IDENTIFICATION OF THE INFLUENCE OF IQ ON THEORY OF MIND SKILLS IN A GROUP OF SCHIZOPHRENICS

IDENTIFICACIÓN, EN LAS COMPETENCIAS DE LA TEORÍA DE LA MENTE, DE LA INFLUENCIA DEL COCIENTE INTELECTUAL EN UN GRUPO DE ESQUIZOFRÉNICOS

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ABSTRACT

Schizophrenia sufferers may have Theory of Mind (ToM) deficits. These deficits are not as severe as those shown by people with other disorders such as autism, because schizophrenic patients can solve simple ToM tests using their Intelligence Quotient (IQ) and general problem-solving skills.

Our aim was to study ToM by asking a group of schizophrenics to perform a mental verbs task. We then identified the categories into which the mental verbs were grouped and their use profile, and assessed the influence of intelligence quotient.

We observed that those with a higher IQ had lower ToM deficits. Subjects with average IQs grouped the mental activities quite well and those with low IQ performed the task poorly as a result of the combined effects of schizophrenia processes and low IQ.

Keywords: intelligence quotient, mental verbs task, schizophrenia, theory of mind.

RESUMEN

En la esquizofrenia pueden aparecer dificultades en Teoría de la Mente (TM). Tales déficits son menores que los que se manifiestan en otros trastornos puesto que estos pacientes resuelven pruebas sencillas de TM utilizando su Cociente Intelectual (CI) y habilidades generales de solución de problemas.

Nuestro objetivo sería estudiar la TM, utilizando una tarea de verbos mentales en un grupo de esquizofrénicos. Así, se identificarán las categorías en las que se agrupan los verbos mentales, su perfil de uso y, se examinará la influencia del cociente intelectual.

En esta investigación se observa una compensación de los déficits en TM en función del CI. Los sujetos con CI medio organizan mejor las actividades mentales y los de CI inferior presentan un efecto acumulativo de los procesos de la esquizofrenia y del CI que se refleja en una peor realización de la tarea de verbos mentales.

Palabras clave: esquizofrenia, cociente intelectual, tarea de verbos mentales, teoría de la mente.

1. INTRODUCTION

According to Doody Götz, Johnstone, Frith and Cunningham (1998) and Thomas (1997) in 1956 Diamond presented evidence to support the theory that schizophrenia sufferers were incapable of correctly internalizing the points of view of other people so as to be able to predict their behaviour. Also according to Brüne (2003), in 1958 Conrad argued that impaired perspective-taking was the main characteristic of the early stages of schizophrenic disorders. The cognitive anomalies that underlie the signs and symptoms of schizophrenia are evidence of a fault in a fundamental mechanism for conscious experience. This mechanism is known as Theory of Mind (ToM), metarrepresentation or a knowledge of oneself based on what other people know. Schizophrenic patients may have problems when it comes to making inferences about the intentions and the knowledge of the person they are talking to, and when it comes to using these inferences as a guide in their discourse (Guinea, Tirapu & Pollán, 2007). It has in fact been suggested that schizophrenia may be a self-awareness disorder that causes problems in relation to voluntary action, self-control and control over the intentions of other people (Bentall & Kinderman, 1998; Perona, Cuevas, Vallina & Lemos, 2003). Frith went a stage further when she suggested that metarrepresentation problems are due to difficulties in representing propositions

that contain mental states such as “think that” or “believe that”, given that the part of the representation that includes the mental verbs is separate from the rest of the representation (Drury, Robinson & Birchwood, 1998).

Similarly, Corcoran (2000), Corcoran, Cahill and Frith (1997), Corcoran, Mercer and Frith (1995), Mazza, De Risio, Roncone and Casacchia (2001) and Pickup and Frith (2001) all observed ToM failings in different groups of schizophrenic patients. However these failings diminished when patients were grouped together according to their intellectual quotient (IQ) and their results were compared. For example both Brüne (2001) and Corcoran et al. (1995) concluded that acute schizophrenics had difficulties in performing different ToM tasks correctly and that results could be influenced by IQ. This would imply that ToM deficits are related to the patients’ IQ and there is therefore a link between ToM and intelligence (in particular with verbal IQ) irrespective of diagnosis, age or sex (Bora, Yucel & Pantelis, 2009; Standford, Messinger, Malaspina & Corcoran, 2011). A high IQ would therefore compensate for slight ToM deficits, as it would enable the patient to use general problem-solving skills rather than ToM abilities (Pickup y Frith, 2001).

Janssen, Krabbendam, Jolles and Van Os (2003) and Langdon, Coltheart, Ward and Catts (2002) also observed that people with chronic schizophrenia and normal IQ obtained worse scores in ToM stories than people without the pathology. According to these researchers the link between IQ and ToM task-solving was logical but insufficient to explain the mistakes made in the tasks. Frith and Corcoran (1996) and Marjoram et al. (2005) observed that the group with behavioural signs showed ToM errors, even when IQ and memory were controlled. They therefore suggested that there was a specific ToM deficit in schizophrenia that could not be accounted for solely by the effects of IQ. Neither Abdel-Hamid et al. (2009), Mazza et al. (2001), Mazza, De Risio, Tozzini, Roncone and Casacchia (2003) and Mazza, Di Michele, Pollice,

Casacchia and Roncone (2008) could find any link between the performance of ToM tasks and IQ. They claimed that the variable IQ had no significant effect on ToM performance, and that the ToM failings were sufficiently serious not to be affected by what they regarded as irrelevant variables (Sprong, Schothorst, Vox, Hox & Van Engeland, 2007). Some researchers even proposed that the ToM deficits observed in schizophrenics are completely unrelated to psychopathology or intelligence, which would mean that poor ToM performance is a trait, and not a state, of the illness (Koelkebeck et al., 2010).

What is clear is that the deficits in schizophrenics are much less serious than in people suffering from other disorders such as autism. This could be because as we mentioned earlier schizophrenics can perform simple tests such as first-order tasks using their IQ, in other words using their general problem-solving skills rather than their ToM skills. In fact some researchers have observed that a high IQ can offset ToM deficits, while patients with a low IQ (62 ± 11) suffer the combined effects of their schizophrenia and their low IQ, and perform worse in the tests (Bora et al. 2009; Doody et al., 1998; Mitcheley, Barber, Gray, Brooks & Livingstone,1998; Sarfati, 2000; Scheeren, Rosnay, Koot & Begeer, 2013).

Schwanenflugel et al. devised a useful tool for studying ToM that explores the meaning and use that children give to verbs that describe mental activities. For these researchers the appearance of new concepts about mental verbs and the changes in the organization of these concepts that take place in the growing child are consistent with the development of a constructivist theory of mind during the school years (López-Herrero, Mendoza, Muela & Shergill, 2006; López-Herrero, Mendoza, Muñoz, Fresneda & Carballo, 2007; Mendoza, 2001). They also observed an intentional, abstract use related to the construction of mental spaces separate from reality, which allows children to conceive intentions and false beliefs. In a

linguistic sense, a semantic mastery of the mental verbs could be achieved through the deployment of meta-representational capacities (Bouchand & Caron, 1999; Naigles , 2000).

In particular, the transformation of ToM in infancy can be observed in the progress children make in aspects of processing / information in relation to mental actions, by which these actions are organized and extended, without interruption, from the perceptive to the conceptual, from the outer world to the inner world and from the input category to the output category. Another characteristic of ToM development is that which states that people view the question of certainty as important not only depending on their age, but also on their level of understanding of what is required of them in comprehension-type tasks. In fact memory-related activities are seen as the most certain, input/output activities as moderately uncertain, and processing tasks as the most uncertain (Clark, Schwanenflugel, Everhart & Bartini, 1996; Moore, Pure & Furrow, 1990; Schwanenflugel, Fabricius & Alexander, 1994a; Schwanenflugel, Fabricius & Noyes, 1996; Schwanenflugel, Henderson & Fabricius, 1998; Schwanenflugel, Martin & Takahashi, 1999). On the basis of these organizational schemes, Schwanenflugel, Fabricius, Noyes, Bigler and Alexander (1994b) and Schwanenflugel et al. (1998) proposed that mental verbs be grouped into three categories: Input, Memory and Processing.

The main objective of our research is to study ToM using a mental verbs test in a group of subjects diagnosed with schizophrenia (Clinical Group) and compare their answers with those achieved by a group of normal subjects (Control Group). This objective could be divided into the following sub-objectives:

Assess the relationship between Intelligence Quotient (IQ) and ToM skills.

Identify the categories into which the mental verbs are grouped and the verbs in each category.

Describe the meaning and the use profile attributed to mental activities.

2. METHOD

2.1. Participants

The Clinical Group was made up of 27 schizophrenic patients evaluated, diagnosed and treated at the Psychiatry Unit of the Melilla (Spain) Local Authority Health Area. Members of the group complied with the following conditions: maximum age of 55 years, no mental retardation, verbal comprehension (minimum centil score-5), no hearing or neurological problems, or drug addiction (no drug use in the previous six months), having completed at least the minimum level of Spanish education (School-Leaving Certificate or similar- 8 years of education-), attendance at psychiatric check-ups and use of medication.

They were chosen on the basis of the psychiatric diagnosis established by the Unit, which in turn is based on World Health Organization criteria for classifying mental and behavioural disorders (ICD) for the various types of schizophrenia (20.0, n= 16. 20.3, n= 2. 20.5, n= 7. 20.6, n= 2) and also of The Positive and Negative Symptom Scale (PANSS) (Kay, Fiszbein and Opler, 1987; Spanish version by Peralta and Cuesta, 1994).Patients with more than one psychiatric diagnosis were excluded.

The Control Group was made up of 20 adults (students of 4th Year of Compulsory Secondary Education and from the Seniors University at the University of Granada). None of them had a history of psychiatric diseases. Our aim was to make this group as similar as possible to the Clinical Group, in terms of age and educational background. The essential socio-demographic and clinical information about the groups is set out in Figure 1.

	Control Group (n = 20)	Clinical Group (n=27)
Sex M:F	7:13	22:5
Average age (years)	31.2 (18-55)	37 (25-55)
Average number of years schooling	10.9	11.2
I.Q.	105.8	85.1
Average duration of illnesss (years)	-----	16.2 (2-35)
Average dose of medication (Chlorpromazine)	-----	378 mg/d

Figure 1: Sociodemographic and clinical information about the participants.

2.2. Measurements

Factor "g" Test (Cattell & Cattell, 2001): The Spanish version of the Measuring Intelligence with the Culture Fair Tests was used to assess IQ. Scales 2 and 3 of this test (Form A) were applied. The scales are composed of the following subtests: completing series, classifying, solving matrices and evaluating conditions. Elements are presented in graphic form, with virtually no cultural content, and examples are given to help the subject to understand and perform the task. Scale 2 is applied to schoolchildren from 8 to 14 years of age, as well as to adults with little academic training. Scale 3 is intended for students in the later stages of secondary education and initial stages of university education, and also for adults in general with a relatively high educational level.

Wechsler's Intelligence Scale for Adults-III: Vocabulary Test (Wechsler, 2001): In this test the subject is presented with a set of words both orally and visually and is required to define their meanings.

Mental Verbs Test (López-Herrero, Mendoza & Santos, 2008): the construct of ToM is measured with an extensive mental verbs test similar to that used by Schwanenflugel et al.,

(1994b) made up of 28 sentences, half of which are affirmative and the other half interrogative. These sentences must be completed with at least three of the 14 mental verbs offered as possible replies. When selecting the verbs the subject has to choose the ones that best suit each sentence because i) when replacing one verb with another it does not change the meaning of the sentence, ii) it completes the sentence or iii) it answers the question raised. One of the items in the test was: **(COMPLETE)** I don't know where I left my umbrella and I have to ... *guess, learn, pay attention, search, compare, believe, decide, choose, understand, listen, look, think, remember and know*...

2.3. Procedure

The Clinical Group carried out the tasks individually, in order to maintain levels of motivation and to avoid tiring the subjects. All the tasks described above were completed: the Factor 'g' Test, the WAIS III Vocabulary Test and the Mental Verbs Extension Task. The Control Group carried out the Factor 'g' Test and Mental Verbs Task collectively. This was undertaken in a single session in view of the lower number of tasks and the speed with which they were accomplished. A clinical trained psychologist applied the tasks to both groups and took note of the answers given by the Clinical Group, while the Control Group noted their own answers.

2.4. Analysis

The Multidimensional Scaling were used to examine the way the two Groups organized the mental verbs and the meaning they gave to them.

The data inputted into these Multidimensional Scaling are understood as subjective estimates of the proximity between stimuli, so what we obtain is a distribution in a space with

various dimensions, such that the distances between the stimuli in this space correspond to the proximities expressed subjectively. In addition a series of axes are extracted which represent the scale or attribute used by the subject when estimating the proximities, and the place of the stimuli on each of these scales in the form of coordinates on the corresponding axis (Real, 2001).

The most interesting area for applying this kind of analysis is that of cognitive development in which researchers have tried to demonstrate that small children organize the stimuli along perceptual dimensions, while older ones use vaguer, more complex dimensions. They are also very useful for understanding the effects of context as they show us that the relative weights in the dimensions vary depending not only on age but also on the particular context, which produces a change in the data structure (Shoben & Ross, 1987).

3. RESULTS AND DISCUSSION

3.1. Designation and use of mental verbs by the Control Group

This group obtained the following stress and fit measurements: normalized raw stress 0.0789, dispersion accounted for (D.A.F.) 0.921 and a Tucker's congruence coefficient of 0.9597.

Figure 1 shows the spatial representations of the verbal stimuli and in these representations we can see that the mental activities are grouped into the following categories:

Input (I): made up of the verbs *pay attention* and *listen*; which means that *look* is missing and *understand* is added (General -G-).

Memory (M): made up of the verbs *remember* and *know*. *Learn* is also added to this category. (G).

Processing (P): made up of *guess, compare, believe, decide, choose* and *think* (*believe* and *guess* are put into this group because the maximum point of inclusion established is 0.03). The verbs *look* (I) and *search* (G) are also added.

An analysis of remoteness shows that *look* (I) and *think* (P), marked with *, are the furthest away, both in terms of the spatial representations of all the verbs as with *look*, or with regard to the group to which it belongs as in the case of the verb *think* (P).

As regards the position of the stimuli on the corresponding axes of abscissas (dimension 1 -D1-: certainty-uncertainty) and ordinates (dimension 2 -D2-: internal/conceptual - external/ perceptive) we observe that when naming the different quadrants in clockwise order, the three categories of mental verbs are distributed as indicated below:

I: the verbs in this category are in the second quadrant.

M: these verbs are centred on the first quadrant.

P: the verbs in this category appear above all in the fourth quadrant, although one verb (*choose*) is in the third.

CONTROL GROUP

	Dimension	
	1	2
GUESS	.023	-.058
LEARN	.440	.111
PAY ATTENT	.378	-.567
SEARCH	-.207	-.444
COMPARE	-.371	.044
BELIEVE	.027	.304
DECIDE	-.802	.068
CHOOSE	-.682	-.285
UNDERSTAND	.742	-.009
HEAR	.470	-.378
SEE	-.111	-.799
THINK	-.578	.661
REMEMBER	.050	.733
KNOW	.620	.619

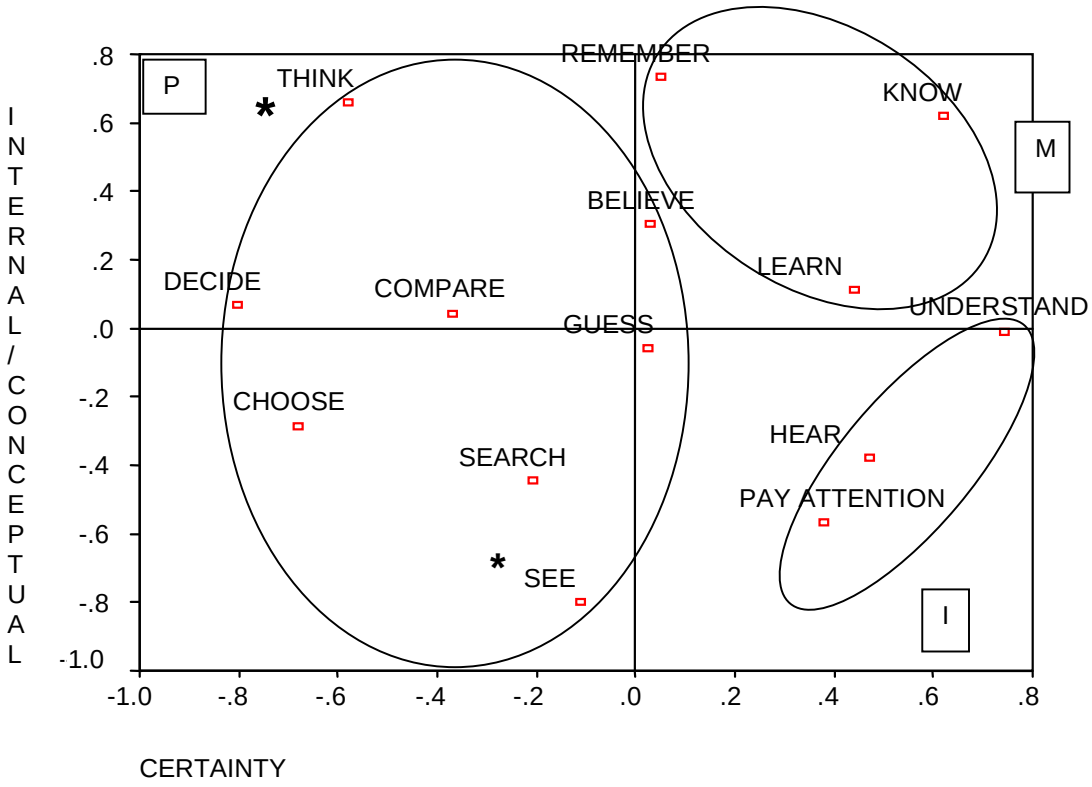

Figure 2. Spatial representation of mental verbs corresponding to control group.

3.2. Designation and use of the mental activities by the Clinical Group

In order to assess the influence of IQ on ToM skills, all members of the group achieved the established minimum score (C-5) in the WAIS-III Vocabulary Test. Moreover, taking into account the absence of mental retardation, the level of education and the age of the subjects, as well as the fact that the mental activities task uses verbs which are acquired at an early age, it may be concluded that the clinical group did not present difficulties in this task.

For the IQ, the subjects were divided into the following three groups on the basis of their results in the Factor “g” Test (Cattell and Cattell, 1990): subjects with a low IQ or LOWIQ (IQ between 71-79), subjects with normal-low IQ or NORMLOWIQ (IQ 80-89) and subjects with average IQ or AVIQ (IQ 90-109).These results are detailed in Figure 3.

Subject	IQ
1	3
2	3
3	3
4	3
5	3
6	3
7	3
8	3
9	3
10	3
11	2
12	2
13	2
14	1
15	1
16	1
17	1
18	1
19	2
20	1
21	2
22	1
23	2
24	1
25	1
26	1
27	1

Figure 3. Results of the clinical group in I.Q. (IQ: 1- LOW 2- NORMAL-LOW, 3- AVERAGE)

LOWIQ obtained the following stress and fit measurements: normalized raw stress 0.1027, D.A.F. 0.8972 and Tucker's congruence coefficient 0.9472.

Figure 2 shows the spatial representations of the mental verbs in such a way that the verbs can be grouped into the following categories:

I: made up of *pay attention* and *look*; *listen* is missing and *compare* is added (P).

M: there is no M group, as the verbs that should be in this group were placed in other groups.

P: contains the verbs *guess, believe, decide, choose* and *think*. *Compare* is missing and *look* (G) and *remember* (M) are added.

Non-proximity is limited to the verbs *look* (I), *think* (P) and *know* (M).

The position of the mental verbs on the corresponding axis of coordinates shows us that:

I: centred on the fourth quadrant.

P: in the first and second quadrants

LOW IQ GROUP

	Dimension	
	1	2
GUESS	,002	,244
LEARN	-,232	-,223
PAY ATTENT	-,639	,196
SEARCH	,190	,536
COMPARE	-354	,404
BELIEVE	,291	-,098
DECIDE	,562	-,457
CHOOSE	,246	-,525
UNDERSTAND	-,540	-,482
HEAR	-,631	-,111
SEE	-,194	,807
THINK	,887	,023
REMEMBER	,563	,475
KNOW	-,0.98	-,789

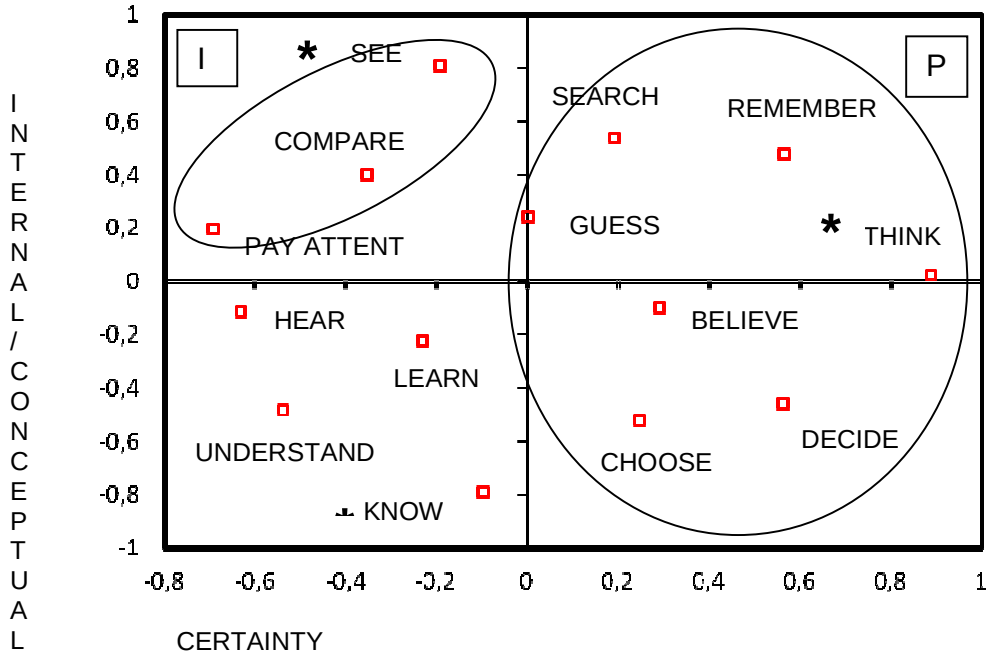

Figure 4. Spatial representation of the mental verbs according to the results for the Low IQ group.

NORMLOWIQ showed these stress and fit measurements: normalized raw stress 0.0862, D.A.F. 0.9137 and Tucker's congruence coefficient 0.9559.

The mental verbs are grouped into the following categories (Figure 3):

I: made up of *pay attention, look, listen* and also *search* (G).

M: no group formed.

P: consisting of *guess, compare, believe, decide, choose* and *think*; *remember* (M) is added.

The remotest verbs are *look* (I) and think (P).

If we observe the position of the stimuli on the two dimensions or axes, we can see that:

I: is located in the third quadrant.

P: is located in the first and fourth quadrants.

NORMLOW IQ GROUP

	Dimension	
	1	2
GUESS	-,079	,041
LEARN	,535	-,116
PAY ATTENT	-,2	-,659
SEARCH	-,463	-,174
COMPARE	-409	,185
BELIEVE	,21	,344
DECIDE	-,238	,72
CHOOSE	-,602	,449
UNDERSTAND	,306	-,407
HEAR	-,049	-,493
SEE	-,794	-,35
THINK	,373	,778
REMEMBER	,769	,262
KNOW	,641	-,58

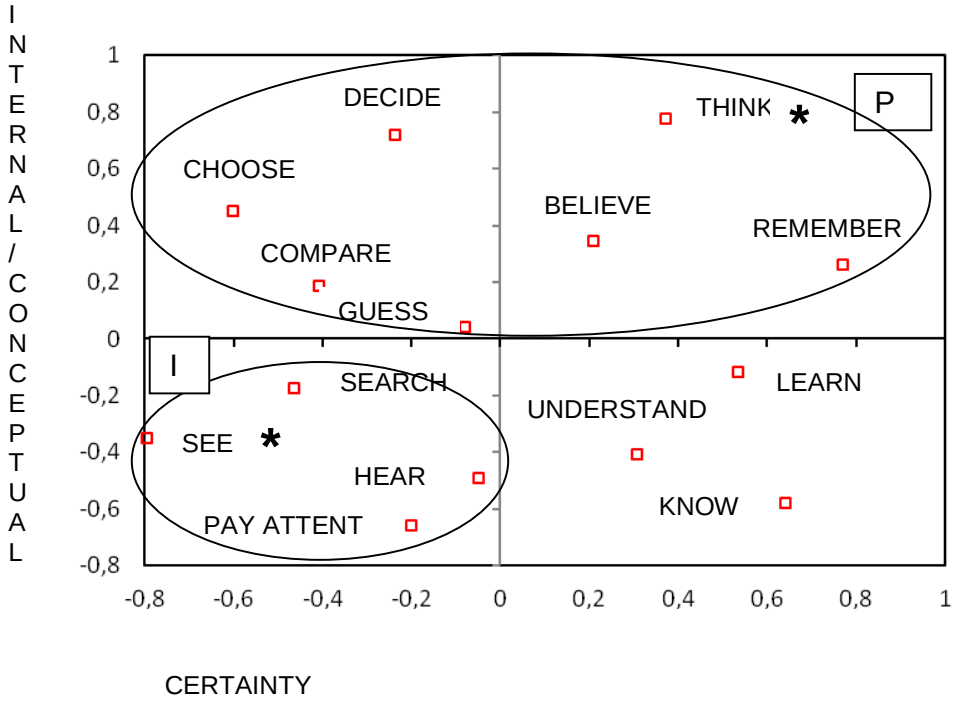

Figure 5. Spatial representation of the mental verbs according to the results for the Normal-Low IQ group.

AVIQ obtained the following fit and stress measurements: normalized raw stress 0.0784, D.A.F. 0.9215 and Tucker's congruence coefficient 0.9599.

The mental verbs are grouped into the following categories:

I: with *pay attention, listen. Look* is missing (I) and *learn/understand* are added (G).

M: made up of *remember, know*.

P: made up of *guess, compare, believe, decide, choose* and *think; search* (G), and *look* (I) are added.

The remotest verbs are *understand* (G) and *think* (P).

If we observe the position of the different verbs on the axes of coordinates, we can see that:

I: is in the third quadrant.

M: fourth quadrant.

P: first and second quadrant.

AV IQ GROUP

	Dimension	
	1	2
GUESS	,021	,110
LEARN	-,415	-,048
PAY ATTENT	-,268	-,643
SEARCH	,175	-,111
COMPARE	,421	-,418
BELIEVE	,072	,369
DECIDE	,737	,154
CHOOSE	,721	-,153
UNDERSTAND	-,814	-,030
HEAR	-,457	-,468
SEE	,151	-,708
THINK	,536	,696
REMEMBER	-,202	,657
KNOW	-,677	,593

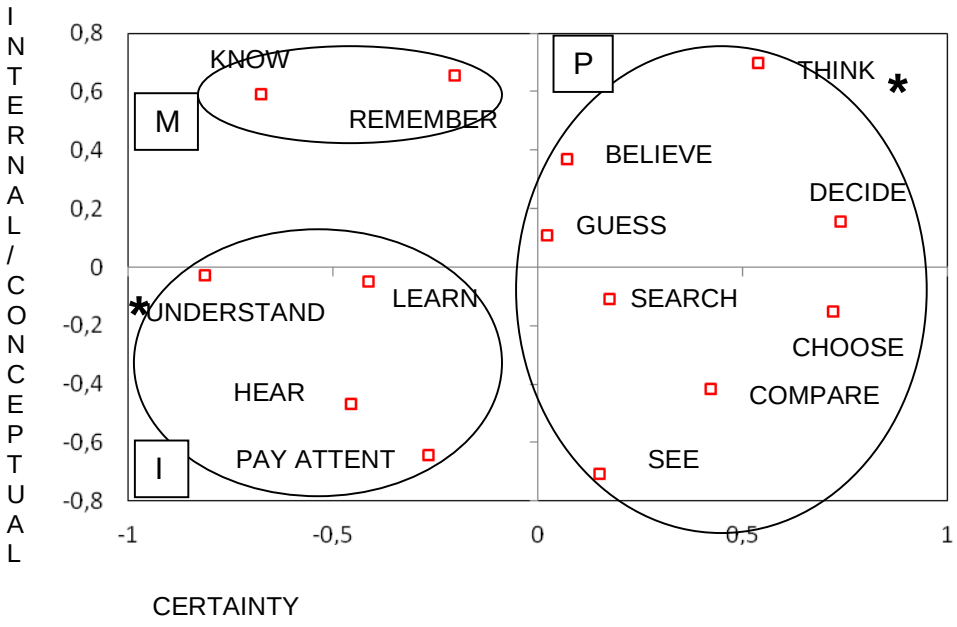

Figure 6. Spatial representation of the mental verbs according to the results for the average IQ group.

4. CONCLUSIONS

In this study the analysis centred on the question of whether the answers given by the Control and Clinical Groups in the mental verbs task are related with the IQ. Therefore we ascertain the categories in which the mental activities are grouped and we identify the verbs forming each group, and also we describe the meaning and utilisation attributed to the mental activities.

4.1. Control Group

There are three categories of mental verbs in this group: I, M and P. Categories M and P are complete, that is they contain all the verbs that they normally contain; In Category I however the verb *look* is missing, as it was put into Category P. This is not surprising if as Schwanenflugel and her co-authors propose in 1998, *look* has a different meaning to *see* and is regarded as a more uncertain verb and is therefore close to the Processing category. There are also a number of versatile mental verbs that fall within the General (G) group. These verbs may also belong to other categories and cannot be defined within one particular group or grouped together to form a specific group of their own. This means that their use profile is very broad but is still correct. In this case they appear in I *understand* (G), in M *learn* (G), and in P *search* (G).

When we analyse the remoteness we find that *look* (I) is the remotest verb in the spatial representation of the data. This is due to the characteristics it shares with the processing verbs. Similarly, although *think* forms part of the processing category, it is the most distant, due to its evaluative function, as *think* is a very common cognitive activity that forms part of a variety of cognitive processes (Rips & Conrad, 1989; Schwanenflugel et al., 1994b, 1998).

If we start from the position of the verbal stimuli in the two dimensions established by Clark et al. (1996), Moore et al. (1990) and Schwanenflugel et al. (1996, 1998, 1999): dimension

1: certainty - uncertainty; dimension 2: internal and conceptual - external and perceptive), we find that the I verbs are defined as external, perceptive and certain; and are situated in the second quadrant. Those belonging to the M category are internal, conceptual and certain, and appear in the first quadrant. The P verbs are mainly in the fourth quadrant and are regarded as doubtful, internal and conceptual mental verbs, except for the verb *choose*, which appears in the third quadrant and is defined as external and perceptive.

From the data set out above, we deduce that the Control Group assigns specific meanings to mental activity verbs, a fact reflected in the clear definition, differentiation and formation of categories I, M and P. The activities that fall within category G have a broader use profile and can thus appear in categories other than their own without this damaging or contaminating the new categories into which they fall. This suggests that the Control Group's use of mental verbs is very correct and mature and they do not suffer any communication deficit, as they are aware that their knowledge, needs, intentions and desires may be different from those of other people and may manifest themselves in different ways.

4.2. Clinical Group

Great instability can be observed in the categories in LOWIQ. The I Group is not complete, as the verb *listen* is missing. At the same time it contains *compare* (P), a verb that is not usually found in this category. There is no M Group and P is also incomplete and mixed with verbs from other categories: it does not include *compare*, but *remember* (M) is added. For its part in NORMLOWIQ the I and P categories are complete, although the latter includes a verb from another group *remember* (M). The M verbs however do not form a group as they are very far apart. AVIQ groups the mental verbs into the three categories (I, M and P) and their composition is similar to that obtained in the Control Group, which means that they appear well-defined,

complete and made up of the verbs that they normally include, with the exception of the verb *look* (I) which falls within the P category. In the different IQ-based groups the verbs in Category G form part of the I and P groups without this affecting the definition of these categories.

Non-proximity is centred, in general, on *look* (I) and *think* (P), except in the LOWIQ group in which *know* (M) also appears and in the AVIQ group to which *understand* (G) is added.

The position of the mental verbs in the dimensions reveals that LOWIQ defines the I verbs as internal, conceptual and uncertain and the P verbs as certain, internal and conceptual, except in the cases of the verbs *believe, decide* and *choose*, which appear as external and perceptive. The NORMLOWIQ group defines I as a category made up of external, perceptive and uncertain verbs and P as a category made up of internal, conceptual and very uncertain activities, except for the verbs *believe* and *think*, which are defined as more certain. In the case of the AVIQ group, the I category appears as external, perceptive and uncertain, and M as internal, conceptual and uncertain, while P is very certain, internal and conceptual, except in the cases of the verbs *compare* and *choose*, which are defined as external and perceptive.

With all this data, we can conclude that the distribution of mental verbs into the input, memory and processing categories improves as IQ increases. This was manifested by the fact that in LOWIQ we observed groups with severe deficits, as there was no M category and the I and P categories were not complete and included verbs that did not belong to them or to the G category (a more flexible group in that its activities can also be included in other categories). In NORMLOWIQ the categories were more complete, except in M, for which there was no group, as occurred in LOWIQ. The only verb totally out of place was *remember* (M) which was in P. However the AVIQ Group classified the mental verbs in a very similar way to the Control Group, in that the three categories were clearly defined and were made up of the verbs that they should contain, except for *look* (I) which is situated near P; and the only verbs included in these

categories that did not actually belong to them were verbs from category G, as also occurred with the Control Group. At the same time, there was an increase in stability in line with IQ in terms of remoteness, as in LOWIQ the distance was greater, and affected *know* (M) as well as the usual verbs *look* (I), which is more of a processing activity, and *think* (P), which is a common evaluative cognitive activity that can also form part of other cognitive processes (Rips & Conrad, 1989; Schwanenflugel et al., 1994b, 1998). The fact that *understand* (G) appears in AVIQ, as a non-proximate action is not relevant due to the versatility of the verbs in category G. For its part and in relation to the position of the stimuli on the axes of the coordinates, it is the AVIQ group that best informs on spatial representation, although it only coincides with that found in the Control Group in which I is external and perceptive, M and P are internal and conceptual, except for the cases of *compare* (P) and *choose* (P), which are defined as more external, perceptive activities. It is important to remember that these characteristics of *choose* were also observed in the Control Group (Clark et al., 1996; Moore et al., 1990; Schwanenflugel et al., 1996, 1998, 1999).

Therefore in line with Standford et al. (2011) and Sun Chung, Kang, Shin, Yoo and Kwon (2008) we support the view that poor performance in certain tests (for example; various memory tests) can be offset by the patients' IQ. In particular in our study we observed an offsetting of the ToM deficits in line with IQ, in such a way that the subjects in the AVIQ group are the ones who organize, distribute and catalogue the mental activities best, and therefore use the verbs of mental activity correctly. The explanation for these results lies, as Doody et al., (1998), Mitcheley et al., (1998) and Sarfati (2000) also proposed, in the fact that a high IQ can compensate for ToM deficits, as it allows the subjects to use general problem-solving skills instead of ToM skills, while patients with a low IQ show the combined effects of the schizophrenia processes and their IQ, which in our research results in a worse performance in the

mental verbs task, which would suggest that they do not use these verbs correctly in their everyday lives.

In spite of this, the structuring made by AVIQ when positioning the mental activities on the axes of coordinates is not as accurate as that of the Control Group, which means that, in line with the findings of Bora et al., (2009), Brüne (2001, 2003), Corcoran et al. (1995), Janssen et al. (2003), Langdon, Coltheart, Ward and Catts (2001) and Langdon et al., (2002), we can assert that IQ and the solving of ToM tasks are related, but that this relation is not sufficient to fully explain the erroneous execution of ToM tasks and that there are other aspects apart from IQ, such as the signs and the symptoms of schizophrenia, and attention, concentration and difficulties with selective memory, which also affect the solution of the extensive mental activity verbs task (Bora et al., 2009; López-Herrero et al., 2007). We therefore believe that in future research, it would be necessary to analyse the relation of these factors in the execution of ToM tasks. We also think, as other authors have suggested, that it would be important to include different tests that evaluate all aspects of ToM, so as not to rely solely on the mental activities test (Brune, 2003). We also recommend that a larger participants group be used in future research.

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