UNIVERSITÀ
DEGLI STUDI
DI BRESCIA

How do patients with Borderline Personality Disorder react to emotional facial expressions?

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XXIXth cycle PhD IAMED

Collaboration between DSM-D (Prof. Vita) and UNIBS neurophysiology (Prof. Mirabella) to study inhibitory control and reaction to emotional stimuli

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Both dimensions are fundamental to an adequate **social cognition**

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"**cognition in which people perceive, think about, interpret, categorize, and judge their own social behaviors and those of others**."

HOW DO WE REACT TO EMOTIONAL STIMULI?

MOTIVATIONAL MODEL: reaction to emotional stimuli is automatic

RECENT STUDIES: emotional valence is critical in the processing of emotional stimuli, influencing inhibitory control and motor readiness.

Controversial results in the literature

I. differences in experimental designs
II. sometimes emotions with a negative valence (e.g. anger and fear) are used interchangeably even if their biological meaning is different
III. arousal is almost never considered
IV. the emotional stimuli used are often irrelevant to the task

Bradley, M. M., Codispoti, M., Cuthbert, B. N. & Lang, P. J. Emotion and motivation I: Defensive and appetitive reactions in picture processing. Emotion 1, 276–298 (2001)

BORDERLINE PERSONALITY DISORDER (BPD)

0.5-5.9% general population
10% outpatient
15-25% inpatient

At least 5 out of 9 criteria (256 possible combinations):

1. **Frantic Efforts to Avoid Abandonment**: This includes both real and imagined scenarios of abandonment.
2. **Unstable and Intense Relationships**: Alternating between extremes of idealization and devaluation.
3. **Identity Disturbance**: Markedly and persistently unstable self-image or sense of self.
4. **Impulsivity in At Least Two Areas**: These areas are potentially self-damaging, such as spending, sex, substance abuse, reckless driving, and binge eating.
5. **Recurrent Suicidal Behavior or Self-Harming Behavior**: Such as threats or gestures, or self-mutilation.
6. **Affective Instability**: Due to a marked reactivity of mood.
7. **Chronic Feelings of Emptiness**.
8. **Inappropriate, Intense Anger or Difficulty Controlling Anger**: Frequent displays of temper, constant anger, or physical fights.
9. **Transient, Stress-Related Paranoid Ideation or Severe Dissociative Symptoms**.

3 fundamental factors:

I. **Relational disorder**
II. **Behavioural dysregulation**
III. **Emotional dysregulation**

→ Always related to the concepts of **dysregulation**, **impulsiveness** and **difficulty in inhibitory control**

Sanislow, C. A. et al. Confirmatory factor analysis of DSM-IV borderline, schizotypal, avoidant and obsessive-compulsive personality disorders: findings from the Collaborative Longitudinal Personality Disorders Study: Confirmatory tests of personality disorders. Acta Psychiatrica Scandinavica 105, 28–36 (2002)

IMPULSIVITY

tendency of the subject to act quickly, without planning one's conduct and without having the possibility of making a rational and conscious assessment of the consequences

DIVIDED into two macro-domains:

- DECISIONAL IMPULSIVITY
    1. “temporal discount”: preference for small immediate rewards over larger but delayed rewards
    2. “probabilistic discount”: preference for smaller and more likely rewards than for larger and less likely rewards
    3. “reflexive impulsivity”: tendency to make quick decisions without adequate collection and consideration of available evidence

- MOTORIC IMPULSIVITY: the inability to restrain motor acts or movements that are inappropriate to the context

Dalley, J. W. & Robbins, T. W. Fractionating impulsivity: neuropsychiatric implications. Nat Rev Neurosci 18, 158–171 (2017)

MOTOR INIBITHORY CONTROL

ability to inhibit a preplanned motor response

two different SUBDOMAINS:

1. REACTIVE INHIBITION: the ability to cancel an ongoing response at the presentation of a stop-signal

2. PROACTIVE INHIBITION: the ability to modulate inhibitory control in advance according to the current context and one's goals

Mirabella G. Inhibitory control and impulsive responses in neurodevelopmental disorders. Dev. Med. Child Neurol. 2021

CORRELATION BETWEEN IMPULSIVITY AND INHIBITORY CONTROL ONLY PARTIALLY CONFIRMED

Tourette Syndrome	Primary Motor Stereotypies	Autism Spectrum Disorders
=	=	=
no inhibitory control deficit	reactive inhibitory control deficit	proactive inhibitory control deficit

IS THERE A DEFICIT IN INHIBITORY CONTROL AND PROCESSING OF EMOTIONAL STIMULI IN BPD?

In literature, the evidence is controversial for several reasons: emotional stimuli have no relevance to the task (background) and there are confounding factors (therapy and comorbidities)

Mirabella, G. Inhibitory control and impulsive responses in neurodevelopmental disorders. Develop Med Child Neuro 63, 520–526 (2021)
Mirabella, G., Mancini, C., Valente, F. & Cardona, F. Children with primary complex motor stereotypies show impaired reactive but not proactive inhibition. Cortex 124, 250–259 (2020)
Schmitt, L. M., White, S. P., Cook, E. H., Sweeney, J. A. & Mosconi, M. W. Cognitive mechanisms of inhibitory control deficits in autism spectrum disorder. J Child Psychol Psychiatr 59, 586–595 (2018)

PRIMARY OUTCOME

Evaluation of reactive inhibitory control in BPD subjects and healthy subjects calculated on the percentage (rate) of commission errors

SECONDARY OUTCOMES

1. Correlation of one or more psychopathological dimensions in BPD subjects with inhibitory control deficit
2. Assessment of the impact of psychopharmacological therapy on aspects of inhibitory control
3. Assessment of the impact of possible comorbidities on aspects of inhibitory control

STUDY DESIGN

Cross-sectional observational study

84 subject (42 healthy control + 42 patients)

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Assesment: psychopathological dimension before and after the task

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Go/No-Go task: emotional task + gender task

HEALTHY SUBJECTS

INCLUSION CRITERIA

- Subjects between 18 and 60 years of age
- Right-handed
- Not visually impaired or corrected if present

EXCLUSION CRITERIA

- Diagnosis of Intellectual Disability (IQ < 70)
- Presence of clinical conditions that may interfere with task performance, e.g. neurological or organic conditions
- Diagnosis of Substance and/or Alcohol Use Disorder in the current or last 3 months

PATIENTS WITH BORDERLINE PERSONALITY DISORDER

INCLUSION CRITERIA

- Subjects between 18 and 60 years of age
- Diagnosis of BPD not in comorbidity with other psychiatric disorders
- Already undergoing or about to start pharmacological treatment for these disorders
- Right-handed
- Not visually impaired or corrected if present

EXCLUSION CRITERIA

- Diagnosis of Intellectual Disability (IQ < 70)
- Presence of clinical conditions that may interfere with task performance, e.g. neurological or organic conditions
- Diagnosis of Substance and/or Alcohol Use Disorder in the current or last 3 months

ASSESSMENT

ALL

BEFORE

- Edinburgh Handedness Inventory
- Barratt Impulsivity Scale – 11
- Toronto Alexithimia Scale – 20
- General Self-Efficacy Scale
- Rosenberg Self-Esteem Scale
- Toronto Empathy Scale
- Brief Self-Control Scale

AFTER: arousal, valence and the ability to recognise emotions

BPD

BEFORE (psychopathological dimensions)

- Zanarini Rating Scale for Borderline Personality Disorder
- Borderline Symptom List 23
- Difficulties in Emotion Regulation Scale

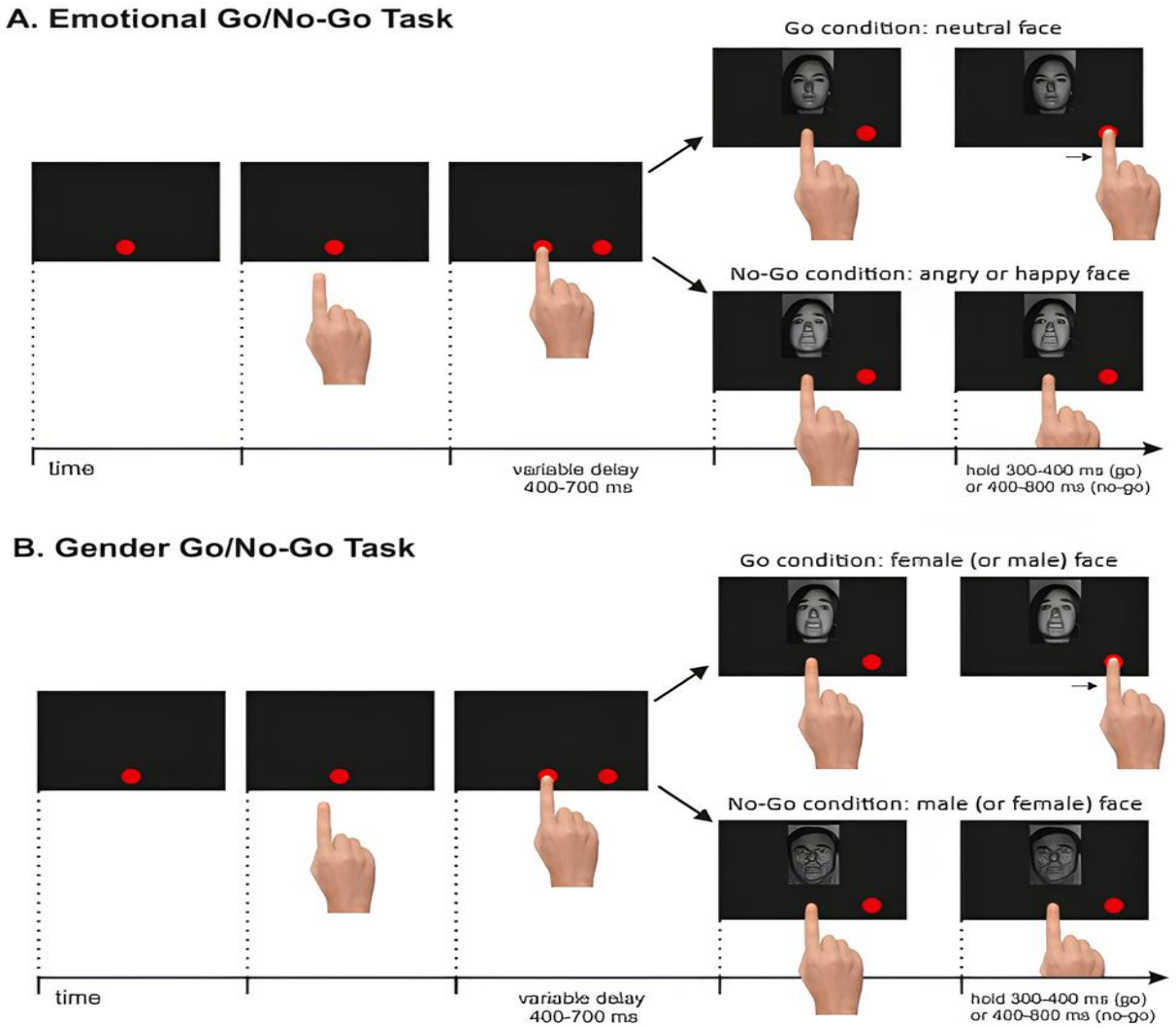
GO/NO-GO TASK

one of the neurophysiological tests for inhibitory control

Two variants of the Go/No-Go task will be used on the CORTEX software:

Emotional task: trials started with the appearance of a red circle at the center of the touchscreen. Immediately after participants had touched it, a peripheral red circle appeared. Holding the central stimulus for a variable period triggered its disappearance and, simultaneously, the appearance of one of the three facial expressions. Participants had to keep holding the central position when the face expressed an emotion (happiness or angriness; No-go condition), or they had to reach and hold the peripheral target when the face displayed a neutral expression (Go condition). Acoustic feedback signaled a correct trial.

Gender task: The sequence of the events was the same as in emotional task. However, in the female version of the task, participants were instructed to refrain from moving when a male face was presented (No-go condition) and to reach and hold the peripheral target only when a female face was shown irrespective of the depicted emotion (Go-condition), or vice versa in the male version of the task.


A. Emotional Go/No-Go Task
Go condition: neutral face
No-Go condition: angry or happy face
time
variable delay
400-700 ms
hold 300-400 ms (go)
or 400-800 ms (no-go)
B. Gender Go/No-Go Task
Go condition: female (or male) face
No-Go condition: male (or female) face
time
variable delay
400-700 ms
hold 300-400 ms (go)
or 400-800 ms (no-go)

STATISTICAL ANALYSES

Analyses conducted in SPSS (IBM) or R version 4.2.3 (R Core Team, 2020)

T-test

Analysis of variance (ANOVA) → Bonferroni's correction to all multiple comparisons

Effect size → ANOVA: partial eta square (η2)
→ T-Test: Cohen's d

To assess the consistency of the null hypothesis with the alternative hypothesis, Bayes Factors (BF10) are calculated for each statistical test

RESULTS OF PREVIOUS STUDIES

Angry and happy expressions affect forward gait initiation only when task relevant

Giovanni Mirabella [1], Michele Grassi [2], Susanna Mezzarobba [3], Paolo Bernardis [2]

Threatening Facial Expressions Impact Goal-Directed Actions Only if Task-Relevant

Christian Mancini [1], Luca Falciati [1], Claudio Maioli [1], Giovanni Mirabella [1 2]

Happy facial expressions impair inhibitory control with respect to fearful facial expressions but only when task-relevant

Christian Mancini [1], Luca Falciati [1], Claudio Maioli [1], Giovanni Mirabella [1]

ONGOING STUDY IN ANXIETY PATIENTS

	PATIENTS means (DS)	CONTROLS means (DS)
Mean stop-signal delay	193,9 (51,3)	208,8 (67,2)
p (failure)	0,52	0,51
Stop-signal reaction time	224,2 (28,1)	206,2 (21,1)
Reaction time no-stop trials	422,4 (52,6)	421,0 (61,5)
Reaction time stop-failure trials	355,2 (47,9)	356,9 (52,0)
Reaction time go-only trials	251,5 (37,2)	247,1 (40,4)
Movement time no-stop trials	328,9 (97,9)	299,7 (75,6)
Movement time go-only trials	382,9 (164,9)	337,1 (80,1)
Accuracy go-only trials	0,93 (0,06)	0,93 (0,06)
Accuracy no-stop trials	0,92 (0,11)	0,94 (0,07)

T-test: $p<0,005$
Effect size: 0,72

PHD STUDY

The protocol has been reviewed by the Hospital Technical Committee and we are making the required changes and submitting it to the Ethics Committee

Difficulties until today

- Reviewing the literature that would bring out studies that also studied impulsivity from a neurophysiological point of view
- Select emotions that were unambiguous
- Create a task that was not too frustrating

Future difficulties

- Enrolling subjects who do not drop out
- Enrolling subjects with minimal or no psychopharmacological therapy
- Enrolling subjects in the absence of other comorbidities

FUTURE TARGETS ——— Correlation between pathology and inhibitory control deficit

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Identification of pathognomonic markers

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IMPLEMENTING THESE MARKERS INTO CARE PATHWAYS TO EVALUATE IMPROVEMENTS AND IDENTIFY POTENTIAL THERAPEUTIC STRATEGIES

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THANK YOU FOR YOUR ATTENTION