>								
Violent offenders								Enticott, Ogloff, Bradshaw, & Fitzgerald (2008)
with schizophrenia	18	36.1	5/13	16.1 (3.2)	24.1 (3.2)	24.9 (4.7)	65.1 (8.9)	
BPD prisoners	18	34.4	0/18	18.9 (3.5)	27.3 (1.5)	31.8 (1.5)	77.4 (3.5)	Kirkpatrick et al. (2007)
Offender + Axis I	42.2	0/40						Dolan & Fullam (2004)
High impulsivity	20			16.0 (6.4)	18.1 (9.7)	18.7 (7.0)	52.9 (15.2)	
Low impulsivity	20			6.4 (3.0)	6.1 (3.9)	11.4 (5.6)	23.9 (8.4)	

(continued on next page)

Table 5 (continued)

Sample	n	M Age	F/M	ATT M (SD)	MOT M (SD)	NP M (SD)	TOT M (SD)	Source
Offenders								Smith et al. (2006)
Violent male	57	27.9	0/57	18.6 (5.6)*	27.8 (7.5)	28.1 (7.5)	74.5 (18.9)	
Nonviolent male	58	27.9	0/58	16.1 (4.6)	23.7 (6.3)	23.6 (6.4)	63.4 (16.0)	
Violent female	66	26.8	66/0	16.0 (4.3)*	22.6 (6.2)	24.0 (7.0)	62.8 (15.6)	
Nonviolent female	67	26.8	67/0	15.5 (4.8)	22.7 (6.7)	23.8 (7.5)	62.0 (17.0)	
DUI conviction	104	44.7	0/104	16.1 (3.0)*	21.8 (4.0)	25.2 (4.6)	?	Brown et al. (2005)
Female offenders								Warren & South (2006)
ASPD	23		23/0	20.2 (4.2)	24.8 (4.7)	28.5 (7.4)	72.5 (15.5)	
PCL-R >25	21		21/0	19.6 (2.8)	23.8 (4.7)	26.8 (4.2)	71.2 (8.05)	
ASPD + PCL-R>25	44		44/0	19.9 (3.5)	23.8 (4.6)	28.0 (5.3)	72.0 (11.4)	
Axis II disorders								
Hospitalized BPD	14	32.9	14/0	18.2 (5.0)	27.5 (7.0)	26.9 (8.0)	75.1 (14.3)	Dougherty, Bjork, Huckabee, Moeller, & Swann (1999)
Personality disorder								Bunce, Noblett, McCloskey, & Coccaro (2005)
–Axis I	45	28.3	11/36	16.4 (3.1)	19.2 (4.1)	27.2 (4.6)	?	
+Axis I	59	31.2	13/50	16.2 (3.3)	20.4 (4.1)	28.4 (5.0)	?	
Lifetime psychiatry DX								Swann, Bjork, Moeller, & Dougherty (2002)
Axis I	12			18.8 (5.3)	22.7 (3.4)	25.3 (5.6)	66.8 (11.8)	
Axis II	22			16.8 (5.0)	23.0 (3.8)	24.1 (5.3)	63.8 (11.4)	
Alcohol dependent								Rubio et al. (2007)
No PD	178	41.4	0/178	19.5 (5.0)*	17.0 (5.7)	18.6 (8.1)	55.1 (14.2)	
+BPD	29	37.0	0/29	21.3 (5.8)*	21.8 (8.6)	24.6 (9.2)	68.1 (22.0)	
+ASPD	40	38.0	0/40	21.9 (5.3)*	19.8 (6.2)	23.1 (7.2)	64.2 (16.0)	
Alcohol dependent								Dom, De Wilde, Hulstijn, Van Brink, & Sabbe (2006b)
No PD	40	42.1		14.7 (5.8)*	14.9 (6.3)	20.2 (7.8)	49.8 (16.1)	
Cluster B	22	42.1		18.1 (6.2)*	18.9 (8.9)	24.7 (8.8)	61.7 (17.1)	
Neurodegenerative disorders and traumatic brain injury								
Traumatic brain injury								Greve et al. (2002)
Non-aggressive	18	38.9	1/17	15.1 (4.7)	23.2 (5.8)	25.1 (4.9)	60.0 (12.9)	
Impulsive aggression	18	35.9	2/16	16.8 (4.4)	23.3 (4.3)	24.5 (6.9)	64.5 (12.9)	
Traumatic brain injury								Greve et al. (2001)
Non-aggressive	19	38.9	2/17	14.7 (4.9)	22.8 (5.9)	21.2 (5.0)	44.2 (13.2)	
Impulsive aggression	26	33.9	2/24	17.6 (4.6)	24.4 (4.7)	25.3 (6.6)	52.4 (13.2)	
Parkinson disease								Voon et al. (2007)
–Path. gambling	42	65.7	21/21	15.6 (4.1)	17.3 (4.4)	21.1 (4.6)	54.1 (10.1)	
+Path. gambling	21	60.2	6/15	16.9 (3.8)	20.9 (5.6)	27.0 (6.0)	65.2 (12.2)	
Axis I/II mixed samples								
Recommended therapy								Visintini, Ubbiali, Donati, Chiorri, & Maffei (2007)
Group	50			23.5 (4.3)*	21.1 (5.0)	20.8 (5.0)	?	
Individual	25			24.4 (4.4)*	22.2 (5.8)	19.7 (5.1)	?	
None	14			25.1 (5.8)	24.1 (5.6)	20.6 (4.8)	?	
Veteran Med/Psych	474	55.6	43/431	17.3 (4.0)	20.3 (4.7)	25.6 (6.2)	63.3 (12.6)	Suris et al. (2005)
Physically aggressive	170	37.0	42/128	16.2 (5.1)	22.2 (5.3)	24.1 (5.9)	?	Kockler & Stanford (2008)

\* Indicates this value was reported as the Cognitive score, but referenced Patton et al. (1995) as the source, so it is assumed that this is equivalent to the Attentional Impulsiveness score.

from investigating the general nature of impulsivity to developmental issues and employment screening. In this section we will review articles in three areas of significant importance to the measurement of impulsiveness.

#### 4.2.1. Punishment and reinforcement sensitivity

Impulsivity has long been considered from the perspective of reduced punishment sensitivity or response inhibition. In studies using the BIS-11 with psychophysiological measures, impulsivity appears related to Gray's (1981) behavioral inhibition and activation systems. One study (Potts, George, Martin, & Barratt, 2005) found evidence of reduced behavioral inhibition among those with higher BIS-11 scores. This study classified adults as low or high in impulsivity and measured sensitivity to punishment using the error-related negativity (ErN). Another study of college students using the BIS-11 reported evidence of increased sensitivity to reward for the high impulsive group. This study (Martin & Potts, 2004) found increased P2a event related potential activity for the high group performing a stimulus match/mismatch paradigm in which non-predicted rewards were occasionally delivered. The finding of both low behavioral inhibition and high behavioral activation in high impulsive individuals is consistent with Gray's theory (Gray, 1987).

#### 4.2.2. Vigilance and attention

While impulsivity is a distinct psychological process from lapses in attention (Sonuga-Barke, 2002), problems with the attention system may result in impulsive behavior. BIS-11 scores do seem to be related to problems with attention. While one study (Markus & Jonkman, 2007) failed to find any differences in attention between those scoring high and low on the BIS-11 at baseline, attention on a task-switching paradigm was reduced among the high BIS-11 group following a tryptophan-enriched breakfast. This effect was interpreted as reflecting a greater susceptibility of high impulsive individuals to changes in arousal produced by the tryptophan enhancement. Another study (Levine, Waite, & Bowman, 2007) tested impulsivity as it relates to lapses in attention or distractibility. BIS-11 scores were significantly correlated with scores on a measure of academic distractibility.

#### 4.2.3. Executive function and decision making

Problems with the control of information processing or executive functioning can lead to impulsive behaviors and individuals who have executive function deficits tend to score higher on the BIS-11. For instance, the BIS-11 is significantly correlated with measures of cognitive failure, which are also correlated with

anterior cingulate activation (Garavan, Ross, Murphy, Roche, & Stein, 2002). Cingulate activation is important in fast-paced tasks where inhibition of more automatic behaviors is important.

In another study, executive function was assessed using measures of cognitive flexibility (Wisconsin Card Sort Test [WCST], Trail Making Task) and intelligence (WAIS-III). In this study (Cheung, Mitsis, & Halperin, 2004), BIS-11 Motor Impulsiveness accounted for a significant portion of the variance in two measures of executive functioning on the WCST: category fluency and categories achieved. Attentional Impulsiveness accounted for significant variance in the difference between parts A (simple visual search) and B (cognitive set shifting) on the Trail Making Test. Additionally, BIS-11 total score, after controlling for full-scale IQ, accounted for a significant amount of variance in the Letter–Number Sequencing (WAIS-III) task.

Using several measures of executive control Whitney, Jameson, and Hinson (2004) demonstrated that different subtypes of impulsivity are related to different aspects of executive control of working memory. Four measures were derived from the continuous memory scanning task and used to predict BIS-11 scores using regression analysis. Their analysis supported the conclusion that Attentional Impulsiveness was related to participants deleting no-longer-relevant information from working memory while Non-planning Impulsiveness was related to working memory capacity. Motor Impulsiveness proved to be related to a trend towards having a lower overall capacity and a greater ability to restrict access to working memory. They assert that because they were able to show that some forms of impulsiveness are related to problems with different executive control abilities, defining executive control ability as a single index may obscure the role of specific functions in controlling specific behaviors, such as those leading to delinquency.

Spinella (2005) developed a self-rated index of executive function (Executive Function Index, EFI) composed of five subscales. Of these five subscales the Strategic Planning subscale, which is reflective of activity in the dorsolateral prefrontal cortex, premotor cortex, supplementary motor area, striatum, and visuospatial system, correlated (negatively) most strongly with the BIS-11 Non-planning Impulsiveness subscale. The Impulse Control subscale, which addresses self-inhibition and is reflective of orbitofrontal activity, negatively correlated most significantly with the BIS-11 Motor Impulsiveness subscale. Spinella found that these correlations were independent of age, sex, or education and found that the EFI negatively correlated with other measures reflective of impulsive behavior such as poor college GPA (Spinella & Miley, 2003).

Although trait impulsivity seems a distinct latent variable, impulsivity in general, including state impulsivity, is clearly related to and interacts with the processes of attention and executive function. These variables may therefore contribute to the modulation of state impulsivity in certain situations.

#### 4.3. Genetic studies with the BIS-11

A number of studies have tested genetic correlates of impulsiveness using the BIS-11. A majority of these studies have focused on genetic polymorphisms having to do with the function of the serotonin system. It has been reported that those with the short allele polymorphism of the serotonin transporter gene promoter region (5-HTTLPR), which is associated with reduced serotonin turnover (Greenberg, Tolliver, Huang, Bengel, & Murphy, 1999; Lesch et al., 1996), have increased impulsivity scores on the BIS-11 (Baca-Garcia et al., 2005). Further, these differences may be greatest for the Attentional subscale of the BIS-11 (Sakado, Sakado, Muratake, Mundt, & Someya, 2003). However, not all studies have found a significant relationship between this polymorphism

and BIS-11 (Paaver et al., 2007; Roiser, Müller, Clark, & Sahakian, 2007). Studies have also reported significant relationships between the BIS-11 and other aspects of the serotonin system including single nucleotide polymorphisms of the tryptophan hydroxylase-2 (TPH2) gene (de Lara et al., 2007), the C allele of the T102C serotonin 2a receptor (Bjork et al., 2002) and T allele at the A-161T locus of the 5-HT1b receptor gene (Zouk et al., 2007).

Moving beyond the serotonin system, some other genetic variations have been explored with regard to BIS-11 scores, although in a much less systematic manner. For instance one study with children reported a significant negative relationship between MAO activity and the BIS-11 (Paaver et al., 2007), while another found no difference among those with low or high activity MAO-A alleles (Passamonti et al., 2006). No significant relationships or group differences have been found for BIS-11 subscale scores and genetic or allelic polymorphisms of dopamine (Congdon, Lesch, & Canli, 2008; Eisenberg et al., 2007), the adenosine receptor (Al-sene, Deckert, Sand, & de Wit, 2003), or the alpha 2a noradrenergic receptor (Sequeira et al., 2004).

In summary, of the various genes tested, those involved in serotonin function (e.g. 5-HTTLPR, TPH2, 5-HT1b, 5-HT2a, and MAO) have been the most commonly studied in relation to the BIS-11. However, the vast differences in sample size, age of sample, health/clinical characteristics of the sample, and language of the BIS-11 make direct comparison across these studies difficult. Further, gene by environment interactions may account for the mixed findings, since simple Mendelian genetic influences are rare for complex phenotypes like impulsivity. In summary, for some but not all cases, it appears that genetic polymorphisms that would result in lower serotonergic activity predict higher impulsiveness. For any definitive statement to be made about genetic correlates of impulsiveness, more research needs to be accomplished with replication and greater consistency in terms of sampling characteristics and environmental variables.

#### 4.4. The BIS-11a problem

The BIS-11 as described in Patton et al. (1995) is the most up to date and psychometrically sound version of the Barratt Impulsiveness Scale. Other versions of the instrument should not be used unless the goal is to make comparisons with data obtained using an earlier version of the BIS. During the development of the BIS-11, an intermediate version of the scale often designated in the literature as the BIS-11a (Barratt, 1994) was distributed to several labs for review. This version resulted from a partial analysis of BIS-10 data during the early development phase of version 11. Unfortunately, this “working” version of the scale has been more widely disseminated than was ever intended or anticipated by Barratt and his colleagues. The main problem is that the BIS-11a and BIS-11 only share 24 items in common and thus the scores on these two instruments cannot be accurately compared to one another. Given its limited psychometric development (Barratt, 1994) the authors suggest that the BIS-11a not be considered a reliable or valid measure of impulsiveness and strongly recommend that it not be used.

#### 4.5. Translations

While originally developed and normed in English, the BIS-11 has been translated into at least 11 other languages. Translations of the BIS-11 are available in Chinese (Yang, Yao, & Zhu, 2007), Dutch (Goudriaan, Oosterlaan, De Beurs, & van den Brink, 2008), Estonian (Paaver et al., 2007), French (Bayle et al., 2000), German (Preuss et al., 2003), Greek (Giotakos, Markianos, Vaidakis, & Christodoulou, 2003), Hebrew (Glicksohn & Nahari, 2007), Italian (Fos-

sati, Di Ceglie, Acquarini, & Barratt, 2001), Japanese (Someya et al., 2001), Korean (Chung & Lee, 1997), Portuguese (von Diemen, Szobot, Kessler, & Pechansky, 2007) and Spanish (Oquendo et al., 2001). Because the availability of psychometric data related to the reliability and validity of these translations varies greatly, as does the translation techniques used in their development, caution is suggested when interpreting outcomes from translated instruments or comparing them to the original. That having been said, the internal consistencies (Cronbach's  $\alpha$ ) reported for the BIS-11 total score from these translations all fall within an acceptable range (0.71–0.83) suggesting that the scale is reliable across these diverse cultures. For future research we recommend that back translation (Brislin, 1970; Cha, Kim, & Erlen, 2007) be used when conducting research with the BIS-11 in a language other than English. Back translation significantly improves the reliability and validity of a scale by requiring that the quality of the translation be verified by an independent translator translating back into the original language.

## 5. Conclusions

It is clear even from this brief review of the literature that the Barratt Impulsiveness Scale has not only shaped the current conceptualization of impulsiveness as a construct but continues to be an important tool in sparking further research in personality

50 years after its initial development. Few personality traits are as socially relevant as impulsiveness. Its impact is felt across a broad range of domains including mental health, business, criminal justice, and education. It is our hope that as research on impulsiveness moves forward that the BIS-11 might be viewed as a standard point of reference. Its inclusion in all future studies of impulsiveness and consistent reporting of its subscales would help bring about uniformity in definition that has been missing in the impulsivity literature and allow for a level of comparison across studies that would be unparalleled in personality research. In addition, it is suggested that a more detailed investigation of the BIS-11 subscales within differing psychopathologies, as has been done in Bipolar Disorder (Swann et al., 2008), may result in more effective diagnosis and treatment.

There have been great advances during the past 50 years in terms of the assessment of impulsivity. Dr. Ernest S. Barratt and his impulsiveness scale have played a significant role in that progress. Sadly, with Dr. Barratt's unexpected passing in 2005, the field lost a visionary leader. We have conducted this review of the BIS-11 as a resource to other investigators in order to maintain the momentum generated by Dr. Barratt's significant body of work. Dr. Stanford is active in maintaining the BIS-11 and advising other investigators on its use and interpretation. For questions pertaining to the instrument please contact the corresponding author.

## Appendix

Directions: People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement and put an X on the appropriate circle on the right side of this page. Do not spend too much time on any statement. Answer quickly and honestly

	<input type="radio"/> Rarely/Never	<input type="radio"/> Occasionally	<input type="radio"/> Often	<input type="radio"/> Almost Always/Always
1 I plan tasks carefully.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2 I do things without thinking.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3 I make-up my mind quickly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4 I am happy-go-lucky.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5 I don't "pay attention."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6 I have "racing" thoughts.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7 I plan trips well ahead of time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8 I am self controlled.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9 I concentrate easily.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10 I save regularly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11 I "squirm" at plays or lectures.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12 I am a careful thinker.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13 I plan for job security.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14 I say things without thinking.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15 I like to think about complex problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16 I change jobs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17 I act "on impulse."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18 I get easily bored when solving thought problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19 I act on the spur of the moment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20 I am a steady thinker.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21 I change residences.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22 I buy things on impulse.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23 I can only think about one thing at a time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24 I change hobbies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25 I spend or charge more than I earn.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26 I often have extraneous thoughts when thinking.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
27 I am more interested in the present than the future.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
28 I am restless at the theater or lectures.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29 I like puzzles.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
30 I am future oriented.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## References

- Alsene, K., Deckert, J., Sand, P., & de Wit, H. (2003). Association between A-sub(2a) receptor gene polymorphisms and caffeine-induced anxiety. *Neuropsychopharmacology*, 28, 1694–1702.
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders 4th Ed.* Washington, DC: American Psychiatric Association (text revision).
- Baca-Garcia, E., Salgado, B. R., Segal, H. D., Lorenzo, C. V., Acosta, M. N., & Romero, M. A. (2005). A pilot genetic study of the continuum between compulsivity and impulsivity in females: The serotonin transporter promoter polymorphism. *Progress in Neuropsychopharmacology & Biological Psychiatry*, 29, 713–717.
- Barratt, E. S. (1959). Anxiety and impulsiveness related to psychomotor efficiency. *Perceptual and Motor Skills*, 9, 191–198.
- Barratt, E. S. (1965). Factor analysis of some psychometric measures of impulsiveness and anxiety. *Psychological Reports*, 16, 547–554.
- Barratt, E. S. (1967). Perceptual-motor performance related to impulsiveness and anxiety. *Perceptual and Motor Skills*, 25, 485–492.
- Barratt, E. S. (1972). Anxiety and impulsiveness: Toward a neuropsychological model. In C. D. Spielberger (Ed.), *Anxiety: Current trends in theory and research* (pp. 195–222). New York: Academic Press.
- Barratt, E. S. (1985). Impulsiveness subtraits: Arousal and information processing. In J. T. Spence & C. E. Izard (Eds.), *Motivation, emotion and personality* (pp. 137–146). North Holland: Elsevier Science Publishers.
- Barratt, E. S. (1994). Impulsiveness and aggression. In J. Monahan & H. J. Steadman (Eds.), *Violence and mental disorder: Developments in risk assessment* (pp. 61–79). Chicago, IL: University of Chicago Press.
- Barratt, E. S., & Patton, J. H. (1983). Impulsivity: Cognitive, behavioral, and psychophysiological correlates. In M. Zuckerman (Ed.), *Biological bases of sensation-seeking, impulsivity, and anxiety* (pp. 77–121). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Bayle, F. J., Bourdel, M. C., Caci, H., Gorwood, P., Chignon, J. M., Ades, J., et al. (2000). Structure factorielle de la traduction Française de l'échelle d'impulsivité de Barratt (BIS-10). *Canadian Journal of Psychiatry*, 45, 156–166.
- Bjork, J. M., Hommer, D. M., Grant, S. J., & Danube, C. (2004). Impulsivity in abstinent alcohol-dependent patients: Relation to control subjects and type 1-/type 2-like traits. *Alcohol*, 3, 133–150.
- Bjork, J. M., Moeller, F. G., Dougherty, D. M., Swann, A. C., Machado, M. A., & Hanis, C. L. (2002). Serotonin 2a receptor T102c polymorphism and impaired impulse control. *American Journal of Medical Genetics: Neuropsychiatric Genetics*, 114, 336–339.
- Bond, A. J., Verheyden, S. L., Wingrove, J., & Curran, H. V. (2004). Angry cognitive bias, trait aggression and impulsivity in substance users. *Psychopharmacology*, 171, 331–339.
- Brislin, R. W. (1970). Back translation for cross-cultural research. *Journal of Cross-Cultural Psychology*, 1, 185–216.
- Brown, T. G., Gianoulakis, C., Tremblay, J., Nadeau, L., Dongier, M., Kin, N. M. K., et al. (2005). Salivary cortisol: A predictor of convictions for driving under the influence of alcohol? *Alcohol and Alcoholism*, 40, 474–481.
- Bunce, S. C., Noblett, K. L., McCloskey, M. S., & Coccaro, E. F. (2005). High prevalence of personality disorders among healthy volunteers for research: Implications for control group bias. *Journal of Psychiatric Research*, 39, 421–430.
- Carver, C. S., & White, T. L. (1994). Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS Scales. *Journal of Personality and Social Psychology*, 67, 319–333.
- Cattell, R. (1957). *Handbook for the IPAT anxiety scale*. Champaign, IL: Institute for Personality & Ability Testing.
- Cha, E. S., Kim, K. H., & Erlen, J. A. (2007). Translation of scales in cross-cultural research: Issues and techniques. *Journal of Advanced Nursing*, 58, 295–386.
- Cherek, D. R., & Lane, S. D. (2000). Fenfluramine effects on impulsivity in a sample of adults with and without history of conduct disorder. *Psychopharmacology*, 152, 149–156.
- Cheung, A. M., Mitsis, E. M., & Halperin, J. M. (2004). The relationship of behavioral inhibition to executive functions in young adults. *Journal of Clinical and Experimental Neuropsychology*, 26, 393–404.
- Chung, Y. O., & Lee, C. W. (1997). A study of factor structures of the Barratt impulsiveness scale in Korean university students. *Korean Journal of Clinical Psychology*, 16, 117–129.
- Clark, L., Robbins, T. W., Ersche, K. D., & Sahakian, B. J. (2006). Reflection impulsivity in current and former substance users. *Biological Psychiatry*, 60, 515–522.
- Congdon, E., Lesch, K. P., & Canli, T. (2008). Analyses of DRD4 and DAT polymorphisms and behavioral inhibition in healthy adults: Implications for impulsivity. *American Journal of Medical Genetics: Neuropsychiatric Genetics*, 147B, 27–32.
- Conklin, S. M., & Stanford, M. S. (2008). Premeditated aggression is associated with serum cholesterol in abstinent drug and alcohol dependent men. *Psychiatry Research*, 157, 283–287.
- de Lara, C. L., Brezo, J., Rouleau, G., Lesage, A., Dumont, M., Alda, M., et al. (2007). Effect of tryptophan hydroxylase-2 gene variants on suicide risk in major depression. *Biological Psychiatry*, 62, 72–80.
- Diamantopoulou, S., Rydell, A. M., Thorell, L. B., & Bohlin, G. (2007). Impact of executive functioning and symptoms of attention deficit hyperactivity disorder on children's peer relations and school performance. *Developmental Neuropsychology*, 32, 521–542.
- Dolan, M., & Fullam, R. (2004). Behavioural and psychometric measures of impulsivity in a personality disordered population. *Journal of Forensic Psychiatry & Psychology*, 15, 426–450.
- Dom, G., De Wilde, B., Hulstijn, W., Van Brink, W., & Sabbe, B. (2006b). Behavioural aspects of impulsivity in alcoholics with and without a cluster-B personality disorder. *Alcohol and Alcoholism*, 41, 412–420.
- Dom, G., D'haene, P., Hulstijn, W., & Sabbe, B. (2006a). Impulsivity in abstinent early- and late-onset alcoholics: Differences in self-report measures and a discounting task. *British Journal of Addiction*, 101, 50–59.
- Dom, G., Hulstijn, W., & Sabbe, B. (2006c). Differences in impulsivity and sensation seeking between early- and late-onset alcoholics. *Addictive Behaviors*, 31, 298–308.
- Dougherty, D. M., Bjork, J. M., Huckabee, H. C. G., Moeller, F. G., & Swann, A. C. (1999). Laboratory measures of aggression and impulsivity in women with borderline personality disorder. *Psychiatry Research*, 85, 315–326.
- Dougherty, D. M., Marsh, D. M., & Mathias, C. W. (2002). Immediate and delayed memory tasks: A computerized measure of memory, attention, and impulsivity. *Behavior Research Methods, Instruments and Computers*, 34, 391–398.
- Dougherty, D. M., Mathias, C. W., & Marsh, D. M. (2003). Laboratory measures of impulsivity. In E. F. Coccaro (Ed.), *Aggression: Psychiatric assessment and treatment. Medical psychiatric series No. 22* (pp. 247–265). New York: Marcel Dekker Publishers.
- Dougherty, D. M., Mathias, C. W., Marsh, D. M., & Jagar, A. A. (2005). Laboratory behavioral measures of impulsivity. *Behavior Research Methods*, 37, 82–90.
- Dougherty, D. M., Mathias, C. W., Marsh, D. M., Papageorgiou, T. D., Swann, A. C., & Moeller, F. G. (2004). Laboratory measured behavioral impulsivity relates to suicide attempt history. *Suicide and Life-Threatening Behavior*, 34, 374–385.
- Eisenberg, D. T. A., MacKillop, J., Modi, M., Beauchemin, J., Dang, D., Lisman, S. A., et al. (2007). Examining impulsivity as an endophenotype using a behavioral approach: A DRD2 TaqI A and DRD4 48-bp VNTR association study. *Behavioral and Brain Functions*, 3, 2.
- Enticott, P. G., Ogloff, J. R. P., Bradshaw, J. L., & Fitzgerald, P. B. (2008). Cognitive inhibitory control and self-reported impulsivity among violent offenders with schizophrenia. *Journal of Clinical and Experimental Neuropsychology*, 30, 1–6.
- Everton, W. J., Mastrangelo, P. M., & Jolton, J. A. (2005). Personality correlates of employee's use of work computers. *CyberPsychology and Behavior*, 8, 143–153.
- Eysenck, S. B. G., & Eysenck, H. J. (1977). The place of impulsiveness in a dimensional system of personality description. *British Journal of Social and Clinical Psychology*, 16, 57–68.
- Eysenck, S. B. G., Pearson, P. R., Easting, G., & Allsopp, J. F. (1985). Impulsiveness and venturesomeness: Their position in a dimensional system of personality description. *Personality and Individual Differences*, 6, 613–619.
- Fossati, A., Di Ceglie, A., Acquarini, E., & Barratt, E. S. (2001). Psychometric properties of an Italian version of the Barratt Impulsiveness Scale-11 (BIS) in non-clinical subjects. *Journal of Clinical Psychology*, 57, 815–828.
- Garavan, H., Ross, T. J., Murphy, K., Roche, R. A., & Stein, E. A. (2002). Dissociable executive functions in the dynamic control of behavior: Inhibition, error detection, and correction. *NeuroImage*, 17, 1820–1829.
- Gerbing, D. W., Ahadi, S. A., & Patton, J. H. (1987). Toward a conceptualization of impulsivity: Components across the behavioral and self-report domains. *Multivariate Behavioral Research*, 22, 357–379.
- Giotakos, O., Markianos, M., Vaidakis, N., & Christodoulou, G. N. (2003). Aggression, impulsivity, plasma sex hormones, and biogenic amine turnover in a forensic population of rapists. *Journal of Sex and Marital Therapy*, 29, 215–225.
- Glicksohn, J., & Nahari, G. (2007). Interacting personality traits? Smoking as a test case. *European Journal of Personality*, 21, 225–234.
- Goudriaan, A. E., Oosterlaan, J., De Beurs, E., & van den Brink, W. (2008). The role of self-reported impulsivity and reward sensitivity versus neurocognitive measures of disinhibition and decision making in the prediction of relapse in pathological gamblers. *Psychological Medicine*, 38, 41–50.
- Gray, J. A. (1981). A critique of Eysenck's theory of personality. In H. J. Eysenck (Ed.), *A model for personality* (pp. 246–277). Berlin: Springer.
- Gray, J. A. (1987). Perspectives on anxiety and impulsivity: A commentary. *Journal of Research in Personality*, 21, 493–509.
- Greenberg, B. D., Tolliver, T. J., Huang, S. J., Bengel, Q. L., & Murphy, D. L. (1999). Genetic variation in the serotonin transporter promoter region affects serotonin uptake in human platelets. *American Journal of Medical Genetics*, 88, 83–87.
- Greve, K. W., Love, J., Sherwin, E., Stanford, M. S., Mathias, C. W., & Houston, R. (2002). Cognitive strategy usage in long-term survivors of severe traumatic brain injury with persisting impulsive aggression. *Personality and Individual Differences*, 32, 639–647.
- Greve, K. W., Sherwin, E., Stanford, M. S., Mathias, C., Love, J., & Ramzinski, P. (2001). Personality and neurocognitive correlates of impulsive aggression in long-term survivors of severe traumatic brain injury. *Brain Injury*, 15, 255–262.
- Guilford, J. P., & Zimmerman, W. S. (1949). *The Guilford-Zimmerman temperament survey (manual)*. Beverly Hills, CA: Sheridan Supply Co.
- Helfritz, L. E., Stanford, M. S., Greve, K. W., Villemarette-Pittman, N. R., Houston, R. J., & Conklin, S. M. (2006). Usefulness of self-report instruments in assessing men accused of domestic violence. *Psychological Record*, 56, 171–180.
- Houston, R. J., & Stanford, M. S. (2005). Electrophysiological substrates of impulsiveness: Potential effects on aggressive behavior. *Progress in Neuropsychopharmacology and Biological Psychiatry*, 29, 305–313.
- Houston, R. J., Stanford, M. S., Villemarette-Pittman, N. R., Conklin, S. M., & Helfritz, L. E. (2003). Neurobiological correlates and clinical implications of aggressive subtypes. *Journal of Forensic Neuropsychology*, 3, 67–87.

- Hull, C. L. (1943). *Principles of behavior*. New York: Appleton-Century.
- ISI Web of Science. (2009). Citation search on "Patton, J. H., Stanford, M. S., Barratt, E. S. (1995). Factor structure of the Barratt impulsiveness scale. *Journal of Clinical Psychology*, 6, 768–774." Conducted on 03/17/09.
- Jallade, C., Sarfati, Y., & Hardy-Bayle, M. C. (2005). Clinical evolution after self-induced or accidental traumatism: A controlled study of the extent and the specificity of suicidal catharsis. *Journal of Affective Disorders*, 85, 283–292.
- Kirkpatrick, T., Joyce, E., Milton, J., Duggan, C., Tyrer, P., & Rogers, R. D. (2007). Altered memory and affective instability in prisoners assessed for dangerous and severe personality disorder. *British Journal of Psychiatry*, 190, S20–S26.
- Knyazev, G. G., & Slobodskaya, H. R. (2006). Personality types and behavioral activation and inhibition in adolescents. *Personality and Individual Differences*, 41, 1385–1395.
- Kockler, T. R., & Stanford, M. S. (2008). Using a clinically aggressive sample to examine the association between impulsivity, executive functioning, and verbal learning and memory. *Archives of Clinical Neuropsychology*, 23, 165–173.
- Lane, S. D., Cherek, D. R., Rhoades, H. M., Pietras, C. J., & Tcheremissine, O. V. (2003). Relationships among laboratory and psychometric measures of impulsivity: Implications in substance abuse and dependence. *Addictive Disorders and Their Treatment*, 2, 33–40.
- Lane, S. D., Moeller, F. G., Steinberg, J. L., Buzby, M., & Kosten, T. R. (2007). Performance of cocaine dependent individuals and controls on a response inhibition task with varying levels of difficulty. *American Journal of Drug and Alcohol Abuse*, 33, 717–726.
- Lawrence, J. B., & Stanford, M. S. (1999). Impulsivity and time of day: Effects on performance and cognitive tempo. *Personality and Individual Differences*, 26, 199–208.
- Lejuez, C. W., Bornovalova, M. A., Reynolds, E. K., Daughters, S. B., & Curtin, J. J. (2007). Risk factors in the relationship between gender and crack/cocaine. *Experimental and Clinical Psychopharmacology*, 15, 165–175.
- Leland, D. S., & Paulus, M. P. (2005). Increased risk-taking decision-making but not altered response to punishment in stimulant-using young adults. *Drug and Alcohol Dependence*, 78, 83–90.
- Lesch, K. P., Bengel, D., Heils, A., Sabol, S. Z., Greenberg, B. D., Petri, S., et al. (1996). Association of anxiety-related traits with a polymorphism in the serotonin transporter gene regulatory region. *Science*, 274, 1527–1531.
- Levine, L. E., Waite, B. M., & Bowman, L. L. (2007). Electronic media use, reading, and academic distractibility in college youth. *CyberPsychology & Behavior*, 10, 560–566.
- Luengo, M. A., Carrillo-de-la-Pena, M. T., & Otero, J. M. (1991). The components of impulsiveness: A comparison of the I.7 impulsiveness questionnaire and the Barratt impulsiveness scale. *Personality and Individual Differences*, 12(65), 7–667.
- Malloy-Diniz, L., Fuentes, D., Leite, W. B., Correa, H., & Bechara, A. (2007). Impulsive behavior in adults with attention deficit/hyperactivity disorder: Characterization of attentional, motor and cognitive impulsiveness. *Journal of the International Neuropsychological Society*, 13, 693–698.
- Markus, C. R., & Jonkman, L. M. (2007). Attention switching after dietary brain 5-HT challenge in high impulsive subjects. *Journal of Psychopharmacology*, 21, 700–708.
- Martin, L. E., & Potts, G. F. (2004). Reward sensitivity in impulsivity. *Cognitive Neuroscience and Neuropsychology*, 15, 1519–1522.
- Mathias, C. W., & Stanford, M. S. (2003). Impulsiveness and arousal: Heart rate under conditions of rest and challenge in healthy males. *Personality and Individual Differences*, 35, 355–371.
- Miller, E., Joseph, S., & Tudway, J. (2004). Assessing the component structure of four self-report measures of impulsivity. *Personality and Individual Differences*, 37, 349–358.
- Moeller, F. G., Barratt, E. S., Dougherty, D. M., Schmitz, J. M., & Swann, A. C. (2001). Psychiatric aspects of impulsivity. *American Journal of Psychiatry*, 158, 1783–1793.
- Moeller, F. G., Barratt, E. S., Fischer, C. J., Dougherty, D. M., Reilly, E. L., Mathias, C. W., et al. (2004). P300 event-related potential amplitude and impulsivity in cocaine-dependent subjects. *Neuropsychobiology*, 50, 167–173.
- Moeller, F. G., Dougherty, D. M., Barratt, E. S., Schmitz, J. M., Swann, A. C., & Grabowski, J. (2001). The impact of impulsivity on cocaine use and retention in treatment. *Journal of Substance Abuse Treatment*, 21, 193–198.
- Moeller, F. G., Hasan, K. M., Steinberg, J. L., Kramer, L. A., Dougherty, D. M., Santos, R. M., et al. (2005). Reduced anterior corpus callosum white matter integrity is related to increased impulsivity and reduced discriminability in cocaine-dependent subjects: Diffusion tensor imaging. *Neuropsychopharmacology*, 30, 610–617.
- Muller, B. W., Gimbel, K., Keller-Pliebnig, A., Sartory, G., Gastpar, M., & Davids, E. (2007). Neuropsychological assessment of adult patients with attention-deficit/hyperactivity disorder. *European Archives of Psychiatry and Clinical Neuroscience*, 257, 112–119.
- Nasser, J. A., Gluck, M. E., & Geliebter, A. (2004). Impulsivity and test meal intake in obese binge eating women. *Appetite*, 43, 303–307.
- Oquendo, M. A., Baca-Garcia, E., Graver, R., Morales, M., Montalban, V., & Mann, J. J. (2001). Spanish adaption of the Barratt impulsiveness scale (BIS). *European Journal of Psychiatry*, 15, 147–155.
- Paaver, M., Nordquist, N., Parik, J., Harro, M., Orelund, L., & Harro, J. (2007). Platelet MAO activity and the 5-HTT gene promoter polymorphism are associated with impulsivity and cognitive style in visual information processing. *Psychopharmacology*, 194, 545–554.
- Parker, J. D. A., Bagby, R. M., & Webster, C. D. (1993). Domains of the impulsivity construct—A factor analytic investigation. *Personality and Individual Differences*, 15, 267–274.
- Passamonti, L., Fera, F., Magariello, A., Cerasa, A., D'ioia, M. C., Muglia, M., et al. (2006). Monoamine oxidase-A genetic variations influence brain activity associated with inhibitory control: New insight into the neural correlates of impulsivity. *Biological Psychiatry*, 59, 334–340.
- Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt impulsiveness scale. *Journal of Clinical Psychology*, 6, 768–774.
- Peluso, M. A. M., Hatch, J. P., Glahn, D. C., Monkul, E. S., Sanches, M., Najt, P., et al. (2007). Trait impulsivity in patients with mood disorders. *Journal of Affective Disorders*, 100, 227–231.
- Potts, G. F., George, M. R., Martin, L. E., & Barratt, E. S. (2005). Reduced punishment sensitivity in neural systems of behavior monitoring in impulsive individuals. *Neuroscience Letters*, 397, 130–134.
- Preuss, U. W., Rujescu, D., Giegling, I., Koller, G., Bottlender, M., Engel, R. R., et al. (2003). Factor structure and validity of a German version of the Barratt impulsiveness scale. *Fortschritte der Neurologie Psychiatrie*, 71, 527–534.
- Quednow, B. B., Westheide, J., Kuhn, K., Werner, P., Maier, W., Hawellek, B., et al. (2006). Normal prepulse inhibition and habituation of acoustic startle response in suicidal depressive patients without psychotic symptoms. *Journal of Affective Disorders*, 92, 299–303.
- Rodriguez-Jimenez, R., Avila, C., Jimenez-Arriero, M. A., Ponce, G., Monasor, R., Jimenez, M., et al. (2006). Impulsivity and sustained attention in pathological gamblers: Influence of childhood ADHD history. *Journal of Gambling Studies*, 22, 451–461.
- Roiser, J. P., Müller, U., Clark, L., & Sahakian, B. J. (2007). The effects of acute tryptophan depletion and serotonin transporter polymorphism on emotional processing in memory and attention. *International Journal of Neuropsychopharmacology*, 10, 449–461.
- Rubio, G., Jimenez, M., Rodriguez-Jimenez, R., Martinez, I., Iribarren, M. M., Jimenez-Arriero, M. A., et al. (2007). Varieties of impulsivity in males with alcohol dependence. The role of cluster-B personality disorder. *Alcoholism: Clinical and Experimental Research*, 31, 1826–1832.
- Sakado, K., Sakado, M., Muratake, T., Mundt, C., & Someya, T. (2003). A psychometrically derived impulsive trait related to a polymorphism in the serotonin transporter gene-linked polymorphic region (5-HTTLPR) in a Japanese nonclinical population: Assessment by the Barratt impulsiveness scale (BIS). *American Journal of Medical Genetics Part B (Neuropsychiatric Genetics)*, 121B, 71–75.
- Sequeira, A., Mamdani, F., Lalovic, A., Anguelova, M., Lesage, A., Seguin, M., et al. (2004). Alpha 2a adrenergic receptor gene and suicide. *Psychiatry Research*, 125, 87–93.
- Skinner, M. D., Aubin, H., & Berlin, I. (2004). Impulsivity in smoking, nonsmoking, and ex-smoking alcoholics. *Addictive Behaviors*, 29, 973–978.
- Smith, P., Waterman, M., & Ward, N. (2006). Driving aggression in forensic and non-forensic populations: Relationships to self-reported levels of aggression, anger and impulsivity. *British Journal of Psychology*, 97, 387–403.
- Someya, T., Sakado, K., Seki, T., Kojima, M., Reist, C., Tang, S. W., et al. (2001). The Japanese version of the Barratt impulsiveness scale, 11th version (BIS-11): Its reliability and validity. *Psychiatry and Clinical Neurosciences*, 55, 111–114.
- Sonuga-Barke, E. J. (2002). Psychological heterogeneity in AD/HD: A dual pathway model of behavior and cognition. *Behavioral Brain Research*, 130, 26–29.
- Spence, K. W. (1956). *Behavior Theory and Conditioning*. New Haven, CT: Yale University Press.
- Spinella, M. (2005). Self-rated executive function: Development of the executive function index. *International Journal of Neuroscience*, 115, 649–667.
- Spinella, M., & Mile, W. M. (2003). Impulsivity and educational achievement in college students. *College Student Journal*, 37, 545–549.
- Suris, A. M., Lind, L. M., Kashner, M. T., Bernstein, I. H., Young, K., & Worchel, J. (2005). Aggression and impulsivity instruments: An examination in veterans. *Military Psychology*, 17, 283–297.
- Swann, A. C., Bjork, J. M., Moeller, F. G., & Dougherty, D. M. (2002). Two models of impulsivity: Relationship to personality traits and psychopathology. *Biological Psychiatry*, 51, 988–994.
- Swann, A. C., Dougherty, D. M., Pazzaglia, P. G., Pham, M., & Moeller, F. G. (2004). Impulsivity: A link between bipolar disorder and substance abuse. *Bipolar Disorders*, 6, 204–212.
- Swann, A. C., Dougherty, D. M., Pazzaglia, P. J., Pham, M., Steinberg, J. L., & Moeller, F. G. (2005). Increased impulsivity associated with severity of suicide attempt history in patients with bipolar disorder. *American Journal of Psychiatry*, 162, 1680–1687.
- Swann, A. C., Pazzaglia, P., Nicholls, A., Dougherty, D. M., & Moeller, F. G. (2003). Impulsivity and phase of illness in bipolar disorder. *Journal of Affective Disorders*, 73, 105–111.
- Swann, A. C., Steinberg, J. L., Lijffijt, M., & Moeller, F. G. (2008). Impulsivity: Differential relationship to depression and mania in bipolar disorder. *Journal of Affective Disorders*, 106, 241–248.
- Taylor, J. A. (1953). A personality scale of manifest anxiety. *Journal of Abnormal and Social Psychology*, 48, 285–290.
- Thurstone, L. L. (1953). *Examiner's manual for the Thurstone temperament schedule*. Chicago: Science Research Association.
- Twain, D. C. (1957). Factor analysis for particular aspects of behavioral control-impulsivity. *Journal of Clinical Psychology*, 13, 133–136.
- van den Eynde, F., Senturk, V., Naudts, C., Bernagie, K., Thas, O., van Heeringen, C., et al. (2008). Efficacy of quetiapine for impulsivity and affective symptoms in

- borderline personality disorder. *Journal of Clinical Psychopharmacology*, 28, 147–155.
- Visintini, R., Ubbiali, A., Donati, D., Chiorri, C., & Maffei, C. (2007). Referral to group psychotherapy: A retrospective study on patients' personality features associated with clinicians' judgments. *International Journal of Group Psychotherapy*, 57, 515–524.
- von Diemen, L., Szobot, C. M., Kessler, F., & Pechansky, F. (2007). Adaptation and construct validation of the Barratt impulsiveness scale (BIS-11) to Brazilian Portuguese for use in adolescents. *Revista Brasileira de Psiquiatria*, 29, 153–156.
- Voon, V., Thomsen, T., Miyasaki, J. M., de Souza, M., Shafro, A., Fox, S. H., et al. (2007). Factors associated with dopaminergic drug-related pathological gambling in Parkinson disease. *Archives of Neurology*, 64, 212–216.
- Warren, J. I., & South, S. C. (2006). Comparing the constructs of antisocial personality disorder and psychopathy in a sample of incarcerated women. *Behavioral Sciences & the Law*, 24, 1–20.
- Westheide, J., Wagner, M., Quednow, B., Hoppe, C., Cooper-Mahkorn, D., Strater, B., et al. (2007). Neuropsychological performance in partly remitted unipolar depressive patients: Focus on executive functioning. *European Archives of Psychiatry and Clinical Neuroscience*, 257, 389–395.
- Whitney, P., Jameson, T., & Hinson, J. M. (2004). Impulsiveness and executive control of working memory. *Personality and Individual Differences*, 37, 417–428.
- Wittmann, M., Leland, D. S., Churan, J., & Paulus, M. P. (2007). Impaired time perception and motor timing in stimulant-dependent subjects. *Drug and Alcohol Dependence*, 90, 183–192.
- Yang, H. Q., Yao, S. Q., & Zhu, X. Z. (2007). The Chinese version of the Barratt impulsiveness scale 11th version (BIS-11) in college students: Its reliability and validity. *Chinese Mental Health Journal*, 21, 223–225.
- Zouk, H., McGirr, A., Lebel, V., Benkelfat, C., Rouleau, G., & Turecki, G. (2007). The effect of genetic variation of the serotonin 1B receptor gene on impulsive aggressive behavior and suicide. *American Journal of Medical Genetics Part B (Neuropsychiatric Genetics)*, 144B, 996–1002.
- Zuckerman, M., Eysenck, S. B. G., & Eysenck, H. J. (1978). Sensation seeking in England and America: Cross-cultural, age and sex comparisons. *Journal of Consulting and Clinical Psychology*, 46, 139–149.