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RE-ANALYSIS OF CORRELATIONS AMONG FOUR IMPULSIVITY SCALES[1,2]

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Summary.—Impulsivity plays a key role in normal and pathological behavior. Although there is some consensus about its conceptualization, there have been many attempts to build a multidimensional tool due to the lack of agreement in how to measure it. A recent study claimed support for a three-dimensional structure of impulsivity, however with weak empirical support. By re-analysing those data, a four-factor structure was found to describe the correlation matrix much better. The debate remains open and further research is needed to clarify the factor structure. The desirability of constructing new measures, perhaps analogously to the Wechsler Intelligence Scale, is emphasized.

Impulsivity plays a key role in normal and pathological behavior. To measure it, many researchers have developed their own impulsivity constructs and tests (Buss & Plomin, 1975; Eysenck & Eysenck, 1977; Dickman, 1990; Carver & White, 1994; Patton, Stanford, & Barrat, 1995), and many others have tried to unify these varied approaches. Recently, Miller, Joseph, and Tudway (2004) contributed significantly to the analysis of the multidimensionality of impulsivity by administering four widely utilised impulsivity questionnaires (Eysenck's I7, Dickman's Impulsivity Inventory, Carver and White's Behavioral Inhibition/Behavioral Activation Scales and Barratt Impulsiveness Scales) to a UK sample and then factoring their subscales by applying a Principal Components analysis, followed by a varimax rotation method. Based on their results, they claim support for a three-factor model of impulsivity.

Although the results which Miller, *et al.* (2004) presented are quite interesting, they did not provide goodness-of-fit indices for the analysis they conducted. The aim of the present preliminary analysis is to re-examine Miller, *et al.*'s results (2004) to assess whether three factors account for the correlations among the impulsivity subscales they considered.

Method

Miller, *et al.* (2004) assessed a sample of 245 adults (108 men and 137 women), who completed four measures of impulsivity. These measures and

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their psychometric properties are described in the original sources. The different models fitted in this re-analysis were estimated via maximum likelihood estimation, as implemented in MPLUS (Muthén & Muthén, 1998), using the correlations reported in Table 1 of Miller, *et al.* (2004, p. 354) as sample statistics. An exploratory factor analysis was conducted using maximum likelihood estimation and varimax rotation. This rotation method was selected because it was used by Miller's group. Additionally, we conducted an exploratory factor analysis with promax rotation.

To assess the lack of fit of the models being estimated, RMSEA (Steiger, 1990) was employed. An RMSEA of about 0.05 reflects a close fit of the model in relation to its degrees of freedom, whereas a value of 0.08 or less reflects a reasonable error of approximation (Brown & Cudeck, 1993).

Results

Fit indices of the exploratory factor analyses were as follows. Neither model reproduced Miller's correlations well. However, the four-factor model (RMSEA = 0.09; 90% Confidence interval = 0.057 ÷ 0.128; $\chi_{11}^2 = 33.70$) had a better error of approximation than the three-factor model (RMSEA = 0.13; 90% Confidence interval = 0.106 ÷ 0.158; $\chi_{18}^2 = 94.24$).

The results of the three- and four-factor models are summarized in Table 1. The three-factor model yielded a structure very similar to that proposed by Miller, *et al.* (2004). With regard to the four-factor model, the first factor produced five item loadings greater than .4. This first factor was labelled "Functional Venturesomeness and Behavioral Impulsivity." The second factor had five item loadings greater than .4 and was labelled "Dysfunctional and Cognitive Impulsivity." The third factor produced only two item loadings above .4 and was labelled "Motivational Impulsivity." Finally, the fourth factor with two loadings above .4 was labelled as "Response Style." Additional to the varimax rotation, the factors were also rotated using the promax method. This solution shows basically the same pattern as the varimax solution; the main differences are the clear separation between Reward Responsiveness and the other subscales of Behavioral Inhibition/Behavioral Activation Scales, and the exit of Eysenck's impulsivity from the second factor and its inclusion within the fourth.

Discussion

From Miller's data, four or more factors are needed to account for the correlations among the measures. Impulsivity is probably not four-dimensional. Rather the support for a three-dimensional structure is very weak. When RMSEA is compared for the 3- and 4-factor solutions, the latter has a closer approximation to fit. Present results suggest a four-factor model for these data, namely, Functional Venturesomeness and Behavioral Impulsivity, Maladaptive Impulsivity, Motivational Impulsivity, and a response style fac-

TABLE 1

FACTOR LOADINGS AND FACTOR CORRELATIONS FROM THREE- AND FOUR-FACTOR MODELS FOLLOWED BY VARIMAX AND PROMAX ROTATIONS OF IMPULSIVITY MEASURE SUBSCALES FROM MILLER, *et al.* (2004)

Measure	Varimax Rotation							Promax Rotation			
	3-factor Solution			4-factor Solution				4-factor Solution			
	1	2	3	1	2	3	4	1	2	3	4
Dickman											
Functional impulsivity	**.49***	.19	.27	**.64***	.04	.04	.24	**.68***	−.13	−.12	.18
Dysfunctional impulsivity	.07	**.83***	.19	.16	**.60***	.08	**.62***	−.02	**.45***	−.06	**.62***
Eysenck											
Impulsiveness	.17	**.78***	.34	.28	**.54***	.20	**.64***	.11	.34	.04	**.62***
Venturesomeness	**.80***	.08	.02	**.66***	.12	−.01	−.05	**.75***	.05	−.15	−.17
Barratt Impulsiveness Scale-11											
Motor Impulsiveness	.39	**.62***	.24	**.45***	**.67***	.16	.11	.39	**.61***	.04	−.04
Nonplanning Impulsiveness	.10	**.77***	−.02	.06	**.83***	−.06	.20	−.06	**.86***	−.14	.11
Cognitive Impulsiveness	.13	**.58***	.12	.09	**.63***	.20	.12	−.03	**.60***	.16	.03
Behavioral Activation System											
Fun	**.52***	**.40***	**.54***	**.62***	.36	.37	.21	**.58***	.18	.23	.07
Drive	.31	.17	**.67***	**.50***	.13	**.44***	.18	**.47***	−.06	.34	.08
Reward Responsiveness	.01	.08	**.60***	.05	.09	**.84***	.05	−.06	−.07	**.89***	−.03
Eigenvalue	4.44	1.51	1.12	4.44	1.51	1.12	0.75	4.44	1.51	1.12	0.75
								Promax Factor Correlations			
							1				
							2	.37			
							3	.39	.31		
							4	.42	.45	.35	

*Loadings ≥ .4.

tor. Additionally, conducting a factor analysis entering the items as variables rather than the subscales themselves is recommended, to be based on a larger sample, to assess more effectively the multidimensionality of impulsivity. Finally, it is clear one cannot use the same items used in previously published tests but, given the multidimensional nature of impulsivity, the desirability of constructing new measures, perhaps analogously to the Wechsler Intelligence Scale, is emphasized.

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