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## **The Wisconsin Card Sorting Test in the detection of personality disorders**

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### **ABSTRACT**

The official categories of personality disorders were debated entities in the last decades, and researchers have used validity indicators for the proposed categories. Among other measures, the Wisconsin Card Sorting Test (WCST) has been an instrument mainly used in validation studies of the schizotypal personality disorder. The purpose of this study was to test the usefulness of the WCST to determine whether any personality disorder is present. The results indicate that only perseveration errors show sensibility for discriminating between presence or absence of a personality disorder; even that its specificity is doubtful. WCST measures, on the contrary, fail to show significant differences among the categories of personality disorders.

*Key Words:* personality disorders, WCST, assessment, psychopathology

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### **INTRODUCTION**

There have been many attempts to describe the biological bases of both normal personality and personality disorders (Cloninger, 1986; Eysenck, 1967, 1986; Gray, 1970; Zuckerman, 1999). Eysenck (1967; 1986) stated that the differences between introverted and extraverted people resulted from the innate impulse of compensation of the reticular-thalamic-cortical connections' hyper activation or sub activation, whereas Gray (1970; 1972) suggested that extraverted people have a lower activation level of the "behavioural inhibition system" than introverted people; a system that includes the ARAS, the frontal lobe, septal regions and the hippocampus. According to these models, introverted people apparently show a higher cortical activity than extraverted people, especially in the frontal lobes areas. Neuroimage techniques have recently allowed scientists to see the activity of cerebral blood flow in the performance of cognitive activities and have supported the above mentioned differences in brain activity. The relation between the extraversion dimension measured with the NEO-PI-R (Costa and McCrae, 1992) and the brain activity, observed through positron emission tomography (PET) and nuclear

magnetic resonance technique, was also analysed by Johnson and his collaborators, who did not find significant correlations between the extraversion / introversion dimension and the amount of cerebral blood flow as a whole, although in the analysis by zones they found that the prefrontal cortex, the Broca's area, the insular cortex, the right-side temporal cortex and the anterior nucleus of the thalamus correlated with introversion, whereas other cortical regions correlated with extraversion. Among these regions we find the anterior cingulate cortex, the right-side insular cortex, the right-side temporal lobes and the pulvinar nucleus of the thalamus (Johnson, Wiebe, Gold, Andreasen, Hichwa, Watkins and Ponto, 1999). Consequently, these authors concluded that there exists an increase of blood flow in the frontal lobe in introverted people. These findings support the biological theories of Eysenck and Gray. Other indicators, which have been used traditionally in the study of the personality and its disorders, have been the cognitive measures. The use of cognitive-type indicators can be employed to identify endophenotypes and to provide high rates of genotype similarity as regards personality disorders. To be precise, with the schizotypal, schizoid and paranoid personality disorders as well as in the identification of subjects at high risk for psychosis, many research studies have been carried out using evoked potentials, especially P50 and P300 waves and eye monitoring studies (Kwapil, Hegley, Chapman y Chapman, 1990;

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Myles-Worsley, 2004; Posner, Terrence, Reiman, Pardo and Dhawan, 1988).

In the schizotypal personality disorder not only it has been found the greatest number of neuropsychological dysfunctions compared to other abnormal personalities, but also it has been described brain morphological abnormalities such as the increase of lateral ventricule's volume and the decrease of brain volume (Frazier *et al.*, 1996; Siever *et al.*, 2002), especially when negative syntomatology is present. These characteristics have shown significant correlation with a worse premorbid adaptation and much more social and cognitive impairment in subjects with schizophrenia. It has been noticed that the P300 wave amplitude is lower in subjects with schizotypal personality disorder, especially in the left-side temporal lobe (Salisbury, Voglmaier, Seidman and McCarley, 1996).

Sustained attention has been other cognitive variable used as a possible indicator of a personality disorder. Among the various clinical categories of personality disorders, the schizotypal personality disorder presents the greatest number of alterations in the attentional component; whereas the performance in tasks such as the CPT (*Continuous Performance Test*) of subjects with other personality disorders, for instance borderline, histrionic and obsessive-compulsive, seems not to differ significantly from the performance shown by normal subjects (Cornblatt y Keilp, 1994).

Another cognitive variable that has been assessed in subjects with personality disorders is the cognitive capacity to learn concepts and the degree of flexibility in the shifting of direction of the answer. The schizotypal personality disorder has also been the most studied on this regard, in which it was noticed a worse performance in comparison with subjects who suffer from other personality disorders. Subjects with schizotypal tend to give more perseveration answers and

to make more omission errors. These differences have been observed in motor performance tests such as the *Trail Making Test*. Actually, the WCST (*Wisconsin Card Sorting Test*) has been the ultimate test used to assess the functioning of the frontal lobe in schizotypy and schizophrenia.

From the performing of this task by subjects with frontal lobe injuries, it could be noticed the role of this zone in the inhibition of answers and in the flexibility of behaviour. Comparatively poorer achievements than the ones observed in normal subjects or subjects diagnosed with any type of personality disorder have been also found in schizotypal and schizophrenic subjects as well as in healthy relatives. For this reason, this test is included among the neuropsychological tests used for the study of vulnerability indicators to the schizophrenia spectrum disorders.

The aim of this study was to explore the usefulness of the WCST to discriminate between subjects who present a personality disorder and subjects who do not and, mainly, the value of this instrument to predict the existence of personality disorders. Taking into account that the frontal executive functions determine reasoning, the capacity of planning and self-control of behaviour being in the base of stable characteristics of the personality, the purpose of this study is to confirm the existence of considerable differences in these functions in the different abnormal personalities.

Presenting this in other way, the study intends to investigate whether it is possible to find any cognitive indicator that allows the formulation of external validity of personality disorders, or whether the existence of a personality disorder is associated with determined cognitive correlates.

Personality Disorder	n (%)
Cluster A:	8 (21.62)
Paranoid	0 (0)
Schizoid	7(18.92)
Schizotypal	1 (2.7)
Cluster B:	13 (35.13)
Borderline	5 (13.2)
Antisocial	1 (2.6)
Histrionic	5 (13.2)
Narcissistic	2 (5.40)
Cluster C:	13 (35.13)
Obsessive-Compulsive	4 (10.81)
Dependent	6 (16.22)
Avoidant	3 (8.11)
Others (passive- aggressive, non-specified)	3 (8.11)
Total Sample:	37

Table 1. Clinical Diagnoses (DSM-IV) of the experimental group

## METHOD

### Participants

The participants in this study were chosen from two sources: on the one hand, 37 patients

diagnosed with any personality disorder in the Health Mental Services of the Principality of Asturias (Table 1) and, on the other hand, 17 subjects without any psychopathology of the general population (although, as it is stated in the results section, two subjects of this

group had to be excluded). These two groups are the experimental group and the control group, respectively. The difference in size between the samples has to do with a greater difficulty for finding a sample of adults, most of them professionals of the sanitary and university services and students who would participate ad honorem and voluntarily.

The criteria of exclusion for the experimental group were an inferior age of 17, the presence of chronic abuse of substances or the existence of any organic brain disorder. On the other hand, all the subjects were not under any psychotropic medication during the period of the study.

As regards the control group, the mean age was of 29.06 (D.T.=7.45) with 29.4% of men and 70.6% of women; 88.2% of them were single and 11.8%, married; 41.2% had a secondary school diploma, followed by 35.3% who had graduate studies, 17.6% were developing their careers and 5.9% had a school diploma; 64.7% worked regularly outside their homes, 29.4% were students and 5.9% were unemployed.

In the experimental group, the mean age was of 34.16 (D.T.=10.29), with 39.5% men and 60.5% women; 65.8% were single or divorced and 34.2% were married; 36.8% did not receive formal education or they did not finish school, 55.3% had a secondary school diploma and 7.9% had university studies. Regarding their occupations, 57.9% worked outside their homes, 13.2% were housewives, 13.2% were students and 15.8% were unemployed or retired people.

As far as the literacy level is concerned, there were statistically significant differences ( $\chi^2 = 9.54$ ;  $p < .01$ ). In the control group, subjects were grouped according to higher levels of literacy (secondary school and university studies) whereas in the group with personality disorder, the levels of primary and secondary school graduate were considered.

#### *Instruments*

1. Millon Clinical Multiaxial Inventory-II (MCMI-II), (Millon, 1997), questionnaire that encompasses the totality of personality disorders recorded in the DSM-III-R. It is formed by 175 items with two possible answers (T and F), which integrate in two groups of scales: Basic Scales and Clinical Syndromes of moderate severity

2. The Wisconsin Card Sorting Test (WCST) (Grant y Berg, 1948; Heaton, 1981), designed to evaluate abstract cognitive function and in which the classification of cards using three criteria initially unknown (colour, shape and number) is required. The test had 6 categories, each category had 10 correct answers and the classification criterion was not changed until 10 correct answers were obtained. The computer version of the WCST, included in the package STIM (NeuroScan, 1995), in which a subject received auditive and visual feedback to indicate him or her that his or her answer was correct or incorrect, as a way of learning for a future decision. This computer version provides three types of global results: the number of correct answers, the number of errors and the number of categories which have been completed. Perseveration errors were obtained by manual calculation following the instructions of the WCST manual published by TEA (Heaton, Chelune, Talley, Kay y Curtiss, 2001).

#### **Procedure**

The study was carried out in two centres, according to the moment of the investigation. The first phase was done in a Mental Health Centre, where patients were met for the first time. In collaboration with the clinician responsible for the case and with the consent of the chief clinician of the Service Area, each patient and a relative were summoned to perform the first assessment of his or her diagnosis. The second phase was carried out with each of the patients in the study through an individual appointment previously made, in the laboratories of the Faculty of Psychology, Oviedo University. In a well-lit booth and with room sound control, different neuropsychological tests, from which the WCST was part of, were administered.

The same order in the application of the tests was followed with the control group, with the exception that the relatives did not provide measures. The professional sample for this group was recruited from the implementing or member staff of the Mental Health Services and the Faculty of Psychology. They were informed about the purpose of the investigation and the presence of psychological disorders was eliminated through an interview.

Both groups performed all the tests which were included in the study in the presence of the first author of this work (M.I.C.); an experienced professional in the field of research.

#### **RESULTS**

Previous to the presentation of the results, it must be explained that from the control group, two subjects were excluded due to the extreme scores obtained in the WCST test. The results in these two subjects were defined as "outliers".

Firstly, the distribution of the variables with the Kolmogorov-Smirnov test was explored and it was found that the age, the number of total errors and the number of perseveration errors made in the WCST test shown a normal distribution; whereas the number of categories completed and the correct answers in the WCST did not have a normal distribution ( $p < .001$ ). Due to this result and because of the difference in the number of subjects in the two groups, it was considered more appropriate to use nonparametric tests for the analysis.

The first step was to observe the tendencies in the results and, for this purpose, a Spearman correlation with all the data from the WCST was carried out. As it can be seen in Table 2, there exists a inverse correlation between the positive results (correct answers and number of categories completed) and the negative results (total errors in the test and perseveration errors). At the same time, positive and negative correlations between total errors and perseveration errors were found ( $r_s = .83$ ;  $p < .001$ ).

In the comparison between the variables per each group, it can be noticed that statistically significant differences were found only between subjects with a personality disorder and subjects without a clinical diagnosis of total errors ( $U=179.5$ ;  $p=.05$ ); and in perseveration errors ( $U=174.5$ ,  $p<.05$ ) (Table 3). However, with stricter criteria applying the Bonferroni Correction, such differences stop being statistically significant in the four comparisons carried out.

	Categories completed	Total Errors	Perseveration Errors
Correct Responses	.99	-.80	-.59
Categories completed		-.79	-.56
Total Errors			.83

Table 2. Spearman Correlations between the WCST measures

	Groups				Contrastive Test	
	Group without personality disorder (n = 15)		Group with personality disorder (n = 37)			
WCST	Media	D. Tipica	Media	D. Tipica	U	Significance level
Correct Responses	59.20	2.11	56.19	6.33	210	.09
Categories completed	5.67	1.05	5.43	.83	219.5	.14
Total Errors	35.93	18.44	48.11	20.03	179.5	.05
Perseveration Errors	10.47	7.42	18.32	12.37	174.5	.03

Table 3. Between-groups differences in the WCST measures. Initial signification level= 0.05. Bonferroni correction (0.05/4) = 0.0125.

Thirdly, a comparative analysis was performed to explore whether statistically significant differences existed among the examined subjects, taking as a grouping variable the diagnosis obtained in the MCMI-II questionnaire and ignoring the clinical group from which it was derived. For this reason, the achievement of a Base Rate over 85 in any of the basic scales of this test was taken as a psychometric diagnosis of personality disorder. Using the Kruskal-Wallis nonparametric test, it was proved that there were no statistically significant differences among the various personality disorders. In spite of this, outstanding

tendencies were observed in the mean of perseveration errors between diagnostic groups, that can be taken into account clinically speaking. Thus, the number of perseveration errors may reflect the degree of control at a cognitive or behavioural level, associated with each pathological scale of the MCMI-II, with the following order: paranoid personality disorder (mean=24), dependent personality disorder (mean=20), obsessive-compulsive personality disorder (mean=19.40) and narcissistic personality disorder (mean=17).

Variables	Weight	S.E.	Wald	g.l.	Sig	R	Exp(B)
Perseveration Errors	.08	.04	4.62	1	.03	.2	1.09
Constant	-.28	.57	.24	1	.62		

Table 4. Logistic regression to determine the predictive power of the WCST as regards the existence or non-existence of a personality disorder

Finally, a logistic regression analysis was carried out to determine the value of the WCST in predicting a personality disorder; taking as predictors the four measures of the WCST and as dependent variable the existence or non-existence of a personality disorder. Results indicate that perseveration errors are

the only measure of this test which were useful to classify the subjects correctly (Table 4).

## DISCUSSION

Taking into account the preceding analysis, it can be asserted that perseveration errors of the WCST test are the only indicator that discriminates between subjects who have received personality disorder from the normal controls. This finding reveals that perseveration errors might be an indicator sensitive to the presence of any personality disorder. Another issue, however, is whether such cognitive indicator is a specific marker of these disorders or whether it reflects

a broader pathology. While the results show certain sensitivity to this measure, they clearly do not guarantee its specificity. To value this aspect, it must have been necessary to enlarge the study to other clinical categories.

Another conclusion drawn from the study is that the comparison between the diagnosis based on the scales MCMI-II does not provide significant differences in the measures of the WCST; which possibly questions the construct validity of the personality disorders

categories. Such aspect, however, has been recently criticised by many professionals and researchers. Widiger (1993), for example, considers that the lack of construct validity of the current personality disorders of the DSM (American Psychiatric Association, 1995) may be partly due to the absence of a theoretical model which can be used as a fundamental for them; so that the result of the current taxonomy is its poor discriminating validity and the low reliability test-retest seen in the assessment of such clinical categories; the high comorbidity found; an artificial dichotomy of the traits which are of a sustained nature in terms of present or absent diagnostic criteria; and the doubtful consistency of the three clusters proposed by the DSM-IV (Blais y Norman, 1997; Westen, 1997; Zimmerman, 1994). In fact, the DSM-IV Axis II is a hybrid derived from the clinical observations and the research, where diagnostic criteria relative to the cognitions, affectivity, the interpersonal functioning or to the impulse control are simultaneously dealt with; but without an underlying theoretical model (O'Connor y Dyce, 1998; Tyrer, 1995).

Without having significant differences, however, the results have a tendency to show more perseveration errors in the WCST in subjects who have the highest scores in the MCMI-II scales, who seem to represent a bigger component of obsessive traits and a higher control of their thoughts and behaviour. Thus, persons with paranoid personality disorder showed a higher number of perseveration errors, followed by the dependent and the obsessive-compulsive, with slight differences between the last two. As regards the paranoid personality disorder, it was found that thoughts described in these subjects ("feeling resentful for a long time, for instance, they do not forget insults, lies or disdain; they constantly suspect without any proof that their spouse or partner is unfaithful, etc.") are depicted as obsessive and persistent ideas. This characteristic is closely related to the obsessive-compulsive personality disorder. Many researchers interested in the factorial structure of the personality disorders found an obsessive or "anancastic" factor (Mulder and Joyce, 1997; Parker, 1998; Parker and Barret, 2000; Parker *et al.*, 1998; Tyrer and Alexander, 1979), characterized by traits of rigidity and conscientiousness, which is present in both personality disorders.

On the other hand, subjects with borderline and antisocial characteristics in the MCMI-II made the lowest number of perseveration errors, being this theoretically consistent with a higher impulsivity and cognitive and emotional instability. Although this finding is mainly an intuitive and exploratory datum, it is presented as a possible hypothesis for future work: considering perseveration errors as another indicator to describe the trait of control of cognitions, emotions and behaviour which can be found in some personality disorders, together with the persistence component in keeping the same answer with different situations.

As it has been previously highlighted, the majority of the investigations carried out using the WCST have focus on the schizotypal personality disorder. Battaglia and collaborators concluded that this instrument is useful as an indicator of the psychological state of a person, but it cannot be considered a marker of vulnerability to develop a schizophrenic spectrum disorder (Battaglia, Abbruzzese, Ferri, Scarone,

Bellodi y Smeraldi, 1994). Nevertheless, it seems more consistent the relation between negative symptomatology of the schizotypal personality disorder and a worse performance in the WCST (Diforio, Walker and Kestler, 2000; Gooding, Tallent and Hegyi, 2001; Lemos-Giráldez, Inda-Caro, López-Rodrigo, Paíno-Piñeiro and Besteiro-González, 2000). Adolescents who mainly show traits of social anhedonia, absence of emotions and isolation tend to make more errors in this test; whereas with positive symptoms of this disorder is statistically significant. Perseveration errors also seem to be much more frequent in first-degree relatives of patients with schizophrenia, which usually present social anhedonia traits (Franke, Maier, Hardt and Hain, 1993; Laurent *et al.*, 2001).

From these findings, the WCST is an instrument which has been useful to explore the prefrontal lobe functions and its relation with the vulnerability to the schizophrenic spectrum disorders. Raine and collaborators found a smaller volume of grey matter in the prefrontal lobe and a worse performance in the WCST and in the CPT (*Continuous Performance Test*) in subjects with a diagnosis of schizotypal or paranoid personality disorder (Raine, Lencz, Yarialian, Bihrlé, LaCasse, Ventura y Colletti, 2002).

To conclude, it is important to mention that this research has several limitations; one of them is the difference in size between the control group and the experimental group. Another shortcoming is the limited number of subjects with a personality disorder diagnosis, which hampered the making of consistent comparisons between the different categories. However, the aim of this study was to determine whether it was possible to establish differences between normal and pathological personalities by using a neuropsychological indicator such as the WCST; assessing the personality from a purely psychometric view. Another pending aim will be to regroup the disorders according to the Millon model, in which basic and severe personalities are described. Derived from this limitation, it is important to highlight that subjects with combined peaks in the result of the Millon test were found within the personality disorders group, considering this a critical aspect which is added to the validity of the classification of personality disorders. The authors considered only one diagnosis, for this reason the diagnosis carried out by a clinician in the previous appointments was considered as additional information. Nevertheless, the results obtained in this study support the criticisms as regards the construct validity of the diagnostic criteria currently used.

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