UnilaSalle Editora

Revista Saúde e Desenvolvimento Humano
http://dx.doi.org/10.18316/2317-8582.15.0

Factor Analysis of French Translation of the Barratt Impulsiveness Scale (BIS-11)

Adaptação francesa da Escala Barratt de Impulsividade (BIS-11): Um estudo fatorial

http://dx.doi.org/10.18316/2317-8582.15.5

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Recebido : 08/09/2015

Aprovado : 20/10/2015

Abstract

Barratt Impulsiveness Scale (BIS-11) is a 30-items instrument designed to assess the construct of impulsiveness. It's one of the most commonly used scale for the assessment of this construct in research and clinical settings. Although its use is widely spread, there have been numerous questions about the invariance of the factor structure across different populations. This study explored the factor structure of the 22-items of the BIS-11 in a sample of 546 university students in a French Canadian university. The BIS-11 is held to measure 3 theoretical factors (Attentional, Motor and Non-planning Impulsiveness). We evaluated the factor structure of the BIS-11 using exploratory and confirmatory factor analysis. We found no evidence to support the 3 factor model. In fact, we found that the factor structure of the BIS-11 produces a 22 items in 5 factors solution: motor impulsiveness, cognitive complexity impulsiveness, non planning impulsiveness, financial management impulsiveness, and attentional impulsiveness. The utility of the 30-items BIS-11 to assess impulsiveness in non-clinical population is questionable. The authors suggest future studies to investigate comparisons with this modified version of the BIS-11 and other impulsivity or personality scales in non-clinical populations to evaluate criterion validity of this new 22-items model.

Keywords: Validity; Impulsivity; Adaptation; Factor Structure; BIS-11

Resumo

A Escala Barratt de Impulsividade (BIS-11) é um instrumento de 30 items elaborado para avaliar o construto Impulsividade. É o mais utilizado para avaliação deste construto, tanto na clínica quanto na pesquisa. Embora amplamente difundido, o BIS-11 tem sido questionado quanto à invariância de sua estrutura fatorial para diferentes populações. Este estudo explora sua estrutura fatorial com uma amostra de 546 estudantes universitários em uma universidade canadense francesa. Originalmente, esse instrumento avalia 3 fatores (Atencional, Motor e Impulsividade Reativa). Avaliou-se sua estrutura fatorial através das análises fatoriais exploratória e conformatória. Não encontraram-se evidências de validade para apoiar o modelo de três fatores. Cons-

tatou-se a adequação de sua estrutura fatorial com 22 itens, divididos em 5 fatores: Impulsividade Motora, Impulsividade Cognitiva Complexa, Impulsividade Reativa, Impulsividade na Gestão Financeira, e Impulsividade Atencional. A utilidade dos itens 30 itens do BIS-11 para avaliar a impulsividade na população não-clínica é questionada. Sugere-se estudos futuros que comparem esta versão modificada do BIS-11 com outras escalas de impulsividade em populações não-clínicos para avaliar a validade de critério deste novo modelo de 22 itens.

Palavras-chaves: BIS-11; Impulsividade; Adaptação; Validade; Estrutura Fatorial

Introduction

This study is part of a broader study, which aims to explore and validate personality assessment methods in French Canadian sample. This paper presents data results collected on undergraduate students in a public French Canadian university and explores the factor structure of a self-reported measure of impulsiveness, the French translation of the Barratt Impulsiveness Scale (BIS 11)[1]translated in French by Baylé, Guelfi, Jouvent, Olié & Caci[2], which has not been validated yet. Impulsiveness is a relevant construct to assess individual differences on normal and abnormal personality in clinical populations[3]. Impulsiveness during childhood and adolescence has been related to a wide variety of pathologies, such as hyperactivity, learning problems, anxiety disorders, aggression, depression, etc[4-5-6-7-8-9-10]. Later on, impulsiveness is considered to be a central aspect of many psychiatric disorders[11], either as a principal diagnostic feature (i.e. histrionic, antisocial, borderline personality disorders) or as a feature commonly associated with a diagnostic category (conduct, narcissistic personality and compulsive personality disorders)[12]. Impulsivity has been defined as "a predisposition toward rapid, unplanned reactions to internal **or** external stimuli with diminished regard to the negative consequences of these reactions to the impulsive individual or others"[11-13]. However, no universal agreement presently exists about its definition. Barratt is one of the main authors to have interest in the construct of impulsiveness, looking at the same time at measurement and conceptualization of this notion[14]. His theory aims at being generalizable for both clinical and non-clinical populations, whether impulsiveness is a problem or not for these populations[15].

History

The first version of the BIS was published in 1959[16] and is currently in its 11th revision[1]. The original BIS was developed by Ernest S. Barratt, in his attempt to relate impulsiveness, along with anxiety, to psychomotor efficency[16]. He noticed that impulsiveness and anxiety subscales from a number of self-report invtentories[17-18] showed non-significant correlations with each other. It brought him to think these two constructs were orthogonal, hypothesis which as supported by early studies[16-19-20] where the BIS was not significantly correlated with the Taylor Manifest Anxiety Scale[21] and the Institute for Personality and Ability Testing Anxiety Scale[22]. The hypothesized orthogonal nature of impulsiveness and anxiety strongly influenced Barratt's early work on the BIS, in which he both tried to arrive at internal consistency within the BIS and to eliminate items that correlated with measures of anxiety[3]. Later, it aimed to assess impulsivity as a stable action-oriented trait of personality by having an item pool assessing traits such as sensation seeking,

extraversion and risk taking[19]. While the original version of the BIS portrayed impulsiveness as unidimensional, Barratt's view changed over time and subsequent revisions moved to a multidimensional construct[23].

Barratt's model

In its most recent version, the BIS-11[1] contains 30 items on a Likert scale (1 to 4) that have demonstrated stronger psychometric properties compared to its earlier version[24]. The BIS-11 is comprised of six first-order factors: 1) attention, 2) motor, 3) self-control (planification and reflexion), 4) cognitive complexity (reflexive tasks appreciation), 5) perseverance, and 6) cognitive instability (flight of ideas). These factors were further combined to form three second-order factors: 1) attentional impulsiveness, which is the ability to focus on the tasks at hand and cognitive instability (comprised of factors 1 and 6), 2) motor impulsiveness, which is acting on the spur of he moment and perseverance (comprised of factors 2 and 5), and 3) non planning, which is self-control and cognitive complexity (comprised of factors 3 and 4).

Factor structure

While the BIS total and subscale scores appear to successfully differentiate clinical and non-clinical populations[25-26], replicating the factor structure of the BIS-11 has been problematic, making it challenging to apply interpretation of findings to research or clinical application[27]. Some studies confirmed the BIS-11 factor structure[28-29-30-31-32], however, several studies have not replicated the priori factor structure of the BIS-11[33-34-35-36-37-38]. Regardless, suggesting that the factor structure appears to be less robust in samples with high levels of impulsivity[27]. It should be noted that identifying the factor structure was also problematic in translated versions of the BIS[3]. Contradictory evidence regarding the BIS-11 has also been reported concerning the three second-order factor structure, especially when those factors were identified but highly correlated with one another, suggesting that these scales did not provide additional information beyond the total score[39-40]. These results undermine the utility of separating trait impulsiveness into attentional, motor and non planning subtraits[24]. However, cultural differences and experiences may influence how impulsiveness is experienced and expressed, reflecting differences in factor structure among studies performed in different countries.

Strengths and limits

To summarize, Barratt's approach to impulsiveness study is widespread in the literature. Moreover, the BIS-11 is one of the oldest and most widely used self-reported measures of impulsivity. Nonetheless, the operational definition of impulsiveness and Barratt's conceptual approach do not reach consensus in scientific literature. This problem comes from several reasons. In particular, many measures pretend to assess impulsivity, but they do not always combine well, if at all. The BIS-11 factor structure is sometimes difficult to reproduce, depending partially on the studied sample, which makes identification of a robust factor structure arduous to defend. This is

specifically a construct validity problem. Thereby, although Barratt's approach is one of the most widespread, it's important to find ways to overcome some limitations and improve the state of knowledge on impulsiveness and the BIS-11.

Objectives

The purpose of the present study is to analyze psychometric properties and factor structure of the French translation of the BIS-11[2], in order to assess the operational possibilities and study the multidimensional nature of impulsiveness evaluated by the BIS-11. The main objective of this study is to find which factor structure would be the best to explain impulsiveness in a non-clinical French population. We hypothesized that the factor structure from the BIS-11[1] would be mainly supported in a new non-clinical sample as factor structure was mainly problematic on high impulsiveness or non-clinical samples, but since translated version have had some problems with their factor structure, we predict that some adjustments may be required in order to represent the express of impulsiveness in our sample.

To assess the factor structure of the French version of the BIS-11, four questions will lead our process: 1) Which items are not relevant to use on our sample?; 2) How many factors should be retained?; 3) How good is the model fit?; 4) How good is the reliability?.

Method

Participants

Undergraduate students at a public French Canadian university located in Trois-Rivières (N=546; female = 79,6%, male = 20,4%; mean age = 23,2, SD = 7,3) were recruited directly in their classes, and the testing period took place just before the beginning of the lecture.

Procedure – Data collection

Number of participants in each group went from 26 to 60 participants. They were from different fields of studies: psychology, medicine, speech therapy, educational sciences. Students were given no incentive for completion of the BIS-11 and were free to accept or decline to participate to the study. The data were collected with *Université du Québec à Trois-Rivières*' Research Ethics Committee (REC) approval.

Measures

The latest French translation of the Barratt Impulsiveness Scale (BIS 11)[2] is a 30 items self-report measure that uses a 4-points Likert response scale purported to assess trait impulsivity, as developed by Patton & al. (1995)[1]. Stanford & al. (2009)[2] reported total scores on the BIS-11 demonstrated reasonable test-retest reliability over one month (Spearman's rho = .83)

and that the scale was internally consistent (α = .83). The full 30-items of the French translation was used in this study for analysis.

Data analysis

First, a factor analysis was performed using the Unweighted Least Squares extraction method and Oblimin rotation method to explore the latent dimensions and items saturation. Secondly, a confirmatory factor analysis was performed on the same sample to evaluate model fit, using the Generalized Least Squares model estimation technique. Analyses were run Statistical Package for the Social Sciences (SPSS) and its add-on module Analysis for Moment Structures (AMOS).

Results

Results revealed a good internal consistency, which was tested with Cronbach's alpha (α=0,83), supporting Stanford & al. (2009)[2] findings. Item-total correlations found that five items had correlations lower than 0,2 (items 8, 16, 21, 23, 24). Also, when we first ran exploratory factor analysis, three items were found to have complex or low factor loading, or to not load correctly with other items to form a factor (items 5, 12, 20). After interrater consultation, we chose to remove theses eight items from the study, many of them being irrelevant to our sample. We may argue that some of these problems were cultural or translation related, where the original meaning may have been distorted or understood differently by our French Canadian sample. Finally, we kept 22 items to run factor analysis (table 1).

Table 1. Results of the factor structure of the French translation of the BIS-11 (22 items)

Item	Description	Factor				
		1	2	3	4	5
2.	Je fais les choses sans réfléchir. (I do things without thinking.)	.61				
17.	J'agis sur un « coup de tête. » (I act « on impulse. »)	.56				
19.	J'agis selon l'inspiration du moment. (I act on the spur of moment.)	.50				
3.	Je me decide rapidement. (I make-up my mind quickly.)	.45				
14.	Je dis les choses sans réfléchir. (I say things without thinking.)	.44				
15.	J'aime réfléchir à des problèmes complexes. (I like to think about complex problems.)		.76			
18.	Réfléchir sur un problème m'ennuie vite. (I get easily bored when solving thought problems.)		.65			
29.	J'aime les « casse-têtes. » (I like puzzles.)		.52			
30.	Je fais des projets pour l'avenir. (I am future oriented.)			.73		
13.	Je veille à ma sécurité d'emploi. (I plan for job security.)			.43		
1.	Je prépare soigneusement les tâches à accomplir. (I plan tasks carefully.)			.42		
7.	Je programme mes voyages longtemps à l'avance. (I plan trips well ahead of time.)			.42		
27.	Je m'intéresse plus au présent qu'à l'avenir. (I am more interested in the present than the future.)			.42		
4.	Je suis insouciant. (I am happy-go-lucky.)			.37		
10.	Je mets de l'argent de côté raisonnablement. (I save regularly.)				.70	
25.	Je dépense ou paye à crédit plus que je gagne. (I spend or charge more than I earn.)				.55	
22.	J'achète les choses sur un « coup de tête. » (I buy things on impulse.)				.47	
26.	Lorsque je réfléchie d'autres pensées me viennent à l'esprit. (I often have extraneous thoughts when thinking.)					.53
11.	Je ne tiens pas en place aux spectacles ou aux conférences. (I « squirm » at plays or lectures.)					.51
28.	Je m'impatiente lors de conférences ou de discussions. (I am restless at the theater or lectures.)					.50
6.	Mes pensées défilent très vite. (I have « racing » thoughts.)					.49
9.	Je me concentre facilement. (I concentrate easily.)					.38
Percentage of explained variance		18,8	6,2	4,9	3,8	3

Extraction method: ULS (Unweighted Least Square)

Rotation method: Oblimin

A factor analysis was performed using the unweighted least squares extraction method to explore the latent dimensions of the 22 retained items of the French translation of BIS-11. The Kaiser–Meyer–Olkin Measure of Sampling Adequacy (KMO = .82) and the Bartlett Test of Sphericity was significant ($\chi^2_{B(231)}$ = 2656,91; p< 0,001), indicating that the sample was factorable, though the Bartlett Test of Sphericity is almost always significant on large sample. To determinate how many factors were to be extracted, two criteria were used: 1) the number of factors with eigenvalues above; 2) the scree plot graphic. Both criteria suggested three second-order factors. Based on these results, those three factors were rotated using Oblimin rotation with Kaiser Normalization to allow the factors to intercorrelate. The solution is shown on table 1, which

demonstrate five interpretable first-order factors. Some of them were close to Barratt's initial conceptualization, with small differences, but we had to name a new one gathering items linked to money matters. The five first-order factors: 1) motor impulsiveness (items 2, 3, 14, 17, 19), explaining 18,8% of the total variance; 2) cognitive complexity (items 15, 18, 20), adding 6,2% variance explained; 3) non planning (items 1, 4, 7, 13, 27), adding 4,9% variance explained; 4) financial management impulsiveness (items 10, 22, 25), adding 3,8% variance explained; 5) attentional impulsiveness (items 6, 9, 11, 26, 28), adding 3% variance explained. The total scale is shown to explain a total of 36,7% of the construct of impulsiveness. The factor correlation matrix revealed low to average correlation ($0,09 < r < 0,31$) between each extracted factors, demonstrating that while each dimension is linked to one another, they do not measure the same content, since none of them are higher than 0,85[41]. This result also supports the use of oblique rotation technique.

Confirmatory factor analysis

Confirmatory factor analysis (CFA) was used to evaluate the previously fund model in term of how well it accounts for relationships in the data. For the current study, the Generalized Least Squares (GLS) model estimation technique was employed because the data were multivariate normally distributed and our sample was large enough. The GLS model is considered to have computation simplicity and accuracy, thus generating reliable statistical results[42].

Confirmatory factor analysis was performed to assess adequacy evidence between observed data and hypothetical modal. Results demonstrate a chi-square (CMIN (191) = 456,644) statistically significant ($p < 0,01$), showing that the observed covariance matrix is different from the estimated covariance matrix. Relation between chi-square (CMIN) and degree of freedom (DF) must be lower than 5 (CMIN/DF = 2,391), which is the case in this study.

Results obtained for Goodness-of-Fit (GFI) and Adjusted Goodness-of-Fit (AGFI) (GFI = 0,928; AGFI = 0,905) suggests an acceptable model fit. Results obtained for the Root Mean square Residual (RMR) and Standardized Root Mean square Residual (SRMR) also suggests an excellent model fit (SRMR = 0,0535). Since interpretation of the RMR is complex, we used the SRMR, because it removes this interpretation complexity. It fluctuates from 0 to 1, with a value equal or lower than 0.08 indicating an acceptable model[43].

Root Mean Square Error of Approximation (RMSEA) aims to prevent problems linked to sample size by analyzing the difference between the hypothetical model and the observed covariance matrix of the studied population. It fluctuates from 0 to 1. The lower the value, the better the model fit, with a value equal or lower than 0,06 suggestion a good model fit. In the current study, RMSEA (RMSEA = 0,051) suggested an excellent model fit.

Comparative Fit Index (CFI) analyses the model fit by examining the gap between available data and hypothetical model, while correcting sample size problems inherent to chi-square model fit test[44]. CFI fluctuates from 0 to 1, whereas higher values suggest a better model fit. A value equal or higher than 0,9 suggests an acceptable model fit[43]. In this present study, results shown a good model fit (CFI = 0,892).

Item analysis were performed on the 22 retained items to hypothetically evaluate five

first-order factors of the French translation of the BIS-11: motor impulsiveness, cognitive complexity, non planning, financial management impulsiveness and attentional impulsiveness. To demonstrate convergent validity and discriminant validity of these five factors, correlations were performed for each items with its own dimension and with others dimension. Results (see table 2) clearly demonstrate that each item is correlated with its own dimension. Moreover, internal consistency was estimated using Cronbach's alpha (motor impulsiveness = 0,73; cognitive complexity = 0,67; non planning = 0,68; financial management impulsiveness = 0,62; attentional impulsiveness = 0,63) suggested an acceptable reliability.

Table 2. Item-factor correlations

			MI	CCI	NI	FMI	AI
MI	2.	Je fais les choses sans réfléchir. (I do things without thinking.)	.76**	.20**	.45**	.35**	.30**
	17.	J'agis sur un « coup de tête. » (I act « on impulse. »)	**.75****	.17**	.35**	.42**	.29**
	19.	J'agis selon l'inspiration du moment. (I act on the spur of moment.)	**.71****	.01*	.33**	.19**	.30**
	3.	Je me decide rapidement. (I make-up my mind quickly.)	**.58****	.04	.17**	.11**	.08
	14.	Je dis les choses sans réfléchir. (I say things without thinking.)	**.67****	.24**	.28**	.20**	.33**
CCI	15.	J'aime réfléchir à des problèmes complexes. (I like to think about complex problems.)	.14**	.82**	.10*	.09*	.15**
	18.	Réfléchir sur un problème m'ennuie vite. (I get easily bored when solving thought problems.)	.25**	**.75****	.16**	.10*	.26**
	29.	J'aime les « casse-têtes. » (I like puzzles.)	.14**	**.77****	.11*	.03	.18**
NI	30.	Je fais des projets pour l'avenir. (I am future oriented.)	.19**	.18**	.70**	.20**	.13**
	13.	Je veille à ma sécurité d'emploi. (I plan for job security.)	.20**	.06	**.59****	.24**	.11**
	1.	Je prépare soigneusement les tâches à accomplir. (I plan tasks carefully.)	.33	.21	**.62**	.19	.20
	7.	Je programme mes voyages longtemps à l'avance. (I plan trips well ahead of time.)	.33	.04	**.67**	.23	.01
	27.	Je m'intéresse plus au présent qu'à l'avenir. (I am more interested in the present than the future.)	.22**	.01	**.54****	.08	.06
	4.	Je suis insouciant. (I am happy-go-lucky.)	.42	.09	**.61**	.26	.28
FMI	10.	Je mets de l'argent de côté raisonnablement. (I save regularly.)	.26**	.06	.35**	.84**	.22**
	25.	Je dépense ou paye à crédit plus que je gagne. (I spend or charge more than I earn.)	.20**	.01	.18**	**.72****	.15**
	22.	J'achète les choses sur un « coup de tête. » (I buy things on impulse.)	.36**	.13**	.17**	**.71****	.25**
AI	26.	Lorsque je réfléchie d'autres pensées me viennent à l'esprit. (I often have extraneous thoughts when thinking.)	.12**	.08	.07	.17**	.62**
	11.	Je ne tiens pas en place aux spectacles ou aux conférences. (I « squirm » at plays or lectures.)	.28**	.17**	.15**	.14**	**.67****
	28.	Je m'impatiente lors de conférences ou de discussions. (I am restless at the theater or lectures.)	.32**	.30**	.19**	.17**	**.67****
	6.	Mes pensées défilent très vite. (I have « racing » thoughts.)	.28**	-.04	.06	.18**	**.59****
	9.	Je me concentre facilement. (I concentrate easily.)	.19**	.27**	.26**	.23**	**.62****

Note : *p<0.05; **p<0.01

MI= Motor Impulsiveness; CCI= Cognitive Complexity Impulsiveness; NI= Nonplanning Impulsiveness; FMI= Financial Management Impulsiveness; AI= Attentional Impulsiveness.

Discussion

In summary, while we were able to produce an adequate fit in our data after modifying the French version of the BIS-11[2] through item reduction, these results raise questions about the French translated version and suggest modifications to use it on non-clinical populations. Our four initial research questions were answered as follows. Firstly, eight items had to be removed from the BIS, for some or for all of the following reasons: content validity with interrater; low item-total correlations; low or complex factor loadings. Secondly, five impulsiveness factors were identified using oblique rotations. Three factors, motor impulsiveness, cognitive complexity and attentional impulsiveness, were partially consistent with initial findings of Patton & al. (1995)[1]. A fourth factor, financial management impulsiveness was created to emphasize the relation between items linked by their relation to money, which was not consistent with the initial theoretical position. A fifth factor was identified, non planning, which contains items that represent the second-order factor non planning, and is non consistent with initial conceptual operationalization. Thirdly, various index taken from confirmatory factor analysis suggested a good to excellent model fit in our sample. Finally, internal consistency assessed by Cronbach's Alpha suggested a satisfactory reliability.

Overall, the current study demonstrated that the factor structure of the French translation of the BIS-11 may be sample-dependent and that factors resulting may be influenced by cultural and language particularities. Some items removed were not relevant to our sample; for example, items about instability in jobs and housing were not relevant to young university students.

Given the difficulties in reproducing the factor structure, these results question the use of the traditional subscale scores in non-clinical French canadian populations. Identifying the factor structure was also a problem in other studies on translated version of the BIS-11, as explained by Stanford et al. (2009)[3]. Many studies demonstrated problems reproducing the factor structure in clinical samples[34-24-23-45]. However, the current study also questions the structure of impulsivity and Barratt's model in a non-clinical sample.

Nonetheless, this current study does illustrate that the BIS-11 is an internally reliable measure when applied to a non-clinical sample. Other studies on translated version of the BIS-11[46-47-48-49-32-50], also concluded in acceptable internal consistencies, as many studies demonstrated, similar.

Several limitations must be acknowledged. Firstly, the French translation of the BIS-11 is not yet officially validated, which prevented us from comparing our results and have more specific hypothesis. Secondly, students were recruited into their classrooms, and while they could easily decline to participate to our study, they still had to wait for the test administration to finish in order for the class to start. Maybe some of them did have low motivation in this testing. Lastly, we have not had already validated data on each student, preventing us to compare BIS-11 data with other impulsiveness measures.

Conclusion

To summarize, the current study suggests that, as mentioned in Whiteside & Lynam (2001)[51], the concept of impulsivity presents structural difficulties in measurement**.** There is some evi-

dence of a multi-dimensional structure, taking in consideration the actual collected items from the French translation were slightly altered, making it difficult to find a common no sology across samples. The current study also reminds us about the importance of exploring and confirming measure structure, rather than assuming that a published structure will automatically apply to any sample.

When applying our different suggestions on modifying the French translated version of the BIS-11, this instrument seems to be valid and should be used for research purposes, mainly on similar sample of university students.

Additional research should be performed involving clinical groups, such as people suffering from psychopathology linked with high impulsiveness trait in order to demonstrate how the French translation of the BIS-11 could be use in clinical and diagnosis context.

Finally, more research could also be done to assess psychometric properties of the Brazilian Portuguese translation of the BIS-11[52] and to continue work on obtaining psychometric data on different samples.

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