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## Theory of mind and central coherence in eating disorders: Two sides of the same coin?

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### ABSTRACT

The aim of this study was to evaluate central coherence and theory of mind (ToM) and explore the relationships between these domains in patients with eating disorders (ED). ToM and central coherence were assessed in 72 women [24 with anorexia nervosa (AN), 24 with bulimia nervosa (BN) and 24 healthy controls (HC)]. The Reading the Mind in the Eyes (RME) and the Faux Pas Test (FPT) to measure ToM, and the copy strategy of the Rey–Osterrieth Complex Figure Test to assess central coherence were used. It was observed that patients with ED had a decrease in central coherence skills compared with the control group; that patients with anorexia had a poor performance on RME ToM task compared with BN patients and HCs, and also that these measures were related in both clinical groups. The statistically significant correlation between them suggests that the central coherence and ToM measures might involve common cognitive processes. These results provide a better understanding of the nature of the socio-cognitive deficits observed in patients with eating disorders.

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### 1. Introduction

The goal of this study is to investigate the relations between central coherence and theory of mind – a component of social cognition – in patients with eating disorders (ED). Central coherence (CC) is a term introduced by Frith (1989) from autism literature to describe the spontaneous tendency of typically developing individuals to process incoming information in a comprehensive, gestalt and inclusive form. In fact, a weak central coherence, mainly characterized by poor global integration and superior detail processing, is one of the three main neurocognitive theories of autism to explain its characteristic behavioral impairments (Oldershaw et al., 2011). More recently, it was extensively observed that patients with anorexia and bulimia present a poor central coherence (Southgate et al., 2008; C. Lopez et al., 2008; C.A. Lopez et al., 2008b). Since this feature persists even in recovered patients, it is considered as a trait associated with the disease and a maintenance factor (Lopez et al., 2009).

On the other hand, it was observed in recent studies that patients with anorexia have difficulties in social cognition, mainly on theory of mind (Russell et al., 2009; Harrison et al., 2009, 2010; Oldershaw et al., 2010; Tapajóz Pereira de Sampaio et al., 2013), although this research is in its initial stage and some divergent results have been reported (Adenzato et al., 2012). ‘Theory of mind’ (ToM) refers to the ability to attribute or infer the mental states, feelings and thinking of others, in order to predict their behavior, beliefs and intentions and use this information to guide social behavior (Premack and Woodruff, 1978).

The specific relationship between neurocognition and social cognition has been little explored in eating disorders (Harrison et al., 2012). Particularly, it is an important and unexplored question to know if these primary alterations in the style of processing information and difficulties in ToM are in any way related, given that some aspects of the processing of social information demands global integration, such as the ability to process faces, or language comprehension. It is natural to expect that this weakness in central coherence should affect the subject’s ability to make a proper inference about social situations, such as the intentions of other people, as this requires the integration of different sources of information.

In the autism field, it has been questioned whether the deficit in ToM is due to this primary weak central coherence. In this sense,

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potential links between central coherence and theory of mind were explored by Happé (1997), and her results suggest that a deficit in CC can coexist with some degree of competence in theory of mind tasks; hence, it supports the hypothesis that deficits in ToM are independent of weak central coherence. However, she emphasized that relations between these domains deserve further empirical exploration.

In contrast, in an investigation of children with autism, Jarrold et al. (2000) found that poor ToM performance was related to more detailed processing of information, and speculated that this style of processing information could affect the development of ToM. Baron-Cohen and Hammer (1997) reported that fast times on the Embedded Figures Test was related with poor performance on the Reading the Mind in the Eyes – an advanced ToM test – and suggested that “weak CC may go hand in hand with impaired mind-reading” (p. 550). Similarly, Burnette et al. (2005) in an investigation of the relationship between the weak central coherence hypothesis, theory of mind skills, and social-emotional functioning in a group of high functioning children with autism, concluded that central coherence and ToM were moderately related, although socio emotional functioning is a separate domain.

In the field of eating disorders, Harrison et al. (2012) studied social-emotional functioning and cognitive styles (central coherence and set shifting), and found that this variables were psychometrically separated.

Although the literature discussed presents conflicting results, most of this evidence indicates overlapping deficits in central coherence and theory of mind in patients with autism and eating disorders. Thus based on that, and mainly on the findings on autism that show a possible association between CC and ToM, our first hypothesis is that people with ED (anorexia and bulimia) should present a poorer performance on tasks of ToM and central coherence than healthy controls (HC); and the second one is that central coherence and ToM measures might reflect common cognitive processes, and thus, they should be correlated.

In order to probe these statements, this study is going to evaluate the central coherence and the theory of mind in patients with eating disorders, and then explore the relations between these domains.

## 2. Method

### 2.1. Participants

The present study involved a total of 48 Spanish speaking female women diagnosed with eating disorders according to DSM IV (American Psychiatric Association, 2000) and 24 healthy controls. The participants were divided into three groups: the AN group ( $n=24$ ) consists of eight individuals with a restrictive subtype, one with binge-purge subtype and 15 with ED not otherwise specified (EDNOS) – AN type; the BN group ( $n=24$ ) consists of 15 participants with purging subtype, three with non-purging subtype and six with EDNOS – BN type; and the HC group ( $n=24$ ) consists of properly matched women healthy controls. The patients were recruited from the Service of Eating Disorders at the Hospital General Cosme Argerich, Hospital General Abel Zubizarreta and Instituto “Dr. Cormillot”, Argentina. Experienced psychiatrists of the respective staffs made the diagnosis.

Exclusion criteria for both clinical groups were developmental disorders, bipolar disorder, psychosis spectrum disorder, organic brain syndrome or substance dependence, and additionally for the healthy controls group, the absence of an eating disorder, measured by EDI-II, drive for thinness subscale, where the scores should be below the cut-off 14. According to the EDI-II manual a cut-off point of 14 on this subscale was suggested for screening purposes (Garner, 1998). Furthermore, HCs participants were excluded from the study if they had the Body Mass Index ( $BMI=kg/m^2$ ) outside of the established normal range (18.5–24.9) according to the World Health Organization.

The HCs were recruited from a variety of sources (hospital staff, university personnel, and local community) in order to have an age-matched female control group of comparable educational background.

### 2.2. Procedure

The study was approved by the Hospital General Cosme Argerich, Hospital General Abel Zubizarreta and Instituto “Dr. Cormillot” bioethics committees. Written informed consent was collected from all participants, and written parental consent was requested for participants under 18 years old.

The evaluation was carried out in two sessions. In the first meeting, the clinical interview and the evaluation of central coherence were held.

In the second session, the ToM assessment was conducted in this order: Reading the Mind in the Eyes (Baron-Cohen et al., 2001) and “Faux Pas” Test (Baron-Cohen et al., 1999). Questionnaires were completed 1 week before or after the testing session.

In the BN group four participants did not answer part of the variables. In spite of that, the other main measures were included in the analysis.

### 2.3. Measures

#### 2.3.1. Clinical measures

A previous clinical interview was performed in all participants that consisted of: to explain the objectives of research and sign informed consent; request any additional information to that already existing in the medical records; weighing and measuring participants to calculate BMI; inquire about menstruation frequency and pattern during the past year; to confirm the age of onset of the eating pathology and duration of illness. All the interviews and neuropsychological assessment was performed only by one of us (FTPS), who is clinical neuropsychologist and a member of eating disorders service at Cosme Argerich Hospital.

In addition, the following self-report instruments were administered to all participants (in all scales higher scores indicate higher traits studied):

**Beck depression inventory (BDI)** (Beck et al., 1961; Beck et al., 2006): a 21-question multiple-choice self-report inventory to assess the existence and severity of symptoms of depression.

**State-Trait Anxiety Inventory (STAI)** (Spielberger et al., 1982): a 40-item measure that indicates the intensity of feelings of anxiety. It distinguishes between state of anxiety (i.e., a temporary condition experienced in specific situations) and trait anxiety (i.e., a general tendency to perceive situations as threatening).

**Obsessive Compulsive Inventory – Revised (OCI-R)** (Foa et al., 2002; Martínez-González et al., 2011): an 18-item self-report measure of symptoms of obsessive-compulsive disorder (OCD) on six dimensions: Checking, Washing, Ordering, Hoarding, Obsessing, and Neutralizing.

**Eating disorder inventory-two (EDI-II)** (Garner, 1998): a 91-item inventory that evaluates the symptoms and the psychological characteristics of eating behavior disorders. It is composed of 11 subscales: drive for thinness, bulimia, body dissatisfaction, perfectionism, interpersonal distrust, social insecurity, interoceptive awareness, ineffectiveness, maturity fears, asceticism, and impulse regulation.

To evaluate the reliability of the items of the BDI, STAI-state, STAI-trait, OCI-R (total) and EDI-II (total) was calculated Cronbach’s alpha coefficient. The value obtained is 0.778.

To determine the estimated IQ, the Word Accentuation Test – Buenos Aires Version (Burin et al., 2010; Sierra et al., 2010) was completed by all participants, and to screen for cognitive functions, the Mini Mental State Examination (Folstein et al., 1975) was administered.

**Word Accentuation Test** (Burin et al., 2010; Sierra et al., 2010): consists of a card with 50 words of low frequency of use. The participant is asked to read them aloud, without regard to the meaning. Each word read correctly with grapheme-phoneme transcription and correct accentuation is scored 1, the maximum score is 50. Then, the total score is transformed to IQ scores.

**Mini Mental State Examination (MMSE)** (Folstein, 1975): a brief test of 30-point questionnaire that is widely used to screen for cognitive impairment. It evaluates the following cognitive areas: spatial temporal orientation (10 points), registration (3 points), attention and calculation (5 points), recall (3 points), language (8 points) and visual construction (1 point). Higher scores indicate better performance.

#### 2.3.2. Theory of mind measures

**Reading the mind in the Eyes – affective ToM** (Baron-Cohen et al., 2001): consists of 36 photos of the area of the eyes of people of both sexes (19 male and 17 female), whose eyes reflect complex mental states or emotions. The participants were asked to choose between four options the word that best describes how the person in the photograph is feeling or thinking (RME total, maximum score 36). A glossary is provided if the participant does not know the meaning of a word. In addition, as control task (RME control, maximum score 36) the participants were asked to identify the gender of the eyes pairs of the photo. We used the Spanish language adaptation made by the Laboratory of Memory, Hospital Zubizarreta (Serrano, 2006a).

**“Faux Pas” Test – affective and cognitive ToM** (Baron-Cohen et al., 1999): we used a shortened version consisting of five stories that the participant reads where a character said something that did not correspond to the social situation (in ignorance or misunderstanding), wounding the feelings of another person but

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