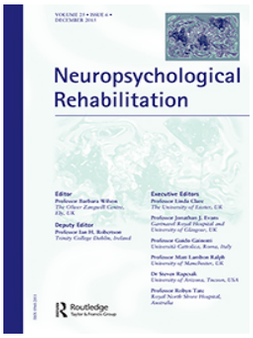

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Dysexecutive Questionnaire (DEX): Unrestricted structural analysis in large clinical and non-clinical samples

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The factorial structure of the Dysexecutive Questionnaire (DEX) is an unresolved issue in scientific literature. One-to-five-factor solutions have been found in several studies by applying different research methods. Only a few of these studies used appropriate analysis procedures to suit a Likert scale-type of answer or investigated large enough samples to ensure the stability of factorial solutions. The present study examines a sample of 2151 subjects, 1482 from the general population and 669 from a clinical population. An unrestricted factorial analysis was carried out on both samples. The results unequivocally point to a single-factor solution in both samples. This means that only one latent variable is displayed in the DEX, which accounts for symptoms of oversight malfunction in activities of daily living. It is concluded that the diversity of results previously obtained in other studies may be due to using research methods that depict Likert-type scales on a continuum when they are actually ordinal categorical measures. In conclusion, the DEX should be considered a screening test that reports symptoms of prefrontal malfunction, although it is unable to specify what areas or functions have been affected, as previous studies have claimed.

Keywords: Prefrontal cortex; Assessment; Construct validity; Activities of daily living; Executive dysfunction; Parallel analysis.

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INTRODUCTION

The Dysexecutive Questionnaire (DEX) is an inventory of cognitive, emotional and behavioural symptoms presented in day-to-day activities. It initially formed part of the BADS (Behavioural Assessment of the Dysexecutive Syndrome; Wilson, Alderman, Burgess, Emslie, & Evans, 1996), a battery of tests designed to evaluate the effects of the dysexecutive syndrome. Such syndrome is a cluster of impairments generally associated with damage to the frontal lobes, including difficulty engaging in high-level tasks such as planning, organising, initiating, maintaining and adapting behaviours. This battery of tests was presented as a more ecological alternative to classic neuropsychological tests. The DEX was designed to indicate how behavioural symptoms associated with frontal system dysfunction may manifest. Since then, the DEX has been used to test many neurobehavioural alterations, from brain damage (e.g., Quinn et al., 2014) to schizophrenia (Chan & Chen, 2005) or substance addiction (Llanero-Luque et al., 2008), amongst many others.

Despite its varied uses in research and clinical fields, doubts remain over how to interpret the results obtained in the DEX, as different studies have found distinct structures in the questionnaire's factor analysis (Table 1). All the possibilities, ranging from one to five factors, have been found. Both clinical and non-clinical samples have been tested and several factor analysis strategies have been used, which contributed little to the factual knowledge about the test's structure. This study still debates whether the DEX is able to measure dysexecutive symptomatology as one latent construct, or whether it can find the syndrome's components by relating specific symptoms to different locations in the brain which develop functional specialisation. Alterations in motivation, such as apathy (which is associated with damage to the anterior cingulate circuit), disinhibited behaviour (associated with damage to the orbitofrontal circuit) and executive functions (associated with damage to the dorsolateral prefrontal circuit) can account for the so-called, although not universally accepted, dysexecutive syndrome (Stuss & Alexander, 2007). In addition, the results obtained in the DEX prove that the dysexecutive syndrome is not just a cognitive alteration, but that behavioural and emotional factors also play a role (Wilson, Alderman, Burgess, Emslie, & Evans, 2003).

Current studies about the DEX's factorial validity have, in most cases, used classic strategies to estimate the number of factors that should be kept for further analysis, such as principal component analysis (PCA), the Kaiser Criterion, the Scree-test, orthogonal rotations calculated using a Pearson correlation matrix, etc. These methods are usually inadequate in a test scored using a Likert-type scale, as the answers provide discrete ordinal data. These strategies benefit the emergence of factors that group items depending on their response distribution and not their content: The items that are easy to

TABLE 1
Several studies about DEX's factorial validity

Primary author	*Year*	*Population*	n	*Number of factors*	*Method*
Burgess	1998	Non-clinical; Clinical (several pathologies)	92+216	5	Classical: PCA, Varimax
Chan	2001	Non-clinical	93	5	Classical: PCA, Varimax
Amieva	2003	Non-clinical	20	5	Classical: PCA, Varimax
Wilson	2003	Clinical (several pathologies)	92	3	Unknown
Mooney	2006	Non-clinical; Clinical (drug abusers)	293+49	4	Classical: PAA, Varimax
Chaytor	2007	Clinical (several pathologies)	46	5	Classical: PCA, Varimax
Shinagawa	2007	Clinical: Alzheimer	122	3	Classical: PCA, Varimax
Gerstorf	2008	Non-clinical	1137	1	CFA
Bodenburg	2008	Clinical (ABI)	191	4	IRT
Pedrero-Pérez	2009	Non-clinical; Clinical (drug abusers)	131+127	4 ó 5	Classical: PCA, Scree-test, Varimax; CFA
Pedrero-Pérez	2011	Non-clinical	1013	2	Classical: MLA, PCA, Varimax, Parallel: Hull
Simblett	2011	Clinical (ABI)	363	3	IRT: Rasch
Luna-Lario	2012	Clinical (ABI)	119	5	Classical: PCA, Varimax
Takeuchi	2013	Non-clinical	303	1	Classical: Scree-test, Promax

PCA = Principal Component Analysis; PAA = Principle Axis Analysis; CFA = Confirmatory Factor Analysis; IRT = Item Response Theory; MLA = Maximum Likelihood Analysis; ABI = Acquired brain injury.

answer tend to form different factors to those formed by difficult items, even when all the items measure the same unidimensional latent variable (Nunnaly & Bernstein, 1994). The Kaiser Criterion is only useful when the sample size *n* tends to infinity. Moreover, the results obtained in a Scree-test are greatly subject to interpretation. Only two studies have been found to use methods based on the Item Response Theory, one of the recommended strategies for this type of test. The other alternative is to perform a factorial analysis using a polychoric correlation matrix (which is based on the assumption that response categories are estimates of normally distributed latent variables) when items are organised in ordinal categories, such as Likert-type scales (Panter, Swygert, Dahlstrom, & Tanaka, 1997). Polychoric correlation matrices are particularly relevant in certain situations, e.g., when several items exhibit kurtosis indexes greater than 1 (Ferrando & Lorenzo-Seva, 2014). Another problem that previous studies have in common is the usage of small samples, as factorial solutions vary when a few more subjects are added to the sample.

The present study aims to explore the structure of the DEX, applied to both clinical and non-clinical populations. The hypothesis holds that the scale is unidimensional, which will be tested using an unrestricted factor analysis strategy, controlling the items' distribution, using pertinent tests to estimate the latent dimensions, and comparing solutions by using the appropriate research methods. Large samples will be used in order to verify the reliability of the factorial solutions, comparing the results obtained in a clinical sample with those of a non-clinical one.

METHOD

Participants

The sample was formed by 2151 subjects, out of which 669 were at the preliminary phase of treatment for substance abuse-related problems in a community-based outpatient clinic specialised in treating addictive behaviours (CAD San Blas, Instituto de Adicciones de Madrid. Ayuntamiento de Madrid). In order to participate in the study, the clinical subjects had to abstain from taking any non-prescription drugs for at least two weeks before completing the questionnaire, which was part of a battery of psychometric tests. They received some support to help them cope with the two-week abstinence period prior to starting the treatment. Abstinence was verified through urine toxicology and breath alcohol tests. In addition, it was established that subjects had to meet the DSM-IV criteria for drug abuse of at least one substance at the time the treatment started. They were also informed of the clinical and research purposes of the study, as well as of their rights, in a signed consent form.

The rest of the sample was formed of 1482 subjects from a non-clinical population, who were recruited by neuropsychology postgraduate students. All of them took part altruistically. The students were instructed to ask people in their close environment to fill in the test, trying to make sure there was a wide variety of ages and education levels. All the participants had to complete the questionnaire, as well as a data collection form that contained variables such as age, gender, education level and whether or not they had ever received psychiatric or neurological treatment. Those who gave an affirmative answer to this last question were excluded from the sample. Table 2 shows the descriptive statistics of both subsamples.

Instrument

The Dysexecutive Questionnaire (DEX; Wilson et al., 1996), Spanish version (DEX-Sp; Llanero-Luque et al., 2008), is an inventory of 20 symptoms of malfunction in tasks related to daily living, which are associated with

TABLE 2
Descriptive statistics for the sample

	Non-clinical sample			*Clinical sample*		
Gender	*Males*	*Females*	*Total*	*Males*	*Females*	*Total*
	576	906	1482	512	157	669
Age						
Mean	36.4	35.9	36.1	37.1	37.3	37.1
SD	13.7	13.5	13.6	8.9	10.1	9.2
Range	18–78	18–78	18–78	18–67	19–66	18–67
Level of education						
Primary school	6.6%	5.4%	5.9%	20.3%	17.2%	19.6%
Secondary school	14.8%	11.5%	12.8%	36.1%	22.9%	33.0%
Further Education*	30.0%	24.7%	26.8%	30.5%	38.2%	32.3%
University	48.6%	58.4%	54.6%	13.1%	21.7%	15.1%
Main drug						
Heroine				14.1%	8.3%	12.7%
Cocaine				46.9%	38.9%	45.0%
Alcohol				34.2%	46.5%	37.1%
Cannabis				4.9%	6.4%	5.2%

*Sixth form or work-based training.

neuropsychological alterations presented in the dysexecutive syndrome. It is scored on a 5-point Likert scale ("Never", "Occasionally", "Sometimes", "Often", "Very often"). The DEX-Sp has shown an adequate internal consistency ($\alpha > .85$) and convergent validity (Pedrero-Pérez et al., 2009, 2011).

Procedure

An exploratory analysis was carried out using the FACTOR 9.2 program (Lorenzo-Seva & Ferrando, 2013). After exploring the distribution of the items, a polychoric correlation matrix among the 20 items was observed, verifying the multivariate normality by adopting Mardia's criterion (1970). Subsequently, two procedures were developed to estimate the number of remaining factors: A Minimum Average Partial test (MAP; Velicer, 1976) and an Optimal Parallel Analysis based on a minimum rank factor analysis (Timmerman & Lorenzo-Seva, 2011). An overall factor analysis and a Simplimax rotation were performed next (Kiers, 1994). The residues were analysed according to Kelley's criterion (1935) and simplicity indices were calculated (Lorenzo-Seva, 2003). Afterwards, a second order rotation was obtained by applying the Schmid-Leiman solution (Schmid & Leiman, 1957). Lastly, a bidimensional scaling plot that used the ALSCAL algorithm was elaborated in order to graphically represent the distance between items

(Figure 1). This procedure was applied, in the first instance, to the non-clinical sample, and was then repeated in the clinical sample.

RESULTS

Non-clinical sample

Descriptive statistics for each of the items of the DEX-Sp are shown in Table 3.

The observed distribution of items and sample size suggested using a non-linear analysis. Firstly, a matrix of polychoric correlations was performed among the 20 items, which was shaped into a multivariate normal distribution when applying Mardia's criterion ($p < .001$). In addition, the following measures verified the adequacy of the sample (Barlett 7354.7; g.l. = 190; $p < .001$; KMO = 0.92) .

Two procedures were then developed to estimate the number of remaining factors: a Minimum Average Partial (MAP) test and an Optimal Parallel Analysis. Both methods (Table 4) coincided in the unidimensionality of the scale.

The next step was to carry out an overall factor analysis, the results of which are shown in Table 5. The unifactorial solution explained only 56.1% of the common variance. This is not significant, since factorial solutions should account for more than 70% of the common variance in order to be accepted (Acito, Anderson, & Engledow, 1980). In this way, only three-factor to five-factor solutions would meet the criteria, the five-factor solution being the one accounting for a greater common variance, at 82.3%.

Table 6 shows factorial loads in solutions based on 1, 2, 3, 4 and 5 dimensions.

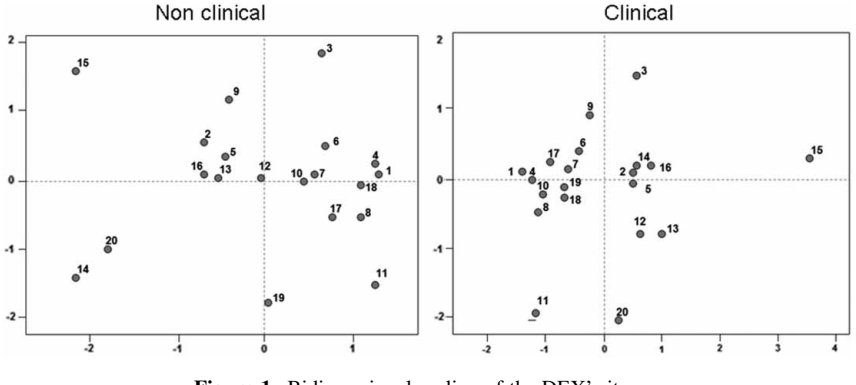

Figure 1. Bidimensional scaling of the DEX's items.

TABLE 3
Descriptive statistics for the items in the DEX-Sp (non-clinical population; $n = 1482$)

Item	*Mean*	*Median*	*CI 95%*	*Variance*	*Skewness*	*Kurtosis*	r_{it}
1	0.57	0	(0.52–0.62)	0.50	1.18	1.46	0.48
2	0.94	1	(0.88–1.00)	0.84	0.78	0.19	0.50
3	0.20	0	(0.17–0.24)	0.27	2.94	9.78	0.36
4	0.55	0	(0.49–0.60)	0.64	1.54	2.27	0.48
5	1.03	1	(0.97–1.09)	0.85	0.71	0.29	0.55
6	0.52	0	(0.47–0.57)	0.56	1.48	2.07	0.51
7	0.59	0	(0.53–0.65)	0.72	1.48	1.84	0.57
8	0.84	1	(0.78–0.90)	0.90	1.06	0.72	0.57
9	0.42	0	(0.37–0.47)	0.53	2.00	4.50	0.45
10	0.80	1	(0.74–0.86)	0.84	1.08	0.77	0.57
11	1.15	1	(1.08–1.22)	1.12	0.67	−0.23	0.39
12	1.18	1	(111–1.24)	0.99	0.76	0.31	0.54
13	0.89	1	(0.83–0.96)	0.91	0.92	0.27	0.51
14	1.47	1	(1.40–1.55)	1.42	0.50	−0.63	0.27
15	1.43	1	(1.35–1.51)	1.42	0.44	−0.73	0.27
16	0.94	1	(0.88 −1.00)	0.85	0.86	0.40	0.50
17	1.14	1	(1.07–1.21)	0,98	0.84	0.46	0.53
18	1.22	1	(1.15–1.29)	1.10	0.74	0.08	0.53
19	1.24	1	(1.17–1.31)	1.11	0.64	−0.14	0.41
20	1.06	1	(0.99–1.12)	1.05	0.76	−0.02	0.34

r_{it} = Correlation between an individual item and the total score on the test, once that item has been excluded.

Clinical population

The same procedure was followed for the clinical sample. The item's descriptive statistics are shown in Table 7. The observed characteristics of the items

TABLE 4
Procedures (MAP and Optimised Parallel Analysis) applied on the DEX-Sp's items (non-clinical population; $n = 1482$)

					Mean for random data	*95th percentile in random data*
Factors	*Eigenvalue*	*% explained variance*	*MAP*	*Real data*	*% explained variance*	
1	7.17	35.87	0.011*	42.5*	10.3	11.8
2	1.39	6.94	0.015	7.8	9.5	10.8
3	1.17	5.84	0.028	5.8	8.9	10.0
4	1.10	5.49	0.061	5.5	8.3	9.2
5	0.93	4.66	0.178	4.9	7.8	8.6

*Retained factor.

TABLE 5
Overall factorial data analysis (non-clinical population; $n = 1482$)

Factors	*Eigenvalue*	*% explained common variance*
1	6.81	56.06
2	1.00	8.21
3	0.79	6.47
4	0.72	5.92
5	0.68	5.60

also suggested using a nonlinear analysis approach in this case. The matrix of polychoric correlations was also shaped into a multivariate normal distribution (Mardia $p < .001$) and showed good sampling adequacy indexes (Barlett 4630.0; g.l. = 190; $p < .001$; KMO = 0.94). Both of the procedures used to estimate the number of appropriate items supported, once again, the unidimensionality of the scale (Table 8).

The unifactorial solution obtained from an overall factorial analysis only explained 58.5% of the common variance. Only the solutions with three- to five-factors were found to be significant. The five-factor solution explained 82.6% of the common variance (Table 9). Table 10 shows the items' load distribution in each factorial solution.

Bidimensional scaling

In order to visualise the distance between the items, a two-dimensional scaling was carried out using algorithms as indicated in the ALSCAL procedure. The adjustment indexes of the scaled matrix were acceptable in both samples (Stress = 0.20 and 0.21; RSQ = 0.81 and 0.83 in the non-clinical and clinical samples, respectively). Results are shown in Figure 1.

Second-order factor

A second rotation was performed by applying the Schmid-Leiman transformation, which was found viable in almost all the two- to four-factor solutions in both samples (second-order factor loadings > 0.060). Out of all of them, the two-factor solutions displayed the highest (> 0.80) and most homogeneous loads in both samples (Table 11).

DISCUSSION

Previous studies investigating the DEX's factorial structure have provided a wide array of solutions, the pentafactorial one being the most frequent. However, not all the studies that adopt this solution have

TABLE 6
Factorial solutions (non-clinical population; $n = 1482$)

	1 Factor	*2 Factors*		*3 Factors*			*4 Factors*				*5 Factors*				
Item	*1*	*1*	*2*	*1*	*2*	*3*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*5*
1	0.61	0.19	**0.48**	**0.79**	−0.05	0.19	0.38	−0.07	**0.53**	−0.01	0.36	0.17	0.00	0.04	**0.48**
2	0.59	**0.71**	−0.07	**0.51**	0.40	0.29	−0.04	−0.18	**0.63**	0.00	−0.01	**0.59**	0.05	0.44	−0.03
3	0.59	**0.46**	0.17	**0.98**	0.00	0.60	0.30	−0.35	**0.55**	0.03	0.00	**0.45**	−0.15	0.36	0.35
4	0.65	0.07	**0.61**	**0.64**	−0.02	−0.05	0.51	0.14	**0.52**	0.18	0.69	0.00	0.00	−0.48	**0.87**
5	0.64	**0.66**	0.02	**0.49**	0.40	0.19	−0.01	−0.12	**0.66**	0.01	0.00	**0.71**	0.33	0.26	0.00
6	0.66	0.36	0.36	**0.86**	0.04	0.32	0.31	−0.16	**0.60**	−0.02	0.23	0.33	0.00	0.20	**0.39**
7	0.70	0.28	**0.49**	**0.67**	0.12	0.03	0.31	0.04	**0.64**	0.02	**0.44**	0.26	0.12	0.00	0.42
8	0.69	−0.03	**0.78**	**0.56**	0.01	−0.26	0.36	0.22	**0.59**	−0.13	**0.71**	0.00	0.40	−0.31	**0.55**
9	0.61	**0.63**	0.02	**0.59**	0.32	0.30	0.04	−0.18	**0.63**	0.00	0.00	**0.57**	−0.05	0.49	0.04
10	0.66	0.36	0.36	**0.56**	0.22	0.02	0.17	0.02	**0.64**	−0.05	**0.35**	0.29	0.09	0.18	0.25
11	0.46	−0.04	**0.54**	0.21	0.08	**−0.36**	0.22	0.29	**0.39**	−0.01	**0.56**	0.00	0.32	−0.32	0.32
12	0.63	**0.49**	0.16	**0.39**	0.35	0.01	−0.03	−0.02	**0.62**	−0.11	0.00	0.78	**1.00**	0.00	−0.14
13	0.60	**0.46**	0.18	**0.38**	0.34	−0.01	0.12	0.08	**0.59**	0.19	0.31	**0.44**	0.12	0.01	0.16
14	0.33	**0.49**	−0.15	0.00	**0.45**	−0.04	−0.33	0.01	**0.41**	−0.14	0.00	0.37	0.00	**0.64**	−0.51
15	0.33	**0.52**	−0.18	0.15	**0.36**	0.12	0.03	0.00	0.38	**0.49**	−0.01	**0.56**	−0.02	0.00	0.00
16	0.58	**0.50**	0.12	0.38	**0.35**	0.04	0.00	−0.01	**0.59**	−0.02	0.18	0.38	0.00	**0.40**	0.00
17	0.65	0.27	**0.41**	**0.51**	0.17	−0.03	0.03	0.00	**0.61**	−0.38	0.37	0.00	0.00	**0.73**	0.00
18	0.62	0.02	**0.67**	**0.54**	0.02	−0.18	0.31	0.15	**0.54**	−0.12	**0.57**	−0.01	0.19	−0.07	0.45
19	0.47	0.16	**0.34**	0.02	0.32	**−0.42**	0.01	0.36	**0.46**	0.02	**0.66**	−0.01	0.00	0.00	0.00
20	0.40	**0.33**	0.08	−0.01	**0.40**	−0.23	−0.02	0.27	**0.42**	0.28	**0.49**	0.26	−0.09	−0.04	−0.13
eRMSR	0.061	0.046		0.039			0.032				0.031				
oRMSR	0.026	0.026		0.026			0.026				0.026				
Difference	*0.035*	*0.020*		*0.013*			*0.006*				*0.005*				
Bentler S Percentile		100		74			91				65				
LS Percentile		100		100			100				100				

eRMSR = Expected root mean square residuals; oRMSR = Observed root mean square residuals; Bentler S = Bentler's Simplicity Index; LS = Loading Simplicity Index. Primary loadings are highlighted in bold.

TABLE 7
Descriptive statistics for the items in the DEX-Sp (clinical population; $n = 669$)

Item	*Mean*	*Median*	*CI 95%*	*Variance*	*Skewness*	*Kurtosis*	r_{it}
1	0.84	1	(0.74–0.93)	0.94	1.02	0.52	0.47
2	1.63	2	(1.52–1.74)	1.31	0.32	−0.58	0.62
3	0.45	0	(0.37–0.53)	0.65	1.83	2.94	0.39
4	1.35	1	(1.24–1.47)	1.41	0.49	−0.70	0.61
5	1.55	2	(1.44–1.65)	1.17	0.26	−0.58	0.63
6	1.06	1	(0.95–1.18)	1.25	0.84	−0.13	0.59
7	1.55	1	(1.43–1.68)	1.56	0.37	−0.88	0.60
8	1.72	2	(1.60–1.84)	1.53	0.21	−0.93	0.62
9	0.58	0	(0.50–0.67)	0.73	1.50	1.93	0.48
10	1.40	1	(1.29–1.50)	1.19	0.47	−0.41	0.63
11	1.71	2	(1.59–1.84)	1.69	0.21	−1.04	0.36
12	1.53	1	(1.42–1.65)	1.27	0.40	−0.55	0.52
13	1.28	1	(1.18–1.39)	1.12	0.50	−0.42	0.45
14	1.32	1	(1.21–1.42)	1.12	0.43	−0.47	0.51
15	1.99	2	(1.87–2.12)	1.61	0.06	−1.04	0.17
16	1.70	2	(1.58–1.81)	1.31	0.26	−0.69	0.53
17	1.80	2	(1.69–1.92)	1.32	0.22	−0.68	0.62
18	1.82	2	(1.70–1.94)	1.39	0.21	−0.81	0.67
19	1.76	2	(1.64–1.87)	1.42	0.17	−0.83	0.65
20	1.56	2	(1.44–1.67)	1.35	0.31	−0.69	0.36

r_{it} = Correlation between an individual item and the total score on the test, once that item has been excluded.

TABLE 8
Procedures (MAP and Optimised Parallel Analysis) applied on the DEX-Sp's items (clinical population; $n = 669$)

				Real data	*Mean for random data*	*95th percentile in random data*
Factors	*Eigenvalue*	*% explained variance*	*MAP*	*% explained variance*		
1	7.14	35.70	0.011*	40.8*	10.0	11.4
2	1.45	7.27	0.014	7.9	9.4	10.5
3	1.12	5.62	0.029	6.0	8.8	9.8
4	1.09	5.44	0.066	5.2	8.3	9.2
5	0.90	4.52	0.202	4.9	7.7	8.5

*Retained factor.

found that the five factors are formed by the same items, neither have they found whether each factor is measuring the same construct. Moreover, they name each group of items in different ways depending on

TABLE 9
Overall factorial data analysis (clinical population; $n = 669$)

Factors	*Eigenvalue*	*% explained common variance*
1	6.75	58.51
2	1.05	9.12
3	0.69	5.95
4	0.59	5.10
5	0.45	3.90

their contents (Pedrero-Pérez et al., 2009). Such disparity of results is due to several limitations: using small samples that produce unstable factors, using inadequate analysis strategies, etc. As a consequence, the inventory's structure remains unknown. Despite this, it is still being widely used to test several neuropsychological alterations.

The present study has explored the DEX's structure without considering the scale as a continuum but rather as discrete ordinal variables, as is appropriate for a Likert-type scale (Holgado-Tello, Chacón-Moscoso, Barbero-García, & Vila-Abad, 2010).

Using a nonlinear analysis is often recommended for this type of testing, which consists of a matrix of polychoric correlations and adopts a nonlinear model based on the item response theory: Samejima's graded response model. Such a model presents some problems in its application despite being an advanced strategy (Ferrando & Lorenzo-Seva, 2014).

In this way, the number of underlying factors to extract from the matrix of polychoric correlations was determined through more appropriate methods than the traditional Scree-test and the Kaiser Criterion. Optimal Parallel Analysis and MAP have been found conclusive: The DEX is a unifactorial scale. This appears to be as obvious in the non-clinical sample as in the clinical sample, due to the fact that n is large enough to guarantee a consistency of results.

However, this alternative does not take into account a fair amount of information. Item 15 shows poor discriminative capacity and poor factor loading in both samples. This item seems to measure a different, although related, construct to the one measured by the rest of the items in the questionnaire. Hyperkinesia or motor hyperactivity may be a consequence of the lack of executive control, particularly when managing attention span. However, most likely it is not a direct manifestation of the dysexecutive syndrome. Item 15 has already proven to be problematic in previous studies (Pedrero-Pérez et al., 2009), although it should be noted that some authors found similar problems in other items too. For example, Mooney, Walmsley, and McFarland (2006) had problems with item 10, and Chan (2001) with items 6 and 10, which they eliminated from their studies. Nevertheless, such

TABLE 10
Factorial solutions (clinical population; $n = 669$)

	1 Factor	*2 Factors*		*3 Factors*			*4 Factors*				*5 Factors*				
Item	*1*	*1*	*2*	*1*	*2*	*3*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*5*
1	0.51	**0.53**	−0.05	0.32	0.00	**0.45**	**0.49**	0.38	0.19	0.14	−0.68	0.03	**1.25**	0.03	0.00
2	0.66	**0.59**	0.27	0.01	**0.73**	−0.12	0.00	−0.01	0.01	**0.69**	**1.06**	−0.08	−0.58	0.11	0.19
3	0.42	**0.38**	0.16	0.01	**0.30**	0.23	0.00	0.33	−0.01	**0.45**	0.00	−0.25	**0.44**	0.06	0.00
4	0.67	**0.74**	−0.20	**0.64**	−0.01	0.24	**0.74**	0.24	0.00	0.00	0.15	0.08	**0.69**	−0.01	−0.15
5	0.68	**0.58**	0.38	−0.14	**0.81**	0.02	0.00	0.00	0.29	**0.82**	**0.62**	0.00	−0.36	0.01	0.57
6	0.65	**0.64**	0.04	0.28	0.24	**0.32**	0.33	**0.40**	0.01	0.38	0.00	−0.22	**0.71**	0.00	−0.03
7	0.64	**0.64**	0.04	0.31	**0.37**	0.04	0.34	0.11	−0.02	**0.35**	**0.64**	−0.01	0.00	0.05	0.01
8	0.68	**0.74**	−0.19	**0.65**	0.13	0.01	**0.76**	−0.02	0.01	0.00	**0.70**	0.22	0.01	−0.06	0.00
9	0.52	**0.47**	0.21	−0.02	**0.40**	0.29	0.00	0.37	0.06	**0.58**	0.00	−0.36	**0.40**	−0.09	0.23
10	0.68	**0.68**	0.01	0.37	**0.39**	−0.03	**0.44**	0.01	0.03	0.31	**0.81**	0.08	−0.20	0.01	0.10
11	0.39	**0.41**	−0.05	**0.27**	0.02	0.26	**0.60**	0.00	0.46	0.00	−0.56	0.49	**0.75**	0.01	0.34
12	0.55	**0.45**	0.38	−0.22	**0.70**	0.12	0.08	−0.09	0.58	**0.71**	0.00	0.31	−0.07	−0.01	**0.86**
13	0.47	**0.39**	0.29	−0.14	**0.54**	0.11	0.00	0.06	0.28	**0.59**	0.11	0.07	0.06	0.08	**0.40**
14	0.54	**0.49**	0.21	0.03	**0.55**	−0.03	0.02	0.07	0.00	**0.55**	**0.69**	−0.04	−0.20	0.18	0.03
15	0.19	0.00	**0.68**	−0.80	**0.90**	−0.01	−0.81	0.07	0.22	**1.05**	0.00	0.00	0.00	**1.00**	0.00
16	0.56	**0.49**	0.28	−0.02	**0.81**	−0.37	−0.10	−0.22	−0.09	**0.66**	**1.67**	0.00	−1.29	0.16	0.15
17	0.69	**0.69**	0.02	0.40	**0.61**	−0.45	0.28	−0.27	−0.27	**0.36**	**1.96**	0.00	−1.32	0.00	0.00
18	0.72	**0.74**	−0.04	**0.47**	0.34	−0.02	**0.49**	0.07	−0.08	0.26	**0.86**	0.08	−0.05	0.12	−0.14
19	0.71	**0.76**	−0.14	**0.60**	0.21	0.00	**0.68**	0.01	−0.01	0.10	**0.76**	0.18	−0.01	0.00	−0.03
20	0.38	**0.34**	0.16	0.00	**0.36**	0.07	0.13	0.00	0.23	**0.36**	0.14	0.11	0.00	−0.01	**0.34**
eRMSR	0.059	0.045		0.037			0.030				0.026				
oRMSR	0.039	0.039		0.039			0.039				0.039				
Difference	*0.020*	*0.006*		*0.002*			*-0.009*				*-0.013*				
Bentler S Percentile		98		85			99				95				
LS Percentile		87		100			100				100				

eRMSR = Expected root mean square residuals; oRMSR = Observed root mean square residuals; Bentler S = Bentler's Simplicity Index; LS = Loading Simplicity Index. Primary loadings are highlighted in bold.

TABLE 11
Second rotation and second order factor of both samples's bifactorial solutions

	Non-clinical			*Clinical*		
Ítem	*F 1*	*F 2*	*G 1*	*F 1*	*F 2*	*G 1*
1	0.05	**0.16**	0.60	0.00	**0.18**	0.48
2	**0.42**	−0.06	0.51	**0.30**	0.08	0.60
3	**0.24**	0.04	0.54	**0.17**	0.06	0.38
4	−0.03	**0.21**	0.63	−0.12	**0.31**	0.66
5	**0.37**	−0.03	0.56	**0.38**	0.04	0.60
6	**0.16**	0.11	0.63	0.10	**0.18**	0.60
7	0.10	**0.16**	0.69	0.10	**0.18**	0.60
8	−0.11	**0.28**	0.71	−0.11	**0.31**	0.67
9	**0.36**	−0.02	0.54	**0.23**	0.07	0.47
10	**0.17**	0.11	0.63	0.08	**0.21**	0.64
11	−0.09	**0.19**	0.47	0.00	**0.14**	0.37
12	**0.26**	0.03	0.55	**0.35**	0.01	0.48
13	**0.24**	0.04	0.54	**0.29**	0.01	0.41
14	**0.30**	−0.08	0.26	**0.22**	0.08	0.49
15	**0.32**	−0.09	0.26	**0.46**	−0.18	0.13
16	**0.27**	0.02	0.52	**0.30**	0.04	0.51
17	0.10	**0.13**	0.60	0.11	**0.19**	0.63
18	−0.07	**0.23**	0.63	0.03	**0.25**	0.68
19	0.05	**0.11**	0.44	−0.04	**0.29**	0.69
20	**0.18**	0.01	0.35	**0.17**	0.04	0.34

Primary loadings are highlighted in bold.

authors did not control the peculiar distribution of some items. Item 15 follows a distinctively platykurtic distribution in both samples and, as shown in Figure 1, is positioned far away from the rest of the items. This occurs regardless of what sample is being studied.

The five-factor solutions found in the present study show random clusters of items and abnormal factor loadings which are completely different between the samples, including factors in which only one or none of the items loaded mainly on them. The four-factor solution in the non-clinical sample consists of a unifactorial solution that has excluded item 15 (same as the two-factor one in the non-clinical sample), whilst the clinical population presents a two-factor cluster and two empty factors. The rest of the two-factor and three-factor solutions are not congruent or interpretable. Moreover, they are completely different in both subsamples.

Another piece of evidence for DEX's unifactoriality is the second order rotation, which provides a similar solution in both samples and includes the residues generated by solutions with more than one factor in a communal

dimension. Such supra-factor represents the most congruent solution, leaving item 15 with an excessively low load once more.

In conclusion, the present study has found that the DEX measures only one latent construct, which may be called the dysexecutive syndrome. It should be considered a screening test that ratifies prefrontal cortex malfunctioning based on cognitive and emotional symptoms responsible for modifying the effectiveness of behaviour in everyday situations. On the other hand, it provides little evidence of which components play a bigger role in such behaviour. Previous studies exhibit important limitations in their analytical strategies, which have revealed a disparity of conclusions. The present study has adopted an appropriate strategy given the answer options in the test, and has used large samples of clinical and non-clinical populations.

The DEX has proved to be very useful in clinical fields and has shown a significant psychometric consistency in the present study, although it would improve if some items were deleted (item 15, to be precise), but it does not allow us to explore causes or components of brain function that are responsible for dysexecutive behaviour in detail, as some of these are under-represented in the 20-item battery. In order to complete this task, there are other tests available that are more detailed and complex (e.g., the *Frontal Systems Behavior Scale*, Grace & Malloy, 2001; the *Prefrontal Symptoms Inventory*, Ruiz-Sánchez de León et al., 2012). However, such tests lack the parsimony and simplicity of the DEX.

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