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Differences in social cognition between male prisoners with antisocial personality or psychotic disorder

Diferencias en la cognición social entre hombres presos con personalidad antisocial o trastorno psicótico

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Abstract
The objective of this work is to discriminate between different neurocognitive circuits involved in empathy, one of them linked to emotional processing and the other associated with cognitive function. This is evaluated through the use of neuropsychological tools (Hinting Task, Reading the Mind in the Eyes Test and Cambridge Mind Reading Test) empathic cognition and empathic emotion. In this study, 57 male prisoners were divided into three groups: psychotic patients (20), antisocial patients (17), and a control group (20). Patients with psychosis were found to have significantly lower scores than the antisocial and control groups in a social reasoning test, but using tests of emotional recognition, we found that both psychotic patients and antisocial subjects scored significantly lower than the control group.

Resumen
El objetivo de este trabajo es discriminar diferentes circuitos neurocognitivos involucrados en la empatía, uno de ellos vinculado al procesamiento emocional y otro asociado con la función cognitiva. Evaluamos mediante el uso de herramientas neuropsicológicas (Hinting Task, Reading the Mind in the Eyes Test y Cambridge Mind Reading Test) la cognición empática y la emoción empática. Participaron del estudio, 57 presos varones que se dividieron en tres grupos: pacientes psicóticos (20), antisociales (17) y un grupo control (20). Se encontró que los pacientes con psicosis tenían puntuaciones significativamente más bajas que los grupos antisociales y de control en una prueba de razonamiento social, pero utilizando pruebas de reconocimiento emocional, encontramos que tanto los pacientes psicóticos como los sujetos antisociales obtuvieron puntuaciones significativamente más bajas que el grupo control.

Keywords
Social cognition; psychosis; antisocial disorder; facial emotion recognition; theory of mind.
Palabras Clave
Cognición social; psicosis; antisociales; reconocimiento de emociones faciales; teoría de la mente.

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1. Introduction

Social cognition can be understood as the set of cognitive processes involved in the way people think about themselves, other people, social situations and their interactions. These social cognitive processes are involved in the way in which inferences are made about the intentions and beliefs of other people and how social situational factors are assessed in making such inferences. They are part of social cognition: emotional pro-

cessing, theory of mind, social perception, social knowledge and attributional style or bias (Ruíz-Ruíz, García-Ferrer, & Fuentes-Durá, 2006).

Emotional processing refers to all those aspects involved in the perception, understanding, emotional regulation and its use for social functioning. Empirical knowledge in this aspect of cognition is based on studies on the perception of faces, ii.e. the ability to recognize and understand facial expressions of emotions in others (Sucksmith, Allison, Baron-Cohen, Chakrabarti, & Hoekstra, 2013).

The capacity for empathy or the ability to detect what another person feels is evaluated by the ability to reproduce a similar emotional state in our own body. For this, the mechanisms of interpretation of relevant signs must be unharmed (Iacoboni, 2009; Iacoboni & Dapretto, 2006).

Social cognition refers to a complex neurocognitive process involving many brain regions implicated in perception, processing and response in social contexts (Butman, 2001). Different areas on the prefrontal cortex (PFC), amygdala, somatosensory cortex and insula are part of a broad neurocognitive circuit that presents dissociated functions while, at the same time, integrating the social information they process (Adolphs, 1999)

The study of social cognition over the years has allowed the identification of several semi-independent processes, some of which are very clear. Discriminating between empathic cognition and empathic emotion allows us to understand how in some mental or personality disorders these functions may be dissociated (Molina, 2013). These findings have allowed the dissection of more specific, though interrelated, complex processes of social cognition.

Empathy as a component of social cognition was also subdivided into functions that were thought to be differentiated. Empathic cognition (EC) is composed of the circuits and functions necessary to make a rational reading of situations of social interaction, but does not activate an affective representation in the subject. Empathic emotion, (EE) on the other hand, includes the affective component to that register and is linked to the functioning of the frontal operculum (Ruggieri, 2013).

The EC processes social information in anterior regions of the frontal lobe (Brodmann's area 10 and 11). These ventromedial areas of the PFC are also linked to impulse control and inhibition (Shamay-Tsoory, 2010).

Kleist (1997) argues that the ventral cortices are the areas in charge of integrating the information processed in the dorsolateral areas of the PFC.

These data indicate that although empathy uses differentiated circuits to process cognitive and emotional components, both circuits are located in the frontal lobes and not only interact with each other, but also involve areas of executive and inhibitory processing. In this complex network of mental operations that underlie social interactions, processes involved in the perception, interpretation, and generation of responses to the intentions, dispositions and behaviors of others are included (Ruíz-Ruíz et al., 2006).

One of the sensory modalities that contributes the most information to the processing of social cognition is the visual modality. Social visual signs include information about the face - expression or the direction of the gaze - as well as body postures and movements (Belmonte, Gomot, & Baron-Cohen, 2010). Visual processing starts from the occipital primary visual cortex involving the superior temporal cortex and the fusiform gyrus. One of the ways to investigate a subject's ability to interpret the expression of a face, is to reproduce the expression of the face in the organism and detect the feeling it triggers (Ruíz-Ruíz et al., 2006). In this process the amygdala performs a cognitive assessment of the emotional content of complex perceptual stimuli.

Social perception is associated with the capacities to value social rules and roles, as well as to assess the social context. These evaluations are based primarily on perceptual processes that should direct the attention of the person to those key social cues, helping him to situate and properly interpret situations in which he may be involved. Throughout that process the context is critical. It corresponds to a type of perception that requires "reading between lines" (Penn, Ritchie, Francis, Combs, & Martin, 2002).

Social knowledge refers to the ability to identify the components that characterize a given social situation. The identification of social signals requires a certain knowledge of what is typical in a given social situation. Social schemas vary depending on the components or characteristics that allow their understanding, but basically four basic components are considered: actions, roles, rules and aims or goals (Brothers, 1990). These act as a guide in social situations. Social knowledge is the frame of reference that allows the subject to know how to act, what his role and the roles of other actors in the situation are, what the rules that by convention are used in that situation are and finally the reason why he is involved in this social situation (Piemontesi, 2010).

Social cognition, as indicated above, includes a behavioral component governed by rules, social skills and strategies that make the behavior of the subject more or less well-adapted. This knowledge allows people to select relevant responses or actions in different social settings (J. Beer & Ochsner, 2006).

Theory of mind (TOM) is a term proposed by Premack and Woodruff (1978) for the component of social cognition that refers to the ability to make inferences about the mental states of others, such as intentions, dispositions and beliefs. The ability to understand the role of other individuals as well as to understand other points of view or to attribute an intention to another individual is known as "theory of mind." These kinds of inferences allow one to understand the other's mental states, their desires, intentions and behavior and make it possible to understand the representations that the other makes of the world. This ability is essential for proper adaptation and social interaction (Román et al., 2012).

When a subject with functional brain structures perceives facial emotion, body language and prosody, there are signs

that provide the subject with an understanding of emotional meaning (nez & Manes, 2012). Acting efficiently in social interactions requires the implicit and explicit interpretation of context signals in order to choose the most appropriate behavior.

1.1 Anatomic-functional correlations

The brain areas generally associated with social cognition are the orbitofrontal cortex, the frontal, cingulate cortex, the insula, the temporal lobe, the amygdalas, the fusiform gyrus and the somatosensory cortex (J. S. Beer, Shimamura, & Knight, 2004).

Medial cortical structures including the medial prefrontal cortex, anterior cingulate cortex and precuneus have been associated with social cognition. In addition, a right frontoparietal circuit is included as part of a network of mirror neurons involved in self-recognition and social understanding (Lawrence, P.Shaw, Baker, Baron-Cohen, & David, 2004). There is evidence to suggest that there is a right lateralization of the mirror neuron system involved in the multimodal understanding of the face - for example, the face and voice while corticomedial structures appear to represent less corporal terrain such as social relationships. Interactions between these two systems are crucial in social functioning and development (Uddin, Iacoboni, Lange, & Keenan, 2007).

There are direct connections between the mesial frontal areas and the lower frontal gyrus. Thus, the anterior and posterior nodes of the corticomedial structures and the mirror neuron system are in direct communication. Although the exact nature of the interactions between these two networks is unknown, direct connections between them are likely to facilitate the integration of information that is necessary to maintain the representations of others through multiple domains (Lou et al., 2004).

Representations of self and others are crucial to social functioning. The mirror neuron system and the right frontoparietal region seem to support these abilities, albeit in different ways. In this sense, it is proposed that the mirror neuron system allows a physical representation while the corticomedial structures are focused on mental state and evaluation simulation. Both processes are crucial to understanding others (Leslie, 1987). Although their differences are not fully understood, both neural systems contribute to the ability to move beyond motor imitation, from simple forms to more complex forms of social learning and understanding. By providing both the neural bases of representation and the distinction between the self and the other, these two systems integrate themselves with the brain as a whole, enabling the individual to move successfully in the social world (Uddin et al., 2007).

In 1988 Leonor Welt published a doctoral thesis describing the correlation between orbital lesions next to the midline and changes of character, based on the observation of 12 patients, one of whom was Phineas Gage. Welt observed that patients with lesions in orbital areas manifested problems inhibiting impulses. This suggests that the ventral cortex and ventral paralimbic structures are concerned with giving value to the feelings and actions that the dorsal cortex executes. The study of injured patients shows that they have difficulties in decision making and social reasoning (Butman, 2001).

According Damasio (1994) to make decisions is to choose a response option among many possibilities at a given time in relation to a given situation. It implies knowing the situation that requires it, the different options for action and the immediate or future consequences of each action. Patients with ventromedial prefrontal cortex lesions fail to use somatic or emotional cues to guide behavior and are oblivious to the future consequences of their actions. Consequently, they act according to their immediate perspectives, taking no preventive action and acting more impulsively (Butman, 2001; Damasio, 1994).

Limbic system structures such as the amygdalas perform a cognitive evaluation of the emotional content of complex perceptual stimuli. According to Emery and Amaral (2000), the basal nucleus, having the greatest interconnection with the ventromedial prefrontal cortex, intervenes in the pairing of social signals with the appropriate social context. It has been found that in the left insula there is a greater activation with respect to unpleasant stimuli regardless of their intensity (Small, Gregory, Mak, Gitelman, & Marsel, 2003). Through brain imaging it has also been shown that the anterior insula is activated by the sight of facial expressions of disgust in others and that the amplitude of response depends on the type of expression of disgust that the other person had on their face. These findings were corroborated from depth recordings of the electrodes in the insula of patients with epilepsy, finding that the electrodes located in the anterior part, but not those located in the posterior insula, were selectively activated by observing expressions of disgust in the face of another person (Krolak-Salmon, 2003).

1.2 Social cognition and antisocial personality disorder

Works by Marshall and Marshall (2011) argue that the deficits in the emotional processing of the empathy of subjects with antisocial personality is what drives them to commit violent acts.

In a study of various domains of social cognition linked to mentalization in offenders with and without a diagnosis of antisocial disorders, both groups were found to score lower than the control group in the study. The authors used the Perspectives Taking Test, Reading the Mind in the Eyes Test and the Movie for the Assessment of Social Cognition to value mentalization tasks. They also found greater deficits in the three trials applied to offenders diagnosed with antisocial disorder when compared to the group of offenders without a diagnosis of antisocial disorder (Newbury-Helps, Feigenbaum, & Fonagy, 2017).

Other authors (Bagcioglu et al., 2014) ocused on investigating the existence of differences between facial recognition of emotions in subjects with antisocial disorder with and with-

out a history of attention deficit disorder. In this study, subjects were asked to identify the 6 basic emotions through facial expression, as well as neutral facial expressions. The Wender Utah Rating Scale was also applied to assess symptoms of (ADD). The results indicated that both groups of antisocial subjects manifested problems in identifying specific dissatisfaction. This finding is of interest since it links the functioning of the brain insula to the recognition of that emotional expression and as part of the complex neurocognitive system that processes empathy. Finally, this work also found differences between groups with and without attention deficit disorder, finding that subjects with a history of ADD had used much more time for the recognition of emotions.

Dolan and Fullam (2004) have done a lot of work on the topic that we have discussed in our own research. The authors evaluated the mentalization capacity of antisocial subjects with and without a diagnosis of psychopathy. Among the findings, they indicated that:

The deficits in mentalization tasks of these groups are subtle and that the skills in mind theory were almost intact. This would explain their adaptive role to the criminal lifestyle they lead, and can be interpreted as a correct functioning of cognitive empathy. But they found alterations in both groups when they assessed the ability to recognize emotions or adopt the perspective of the victim, which we believe to be included in emotional empathy.

1.3 Social cognition and psychosis

It has also been shown that emotional information is altered in schizophrenia. The biological foundations of these abnormalities can be explained by an abnormally functioning mirror neuron system. McCormick and colleagues in 2012 studied schizophrenic patients at various stages of their disease progression. Using electroencephalography studies, they found alterations in brain electrical activity during tasks that activated mirror neurons. Their other finding of interest, was that these alterations correlated positively with the years of evolution of the disease.

Other papers used psychometric tests to analyze and differentiate alterations in empathy systems in psychotic patients. Through the administration of the interpersonal reactivity index (IRI), it was found that psychotic subjects who have had their first episode score similarly to control subjects in the subscales of empathy and mentalization, only observing differences in anxiety values. In contrast, subjects with chronicity in their disorder scored significantly lower than controls when assessing subscales that explored social cognition and empathy (Achima, Ouelleta, Rova, & Jacksona, 2011).

An important meta-analysis study by Bora and Pantelis (2013) analyzed the functioning of the theory of mind in patients after their first episode of psychosis, subjects assessed with a high risk of psychosis, unaffected relatives and controls. The authors found deficits in social cognition tasks in the three groups evaluated. The subjects who had their first psychotic episode were the ones that performed the worst, with the groups of unaffected relatives and those with a high risk of psychosis recording scores between those of the psychotic group and the control group. The authors add that the results obtained by the patients with the first episode of psychosis were similar to those of the chronic patients.

In summary, the current literature deals with differentiated neurocognitive systems for the integral processing of social information. The dichotomy observed in subjects with personality disorders with respect to their social skills was the question that inspired this research. The differentiation of circuits of social reasoning and emotional processing in social situations explains the paradox of finding cases that show extreme insensitivity in the forensic domain with a conversation of functional social skills for their environment.

2. Method

2.1 Ethical responsabilities

Protection of people and animals. The authors state that the procedures followed conformed to the ethical standards of the responsible human experimentation committee and in agreement with the World Medical Association and the Declaration of Helsinki.

Confidentiality of the data. The authors state that they have followed the protocols of their work center on the publication of patient data and that all patients included in the study have received sufficient information and have given written informed consent to participate in the study.

Right to privacy and informed consent. The authors have obtained the informed consent of the patients and/or subjects referred to in the article. Review by Independent Ethics Committee. The work was reviewed and approved by an Independent Ethics Committee (I.E.C.) of the Center for Studies in Applied Cognitive Neuroscience.

2.2 Description of the sample

A non-probabilistic sample was set up for the convenience of 57 male subjects with a mean age of 29.37 years ($SD = 7.44$). It was divided into three groups: 35% (20 subjects) of the patients were diagnosed with psychosis, 30% (17 subjects) with an antisocial personality disorder and 35 (20 subjects) belonged to the control group.

The group patients with psychosis consisted in schizophrenic patients. Half of them showed a predominance of positive symptoms and the other half a predominance of negative symptoms according to the results of the Positive and Negative Syndrome Scale (PANSS). Subjects with medical or neurological diseases, or cases of simulation or mental retardation were excluded from the investigation. Patients in both the psychotic and antisocial groups were deprived of their liberty, having either been convicted of or being tried for a criminal offense at the time of participating in the evaluation.

The participants in the control group were selected in the same detention unit, within the prison complex No. 1 of Ezeiza. It was composed of subjects matched by socio-

Figure 1. Psychotic patients group offenses

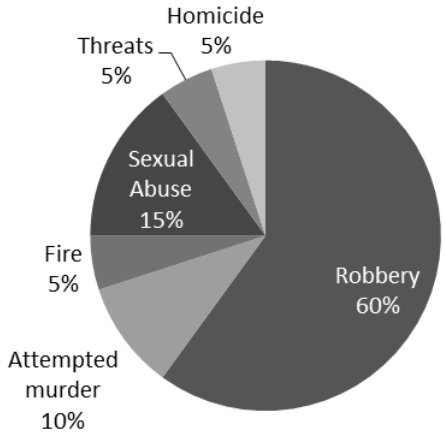
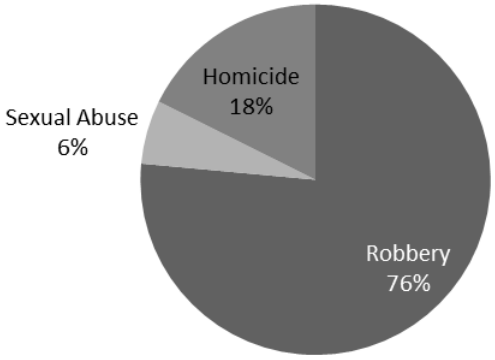


Figure 2. Antisocial patient group offenses



economic-cultural level without a diagnosis of psychosis or antisocial personality disorder.

In terms of education level in the sample, 12% had not completed primary school while 26% had only finished primary school. 40% hadn't completed secondary school and 17.5% had only completed secondary school. Finally, 3.5% had continued to study after finishing secondary school. Regarding criminal history, 28 patients indicated having a history (49%) and 8 patients did not (14%). The rest of the patients did not respond. Of these 28 patients who indicated having criminal record, 16 patients belong to the group diagnosed with psychosis and 12 patients to the group diagnosed with antisocial personality disorder.

Additionally, the group of psychotic patients had been detained for reasons of theft, homicide and attempted murder, fire, sexual abuse and threats (type of crime committed by psychotic patients is shown in Figure 1).

Theft, sexual abuse and homicide were the crimes committed by the subjects who were part of the group of subjects with antisocial disorders (see Figure 2).

The work was carried out in the Diagnostic and Stabilization Evaluation Room of the Psychiatric Hospital of Federal Penitentiary Complex No. I of Ezeiza belonging to the Federal Penitentiary Service.

The professionals who administered the tests, psychologists, neuropsychologists and psychiatrists were civilian personnel who belong to the Interministerial Program of Mental Health in Argentina (PRISMA) and develop functions in this hospital and evaluation device.

The clinical evaluation was performed by an interdisciplinary mental health team, which used the DSM IV TR diagnostic criteria for the clinical diagnosis of antisocial personality disorder (APD) and psychosis.

All three groups those with antisocial personality disorder, psychosis and the control group were assessed by applying three social cognition tests.

2.3 Administered tests

An adapted Spanish - language version of the Hinting Task or Test of Insinuations was administered (Gil, Fernández-Modamio, Benhochea, & Arrieta, 2012). The test includes ten short stories, in which two characters participating in a social interaction appear. At the end of each, one of the characters transmits a masked message to the other. The evaluated subject is asked what the character of the story really meant by the comment he made. If the answer is correct in its total interpretation, it is scored with 2 points. If additional information is required to get the correct answer, it is scored with a 1. An incorrect answer is equivalent to a 0. The total score of the test goes from 0 to 20. In the present work we used the abbreviated version in which only 5 stories were scored (2, 3, 6, 7 and 9). For that reason the overall test score is from 0 to 10 points. The reduced version was selected as it has an internal consistency of 0.73 for control subjects and 0.78 for patients in previous studies (Janssen, Krabbendam, Jolles, & Os, 2003). Also, the five-story version showed a high correlation with the complete test in both control subjects ($r = 0.75$, $p < 0.001$) and in the patients ($r = 0.911$, $p < 0.001$).

We also used the "Reading the Mind in the Eyes Test" or Test of the Gaze (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997). In this test the subject is asked to identify between 4 emotions expressed in an image of the upper part of a face, in which the look of a person can be visualized.

This test consists of 36 photographs of the upper part of the face (eyes and eyebrows). In these photographs you can see the looks of men and women expressing a feeling or thought. The subject must choose the word that he considers best describes what the person in the photograph is thinking or feeling. Although one word may seem to be applicable, the subject is limited to the one word he considers most appropriate. The subject has to read the look; each photograph has four possible responses that appear on the screen and the subject must choose the one that best represents that emotional state. If the subject is not familiar with the meaning of a word he can ask for the exact definition in the instruction manual (García, Ustárroz, & López-Goñi, 2012).

With the Reading the Mind in the Eyes Test, the ability to recognize emotion is targeted, employing tasks in which only the face is shown without an indication of the context in which a certain emotion is being expressed (García et al., 2012). We used the Spanish version of the Test of the gaze by Serrano and Allegri (2006), which was carried out using the revised version of the Test (Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). The maximum score is 36. For the correction of the test, the errors were counted and valued according to the normative data for the local population according to previous studies (Román et al., 2012).

Finally the Cambridge Mind Reading Test (CAM) was applied. This test consists of 50 videos of the faces of men and women expressing a feeling or thought through the dynamic expression of their face. The subject must choose the word that he considers best describes what the person in the video is thinking or feeling. Although one word may seem to be applicable, the subject is limited to the one word he considers most appropriate. The subject has the task of interpreting or inferring the emotional expression of the person; each video has four possible answers that appear on the screen and the subject must choose the one that best represents the emotional state expressed in the video. If the subject is not familiar with the meaning of a word he can ask for the exact definition in the instruction manual. It is a test that values complex emotional aspects that drive social interaction while putting the subject in "the place of the other person" (Cohen et al., 2001). The complexity of the test lies in the requirement that the subject know the meaning of the lexicon referring to emotions and feelings; based on the complete expression of the face, hemust identify the emotion that generates that particular expression. A point is awarded for each correct answer, with a maximum score of 50.

The test was developed by Prof. Dr. Simon Baron Cohen of the University of Cambridge and was authorized for use through a material transfer agreement with the Argentine School of Cognitive Neurosciences.

3. Results

In the results we present the differences found between the control group and the psychotic and antisocial patient groups. In these comparisons, the empathic emotion is represented by the scores obtained in the Cambridge Mind Reading Test and Reading the Mind in the Eyes Test, and empathic cognition is measured with the Hinting Task.

3.1 Statistical methods

In order to analyze if there are differences between the three groups of patients that conform the sample according to the score obtained in the Hinting, a ONE WAY ANOVA test was performed. The results showed that there were differences between the three groups ($F(gl, N) = 13.36\ (2, 57)$; $p < 0.01$; $M\ (SD)\ psychosis = 4.70\ (2.83)$, $M\ antisocial\ (SD) = 7.18\ (2.06)$, $M\ control\ (SD) = 8.60\ (2.21)$).

The Bonferroni contrast was used as a test for Post-Hoc analysis. Differences were observed between patients with psychosis and patients with antisocial personality disorder ($p < 0.01$), as well as between patients with psychosis and patients in the control group ($p < 0.01$). No differences were observed between patients with antisocial personality disorder and the control group.

In order to corroborate the existence of differences between the three groups of patients that made up the sample according to the type of incorrect answers in the Reading of Faces, a ONE WAY ANOVA test was performed. The results showed that there were differences between the three groups ($F(gl, N) = 48.67\ (2, 57)$; $p < 0.01$; $M\ (SD)\ psychosis = 22.55\ (4.27)$, $M\ antisocial\ (SD) = 21.76\ (5)$, $M\ control\ (SD) = 10.80\ (3.15)$).

The Bonferroni contrast was used as a test for Post-Hoc analysis. Differences were observed between patients with psychosis and patients in the control group ($p < 0.01$), as well as between patients with antisocial personality disorder and patients in the control group ($p < 0.01$). There were no differences between patients with antisocial personality disorder and with psychosis.

To verify if there were differences between the three groups of patients that made up the sample according to the type of incorrect answers in the CAM, a ONE WAY ANOVA test was performed. The results showed that there were differences between the three groups ($F(gl, N) = 50.54\ (2, 57)$; $p < 0.01$; $M\ (SD)\ psychosis = 30.50\ (5.69)$, $M\ antisocial\ (SD) = 26.59\ (5.86)$, $M\ control\ (SD) = 14.50\ (4.02)$).

The Bonferroni contrast was used as a test for Post-Hoc analysis. Differences were observed between patients with psychosis and patients in the control group ($p < 0.01$), as well as between patients with antisocial personality disorder and patients in the control group ($p < 0.01$). No differences were observed between patients with antisocial personality disorder and psychosis.

The obtained results demonstrated significant differences between the experimental groups and the control group. The group of subjects with a diagnosis of psychosis obtained statistically significantly lower scores both in the evaluation of empathic cognition (through administration of the Hinting Task, see Figure 3) and in the evaluation of empathic emotion as indicated by the results of the Cambridge Mind Reading test and Reading the Mind in the Eyes Test.

On the other hand, subjects with a diagnosis of antisocial personality disorder only obtained lower scores with a degree of statistical significance in the case of EE evaluation. The results of the Hinting Task for this group did not show statistically significant differences regarding the scores of the control group (see Figure 3).

These results indicate a functional dissociation between both forms of empathic processing (both cognitive and emotional), with alterations of both systems in psychotic subjects and specific dysfunctions for emotional processing in subjects with antisocial personality (scores on emotion recognition

Figure 3. The differences in the Hinting task scores between the groups

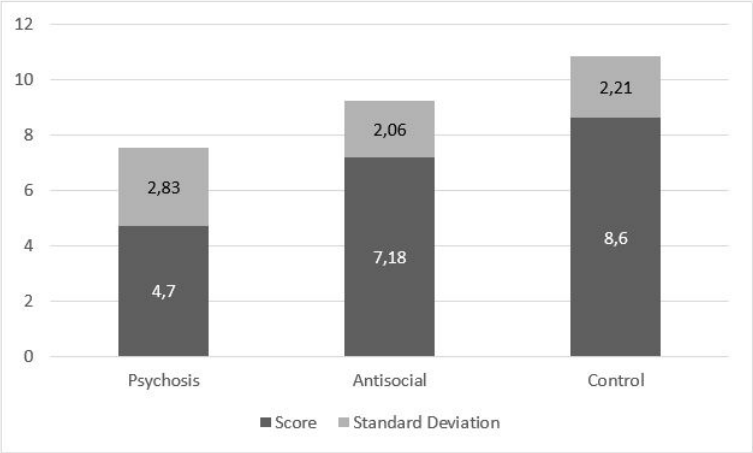
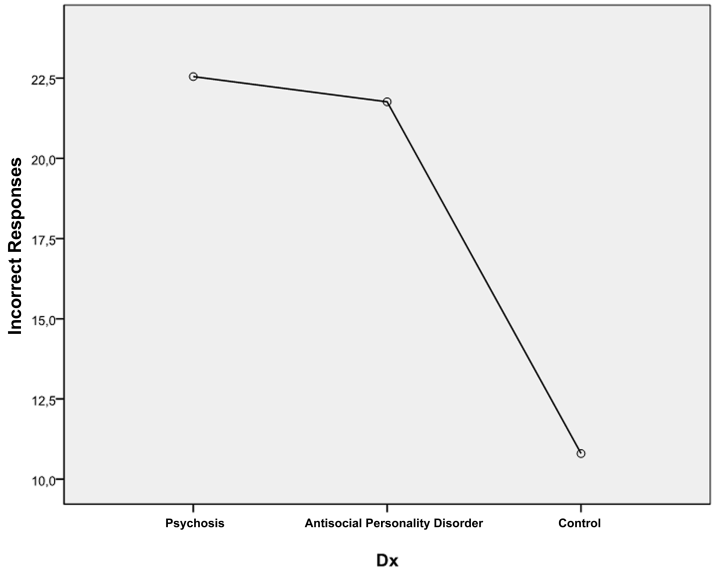


Figure 4. The differences in the Reading the Mind in the Eyes Test scores between groups



tests are shown in Figure 4 and 5).

4. Discussion

This study shows an evident double functional dissociation in tasks related to social cognition. The data obtained indicates that patients diagnosed with psychosis have deficits in social reasoning and emotion recognition tasks; on the other hand, patients with antisocial personality disorder only showed lower scores in emotion recognition tests. These findings are of interest for the diagnosis and development of new therapeutic strategies, and add to our understanding of the empathic ability of people with antisocial personality disorder.

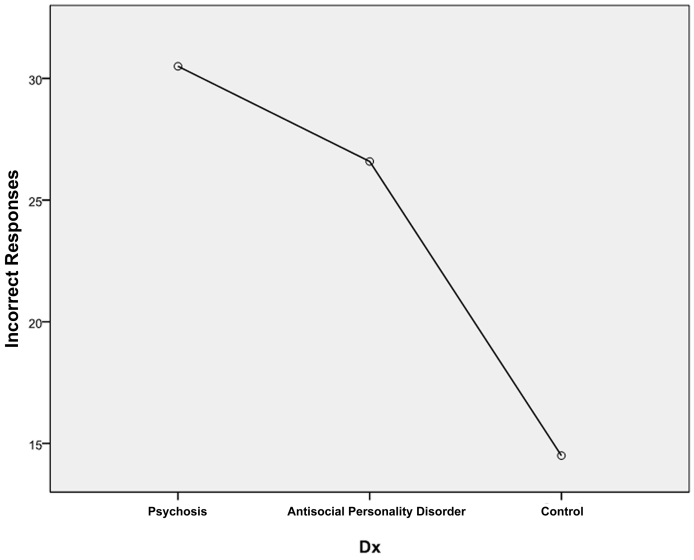
The results obtained coincide with previous work and several studies that postulate a dissociation between the rational component in social and affective-emotional processing (Alcázar-Córcoles, Verdejo-García, & Bouso-Saiz, 2008).

The Hinting Task explores a form of social reasoning which dispenses with the affective component for its correct execution. This function is linked to the cognitive processing of empathy and is linked to Brodmann's areas 10 and 11 (Alcázar-Córcoles et al., 2008).

On the contrary, emotion recognition tests on faces, both in their reading version of the eyes, and in the CAM, require the integration of emotional information through neurocognitive circuits involving affective structures. This empathic component of emotion forms part of a complex circuit of face recognition, identification of emotions and integration of that information by the frontal operculum (Golan, Baron-Cohen, & Hill, 2006).

The superior performance obtained by APD patients compared to the psychotic group explains their preserved ability to manage certain types of interactions in which emotion processing is not involved (Decety & Moriguchi, 2007). It therefore

Figure 5. The differences in the Cambridge mind reading test scores between the groups



follows that they can be skillful swindlers and manipulators and sustain social bonds, even if they are superficial or report some benefit for them.

The similarities in deficit scores appear at the time of identifying facial emotions. The brain dysfunction suffered by people with APD is related to several factors: the size and function of the amygdalas (Pardini, Raine, Erickson, & Loeber, 2014), alterations of the orbital crusts (Raine, Lencz, Bihrle, LaCasse, & Colletti, 2000), and finally dysfunctions in the connectivity between these two regions linked to alterations in the structure of the uncinate fascicle (Craig et al., 2009).

This differentiated dysfunctionality in the social processing of antisocial subjects allows us to perform a more precise discrimination of their neurocognitive deficits. The neuropsychological tests administered only confirm the neurocognitive dysfunctions that have been enumerated by other disciplines (Yang & Raine, 2009).

Several authors have postulated the capacity to regulate behavior for emotional reasons as a fundamental deficit in psychopathy (Lykken & Ferrer, 2000; Patrick, 2000). The The deficits in the processing of fear, in both the perception of fear itself and in the perception of the expressions of fear, are part of the disturbances in behavioral inhibition since patients with psychopathy lack the aversive component that is normally contributed by fear.

On the other hand, the deficits found in psychotic patients are more extensive. Psychotic patients have shown deficits in several domains linked to social cognition: social perception, emotional perception, attributional style, and mind theory (Couture, Penn, & Roberts, 2006).

The understanding of empathy as a process composed of an emotional and a cognitive component is a currently agreed-upon fact. Empathic cognition (Shamay-Tsoory, Aharon-Peretz, & Perry, 2009) is associated with the lower frontal gyrus (area 44) to the emotional processing of empathy and regions of the ventromedial cortex (areas 10 and 11).

Differentiating these two forms of processing allows us to conceptually order the study of empathy in a generic way, but also opens the possibility of the in-depth study of various mental disorders in our case of antisocial personalities and psychoses.

The information that emerges from this study can guide researchers, clinicians and forensic experts in selecting neuropsychological tests for the evaluation of social cognition and for designing treatment programs that include the rehabilitation of detailed dysfunctions to optimize social interaction by people in processes of reintegration and social adaptation.

Finally, the forensic implications of the study of social cognition, empathy and moral reasoning would allow the possibility of new fields of discussion regarding decision-making in psychopaths, free will and the concept of non-imputability. Additionally, this information will be indispensable not only for the work of forensic doctors and psychologists, but also for judges, prosecutors and all personnel belonging to the field of justice.

5. Limitations

Because of the nature of our sample and the fact that this is a research project developed within the penitentiary system, we have found several limitations. The size of the groups was reduced due to problems with recruitment and the cases that had to be discarded. Evaluations of some psychotic patients had to be suspended because of their referral to other units or hospitals during the period of the evaluation process, their inability to complete the tests or the incidence of decompensations. In the case of subjects with antisocial personality disorder, a large number of cases had to be discarded when simulation signs were identified and then confirmed with complementary tests. Although it had been clearly explained to

them that the tests administered would not affect their judicial situation, several subjects had to be discarded from the sample because they simulated deficits in order to give the impression of symptoms or psychiatric alterations that could help their legal situation. Some of these cases also left the evaluation process because they found it extensive, difficult or simply boring.

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