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COGNITIVE FEATURES OF SCHIZOTYPAL PERSONALITY

P.C. Martínez Suárez, S. Lemos Giráldez, M. Inda Caro, M. Paino Piñeiro and A. López-Rodrigo
Universidad de Oviedo

This paper examines the relationship between schizotypal personality and high-risk neuropsychological markers for schizophrenia. The sample consisted of 726 subjects, aged 14 to 20, divided into two groups according to schizotypal level (measured by the Multidimensional Schizotypal Traits Questionnaire, MSTQ). Four cut-off points (centiles 15-85 and 5-95) were chosen as grouping criteria. A comparison of the two groups was made by computing errors in several cognitive tasks (Category Test, CAT; Word Recognition Test, TRP; Visual Working Memory Task, PVMO-1; and Working Memory Verbal Task, PVMO-2). No significant differences were found between the two groups for the first cut-off point (15%). However, significant differences were found for the second cut-off point (5%) in two tasks (TRP and PVMO-1).

El presente trabajo estudia la relación entre personalidad esquizotípica e indicadores neuropsicológicos de alto-riesgo de esquizofrenia. La muestra inicial la formaron 726 sujetos (14-20 años) los cuáles fueron divididos en dos grupos según su nivel de esquizotipia (Multidimensional Schizotypal Traits Questionnaire; MSTQ). Como criterios de agrupamiento se tomaron los puntos de corte correspondientes o los centiles 15-85 y 5-95 en MSTQ. Se computaron los errores en varias tareas cognítivas (Category Test, CAT; Test de Reconocimiento de Palabras, TRP; Prueba Visual de Memoria Operativa, PVMO-1 y Prueba Verbal de Memoria Operativa, PVMO-2) con el fin de comparar ambos grupos. Pero el primer punto de corte (15%), de las comparaciones realizadas entre ambos grupos (esquizotípicos-no esquizotípicos) no se obtuvieron diferencias significativas pero ninguna de las tareas. Paro el segundo punto de corte (5%), se constataron diferencias significativas en dos de las tareas (TRP y PVM0-1).

The fundamental role of personality in the onset and prevention of schizophrenia is still not known. Although some features of the schizotypal and/or paranoid personality (APA, 1992) are occasionally considered to be predisposing factors, neither all schizophrenics have an altered pre-morbid personality, nor all those that present personality disorders within the schizophrenic spectrum go on to develop the illness. Thus, the search for indicators of external validation that might throw some light on the matter (Godoy, Muela, Sánchez-Barrera, Sánchez-Huete *et al.*, 1995). This may explain why the literature on schizophrenia and information processing has increased so much in recent years (Gray *et al.*, 1991; Frith, 1992; David & Cutting, 1994). Less abundant is research on the application of these indicators in the schizotypal population (Goldberg and Gold, 1995). Indeed, the study of the cognitive functioning of schizotypal subjects has been determined by cognitive markers of vulnerability to schizophrenia (Nuechterlein, Buchsbaum and Dawson, 1994). The theoretical framework of information processing has led to an enormous proliferation of markers in this line (Ruiz-Vargas, 1987; Baños, 1989; Frith, 1992). Thus, the most studied processes have been: sustained attention, frontal executive functions and, recently, working memory (Gray, Feldon, Rawlins and Smith, 1991; Siever, Bergman and Keefe, 1995; Goldberg and Gold, 1995).

Nevertheless, the incorporation of cognitive aspects into the concepts of schizophrenia and schizotype would seem to be definitive on analysing the situation from various perspectives:

First of all, the factor known as cognitive disorganisation forms part of the factorial structure of both the schizophrenia construct (Liddle, 1994; Peralta and Cuesta, 1996) and the schizotype construct (Rawlings and MacFarlane, 1994).

Secondly, the study of the cognitive functioning of schizophrenics and schizotypes has formed the basis for new rehabilitation programmes (Spaulding, Garbin and Dras, 1989; Bentall, 1996).

Thirdly, cognitive components are considered as external measures that are also used as predictors of social competence in schizophrenic type patients (van der Does, et al. 1993).

The present work seeks to check the relationship bet-

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Correspondence concerning this article should be addressed to Serafin Lemos Giraldez. *Facultad de Psicología. Universidad de Oviedo. Pza. Feijoo, s/n. 33003 Oviedo, Asturias. Spain.*
E-mail: slemos@sci.cpd.uniovi.es

ween classic cognitive markers (performance in frontality tasks) or others of more recent relevance (central control and working memory) and those schizotypal features which, according to DSM-III-R, are found in self-reports. On the basis of this relationship, we shall attempt to ascertain whether there are statistically significant differences between the group classified as schizotypal (based on the number of self-reported schizotypal experiences) and the non-schizotypal group.

There are some studies on categorisation with the WCST (Wisconsin Card Sorting Test) in schizotypal populations. Raine, Sheard, Reynolds and Lencz (1992) found differences between schizotypal and normal subjects in the number of correct classifications validated with the differences obtained through magnetic resonance, thus confirming the close relationship between schizotypes and prefrontal cortex also in schizotypes. Other studies have found statistically significant differences in the number of perseverations between schizotypes and control groups (Lyons, Merla, Young and Kremen, 1991; Battaglia, Abruzzese, Ferri and Scarone, 1994). In addition, studies such as those of Keefe, Silverman, Roitman and Harvey (1994), and Lenzenweger and Karfine (1994) appear to demonstrate the inability of schizotypal subjects to maintain criteria throughout the series. Finally, it should be highlighted that in a study carried out by Klonoff, Hutton and Fibiger (1970) with chronic schizophrenics, mention was made of the inability of these patients to make judgements in the solution of problems such as the CAT series.

Judging by the studies of Vázquez, López and Florit (1996), schizophrenics and those with similar disorders present disorders in recall memory but not in recognition memory, even though chronic schizophrenics may also present disorders in the latter type. According to Vázquez *et al.*, (1997) one could even speak of defective organisation of information and, above all, a fault in the ability to make evocative effort.

In the light of the research presented, it appears appropriate to examine the possible differences between schizotypal subjects and control groups in executive frontal tasks, recognition and recall, the last of these emulating the delayed memory tasks used to study working and/or functional memory. It is also worth bearing in mind the close relationship that exists between executive tasks of planning and categorisation and recall tasks of a working type (with an important attentional element), which have the prefrontal cortex as the common link.

Finally, we can justify the need to separate verbal memory from visual memory: according to recent findings by Vázquez *et al.* (1997), and previously by Ruiz-Vargas (1987), in disorders of the schizophrenic spectrum, verbal memory appears to be particularly deteriorated.

METHOD

SUBJECTS

726 secondary school students aged between 14 and 20 took part in the first phase of this study. 55.9% of them were female and 42.1% male. In a second phase, two groups were formed based on extreme scores in the schizotypal questionnaire –MSTQ– used as a grouping variable. The two groups were compared in four cognitive tests, corresponding to four sub-samples of 86, 87, 85 and 82 subjects, respectively. The composition of these sub-samples was very similar in terms of age, while in terms of the gender variable, the ratio was 1.8 : 1 in favour of women for all the sub-samples. The age range of 14 to 20 was maintained for the first and fourth sub-samples, with the range for the second and third sub-samples being 14 to 18. Mean ages were 15.57, 15.59, 15.49 and 15.56, respectively. Medians were maintained at 16 for the first two sub-samples and 15 for the remaining two. The modes were 14 for all the sub-samples except the first, whose mode was 16 years.

INSTRUMENTS

Rawlings and MacFarlane's Multi-dimensional Schizotypal Traits Questionnaire (MSTQ) of 1994 was employed. This test was originally composed of 95 dichotomic items taken from 8 independent scales.

Items that added nothing to the reliability of the research, thus being redundant, were eliminated, along with those inappropriate for an adolescent population. The resulting scale was one of 74 dichotomic items divided into 7 scales or sub-scales: perceptual aberration (unusual perceptual experiences, 13 items, $\propto$=0.60), magical ideation (superstitious thoughts, 13 items, $\propto$=0.33), cognitive disorganisation (concentration difficulties and attentional and/or memory disorders, 7 items, $\propto$=0.56), paranoid ideation (strange beliefs of a persecutory nature and experiences of passivity, 6 items, $\propto$=0.28), physical anhedonia (inability to feel physical pleasure, 14 items, $\propto$=0.47), social anhedonia (inability to enjoy social relationships, 8 items, $\propto$=0.20), and impulsive non-conformity (inability to control impulses and actions, 13 items, $\propto$=0.20).

Version 6.0 of the Category Test (CAT), distributed by MultiHealth Systems Inc., was also administered in the revised and abbreviated form of Russell and Levy (1987). It consists of 95 figures grouped in 6 subtests corresponding to 5 different classification criteria and 1

summary series that also assesses memory. This test was constructed by Halstead and Settlage (1943), and distributed by the Reitan Neuropsychological Laboratory in 1947. In its original form, it consists of 208 items. In this version, once the response has been emitted and cannot be modified, the person receives auditory feedback indicating whether the response is correct or not, and is given the opportunity to modify his/her response pattern for the following item. The type of items is very similar to other classification tests such as the WCST. For example, in the first series the classification criterion is "Roman numerals", so that the first stimulus of the series is a Roman "one" ("I") which the subject must associate with an Arabic number by pressing "1, 2, 3 or 4" according to the criterion (obviously "1" in this case). In a similar way number of elements, shapes, colours, odd man out and a summary series are used.

Estimated time for completing the test is 40 minutes, and this is reduced considerably for the abbreviated Russell-Levy version (7 minutes). The sum of the errors committed in each series gives the total number of errors for the CAT, which in the abbreviated version must be multiplied by 2.2 in order to obtain the errors predicted for the complete version. Further details of the programme can be found in Choca, Laatsch, Garside and Arnemann (1994).

The Visual Working Memory Test (PVMO-1) is a test in its validation phase produced by the present authors in the PASCAL computer programming language. It consists of 5 repeated series of 2, 3, 4, 5 and 6 screens, respectively, with a different number of blue and green circles. The subject is asked to give the number of circles per screen at the end of each series. For example, if 12 target circles (green in this case) appear on a screen, the subject, after counting them, presses a key to continue and another screen appears with 18 target circles. In the same way, on counting them, he/she presses a key and is immediately asked how many green circles there were in the first series (i.e., the first two screens). After this, another series of two screens appears and the subject is asked to recall the number of target circles in the second series (the last two screens, not the four that represent the two series). The test continues with a series of three screens, and the subject is asked to remember the number of target circles of this last series. The process continues in this way before ending with two series of 6 screens. The *number of errors* is obtained, an error being made when the number of circles the subject gives does not correspond to the actual number appearing on the screen.

In its verbal form (PVMO-2) the test was designed in the BASIC programming language. In this test, the subject has to complete sentences presented in successive series (each series consists of between 2 and 6 screens, and the same presentation procedure is followed as in the PVMO-1. Four types of error are obtained: *errors of omission:* when the subject does not recall the words uttered. *Errors of commission*: when the subject refers to a word not actually spoken. *Errors of order*: the subject remembers the words spoken, but in a different order. *Total errors*: the sum of the three errors mentioned above. The aim of the two test forms is to measure the capacity of the subject to store information for the period of time required to do the task (working memory).

The Word Recognition Test (TRP) aims to assess verbal control functions. In its first phase, the test consists of the subject having to type a word semantically related to that generated by the computer (the words generated by the computer are always the same for all subjects). The word typed in by the subject does not appear on the screen, as a visual reference (feedback) is considered to facilitate fixation and, in turn, recall (in this way the task is made more difficult and focuses exclusively on the motor-memory trace). In a second phase, the sixty words (30 generated by the computer and 30 by the subject) are presented randomly, so that the subject must recognise whether the word that appears on the screen has been generated by him/her (internal source) or by the computer (external source). The program allows the following errors to be obtained: a) internal attribution errors (IAE): words generated by the subject but attributed to the experimenter; b) external attribution errors (EAE): words generated by the experimenter which the subject attributes to himself/herself; and overall errors (OE): the sum of all erroneous attributions, irrespective of whether they are internal or external.

PROCEDURE

The MSTQ was administered collectively, though for practical reasons it was not possible to apply it to all 726 subjects at the same time. Therefore, 5 groups of 140 members were formed. Once corrections had been applied, the next step was to carry out the descriptive analyses, on the basis of which, the cut-off scores were obtained from the total score (TS) in the MSTQ. These scores corresponded to centile 85 and centile 15 (Total scores = 39 and 18, respectively). Next, the two study groups were formed: schizotypal (centile 85, T.S. = 39 or more) and control (centile 15, T.S. = 8 or less). The selected subjects, who participated voluntarily in this

phase, carried out the following tests: CAT, TRP, PVMO-2 and PVMO-1. All subjects carried out the tests in the same order; tests were administered using Olivetti PCs.

RESULTS

First of all, linear correlations were carried out between the parameters obtained in the cognitive tests and the direct scores for the MSTQ and each of its scales (Table 1). On the one hand, this was done in order to justify the use of "errors" as a parameter, given their simplicity and their important explanatory role in the interpretation of the results. In neuropsychology, errors are used as dependent variables because of their intuitive character when it comes to their interpretation and because of their explanatory value, given that poor functioning (the study of possible functional lesions or disorders) tends to be of more interest than efficiency or correct functioning. On the other hand, it should be pointed out that although the subjects making up the sample were preselected according to their MSTQ level, it was decided also to apply Pearson's correlation coefficient, given its robustness in the face of non-fulfilment of the parametric assumptions. There is, however, a risk of underestimating the value of the correlations, owing to the sample being composed of two supposedly homogenous groups, thereby restricting variability and consequently undermining the correlation.

As an introductory addendum to the explanation of the results, it should be made clear that not all the errors have the same value. For example, *a priori*, it would be plausible to expect that the schizophrenics would have more perseveration errors. That is, once a criterion has been chosen, they tend to continue with it come what may, regardless of whether it is correct or not. In other studies in which deterioration was not particularly serious and, therefore, the influence of the frontal lobe would not be great, it would appear to have been found that the difficulties lay precisely in keeping the correct criterion in mind ("on line"). Unfortunately, we cannot infer this from the present study, since only total errors were considered, with no detailed analysis of each error in every series (for reasons of procedure and workload). In the same way, it might be expected that patients with lesions of the frontal lobe would make more commission errors in the PVMO-2, that those with anxiety problems would commit more omission errors and that those with more cognitive disorganisation would make more errors of order. It would also be logical to expect schizotypes to have particular difficulties in the verbal test. All of this would be presupposed on the basis of the reviewed literature, to which we already referred in the introduction.

Given the theoretical framework and the methodological difficulties outlined above, we shall take levels $\propto$=0.10 to be acceptable. Bearing this in mind, we can observe several features worthy of comment in Table 1.

1) The number of errors in the frontality task (CAT) does not correlate significantly with any of the characteristics of the schizotypal personality measured by the MSTQ.
2) The number of errors in the word recognition task correlates positively (0.20 and 0.19) with the score in the subscale of cognitive disorganisation and impulsive non-conformity (p=0.10). There is also a positive correlation between errors in external attribution and the social anhedony subscale (0.18, p=0.10), and between errors in internal attribution and impulsive non-conformity (p=0.08).
3) With respect to the verbal test of working memory, there is a significant negative correlation (-0.22; p=0.05) between commission errors and the physical anhedony subscale. Errors of order correlate positively and significantly (0.20; p=0.07) with the paranoid ideation subscale.
4) In the visual working memory test, there is significant positive correlation between errors committed in the test and the impulsive non-conformity subscale (0.24; p=0.03).

DIFFERENCES IN THE CATEGORISATION TASK (CAT)

Taking as the experimental or schizotypal group those subjects with a score higher than or equal to centile-85 (direct score, d.s. = 39) in the MSTQ, and as the control or non-schizotypal group those with a score equal to or lower than centile-15 (d.s.=23), we find the following:

1) A positive (in favour of females) and statistically significant correlation of 0.20 (p=0.05) between gender and total number of errors in the CAT. For this reason, it was decided to carry out an overall analysis and an analysis by gender;
2) No statistically significant differences were found between the two groups with regard to total number of errors;
3) The direction of the means shows a greater number of errors for the control group and greater variability both in the overall sample and in the samples of men and women.

Taking as the experimental group those subjects with MSTQ scores greater than or equal to centile-95 (d.s.=42), and as the control group those with an

MSTQ score equal to or lower than centile-5 (d.s.=18), we find:

1) There are no significant differences between the groups for total number of errors considering the overall sample and the sample of males;
2) There are significant differences between the groups for total number of errors considering the sample of females (Table 2).

DIFFERENCES IN THE MONITORING TASK (TRP)

Taking as the experimental group those subjects with MSTQ scores higher than or equal to centile-85 (d.s.=39), and as the control group those with MSTQ scores lower than or equal to centile-15 (d.s.=23), we find:

1) There are no statistically significant differences for any of the variables studied;
2) The average number of total errors, internal attribution errors and external attribution errors is greater in the control group, as is variability. Also, it should be pointed out that the average number of internal attribution errors is slightly lower than that of external attribution errors for both groups, especially for the experimental group.

Taking as the experimental group those subjects with MSTQ scores higher than or equal to centile-95 (d.s.=42) and as the control group those with an MSTQ score of lower than or equal to centile-5 (d.s.=18), we find:

1) There are no statistically significant differences for any of the variables studied;
2) With respect to internal attribution errors, the differences may be significant if we take the value of $\propto = 0.10$ (Table 2).
3) The direction of the means indicates a higher average of total errors, internal attribution errors and external attribution errors for the experimental group. In addition, greater variability is observed, except for external attribution errors.

DIFFERENCES IN THE VERBAL WORKING MEMORY TEST (PVMO-2)

Taking as the experimental group those subjects with MSTQ scores higher than or equal to centile-85 (d.s.=39), and as the control group those with MSTQ scores lower than or equal to centile-15 (d.s.=23), we find:

1) There are no statistically significant differences for any of the variables studied;
2) The averages in all error types (except commission errors) are greater for the experimental group.

Similarly, variability is greater for this group, except for total errors.

DIFFERENCES IN THE VISUAL WORKING

TABLE 1
Matrix of correlations between dependent variables of the cognitive tasks (CAT, TRP, PVMO-2 and PVMO-1) and the grouping variable (MSTQ self-report), divided into subscales (N=82)

		D.S. MSTQ	Perceptual aberration	Paranoid ideation	Magical ideation	Cognitive disorganisation	Physical anhedonia	Social anhedonia	Impulsive non-conformity
CAT	Errors	-0.5	-0.9	-0.06	0.004	-0.11	0.02	-0.14	0.04
TRP	Errors	0.16	0.12	0.17	0.06	0.20 p=0.07	0.04	0.17	0.19 p=0.09
	External attribn. errors	0.17	0.15	-0.01	0.07	0.17	0.10	0.18 p=0.10	0.14
	Internal attribn. errors	0.11	0.05	-0.01	0.04	0.19	-0.04	0.10	0.20 p=0.08
PVMO-2	Errors	0.06	0.05	0.04	0.05	0.18	-0.14	-0.007	0.08
	Omission errors	0.08	0.05	-0.03	-0.01	0.17	0.04	0.06	0.12
	Commission errors	-0.07	-0.01	-0.004	0.01	-0.003	-0.22* p=0.05	-0.10	-0.08
	Order errors	0.13	0.04	0.20 p=0.07	0.08	0.14	-0.02	0.08	0.13
PVMO-1	Errors	0.17	0.17	0.10	0.14	0.16	-0.18	0.06	0.24* p=0.03

* p 0.05 for the value obtained using Pearson's correlation coefficient.
** p 0.01
*** p 0.001

MEMORY TEST (PVMO-1)

Taking as the experimental group those subjects with MSTQ scores higher than or equal to centile-85 (d.s.=39), and as the control group those with MSTQ scores lower than or equal to centile-15 (d.s.=23), we find:

1) There are no statistically significant differences for the dependent variable studied;
2) The direction of the means indicates a higher average in the number of errors and a lower variability for the experimental group.

Taking as the experimental group those subjects with MSTQ scores higher than or equal to centile-95 (d.s.=42), and as the control group those with an MSTQ score lower than or equal to centile-5 (d.s.=18), we find:

1) The direction of the means indicates a higher average in the number of errors for the experimental group, the difference between this group and the control group being statistically significant for $\propto$=0.05 (Table 2);
2) The variability is lower for the experimental group.

DISCUSSION

With respect to performance in the frontality test (CAT), differences were observed in the sample of women (Table 2). Research carried out with categorisation tests on schizotypal populations are scarce (Battaglia et al., 1994; Lenzenweger and Korfine, 1994), and in any case show performances similar to those obtained from relatives of schizophrenics. In general, high-risk subjects present more perseveration and find it more difficult to maintain criteria than normal subjects. However, most studies have used the Wisconsin Card Sorting Test (WCST), and not the category test (CAT). In this respect, O'Donnell, MacGregor, Dabrowski et al. (1994), in a study on the validation of various neuropsychological tests, found that the WCST and CAT form a common factor, which they call "concept formation". One of the few studies that relates schizotypes with deficiencies in the CAT is that of McNiven and Finlayson (1993), who emphasise as good predictor a high score in the schizophrenia scale of the Minnesota Multiphasic Personality Inventory (MMPI). In our study, both in the case that the CAT test is related to the ability to maintain active information during the carrying out of a task, and in the case of its being related to concept formation, it cannot be concluded that those subjects of the adolescent population that self-report high numbers of schizotypal experiences have deficiencies in any of these aspects. In the analysis of correlations, moreover, it can be observed that there is no relationship whatsoever between errors in the CAT test and any schizotypal characteristics.

In the Word Recognition Test, error averages were higher for the schizotypal group, with no significant diffe-

TABLE 2
Comparison between study groups (high MSTQ – low MSTQ) in the cognitive tasks

		CUT-OFF POINT											
		Cut-off 1 = centile-15 (Group 1) vs. centile-85 (Group 2)						Cut-off 2 = centile-5 (Group 3) vs. centile-95 (Group 4)					
		Group 1			Group 2			Group 3			Group 4		
Task	D.V.	X	S_X	%	X	S_X	%	X	S_X	%	X	S_X	%
CAT	ERR[1]	29.61	13.36	31	26.93	12.39	28.34	25.45	12.93	26.78	31.45	12.18	33.1
TRP	ERR	6.57	4.84	10.95	5.35	4.19	8.91	5.68	4.91	9.46	7.73	4.49	12.8
	IAE[2]	3.27	2.72	10.9	2.55	2.17	8.5	2.42	2.21	8.06	3.95*	3.12	10.4
	EAE[3]	3.29	2.82	10.96	2.8	2.76	9.3	3.26	3.16	10.86	3.78	3.24	12.6
PVMO-2	ERR	13.92	7.65	34.8	14.47	7.22	36.17	12.36	7.09	30.9	14.49	8.24	36.2
	EOM[4]	6.25	5.8	15.62	6.97	6.4	17.42	5.42	5.36	13.55	5.78	6.39	14.4
	EC[5]	4.37	5.49	10.9	3.8	5.66	9.5	3.89	2.99	9.72	5.36	7.62	13.4
	EOR[6]	3.3	1.97	8.25	3.69	2.33	9.22	3.05	2.32	7.62	3.31	2.49	8.27
PVMO-1	ERR	10.05	8.53	25.12	11.6	8.03	28.25	10.21	10.11	25.52	12.33**	8.61	30.7

1 ERR: total errors in the test. 2 IEA: internal attribution errors. EAE: external attribution errors. 4. EOM: errors of omission. 5. EC: errors of commission. 6. EOR: errors of order.
*Significance at 0.10
**Significance at 0.05

rences for any of the variables. If we take ∝=0.10, it is observed that the two groups differ in internal attribution errors (IAE) (Table 2). It can be deduced from these results that there are deficiencies in the schizotypal population in terms of discrimination of stimulus source or in monitoring as Johnson and Raye (1981) conceives of it. The results can be interpreted in accordance with Frith's (1987) model. If schizotypal subjects make poor use of the information coming from internal feedback channels, i.e., if the motor traces that lead to the voluntary generation of the written word are not properly reactivated, the result will be a poorer performance when it comes to deciding whether the word has been generated or not. Furthermore, the correlation analyses indicate that the only correlations worth highlighting are produced with the factors corresponding to the cognitive and negative pole of schizotypal features.

As regards the Verbal Test of Working Memory, none of the dependent variables were found to be discriminative. If we bear in mind that the sub-samples were 90% to 95% made up of the same subjects, we can conclude from these results that difficulties in central control (meta-representation) do not appear to imply deficiencies in verbal working memory. Neither can it be deduced that there is any relationship between verbal working memory and frontality tasks, as Siever *et al*. (1995) argued. It is worth pointing out, though, that for the two cut-offs made, the direction of the means was as expected. That is, that although no statistically significant differences were found, the average of errors was higher for the schizotypal subjects than for the control group, (Table 2). From the correlation analyses it is found that this is the only test which has any relationship with positive schizotypal characteristics; specifically, order errors correlate 0.20 with the paranoid ideation subscale, and commission errors -0.22 with the physical anhedonia subscale.

In the Visual Test of Working Memory (PVMO), differences are observed between the two groups when the 5% of the sample that scored highest and lowest in the MSTQ questionnaire are selected (Table 2). The correlation analyses with respect to this test, only show significant positive correlation between total errors and the impulsive non-conformity subscale. It should be emphasised that recent studies (Park, Holzman and Lenzenweger, 1995; Lenzenweger and Korfine, 1994) indicate that poor performance in visual working memory tasks are normally associated with similar patterns in concept formation tests. One could, therefore, speak of a connection between frontality, working memory and meta-representation (Davis and Pratt, 1995). Finally, as alternative explanations for these results, the following could at least be considered:

a) This study deals with a population within an age range below that of the age of onset of the illness, and the age of maximum risk may be situated outside of this range.
b) The study deals with a normal population. For this reason there may be differences between it and those studies using schizotypal indicators that clearly mark psychopathological tendencies. Thus, the MMPI schizophrenia scale provides information on the risk of schizophrenia or relapse, whilst the MSTQ assesses schizotypal experiences occurring in a normal population.
c) The questionnaire used for assessing schizotypal features does not assess in depth those aspects more related to poorer premorbid adjustment. It concentrates more on characteristics related to positive symptoms that tend to appear abruptly in subjects with a good level of adaptation.
d) The classification criterion should be stricter. If we were to take a more restricted population margin, we would probably find differences more accentuated than around 15% or 5%.

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