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# Disentangling impulsiveness, aggressiveness and impulsive aggression: An empirical approach using self-report measures

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## Abstract

There is confusion in the literature concerning the concept of impulsive aggression. Based on previous research, we hypothesize that impulsivity and aggression may be related, though not as closely as to consider them the same construct. So, our aim was to provide empirical evidence of the relationship between the impulsivity and aggressiveness constructs when considered as traits. Two widely used questionnaires [Barratt's Impulsiveness Scale (BIS) and Aggression Questionnaire—Refined (AQ-R)] were administered to 768 healthy respondents. Product-moment and canonical correlations were then calculated. In addition, a principal components analysis was conducted to explore whether impulsive aggression can be defined phenotypically as the expression of a single trait. The common variance between impulsivity and aggressiveness was never higher than 42%. The principal components analysis reveals that one component is not enough to represent all the variables. In conclusion, our results show that impulsivity and aggressiveness are two separate, although related constructs. This is particularly important in view of the misconceptions in the literature.

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## 1. Introduction

According to the World Health Organization, violence is one of the leading public health problems worldwide (Krug et al., 2002). Acts of aggression have a deep impact on society and therefore on psychiatry and related fields. But what is aggression? Many definitions have been put forward. The most widely accepted is the one proposed by Berkowitz (1993): a goal-directed motor behavior that has a deliberate

intent to harm or injure another object or person. This is a relatively consensual definition of aggression (Berkowitz and Harmon-Jones, 2004).

In order to understand the etiology and origins of aggressive behavior and to find a successful treatment, several taxonomic systems have been proposed (Parrott and Giancola, 2007). However, although there is relative agreement that aggression refers to observable behavior, the terms "anger", "aggression", "hostility", "impulsivity" and other traits and behaviors have been used interchangeably by some clinicians and researchers, while remaining clearly distinct to others (Suris et al., 2004). This lack of clarity may be representative of the theoretical overlap of concepts, or it may be that some terms represent behavioral manifestations of the higher level organizing

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principles represented by other terms. Some authors (Coccaro, 1998) state that there may be a lack of conceptual differentiation between the terms used to represent target behaviors, which has led to confusion in differentiating between predictor and criterion measures. It is important to define clear criteria to explore the constructs, because precise criteria would improve predictions based on measures of observable conducts or non-observable traits (predictors). Moreover, confusion may arise both at conceptual or methodological levels. It is also evident in the DSM-IV-TR, where there is no specific definition of aggression. In addition, it includes a cluster of underlying and precipitating variables that are frequently related to aggression (Buss and Perry, 1992; Eysenck and Eysenck, 1978), the most important of them being impulsivity (Hollander and Stein, 1995). Some authors state that these variables are interrelated via higher order constructs to the degree that they share common variance (Suris et al., 2004). Impulsivity is often defined as “a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions to the impulsive individual or to others”, p. 1784 (Moeller et al., 2001), a definition only suitable for a personality trait, understood as a propensity to emit a certain response to stimuli.

Considerable efforts have been devoted to the classification of aggressive behaviors. Barratt and Slaughter (1998) classified aggression into three categories: pre-meditated, medically related, and impulsive. Coccaro went a step further and defined impulsive aggression as aggressive behavior in a deliberate and non-premeditated fashion (Coccaro, 1998; Moeller et al., 2001). This distinction between premeditated and impulsive aggression has become popular in the literature (Coccaro and Kavoussi, 1997; New et al., 2002), and has even led to the development of specific tools to capture it (Mathias et al., 2007; Stanford et al., 2003). Impulsive aggression *per se* has been described variously as (1) a single trait-like dimension (Coccaro et al., 1989; Siever and Davis, 1991); (2) a subset of impulsive behaviors (e.g., “impulsivity with an aggressive flair”: Seroczynski et al., 1999); (3) a subset of aggressive behaviors (e.g., “unplanned aggression”: Barratt et al., 1994; Barratt et al., 1999); or (4) the combination or interaction of separate traits (Depue and Lenzenweger, 2001). As a result of this mixture of definitions both in terms of traits and behaviors, boundaries and relations between terms are unclear (Critchfield et al., 2004, p. 558). For instance, in an excellent review, Coccaro (1992) argues “that the existence of a dimensional brain–behavior relationship such that reduced central 5-HT system function in patients affected by major mood and/or personality disorder is associated with a trait dysregulation of impulse

control, the presence of which enhances the likelihood of self- and/or other-directed aggressive behavior, given appropriate environmental triggers” (p. 10). Critchfield et al. (2004) points out that one implication of this theory is that impulsivity and aggression are expected to appear together on the phenotypic level, justifying the use of the term *impulsive aggression* as a single trait-like dimension.

Regarding the assessment of impulsive aggression, Coccaro and his team (Coccaro, 1998; Coccaro et al., 1998) devoted much effort to defining the concept of intermittent explosive disorder (IED). These articles laid the groundwork for future research in the field and were later on extended to children and adolescents (Olvera et al., 2001). In those seminal articles, Coccaro and colleagues explored the reliability and validity of IED based on behavioral measures. Certainly, it was a cleverly designed study and it provided useful insights on the diagnosis of IED, but it might seem that their results went unnoticed in the literature. When addressing the issue of construct validity (Coccaro et al., 1998), they stated that “the findings using the impulsivity measures were less striking with *only a trend towards statistical significance* for BIS-11 impulsivity ( $F[1,56]=3.70, P=0.061$ ) and *no significant difference on the I7 impulsivity* ( $F[1,62]=2.05, P=0.16$ ) measures” (p. 371, the italics added). Coccaro and his group do not view impulsivity and aggression as interchangeable, but they fail to clarify the issue in the discussion by simply pointing out that subjects with IED-R scored higher on impulsivity. Certainly, they scored higher in their sample, but not significantly, which invalidates the argument for the population. These criteria have influenced other studies in the field (e.g. Best et al., 2002), which perpetuate the same misinterpretation: “Severe psychiatric conditions related to IED are characterized by the inability to inhibit *aggressive or impulsive behavior*” (p. 5, italics added).

Nonetheless, there is evidence of a misuse of the term “impulsive aggression”. For instance, Dolan et al. (2001) explored the relationships between impulsivity, aggression and serotonin function in a sample of male offenders with personality disorders. They stated that “impulsivity and aggression were difficult to separate”, but they used composites based on z-scores, and, although aggression scores were not significant for prediction of serotonergic function, they refer throughout the article to “impulsivity/aggression” (p. 358). In another study, Siever et al. (1999) studied the d,l-fenfluramine response in “impulsive personality disorder” with positron emission tomography. They equate “impulsive aggression disorder” with “intermittent explosive disorder” assessed by means of the “Module for Impulse Aggression Disorder (E. Coccaro et al., personal communication)” (p. 414, italics added). This kind of misinterpretation should be avoided, the original

citation is “Module for Intermittent Explosive Disorder—Revised”. It is easy to get confused only by changing two words. Terminology should be precise; careless use of terms renders them meaningless. This article influenced Dougherty et al. (2004) in the discussion of their results. In that sample, they assessed anger attacks by means of a questionnaire specifically designed with this aim (Fava et al., 1991), but they assess neither impulsivity nor aggressiveness psychometrically as a trait. However, in the discussion, they state (p. 801) that these studies provide evidence about the pathophysiology of impulsive aggression without providing any definition for it.

In an excellent and influential review, Moeller et al. (2001) addressed some key features of impulsivity and its relation to psychiatric disorders. They cover core aspects of impulsivity very well, but they conclude their article by stating (p. 1790) that “aggressive acts are more easily measured than other aspects of impulsivity”. We agree with Moeller et al. (2001) that capturing core aspects is necessary, but, again, we must distinguish between acts (or observable behavior, e.g. an aggression) and traits or predispositions (e.g. impulsivity), which are non-observable, inferred constructs. They are at different levels of analysis.

Positron emission tomography has been also related to “impulsive aggression” (New et al., 2002). The authors selected patients “who met DSM-IV criteria for 1 or more personality disorders” (p. 622) and with regard to measures, “trait aggression was assessed using the Module for Intermittent Explosive Disorder—Revised” (p. 622). In this case, specificity of the findings within the framework of impulsive aggression is difficult to attain, given comorbidity rates among personality disorders. Moreover, the Module for Intermittent Explosive Disorder was not designed to assess trait aggression. Throughout the article, the authors did not use any single test to measure impulsivity. The contribution of this article to the neurobiology of aggression is relevant, but impulsivity is neither assessed nor mentioned in the discussion. More importantly, in this study actual aggression was not measured, but aggressiveness. Again, there is confusion when referring to aggression, aggressiveness, impulsive aggression or an impulse. Frankle et al. (2005) used a composite index of impulsive aggression based on a few clinical items (p. 916). This article has received 24 citations since publication as it provides good contributions, but it is remarkable how carefully prepared is the neuroimaging paradigm, and how comparatively little attention they paid to behavioral assessment. Moreover, they refer to impulsive aggression while using the term “impulsive aggressivity” in the title.

These are just a few examples of the lack of clarity in the field. Impulsivity as a sign, and also as a symptom, cuts across a number of psychiatric disorders (Moeller et al.,

2001), and it is a feasible endophenotype for many disorders (Gould and Gottesman, 2006). As presented before, some researchers say “aggression” when they refer to “aggressiveness”, some say “impulsive aggression” when they simply want to say “aggression”, and so on. This is a matter of concern, since it affects the definition and operationalization of the descriptor “impulsive.” The lack of scientific rigor that this entails may lead to errors in the interpretation of research results from a theoretical point of view. What are the reasons leading to confusion? They could be summarized as follows: (a) definitions of impulsivity are rather similar to those of aggressiveness or aggression (Berkowitz, 1993; Moeller et al., 2001); one could argue that this similarity between definitions could be a focus of confusion and could lead to invalid operationalization of these variables. (b) Another explanation that might underlie the confusion is the misunderstanding of what is a trait and what is a conduct. Arguably, impulsivity and aggressiveness are dispositions, aggression is an observable behavior, and an impulse is a drive. (c) It could be argued that the finding that impulsive and aggressive behaviors are linked to common underlying biological mechanisms (Frankle et al., 2005; Seroczynski et al., 1999) could have led investigators to think that both constructs are highly related, even to consider that they function as a single trait-like dimension. In order to solve this puzzle, Critchfield et al. (2004) examined relationships between impulsivity, aggression and impulsive aggression in borderline personality disorder. Using principal components analysis, they explored impulsive aggression as a single phenotypic dimension, finding that impulsivity and aggressiveness/aggression were separate constructs. However, they used a small clinical sample which led them to state that their results should be regarded with caution.

### 1.1. Aims of the study

On the basis of previous research, we hypothesize that impulsivity and aggression may be related, though not as closely as to consider them the same construct. Our goal is to provide empirical evidence of this relationship and to identify the ways in which aggressiveness and impulsiveness relate to each other. Additionally, we intend to replicate the findings of Critchfield et al. (2004) and extend them to a non-clinical sample.

## 2. Method

### 2.1. Subjects

Thirty undergraduate psychology students were trained in the application of two questionnaires: Barratt’s

Impulsiveness Scale (BIS) version 10, and the Aggression Questionnaire—Refined (AQ-R). They were instructed to collect data by using the “snowballing approach”, administering the test to their relatives and friends. Each student was told to ask 20 subjects of both sexes to complete the scales, maintaining, whenever possible, roughly equal proportions of males and females. The subjects were informed that participation was voluntary and that the aggregate data would be used for research purposes. All of them agreed to be included in the analysis.

The questionnaires were administered to a sample of 768 healthy respondents (51% females) ranging in age from 12 to 73 years (mean=35.02, S.D.=14.10). As regards educational level, 42.2% were college graduates, 17.50% had completed secondary school, 15.2% had elementary studies, 14.5% had no studies, and for 10.5% of the respondents this information was not available. As regards occupation, 20% of the sample were students, 39.5% were in regular employment, 9.7% of the subsample did not work, and 30.8% did not provide information on the issue.

No item or subject had more than 5% missing responses. Overall, 3.4% cases were missing due to non-response on at least one AQ-R or BIS item. No significant differences were found in terms of socio-demographic characteristics between the missing cases and the full sample. Analysis of the missing data suggested that there was no evident differential response pattern that would justify analyzing the missing cases separately.

## 2.2. Personality traits assessment

Full details of the questionnaires and their rationale are reported elsewhere (Gallardo Pujol et al., 2006; Luengo et al., 1991). Briefly, we provide some details of the questionnaires used.

Self-reported impulsivity was measured using the Spanish adaptation of Barratt's Impulsiveness Scale version 10 (Luengo et al., 1991). This scale comprises 34 items scored on a 4-point graded scale. This questionnaire is widely used as a measure of trait impulsivity and comprises three subscales: non-planning (BIS NP), motor (BIS M) and cognitive impulsiveness (BIS C). The BIS also provides a total score, which indicates a global measure of impulsiveness.

Trait aggression was measured with the Spanish adaptation of the AQ-R (Gallardo Pujol et al., 2006). The AQ-R measures four dimensions; each dimension is measured by three items. The dimensions are Physical Aggression (PA), Verbal Aggression or (VA), Anger (ANG) and Hostility (HO). All items are rated on a 5-point

scale ranging from “Never” to “Always”. Like the BIS, the AQ-R provides a global score that can be used as a measure of trait aggressiveness.

## 2.3. Statistical analysis

Bivariate correlations between questionnaire subscales and totals were computed to determine the amount of observed shared variance using the coefficient of determination. We also conducted canonical correlation analyses between scales to compute the maximum possible correlation between scales. Canonical correlation analysis is a multivariate statistical procedure which allows computation of linear composites of variables such that the correlation between two such composites, each based on a different set of variables, is maximized. Using the items composing each scale as variable subsets, this technique yields the maximum estimates for the correlation between the AQ and BIS scales. In addition, if correlations are squared, canonical correlation allows the computation of the upper limit of shared variance between them. Two identical variables should share 100% variance. The further away they are from this limit, the more likely they are to be separate constructs.

In order to correct multiple comparison error rate, significance alpha level for correlations is  $P=0.001$ . Note that Bonferroni correction for multiple comparisons using 5% as the overall alpha level yields a critical alpha for any correlation of 0.0014.

Finally, we conducted an exploratory principal component (PCA) analysis on BIS and AQ subscales, following the procedure in Critchfield et al. (2004). The main purpose of this analysis was to investigate whether the component structure they found could be replicated with our sample or not. This analysis involves the full sample ( $N=768$ ). In our case, the cases by variable ratio is roughly 110:1. In this manner, the analysis results can be considered fairly stable.

## 3. Results

### 3.1. Observed correlations between AQ and BIS

**Table 1** provides the means, standard deviations and correlations between AQ-R and BIS-10 scales and subscales. Significant correlations are marked in boldface. All correlations were significant except for the correlations of BIS Motor Impulsivity with AQ Physical Aggression and with AQ Verbal Aggression, and between BIS Cognitive Impulsiveness and AQ Verbal Aggression.

Trait measures of the global scales impulsivity and aggression presented a correlation of 0.39, which yields

Table 1

Mean, standard deviations and observed correlations between AQ-R Aggression scales and BIS impulsivity measures in the sample.

		AQ HOS	AQ ANG	AQ PA	AQ VA	BIS M	BIS NP	BIS C	BIS TOTAL	AQ TOTAL
AQ HOS	<i>r</i>	1.00								
	<i>P</i>	—								
AQ ANG	<i>r</i>	<b>0.40</b>	1.00							
	<i>P</i>	<0.001	—							
AQ PA	<i>r</i>	<b>0.34</b>	<b>0.35</b>	1.00						
	<i>P</i>	<0.001	<0.001	—						
AQ VA	<i>r</i>	<b>0.26</b>	<b>0.46</b>	<b>0.32</b>	1.00					
	<i>P</i>	<0.001	<0.001	<0.001	—					
BIS M	<i>r</i>	<b>0.13</b>	<b>0.15</b>	0.11	0.10	1.00				
	<i>P</i>	<0.001	<0.001	0.003	0.007	—				
BIS NP	<i>r</i>	<b>0.34</b>	<b>0.48</b>	<b>0.30</b>	<b>0.32</b>	<b>0.39</b>	1.00			
	<i>P</i>	<0.001	<0.001	<0.001	<0.001	<0.001	—			
BIS C	<i>r</i>	<b>0.17</b>	<b>0.25</b>	<b>0.25</b>	0.06	<b>0.45</b>	<b>0.44</b>	1.00		
	<i>P</i>	<0.001	<0.001	<0.001	0.090	<0.001	<0.001	—		
BIS TOTAL	<i>r</i>	<b>0.27</b>	<b>0.37</b>	<b>0.27</b>	<b>0.21</b>	<b>0.82</b>	<b>0.79</b>	<b>0.74</b>	1.00	
	<i>P</i>	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	—	
AQ TOTAL	<i>r</i>	<b>0.70</b>	<b>0.78</b>	<b>0.68</b>	<b>0.71</b>	<b>0.17</b>	<b>0.50</b>	<b>0.25</b>	<b>0.39</b>	1.00
	<i>P</i>	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	—
	Mean	5.98	6.80	4.53	7.83	23.70	21.49	23.80	68.99	25.14
	S.D.	2.13	2.25	1.97	2.12	5.69	5.15	3.47	11.29	6.08

Correlations were computed using  $N=743$ . Two-tailed significant correlations at  $P<0.001$  are marked boldface. AQ HOS: AQ Hostility subscale; AQ ANG: AQ Anger subscale; AQ PA: AQ Physical Aggression subscale; AQ VA: AQ Verbal Aggression subscale; AQ TOTAL: AQ Total score; BIS M: BIS Motor Impulsivity subscale; BIS NP: BIS Non-planning Impulsivity subscale; BIS C: BIS Cognitive Impulsivity subscale; BIS TOTAL: BIS Total score.

15% shared variance between them. By subscale, AQ ANG had the highest correlation with the BIS Total score ( $r=0.37$ ), with 14% common variance. All other AQ subscales had low amounts of shared variance with the BIS Total score, with values close to 6%.

The global correlation pattern between subscales points toward a moderate correlation between BIS and AQ-R subscales, with an average correlation of  $r=0.24$ . BIS NP showed the highest correlations with AQ measures, with an average correlation of 0.36. BIS NP was also the impulsivity subscale that yielded the highest individual correlation with an AQ subscale, with  $r=0.48$  ( $R^2=0.23$ ) with subscale Anger. BIS NP showed correlations around 0.3 for all AQ subscales.

BIS C showed somewhat lower correlations with AQ measures. The average correlation of BIS C and AQ subscales was 0.18, with a low of 0.06 with AQ VA and a high of 0.25 with AQ PA and AQ ANG. BIS M was the subscale with the lowest observed relationship with AQ. The average BIS M and AQ correlation was 0.12, and there was little variance around this value, as the product-moment coefficients of the Motor Impulsivity subscale ranged from 0.10 to 0.15.

### 3.2. Canonical correlations between AQ and BIS

Table 2 provides canonical correlations between AQ-R and BIS-10 scales and subscales. It is worth noting that by

definition, the canonical correlation between the items composing a subtest and all the items of the test is 1, and thus, canonical correlations between AQ-R and BIS-R subscales and total scales are 1. Canonical correlations yield the maximum possible correlation between subscales. Not surprisingly, canonical correlation patterns retrace the observed correlation patterns found with the observed correlations, but instead of direct population estimates, Table 2 provides the maximum.

In our sample, the canonical correlation between trait measures of the global scales impulsivity and aggression was  $r=0.65$ , which implies a common variance of 42%.

The highest correlations between BIS and AQ measures belonged to BIS NP with an average correlation of 0.39. BIS NP was also the impulsivity subscale that yielded the highest individual correlation with an AQ subscale:  $r=0.57$  ( $R^2=0.32$ ) with subscale Anger. All other AQ subscales showed maximum correlations with BIS NP close to 0.40, which yields a maximum shared variance of 16%.

Again, BIS-C correlations with AQ measures were lower. The average BIS-C and AQ-subscales correlation was 0.37. The lowest correlation value was found for AQ VA ( $r=31$ ) and the highest for AQ HOS ( $r=0.43$ ). Thus, the maximum shared variance between BIS and AQ subscales ranged from 10% to 18%.

The average canonical correlation for BIS M was 0.29, with a minimum of 0.28 and a maximum of 0.30.

Table 2  
Canonical correlations.

	AQ HOS	AQ ANG	AQ PA	AQ VA	BIS M	BIS NP	BIS C	BIS TOTAL	AQ TOTAL
AQ HOS	1.00								
AQ ANG	0.48	1.00							
AQ PA	0.35	0.39	1.00						
AQ VA	0.29	0.47	0.32	1.00					
BIS M	0.30	0.28	0.30	0.29	1.00				
BIS NP	0.41	0.57	0.40	0.41	0.63	1.00			
BIS C	0.43	0.37	0.35	0.31	0.66	0.60	1.00		
BIS TOTAL	0.55	0.61	0.49	0.50	1.00	1.00	1.00	1.00	
AQ TOTAL	1.00	1.00	1.00	1.00	0.40	0.61	0.49	0.65	

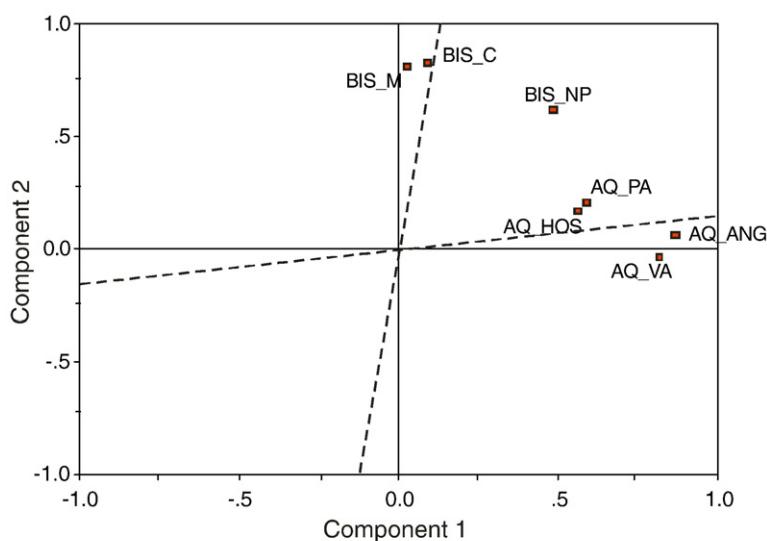
Correlations were computed using  $N=743$ . All correlations were found to be significant at  $P<0.001$ . AQ HOS: AQ Hostility subscale; AQ ANG: AQ Anger subscale; AQ PA: AQ Physical Aggression subscale; AQ VA: AQ Verbal Aggression subscale; AQ TOTAL: AQ Total score; BIS M: BIS Motor Impulsivity subscale; BIS NP: BIS Non-planning Impulsivity subscale; BIS C: BIS Cognitive Impulsivity subscale; BIS TOTAL: BIS Total score.

Thus, BIS M was the subscale with the lowest shared variance with AQ subscales. For all AQ subscales, the maximum common variance that could be found with Motor impulsivity was close to 9%.

### 3.3. Principal component analysis

As can be seen in Table 1, the observed correlation matrix shows a substantial number of significant inter-correlations. Using Bartlett's sphericity, we must reject the hypothesis that the correlation matrix is an identity ( $\chi^2=1472.28$ ,  $df=21$ ,  $P<0.001$ ); thus, the variables show a non-random correlation pattern. As in Critchfield et al. (2004), only two Eigenvalues were found to be

greater than 1 ( $\lambda_1=2.75$ ,  $\lambda_2=1.37$ ), accounting for 58% of the total variance. A single component solution was checked to explore a possible unique underlying impulsivity-aggression dimension. In line with Critchfield et al. (2004), our results showed that a one-component solution was not compelling, with only 39% of total variance explained by this single component. Low communalities were found in the one-component solution for the Aggression scales ( $h^2$  ranged from 0.31 to 0.43), while the  $h^2$  Impulsive scales ranged from 0.22 to 0.55. The two-factor solution was interpreted with a Varimax solution. Table 2 displays the rotated component loadings and the extraction communality for this solution. The first component clearly contains all AQ Aggression subscales.



Note: Axes of the Oblique oblimin rotation ( $\Delta=0$ ) are indicated with dashed lines,  
 $r=0.27$ ,  $p<.01$

Fig. 1. Scatterplot of the orthogonal oblique rotation of PCA factor loadings.

The second factor groups with BIS subscales. An additional Oblimin rotation allowing for maximum component obliquity ( $\Delta=0$ ) was explored.

The component solution is quite similar to the orthogonal one. Component correlation for this solution is low ( $r=0.28$ ). Fig. 1 depicts the component loading pattern for the orthogonal factor solution in both components.

#### 4. Discussion

Given the confusion existing in the literature regarding the relationship between impulsivity and aggressiveness, we addressed a recurrent problem with a classical psychometric method to obtain empirical data in what is, to our knowledge, one of the few direct examinations of this topic carried out so far. In order to examine the construct of impulsive aggression, we investigated the relationships between aggressiveness and impulsiveness using Pearson's correlations and canonical correlations. Canonical correlations are useful to estimate the maximum possible correlation between two composite variables, such as total questionnaire scores. Additionally, we have followed a widely extended procedure to explore the dimensionality of a given set of variables.

A major finding is that, in our sample, we found that the common variance between impulsivity and aggressiveness was never higher than 42%. Another important finding is that the higher scores an individual had on the AQ-ANG subscale, the higher scores on the total BIS score; anger was the aggressiveness trait most closely related to impulsiveness. According to Buss and Perry's model (Buss and Perry, 1992), this finding was to be expected, because anger is the emotional component of aggression, and it has been shown that emotional processing is strongly related to it (Coccaro et al., 2007). Some authors (Barratt, 1991) considered impulsive aggressive behavior reactive in nature, and it is usually accompanied by an agitated or irritated mood, poor modulation of physiological arousal, and a loss of behavioral control. In other terms, it is an emotionally charged, uncontrolled type of aggressive display. Others have found similar results to ours (Ramírez and Andreu, 2006). In the sample of Ramírez and Andreu, the AQ subscale that correlated the most with Impulsiveness was also Anger. However, the Personality trait of impulsivity along with anger provocation may be necessary, though not sufficient, for impulsive aggression. This finding has been confirmed empirically by Hollander et al. (2005). Hence, any possible measure of impulsive aggressive behavior should include the trait anger. To our knowledge, there is only one instrument that has followed standard psychometric procedures, making it valid and reliable

(Stanford et al., 2003) during its development. Stanford and colleagues developed a 30-item self-report instrument (Impulsive/Premeditated Aggression Scales—IPAS) to assess the impulsive and/or premeditated characteristics associated with an individual's aggressive acts. Contrary to other categorical forms of assessment that assign an individual into premeditated or impulsive aggression categories, the IPAS determines whether the individual is predominately impulsive or predominately premeditating in nature in a continuous way. However, although the authors are very cautious when they apply the questionnaire items to the last 6 months prior to the assessment, and they are very careful trying to measure actual aggressive behaviors, they fall into inquiring about habitual behaviors and then estimating a trait (Stanford et al., 2003, p. 187). This is, however, an excellent approach to a good assessment of impulsive aggressive behavior.

Nevertheless, the present study has a potential limitation that should be addressed in further research. Our findings rely on the assumed factor structures of both questionnaires. Although the AQ has a clear structure that has been replicated across cultures (Condon et al., 2006), the BIS does not have a clear factor structure; in previous work we have been unable to replicate the original structure (Gallardo-Pujol and Andrés-Pueyo, 2006). Indeed, the validity of the relationships between the questionnaires depends on the BIS structure.

In the present study, we have replicated and extended the findings of Critchfield et al. (2004) to a large, non-clinical sample. We found that impulsivity and aggressiveness are clearly separated into two different components. That is, impulsiveness and aggressiveness have little overlap when measured psychometrically with the AQ and the BIS in our non-clinical sample (Table 3). The increase in the sample size enhances statistical power and avoids the generalization limitations resulting from the use of a small group of clinical subjects.

So our results show that impulsiveness and aggressiveness are two separate, although related, constructs. This is particularly important in view of the misconceptions in the literature we mentioned in the introduction. According to our results, we can empirically reject the hypothesis that impulsive-aggressive traits are a single trait-like dimension. Unfortunately, the design of this study does not inform us about the nature of the relationships between the two constructs. We need to conduct further research that allows us to establish the nature of the relationships between these traits.

Some other misunderstandings in the study of impulsive aggression should be addressed. For instance, some authors classify certain behaviors according to their consequences (Coccaro and Kavoussi, 1997; Hollander

Table 3  
Orthogonal PCA solution for AQ and BIS subscales in the non-clinical sample.

	Component I: Aggression	Component II: Impulsivity	$h^2$
AQ HO	<b>0.87</b>	0.06	0.34
AQ ANG	<b>0.82</b>	-0.04	0.75
AQ PA	<b>0.59</b>	0.21	0.39
AQ VA	<b>0.56</b>	0.17	0.67
BIS M	0.09	<b>0.83</b>	0.66
BIS NP	0.03	<b>0.81</b>	0.62
BIS C	0.48	<b>0.62</b>	0.69
Eigenvalue	2.75	1.37	
% of total explained variance	39.24%	19.58	

Correlations were computed using  $N=743$ . Two-tailed significant correlations at  $P<0.001$  are marked boldface. AQ HOS: AQ Hostility subscale; AQ ANG: AQ Anger subscale; AQ PA: AQ Physical Aggression subscale; AQ VA: AQ Verbal Aggression subscale; BIS M: BIS Motor Impulsivity subscale; BIS NP: BIS Non-planning Impulsivity subscale; BIS C: BIS Cognitive Impulsivity subscale.

and Stein, 1995), but we think that this is a mistake. Personality psychologists successfully defined personality traits as “dispositions” anteceding behaviors (Eysenck and Eysenck, 1985; Goldberg, 1993; Pervin, 1996), and this step contributed significantly to the advancement in the study of personality dispositions (McCrae and Costa, 1995), favoring the distinction between behaviors and traits.

Other issues regarding impulsive aggression are its misuse as a symptom, rather than a sign (Jensen et al., 2007). Unfortunately, neither impulsivity nor aggressiveness is unidimensional (Gallardo-Pujol and Andrés-Pueyo, 2006). Given their importance in psychiatry and related fields, a good definition and measure of the phenotype must be achieved before addressing more complex issues (Gallardo-Pujol et al., 2008). Undoubtedly, “impulsive aggression” has become a fashionable term, but as Michael Rutter (2006) points out, we should consider whether it is simply a new way of repackaging old material or whether it introduces a new perspective.

In our case, we used the AQ and the BIS as proxies of aggressiveness and impulsivity, respectively. Obviously, a questionnaire does not equate to the construct, but estimates it. Experimental studies in the field would be more appropriate, for instance using the Point Subtraction Aggression Paradigm (Cherek, 1992) to measure actual aggressive responses, and the Balloon Analogue Reaction Test or similar tasks to measure impulsivity. We are currently conducting this type of research in subclinical populations (D. Gallardo-Pujol, personal communication). Hence, we could explore how aggressiveness and impulsiveness traits interact in causing actual aggressive behaviors. People with higher levels of impulsivity tend to

show higher levels of aggressiveness. However, although these constructs are related, they are not the same and are not interchangeable. The relationship between the two may be mediated by higher order variables, such as emotional processing. Additionally, impulsivity is less specific than aggressiveness, and there are many more impulsive than aggressive acts, although impulsivity is doubtless a moderator variable in aggressive behavior. Concretely, impulsivity should be treated as a high-order endophenotype preceding aggressive acts. Traditionally, personality psychologists referred to such constructs as primary traits or secondary traits.

Although application of classification techniques has proved useful in demonstrating significant differences in neurochemistry, psychophysiology, cognitive functioning, and treatment/intervention outcomes between those categorized as impulsive or premeditating, research is stuck in this categorical form of assessment. New systems of classification will tend to overcome the categorical assessment and will add dimensional approaches to the problem (Kupfer et al., 2005). Elucidating actual relationships between aggressiveness and impulsiveness is crucial, and this is the first empirical study that does it in a large, non-clinical sample.

More studies are needed in order to clearly define a measure of impulsive aggression that takes into account the actual relationships between impulsivity and aggressiveness, but these findings represent a step forward in understanding the relationships between these variables. To do so, we have extended a finding that could be limited to a small sample to a large and representative sample, and therefore explored the relationships of these variables in non-clinical conditions. If we can settle how impulsivity and aggressiveness relate to each other under normal conditions, we will be able to clearly distinguish whether they are affected or not in certain pathologies.

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## References

- Barratt, E.S., 1991. Measuring and predicting aggression within the context of a personality theory. *Journal of Neuropsychiatry* 3, 535–539.
- Barratt, E.S., Monahan, J., Steadman, H.J., 1994. Impulsiveness and Aggression, Violence and Mental Disorder: Developments in

- Risk Assessment. University of Chicago Press, Chicago, IL, US, pp. 61–79.
- Barratt, E.S., Slaughter, L., 1998. Defining, measuring, and predicting impulsive aggression: a heuristic model. *Behavioral Sciences and the Law* 16, 285–302.
- Barratt, E.S., Stanford, M.S., Dowdy, L., Liebman, M.J., Kent, T.A., 1999. Impulsive and premeditated aggression: a factor analysis of self-reported acts. *Psychiatry Research* 86, 163–173.
- Berkowitz, L., 1993. Aggression: Its Causes, Consequences and Control. McGraw-Hill, New York.
- Berkowitz, L., Harmon-Jones, E., 2004. Toward an understanding of the determinants of anger. *Emotion* 4, 107–130.
- Best, M., Williams, J.M., Coccaro, E.F., 2002. Evidence for a dysfunctional prefrontal circuit in patients with an impulsive aggressive disorder. *Proceedings of the National Academy of Sciences of the United States of America* 99, 8448–8453.
- Buss, A.H., Perry, M., 1992. The Aggression Questionnaire. *Journal of Personality and Social Psychology* 63, 452–459.
- Cherek, D.R., 1992. Point-subtraction Aggression Paradigm (PSAP). University of Texas, Houston.
- Coccaro, E., 1992. Impulsive aggression and central serotonergic system function in humans: an example of a dimensional brain-behavior relationship. *International Clinical Psychopharmacology* 7, 3–12.
- Coccaro, E.F., 1998. Impulsive aggression: a behavior in search of clinical definition. *Harvard Review of Psychiatry* 5, 1–4.
- Coccaro, E.F., Kavoussi, R.J., 1997. Fluoxetine and impulsive aggressive behavior in personality-disordered subjects. *Archives of General Psychiatry* 54, 1081–1088.
- Coccaro, E.F., Siever, L.J., Klar, H.M., Maurer, G., Cochrane, K., Cooper, T.B., Mohs, R.C., Davis, K.L., 1989. Serotonergic studies in patients with affective and personality disorders. Correlates with suicidal and impulsive aggressive behavior. *Archives of General Psychiatry* 46, 587–599.
- Coccaro, E.F., Kavoussi, R.J., Berman, M.E., Lish, J.D., 1998. Intermittent explosive disorder-revised: development, reliability, and validity of research criteria. *Comprehensive Psychiatry* 39, 368–376.
- Coccaro, E.F., McCloskey, M.S., Fitzgerald, D.A., Phan, K.L., 2007. Amygdala and orbitofrontal reactivity to social threat in individuals with impulsive aggression. *Biological Psychiatry* 62, 168–178.
- Condon, L., Morales-Vives, F., Ferrando, P.J., Vigil-Colet, A., 2006. Sex differences in the full and reduced versions of the aggression questionnaire: a question of differential item functioning? *European Journal of Psychological Assessment* 22, 92–97.
- Critchfield, K., Levy, K., Clarkin, J., 2004. The relationship between impulsivity, aggression, and impulsive-aggression in borderline personality disorder: an empirical analysis of self-report measures. *Journal of Personality Disorders* 18, 555–570.
- Depue, R.A. & Lezenwerger, M.F., 2001. A neurobehavioral dimensional model. In: Livesley, J.W. (Ed.), *Handbook of personality disorders: theory, research and treatment*. (pp. 136–176) Guilford Press, New York.
- Dolan, M., Anderson, I.M., Deakin, J.F.W., 2001. Relationship between 5-HT function and impulsivity and aggression in male offenders with personality disorders. *British Journal of Psychiatry* 178, 352–359.
- Dougherty, D.D., Rauch, S.L., Deckersbach, T., Marci, C., Loh, R., Shin, L.M., Alpert, N.M., Fischman, A.J., Fava, M., 2004. Ventromedial prefrontal cortex and amygdala dysfunction during an anger induction positron emission tomography study in patients with major depressive disorder with anger attacks. *Archives of General Psychiatry* 61, 795–804.
- Eysenck, S.B.G., Eysenck, H.J., 1978. Impulsiveness and venturesomeness—their position in a dimensional system of personality description. *Psychological Reports* 43, 1247–1255.
- Eysenck, H.J., Eysenck, M.W., 1985. *Personality and Individual Differences: A Natural Science Approach*. Plenum Press, New York.
- Fava, M., Rosenbaum, J., McCarthy, M., Pava, J., Steingard, R., Bless, E., 1991. Anger attacks in depressed outpatients and their response to fluoxetine. *Psychopharmacology Bulletin* 27, 275–279.
- Frankle, W.G., Lombardo, I., New, A.S., Goodman, M., Talbot, P.S., Huang, Y., Hwang, D.-R., Slifstein, M., Curry, S., Abi-Dargham, A., Laruelle, M., Siever, L.J., 2005. Brain serotonin transporter distribution in subjects with impulsive aggressivity: A Positron Emission Study With [11C]McN 5652. *American Journal of Psychiatry* 162, 915–923.
- Gallardo-Pujol, D., Andres-Pueyo, A., 2006. Re-analysis of correlations among four impulsivity scales. *Psychological Reports* 99, 221–224.
- Gallardo-Pujol, D., Garcia-Forero, C., Andres-Pueyo, A., Maydeu-Olivares, A., 2008. Monoamine oxidase a, gender differences, and social exclusion: comment on “Eisenberger et al.” *Biological Psychiatry* 63, e9–e10.
- Goldberg, L.R., 1993. The structure of phenotypic personality-traits. *American Psychologist* 48, 26–34.
- Gould, T.D., Gottesman II, 2006. Psychiatric endophenotypes and the development of valid animal models. *Genes, Brain and Behavior* 5, 113–119.
- Hollander, E., Stein, D., 1995. Impulsivity and Aggression. John Wiley & Sons Ltd, Chichester, England.
- Hollander, E., Swann, A.C., Coccaro, E.F., Jiang, P., Smith, T.B., 2005. Impact of trait impulsivity and state aggression on divalproex versus placebo response in borderline personality disorder. *American Journal of Psychiatry* 162, 621–624.
- Jensen, P., Youngstrom, E., Steiner, H., Findling, R., Meyer, R., Malone, R., Carlson, G., Coccaro, E., Aman, M., Blair, J., Dougherty, D., Ferris, C., Flynn, L., Green, E., Hoagwood, K., Hutchinson, J., Laughren, T., Leve, L., Novins, D., Vitiello, B., 2007. Consensus report on impulsive aggression as a symptom across diagnostic categories in child psychiatry: implications for medication studies. *Journal of the American Academy of Child and Adolescent Psychiatry* 46, 309–322.
- Krug, E.G., Dahlberg, L.L., Mercy, J.A., Zwi, A.B., Lozano, R., 2002. World Report on Violence and Health. World Health Organization, Geneva.
- Kupfer, D.J., First, M.B., Regier, D.A., 2005. A Research Agenda for DSM-V. American Psychiatric Association, Washington, DC.
- Luengo, M.A., Carrillo-de-la-Peña, M.T., Otero, J.M., 1991. The components of impulsiveness: a comparison of the I7 Impulsiveness Questionnaire and the Barratt Impulsiveness Scale. *Personality and Individual Differences* 12, 657–667.
- Mathias, C.W., Stanford, M.S., Marsh, D.M., Frick, P.J., Moeller, F.G., Swann, A.C., Dougherty, D.M., 2007. Characterizing aggressive behavior with the Impulsive/Premeditated Aggression Scale among adolescents with conduct disorder. *Psychiatry Research* 151, 231–242.
- McCrae, R.R., Costa, P.T.J., 1995. Trait explanations in personality psychology. *European Journal of Personality* 9, 231–252.
- Moeller, F., Barratt, E., Dougherty, D., Schmitz, J., Swann, A., 2001. Psychiatric aspects of impulsivity. *American Journal of Psychiatry* 158, 1783–1793.
- New, A.S., Hazlett, E.A., Buchsbaum, M.S., Goodman, M., Reynolds, D., Mitropoulou, V., Sprung, L., Shaw Jr, R.B., Koenigsberg, H., Platholi, J., Silverman, J., Siever, L.J., 2002. Blunted prefrontal cortical 18fluorodeoxyglucose positron emission tomography response to meta-chlorophenylpiperazine in impulsive aggression. *Archives of General Psychiatry* 59, 621–629.

- Olvera, R.L., Pliszka, S.R., Konyecsni, W.M., Hernandez, Y., Farnum, S., Tripp, R.F., 2001. Validation of the Interview Module for Intermittent Explosive Disorder (M-IED) in children and adolescents: a pilot study. *Psychiatry Research* 101, 259–267.
- Parrott, D.J., Giancola, P.R., 2007. Addressing “The criterion problem” in the assessment of aggressive behavior: development of a new taxonomic system. *Aggression and Violent Behavior* 12, 280–299.
- Pervin, L.A., 1996. Personality: a view of the future based on a look at the past. *Journal of Research in Personality* 30, 309–318.
- Ramirez, J.M., Andreu, J.M., 2006. Aggression, and some related psychological constructs (anger, hostility, and impulsivity) Some comments from a research project. *Neuroscience & Biobehavioral Reviews* 30, 276–291.
- Rutter, M., 2006. Implications of resilience concepts for scientific understanding. *Annals of the New York Academy of Sciences* 1094, 1–12.
- Seroczynski, A.D., Bergeman, C.S., Coccaro, E.F., 1999. Etiology of the impulsivity/aggression relationship: genes or environment? *Psychiatry Research* 86, 41–57.
- Siever, L.J., Davis, K.L., 1991. A psychobiological perspective on the personality disorders. *American Journal of Psychiatry* 148, 1647–1658.
- Siever, L.J., Buchsbaum, M.S., New, A.S., Spiegel-Cohen, J., Wei, T., Hazlett, E.A., Sevin, E., Nunn, M., Mitropoulou, V., 1999. d,l-Fenfluramine response in impulsive personality disorder assessed with [18F]fluorodeoxyglucose positron emission tomography. *Neuropsychopharmacology* 20, 413–423.
- Stanford, M.S., Houston, R.J., Mathias, C.W., Villemarette-Pittman, N.R., Helfritz, L.E., Conklin, S.M., 2003. Characterizing aggressive behavior. *Assessment* 10, 183–190.
- Suris, A., Lind, L., Emmett, G., Borman, P.D., Kashner, M., Barratt, E.S., 2004. Measures of aggressive behavior: overview of clinical and research instruments. *Aggression and Violent Behavior* 9, 165–227.