



Theory of mind and its relationship with executive functions and emotion recognition in borderline personality disorder

Sandra Baez^{1,2,3,4}, Juan Marengo¹, Ana Perez¹, David Huepe^{4,5},
Fernanda Giralt Font¹, Veronica Rial¹, María Luz
Gonzalez-Gadea^{1,2,4}, Facundo Manes^{1,2,4,6} and Agustin Ibanez^{1,2,4,7*}

¹Laboratory of Experimental Psychology and Neuroscience (LPEN), Institute of Cognitive Neurology (INECO) & Institute of Neuroscience, Favaloro University, Buenos Aires, Argentina

²National Scientific and Technical Research Council (CONICET), Buenos Aires, Argentina

³Pontifical Catholic University of Argentina, Buenos Aires, Argentina

⁴UDP-INECO Foundation Core on Neuroscience (UIFCoN), Diego Portales University, Santiago, Chile

⁵Laboratory of Cognitive and Social Neuroscience, Universidad Diego Portales, Santiago, Chile

⁶Australian Research Council (ACR) Centre of Excellence in Cognition and its Disorders, New South Wales, Australia

⁷Universidad Autónoma del Caribe, Barranquilla, Colombia

Impaired social cognition has been claimed to be a mechanism underlying the development and maintenance of borderline personality disorder (BPD). One important aspect of social cognition is the theory of mind (ToM), a complex skill that seems to be influenced by more basic processes, such as executive functions (EF) and emotion recognition. Previous ToM studies in BPD have yielded inconsistent results. This study assessed the performance of BPD adults on ToM, emotion recognition, and EF tasks. We also examined whether EF and emotion recognition could predict the performance on ToM tasks. We evaluated 15 adults with BPD and 15 matched healthy controls using different tasks of EF, emotion recognition, and ToM. The results showed that BPD adults exhibited deficits in the three domains, which seem to be task-dependent. Furthermore, we found that EF and emotion recognition predicted the performance on ToM. Our results suggest that tasks that involve real-life social scenarios and contextual cues are more sensitive to detect ToM and emotion recognition deficits in BPD individuals. Our findings also indicate that (a) ToM variability in BPD is partially explained by individual differences on EF and emotion recognition; and (b) ToM deficits of BPD patients are partially explained by the capacity to integrate cues from face, prosody, gesture, and social context to identify the emotions and others' beliefs.

*Correspondence should be addressed to Agustin Ibanez, Institute of Cognitive Neurology, Pacheco de Melo 1860, Buenos Aires, Argentina (email: aibanez@ineco.org.ar).

Borderline personality disorder (BPD) is a heterogeneous condition characterized by severe and persistent problems across interpersonal, cognitive, behavioural, and emotional domains (American Psychiatric Association, 1994; Gunderson, 2001). Clinical and empirical observations have suggested that impaired social cognition is a mechanism underlying the development and maintenance of BPD (Bender & Skodol, 2007; Levy, 2005). One important aspect of social cognition is the theory of mind (ToM), the ability to infer the beliefs, intentions, and emotions of others (Baron-Cohen, Leslie, & Frith, 1985). Previous studies in adults with BPD have yielded mixed results, including impaired (Ghiassi, Dimaggio, & Brune, 2010; Harari, Shamay-Tsoory, Ravid, & Levkovitz, 2010), and preserved ToM (Fertuck *et al.*, 2009; Schilling *et al.*, 2012; Scott, Levy, Adams, & Stevenson, 2011). One of the factors that could be associated with these inconsistent findings is the heterogeneity of the cognitive functioning of BPD population (Beblo *et al.*, 2006; Hoermann, Clarkin, Hull, & Levy, 2005; Sprock, Rader, Kendall, & Yoder, 2000). Here, we tested the hypothesis that ToM deficits and their variability in BPD would depend on more basic skills, such as executive functions (EF) and emotion recognition.

Theory of mind is a complex skill that seems to be influenced by EF and emotion recognition. Several studies in children (Cole & Mitchell, 2000; Gordon & Olson, 1998; Sabbagh, Xu, Carlson, Moses, & Lee, 2006), adults (Ahmed & Stephen Miller, 2011; Saltzman, Strauss, Hunter, & Archibald, 2000), and clinical populations (Aboulaflia-Brakha, Christe, Martory, & Annoni, 2011; Fahie & Simons, 2003) have found a direct relationship between EF and ToM. These studies have suggested that better performance in EF tasks was positively associated with better performance in ToM. Furthermore, ToM entails holding information in working memory and switching between own/others' perspectives (Uekermann *et al.*, 2010). Studies exploring EF in BPD have found inconsistent results. Although several reports suggest that BPD is associated with EF impairments (Dinn *et al.*, 2004; Gvirts *et al.*, 2012; LeGris & van Reekum, 2006), other studies failed to find deficits in these domains (Kunert, Druecke, Sass, & Herpertz, 2003; Sprock *et al.*, 2000).

On the other hand, ToM and emotion recognition are interrelated phenomena. The recognition of emotional states is the first step in ToM (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). Assessing other persons' intentions involves the appraisal of their emotional status as well as one's own emotional response to them (Ochsner, 2008). From an ontogenetic perspective, it has been shown (Saxe, Carey, & Kanwisher, 2004) that emotion recognition develops earlier than the ability to mentalize. Furthermore, several studies support the association of these processes demonstrating a positive correlation between them (Brune, 2005; Buitelaar & van der Wees, 1997; Dyck, Piek, Hay, Smith, & Hallmayer, 2006). This relationship is also consistent with the results of a fMRI study (Mier *et al.*, 2010) reporting overlapping brain activity during tasks of emotion recognition and affective ToM.

Studies of emotion recognition in BPD have also yielded mixed results. There is some evidence of impairments in basic emotion recognition (Bland, Williams, Scharer, & Manning, 2004; Levine, Marziali, & Hood, 1997), a negativity bias in the appraisal of neutral or ambiguous faces (Donegan *et al.*, 2003; Dyck *et al.*, 2009), and no difficulties in recognizing emotions (Domes *et al.*, 2008; Wagner & Linehan, 1999).

In sum, studies of ToM in adults with BPD have yielded controversial results. ToM is a complex skill that seems to be influenced by EF and emotion recognition. These three processes have been considered preserved and impaired in BPD. These mixed findings could be associated with the cognitive heterogeneity reported in BPD patients (Beblo

et al., 2006; Blais, Hilsenroth, & Fowler, 1999; Sprock *et al.*, 2000) and the complexity and features of the tasks employed across different studies. Furthermore, it is possible that emotion recognition and EF are differentially impaired among BPD individuals and may affect the ToM performance.

This study assessed the performance of adults with BPD on multiple tasks of ToM, emotion recognition, and EF. Taking into account that mixed results in BPD studies could be explained by the complexity and features of the task employed, we included tasks with different demands and levels of real-life involvement. In addition, we carried out regression analyses to examine whether more basic skills such as EF and emotion recognition could predict the performance on ToM tasks.

Materials and methods

Participants

Thirty subjects (BPD: $n = 15$; controls: $n = 15$) were selected from the outpatient populations of the Institute of Cognitive Neurology (INECO) and met the diagnostic and statistical manual of mental disorders (DSM-IV) criteria for BPD (American Psychiatric Association, 1994). Diagnosis was conducted by a psychiatrist and established by a standardized clinical interview (SCID-II) (First, Spitzer, Smith, & Williams, 1997). Fifteen healthy controls were recruited matched for sex, age, and years of education with the BPD group.

Exclusion criteria for the study were other axis II disorders, bipolar I disorder, schizophrenia and other psychotic disorders, history of substance abuse/dependency, mental retardation, neurological disease, or any clinical condition that might affect cognitive performance. All participants provided written informed consent in agreement with the Helsinki declaration. The present study was approved by the institution's ethical committee.

Instruments

Clinical and EF assessment

All participants completed a series of psychiatric and behavioural questionnaires. The Beck depression inventory II (BDI-II) (Beck, Brown, & Steer, 1996) rated depression. The state-trait anxiety inventory (STAI) (Spielberg, Gorsuch, & Lushene, 1970) assessed anxiety and the Barratt impulsiveness scale (BIS) (Barratt & White, 1969) evaluated impulsivity.

Participants were also evaluated with the INECO frontal screening (IFS) (Torralva, Roca, Gleichgerricht, Lopez, & Manes, 2009), which includes the following eight subtests: motor programming, conflicting instructions, motor inhibitory control, numerical working memory, verbal working memory, spatial working memory, abstraction capacity, and verbal inhibitory control.

Emotion recognition

Emotional morphing. This facial expression recognition task featured six basic emotions (happiness, surprise, sadness, fear, anger, and disgust), which had been morphed for each prototype emotion and for a neutral state (Baez *et al.*, 2013; Young *et al.*, 1997). The accuracy of the emotion recognition and reaction times (RTs) were measured.

The Awareness of Social Inference Test (TASIT). This test comprises videotaped vignettes of everyday social interactions (Baez et al., 2012, 2013; McDonald et al., 2006) and assesses recognition of spontaneous emotional expressions. This task introduces contextual cues that are absent when viewing static displays.

A detailed description of emotion recognition tasks is provided in the supplementary data.

ToM

Faux pas test (FPT). The FPT assesses the emotional and cognitive inference aspects of the ToM. In this task, the participants read stories that may contain a social faux pas (Stone, Baron-Cohen, & Knight, 1998). After each story has been read, the subject is asked whether someone said something awkward. Detailed information is provided in the supplementary data.

Reading the mind in the eyes (RMET). This test (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997) assesses the emotional inference aspect of the ToM. The task consists of 36 pictures of the eye region of a face. Participants are asked to choose which of four words best describes what the person in each photograph is thinking or feeling.

Data analysis

The demographic, neuropsychological, and experimental data were compared between the groups using a mixed-model ANOVA and Tukey's HSD *post-hoc* tests (when appropriate). When analysing categorical variables, chi-square tests were applied. To control for the influence of clinical symptoms (depression and anxiety) on the performance on EF and social cognition tasks, we applied an ANCOVA test that was adjusted for the BDI-II and the STAI scores. We reported only effects that were still significant after covariation. Finally, we conducted linear regression analyses to explore whether emotion recognition or EF independently predicted performance on ToM. The performances on FPT and RMET were independently considered as dependent variables. The group, the IFS total score, the total TASIT score, and the accuracy on the emotional morphing tasks were separately included as predictors. The α value for all statistical tests was set at 0.05.

Results

Demographic, clinical, and EF results are provided in Table 1.

Demographic data

The BDP and control groups were well matched in terms of age, $F(1,28) = 0.15, p = .69$, education, $F(1,28) = 0.003, p = .95$, and gender, $X^2(1) = 0.24, p = .62$.

Clinical assessment

The clinical assessment revealed that BPD patients exhibited more depressive symptoms than controls, $F(1,28) = 7.91, p < .05$, as measured by BDI-II total scores. In addition,

Table 1. Demographic, clinical, and executive function assessments

	BPD (<i>n</i> = 15)	CTR (<i>n</i> = 15)	<i>p</i>
Demographics			
Age (years)	38.4 (12.2)	36.5 (14.3)	N.S
Gender (F:M)	12:3	13:2	N.S
Education (years)	16.4 (3.1)	16.4 (3.2)	N.S
Handedness (R:L)	14:1	13:2	N.S
Clinical profile			
BDI-II	18.6 (11.4)	6.8 (6.6)	0.01
STAI-State	48.3 (10.6)	34.8 (10.1)	0.01
Trait	50.9 (9.5)	39.9 (11.5)	0.03
BIS	62.1 (7.7)	56.8 (16.0)	N.S
Total			
Non-planning	22.8 (4.5)	22.1 (5.6)	N.S
Attentional	18.8 (2.6)	19.1 (7.7)	N.S
Motor	20.9 (3.1)	18.6 (3.0)	N.S
Executive functions assessment			
IFS total score	24.0 (2.5)	26.5 (2.3)	0.01
Motor series	3.0 (0.0)	3.0 (0.0)	N.S
Conflicting instructions	2.8 (0.3)	3.0 (0.0)	N.S
Go-no go	2.2 (0.7)	2.8 (0.5)	0.04
Backward digits span	4.3 (1.2)	4.3 (1.0)	N.S
Verbal working memory	1.9 (0.2)	2.0 (0.0)	N.S
Spatial working memory	1.9 (0.8)	3.0 (1.0)	0.04
Abstraction capacity	2.3 (0.5)	2.7 (0.3)	N.S
Verbal inhibitory control	5.3 (0.8)	5.6 (0.6)	N.S

Table shows mean (SD). BDI-II: Beck depression inventory; STAI: state-trait anxiety inventory; BIS: Barratt impulsiveness scale; IFS: INECO frontal screening. Significant differences are in bold.

STAI-state, $F(1,28) = 7.85$, $p < .05$, and STAI-trait, $F(1,28) = 5.39$, $p < .05$, scores showed that BPD patients exhibited higher anxiety levels than controls.

EF assessment

Figure 1 summarizes the differences between groups in EF, emotion recognition, and ToM tasks.

Borderline personality disorder patients performed significantly worse than controls in the IFS total score, $F(1,28) = 7.61$, $p < .05$ (see Figure 1A). The BPD group also had lower scores in motor inhibitory control, $F(1,28) = 4.48$, $p < .05$, and spatial working memory, $F(1,28) = 9.67$, $p < .01$.

Emotional processing

No differences between groups were observed on the performance, $F(1,28) = 0.03$, $p = .84$, or RTs, $F(1,28) = 0.62$, $p = .43$, of the emotional morphing task. However, BPD patients showed lower scores than controls on the TASIT total score, $F(1,28) = 4.62$, $p < .05$. The per-category analysis showed significant differences between groups, $F(4,112) = 2.63$, $p < .05$. A *post-hoc* analysis (Tukey's HSD, $MS = .3$, $df = 95.30$) revealed

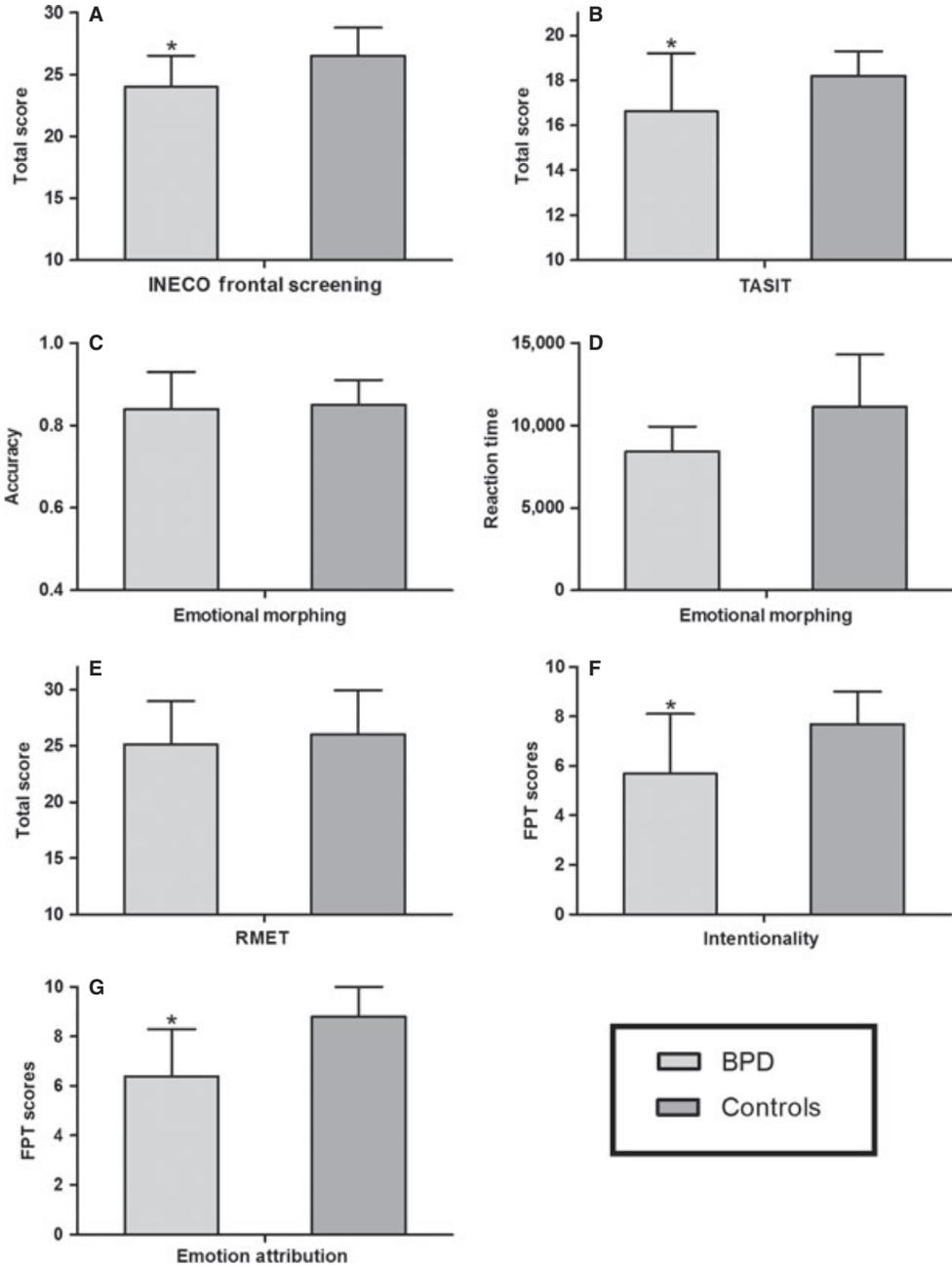


Figure 1. Group comparisons in executive function, emotion recognition, and theory of mind tasks. (A) INECO frontal screening (IFS) total score. (B) The awareness of social inference test (TASIT) total score. (C) Emotional morphing accuracy. (D) Emotional morphing reaction times. (E) Reading the mind in the eyes (RMET) test total score. (F) Faux pas test (FPT) intentionality scores. (G) FPT emotion attribution scores. Asterisks indicate significant differences.

that patients had difficulty with disgust categorization ($p < .05$). This effect remained significant even though a significant effect of depression ($p < .05$) and anxiety ($p < .05$) on disgust recognition was observed.

Theory of mind

The performance on the FPT revealed that patients with BPD showed lower intentionality, $F(1,28) = 6.15, p < .05$, and emotional attribution scores, $F(1,28) = 7.42, p < .05$. Nonetheless, no differences between the groups were observed on the RMET total score, $F(1,28) = 0.43, p = .51$.

Are emotion recognition and EF predicting ToM performance?

Figure 2 shows significant associations in regression analyses.

EF

Results of linear regression analyses were significant, $F(1,28) = 10.02, p < .01$, and showed that IFS total score was a predictor of the FPT performance (beta = .52), explaining 27% of the variance. In contrast, IFS total score was not significantly associated

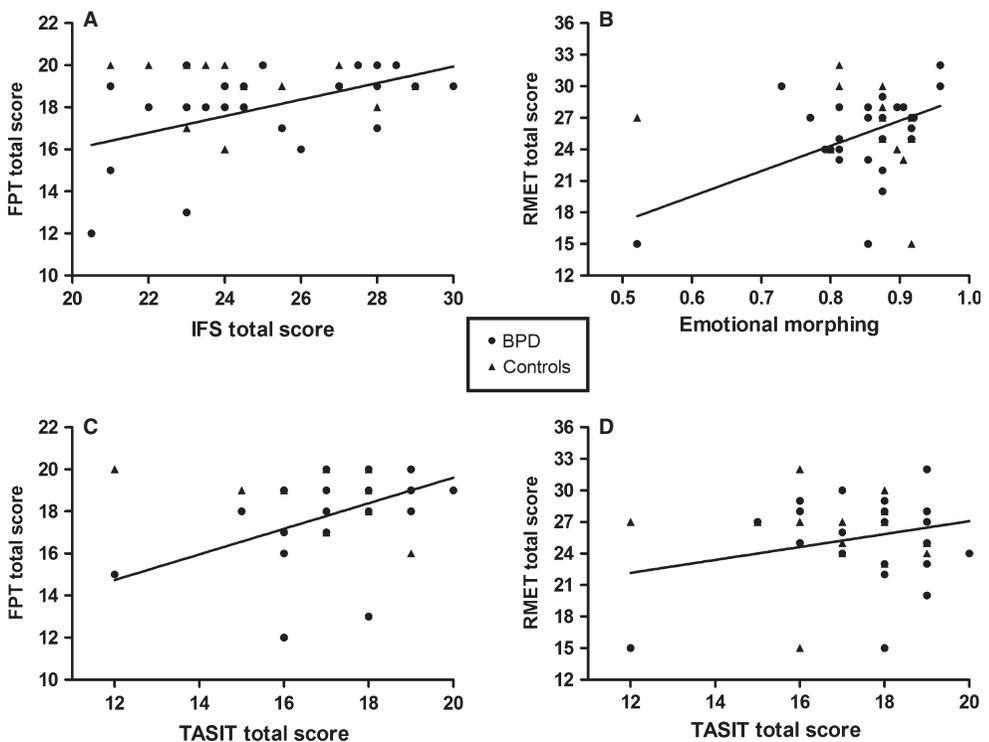


Figure 2. Regression analysis between faux pas test (FPT) total score and (A) INECO frontal screening (IFS) total score, as well as (B) The awareness of social inference test (TASIT) total score. Regression analysis between reading the mind in the eyes (RMET) total score and (C) TASIT total score, and (D) Emotional morphing accuracy.

with RMET performance, $F(1,28) = 1.96$, $p = .17$. The group was not significantly associated with executive functioning in any of the regression analysis when introduced as a second predictor.

Emotion recognition

Higher TASIT total scores predicted a higher performance on the FPT, $F(1,28) = 7.50$, $p < .05$, $\beta = .47$, explaining 22% of the variance. Furthermore, TASIT total score predicted the RMET performance, $F(1,28) = 4.34$, $p < .05$, $\beta = .36$, although it explained a smaller percentage of the variance ($R^2 = .13$). On the other hand, the performance on the emotional morphing task predicted the RMET total score, $F(1,28) = 9.94$, $p < 0.01$, $\beta = .51$, explaining 26% of the variance. However, the performance on the emotional morphing was not associated with FPT scores, $F(1,28) = 1.07$, $p = .31$. The group was not significantly associated with ToM performance in any of the regression analysis when introduced as a second predictor (as dummy variable).

We also performed regression analyses without outliers and all the findings remained significant except for the association between TASIT total score and RMET performance.

Discussion

This study assessed the performance of BPD adults on multiple tasks of ToM, emotion recognition, and EF. We also carried out regression analyses to examine whether more basic skills such as EF and emotion recognition could predict the performance on ToM tasks. Our results showed that BPD patients exhibited deficits in ToM, emotion recognition, and EF that seem to be task-dependent. Regression analyses revealed that more basic skills such as EF and emotion recognition predict the performance on ToM.

The performance of BPD patients on EF, emotion recognition, and ToM tasks

Regarding EF, previous studies in BPD have reported impaired (Dinn *et al.*, 2004; Gvirts *et al.*, 2012; LeGris & van Reekum, 2006) and preserved performances (Kunert *et al.*, 2003; Sprock *et al.*, 2000). We found that BPD patients scored significantly lower than controls on the IFS total score. In line with previous studies, our results showed that BPD adults exhibited impairments in inhibitory control (Fisher & Happe, 2005) and spatial working memory (Gvirts *et al.*, 2012; LeGris & van Reekum, 2006).

With respect to emotion recognition, our results showed no differences between groups on the emotional morphing. These results are in line with a previous investigation (Domes *et al.*, 2008) that used morphed facial stimuli and found no differences between adults with BPD and controls in emotion detection threshold or accuracy.

We included a more ecological task of contextual inference of emotional states (TASIT), which requires the integration of cues from face, prosody, gesture, and social context to identify the emotions (Baez *et al.*, 2012, 2013). In this task, BPD patients performed lower than controls and had difficulty with disgust categorization. These results are consistent with previous studies showing that BPD patients were less accurate than controls in basic emotion recognition (Bland *et al.*, 2004; Levine *et al.*, 1997), particularly in the discrimination of negative emotions (Unoka, Fogd, Fuzy, & Csukly, 2011). Furthermore, our results support the findings of a prior report (Preissler, Dziobek,

Ritter, Heekeren, & Roepke, 2010) in which BPD individuals were impaired in the recognition of the feelings, thoughts, and intentions of movie characters. Our findings are also in line with previous reports suggesting that when emotion recognition tasks imitate more complex social situations (Dyck *et al.*, 2009) or involve additional prosodic information (Minzenberg, Poole, & Vinogradov, 2006), patients with BPD increase their error rates.

The discrepancy in the performance between both emotion recognition tests in the BPD group suggests that although this domain is affected, impairments may be only detected by tasks with particular features and demands, such as TASIT. Although emotional morphing has been shown to be sensitive in other psychiatric disorders (Mendoza *et al.*, 2011; Russell *et al.*, 2007; Schaefer, Baumann, Rich, Luckenbaugh, & Zarate, 2010; Skodol *et al.*, 2002), this does not seem to be the case in individuals with BPD. This task is markedly different from spontaneous dynamic displays of emotion involved in TASIT. Thus, our results and those of previous studies in BPD (Dyck *et al.*, 2009; Minzenberg *et al.*, 2006; Preissler *et al.*, 2010) suggest that tasks involving real-life scenarios (which require the integration of cues from face, prosody, gesture, and social context to identify the emotions of target characters) are more adequate for assessing BPD patients.

On the other hand, as previously reported (Harari *et al.*, 2010), our results revealed that BPD patients exhibited deficits on the FPT scores, but preserved RMET scores. On the FPT, patients with BPD exhibited lower intentionality and emotional attribution scores than controls. Regarding RMET, our results are in line with a previous study (Preissler *et al.*, 2010) reporting no deficits in RMET performance, but differed from two investigations (Fertuck *et al.*, 2009; Scott *et al.*, 2011) that reported higher scores in BPD patients. The discrepancy in the performance between both ToM tests in the BPD group and between the current findings and those of previous studies can be explained by the features of the tasks. Unlike the RMET, the FPT presents social scenarios resembling daily-life situations. These tasks that involve real-life social scenarios are more sensitive to detect ToM deficits of individuals with neuropsychiatric disorders (Burgess, Alderman, Volle, Benoit, & Gilbert, 2009; Ibanez & Manes, 2012; Torralva, Roca, Gleichgerrcht, Bekinschtein, & Manes, 2009). Furthermore, the FPT entails additional demands as an adequate performance in this test involves the capacity to implicitly integrate cognitive inferences about mental states with emotion understanding. This capacity is mediated by the appraisal of contextual clues and relevant social elements provided in the scene information.

Summarizing, BPD patients showed EF impairments, particularly in inhibitory control and spatial working memory. They also exhibited emotion recognition and ToM deficits. However, these deficits were detected only when more ecological tasks with higher contextual demands (TASIT and FPT) were employed. It is possible that the mixed findings of the current and previous studies are associated with complexity and the features of the tasks employed to assess emotion recognition and ToM in BPD patients.

Individual differences in EF and emotion recognition as predictors of ToM performance

Several studies in healthy adults (Ahmed & Stephen Miller, 2011; Saltzman *et al.*, 2000) and clinical populations (Aboulafia-Brakha *et al.*, 2011; Fahie & Simons, 2003; Fisher & Happe, 2005; Ibanez, Aguado, *et al.*, 2013; Ibanez, Huepe, *et al.*, 2013) have suggested that better performance in EF tasks is positively associated with better performance in

ToM. In this same line, our data showed that the IFS total score predicted the FPT performance in both groups. Nonetheless, executive functioning was not associated with the RMET performance. This pattern of results is consistent with the findings of a recent study (Ahmed & Stephen Miller, 2011) showing that verbal fluency and problem solving accounted for performance on the FPT, while none of the EF variables accounted for a significant proportion of variance in RMET performance.

Our results suggest that executive functioning predicts the performance only in more complex ToM tasks. Although both were designed to assess ToM, each of these tasks may involve different cognitive processes (Ahmed & Stephen Miller, 2011). The FPT is a more complex task as it measures a person's ability to simultaneously understand the beliefs of two characters (Gregory *et al.*, 2002; Stone *et al.*, 1998). Therefore, this test implies a higher demand of EF.

In addition, our results showed that in both groups, the performance on the RMET was predicted by the emotional morphing. This is not unexpected as the RMET is a measure of mental state discrimination, the first stage of attribution of ToM (Ibanez, Huepe, *et al.*, 2013). This test does not include the second dimension of ToM: inferring the content of that mental state (e.g., detecting that someone is happy because he won the lottery) (Baron-Cohen *et al.*, 2001; Fertuck *et al.*, 2009). Consequently, the RMET shares some conceptual overlap with measures of emotion recognition, such as the emotional morphing.

In contrast, performance on the FPT was predicted in both groups only by the TASIT total score. Given that our data showed that groups differed only on the FPT performance, regression analysis results suggest that rather than the facial emotion recognition, performance in more complex ToM tasks is predicted by the capacity to integrate cues from face, prosody, gesture, and social context to identify the emotions. Overall, our results confirm that emotional processing is partially predictive (as the case of EF) of ToM (Ibanez, Aguado, *et al.*, 2013).

Conclusions and further directions

There are two major findings in this study. First, BPD adults exhibited EF deficits and both impaired and preserved ToM and emotion recognition. Emotion recognition and ToM tasks that involve real-life social situations and contextual clues integration showed to be more sensitive in detecting the social cognition impairments of BPD patients. Second, the present report provides preliminary evidence that more basic skills (EF and emotion recognition) predict ToM performance in BPD and control groups (see also Couto *et al.*, 2013; Ibanez, Aguado, *et al.*, 2013). EF and TASIT total score predict the performance in more complex ToM tasks (FPT). Thus, ToM deficits of BPD patients seem to be related to EF as well as to the capacity to integrate cues from face, prosody, gesture, and social context to identify the emotions.

This is the first report in BPD to explore the effect of EF and emotion recognition on ToM performance, including tasks with different features. However, some limitations of this study should be acknowledged. First, some of the patients included in the BPD group were taking psychoactive drugs (antipsychotics, antidepressants, or mood stabilizers), which can influence cognitive functioning. However, a meta-analysis (Ingenhoven, Lafay, Rinne, Passchier, & Duivenvoorden, 2010) showed that antipsychotics (classic as well as atypical) tend to improve rather than impair the cognitive functioning of BPD patients. In contrast, antidepressants and mood stabilizers did not improve the cognitive symptoms nor did they worsen them. Thus, given that these medications should not impair the

performance of these patients, differences between groups in EF or social cognition tasks should not be attributed to their effects. Another limitation is that our sample size was relatively small. However, it is enough for the type of analysis performed here and is similar to sample sizes of previous studies in BPD (Arntz & Haaf, 2012; Harari *et al.*, 2010). Furthermore, the patients included in this study have no other axis II diagnoses, history of substance abuse or dependence, bipolar I disorder, or other psychotic disorders. This is because we have made an effort to disentangle BPD from some comorbid and overlapping disorders. In addition, the polythetic format of a DSM-IV BPD diagnosis favours higher heterogeneity between patients (Skodol *et al.*, 2002), given that a set of optional diagnostic criteria are provided (i.e., any five of nine). For instance, we used restricted inclusion criteria that may be considered as strength of our study.

On the other hand, the lack of an IQ measure to control for the influence of this aspect on the performance is a limitation of this study, and our data should be considered as preliminary. Further studies in BPD should explore the relationship between ToM, emotion recognition, and EF controlling for the intellectual functioning. Moreover, although the IFS proved to be useful to assess EF (Baez *et al.*, 2014; Gleichgerrcht, Roca, Manes, & Torralva, 2011; Torralva, Roca, Gleichgerrcht, Lopez, *et al.*, 2009), further studies should employ a more extensive battery. In addition, further research should examine the relationship between EF, emotion recognition, and ToM in BPD patients without comorbid axis I disorders. Future studies should also include a clinical comparison group in addition to the normal subject sample.

Borderline personality disorder and other neuropsychiatric disorders, such as Asperger Syndrome, Attention-deficit/hyperactivity disorder, and bipolar disorder, are characterized by great heterogeneity in the cognitive and social functioning among patients (Baez *et al.*, 2012, 2013; Gonzalez-Gadea *et al.*, 2012; Martino *et al.*, 2008). The mixed findings reported by previous studies assessing EF, emotion recognition, and ToM in BPD would be partially explained by the cognitive variability reported in this disorder (Beblo *et al.*, 2006; Hoermann *et al.*, 2005; Sprock *et al.*, 2000). Indeed, our results also showed a variable performance, also related to the demands of the tasks employed.

The current findings of impaired social cognition have several implications for the theoretical understanding of the interpersonal difficulties and the clinic of BPD. First, deficits in accurately identifying emotions, thoughts, and intentions occurring in social situations may explain some clinical symptoms of BPD, such as the pattern of instability of interpersonal relationships, difficulty controlling anger, and affective instability. From a clinical perspective, deficits in social cognition in patients with BPD should be considered in their treatment. For instance, presumed emotions, thoughts, and intentions of interaction with partners are often triggers of dysfunctional behaviour in BPD. Thus, a reanalysis of these social triggers should be included in psychotherapy (Preissler *et al.*, 2010). Furthermore, psychotherapeutic strategies and trainings for enhancing social cognitive abilities should be integrated into the treatment of these patients.

Finally, our results showing task-specific deficits in BPD patients suggest that ecological tasks that involve real-life social scenarios (FPT and TASIT) may be more sensitive to detect ToM and emotion recognition deficits of these individuals. The current findings highlight the importance to promote the use of these kind of tasks in the assessment of BPD as well as other neuropsychiatric disorders (Burgess *et al.*, 2009; Ibanez & Manes, 2012; Melloni, Lopez, & Ibanez, 2013; Torralva, Roca, Gleichgerrcht, Bekinschtein, *et al.*, 2009; Torralva *et al.*, 2012). Further studies are needed to clarify what cognitive, emotional, and behavioural processes account for the social cognition deficits observed in BPD.

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Supporting Information

The following supporting information may be found in the online edition of the article:

Data S1. Instruments.