# Negative bias towards overweight bodies in healthy women: behavioural and EEG evidence in a novel Body-Flanker task

Ciccarone Sofia[1,2], Moreau Quentin[1,2], Fusco Gabriele[1,3], Bufalari Ilaria[4]

[1]Department of Psychology, "Sapienza" University of Rome, 00185 Rome, Italy; [2]IRCCS, Santa Lucia Foundation, 00142 Rome, Italy; [3]IIT Italian Institute of Technology, Rome, Italy [4]Department of Developmental and Social Psychology, "Sapienza" University of Rome, 00185 Rome, Italy

## Background

- The idealization of skinny women has been associated to body dissatisfaction[1] (negative attitudes and emotions towards the body) and weight concern[2]
- Weight dissatisfaction is associated with:
  1) approach bias towards thin-ideal pictures of bodies and avoidance bias towards non-thin bodies[3]
  2) delayed attentional disengagement (impairment in switching attention from one stimulus to another) from overweight bodies in a spatial cueing paradigm[4]
- N190 is higher for inverted compared to upright human bodies suggesting a disruption in the perception of bodies when presented in an unexpected way[5]
- P2 is higher for over/underweight related words compared to neutral words in women[6] Higher P2 is found in response to overweight body pictures in participants with bulimia nervosa, in relation to drive for thinness and body dissatisfaction[7]
- N2 is higher for incongruent compared to congruent trials of the Flanker task[8] reflecting the inhibition of the activation of competing representations
- Frontal theta band activity (4-7 Hz) was found to have a role in conflict monitoring and behaviour adaptation[9]

## Aims

- Analyse the relationship between conflict/error monitoring and body perception at the behavioral and neural levels in neurotypical women
- Identify neural markers of the cognitive interference produced by overweight bodies on underweight bodies

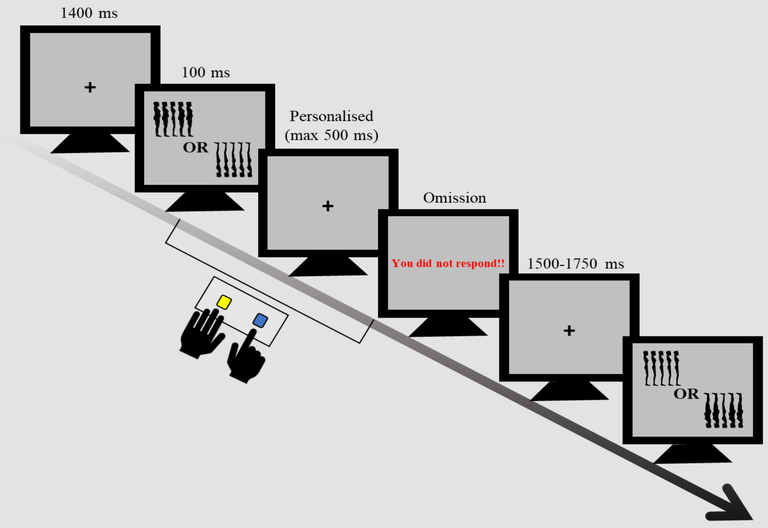
## Methods

### Participants

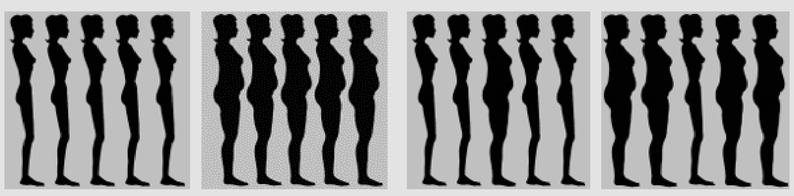
24 females (Mean age: 23 years old [19-36], SD = 3.72; mean BMI = 20.33, SD = 1.27) with no history of mental illness and eating disorders

### Procedure

Participants performed a variation of the original Flanker task[10] with female silhouettes seen from a profile perspective




They were required to identify, as quickly and accurately as possible, the target stimulus, which was flanked by two distracting stimuli on each side. Participants performed a practice phase to set *personalised response window*, which lasted maximum 500 ms.

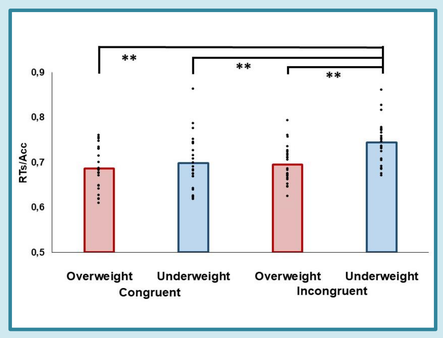


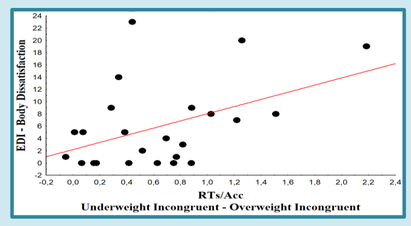
Size factor: Overweight/Underweight
Congruency factor: Congruent-Incongruent
Task factor: Upright /Inverted (each task was repeated 3 times)

## Behavioural Results

**SIZE x CONGRUENCY**
$F(1,23)= 23.846$; $p<0.001$

The worst performance was found when the underweight target was flanked by overweight distractors compared to all other conditions



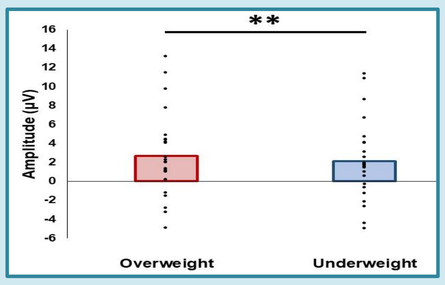



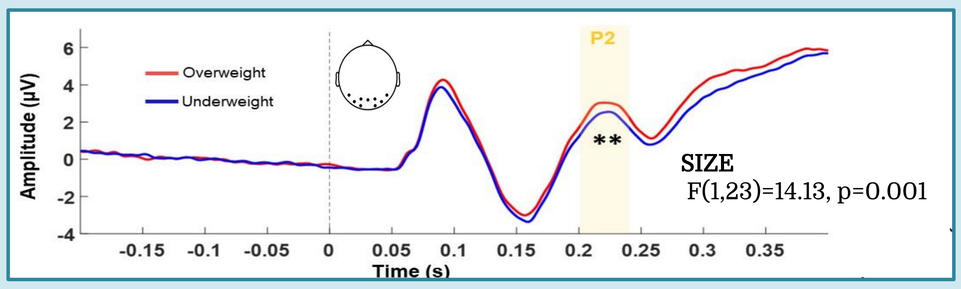

The strength of the effect (Underweight Incongruent - Overweight Incongruent) was positively correlated with individual ratings of Body Dissatisfaction

## EEG Results

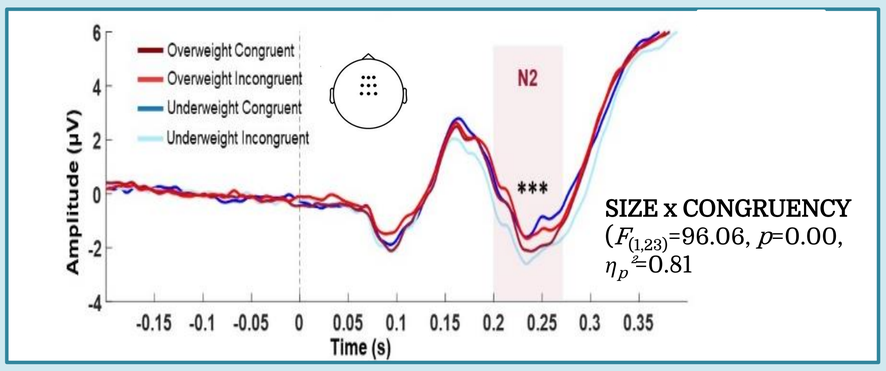
**N190**: HEMISPHERE x SIZE x TASK ($F_{(1,23)}$=6,17, $p$= 0.02). In the left hemisphere, all conditions are different from each other, with inverted silhouettes, specifically underweight ones, eliciting a higher amplitude than upright ones

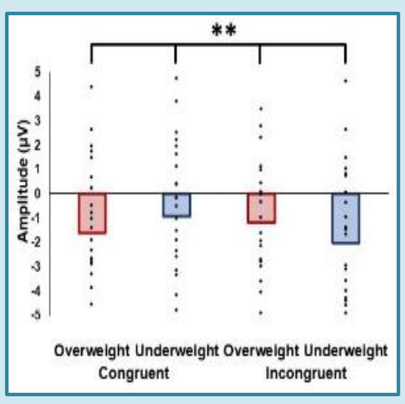
**P2**: Overweight generating a higher P2 amplitude compared to Underweighted targets

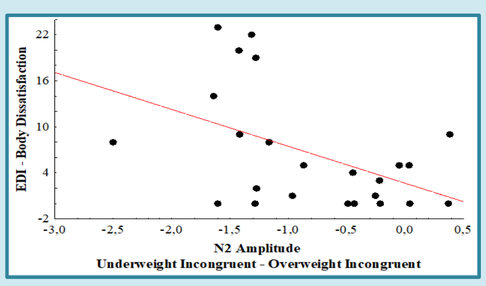


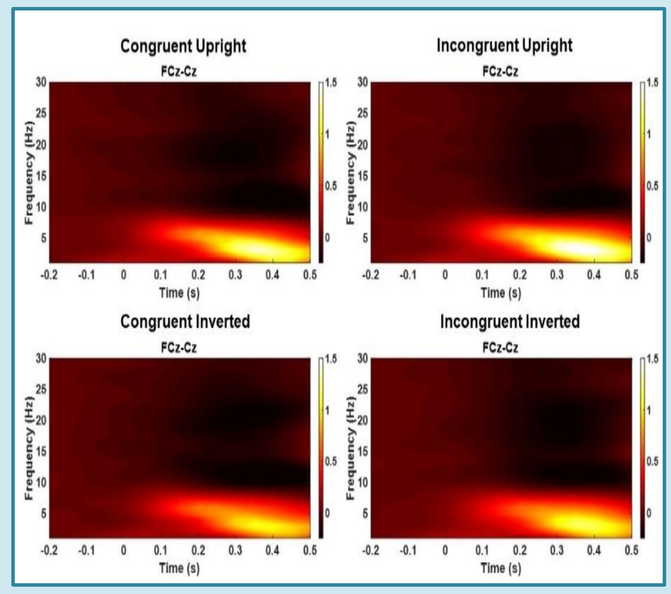

**N2:** Highest amplitude in Underweight Incongruent silhouettes followed by Overweight Congruent, Overweight Incongruent and Underweight Congruent.

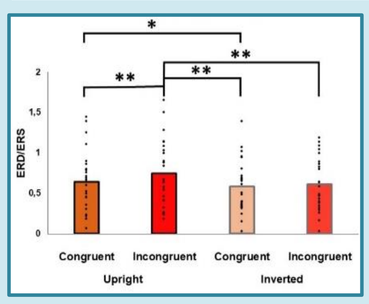



The strength of the effect was positively correlated with individual ratings of Body Dissatisfaction




**Theta:**
CONGRUENCY x TASK ($F_{(1,23)}$=8.62., $p$=0.007)
Incongruent Upright stimuli elicited a higher theta power as compared to all other conditions

## Conclusions

- The study replicates previous findings on conflict, validating the novel body Flanker task by means of performance, ERP (N2) and time-frequency analysis (Theta)
- The stimuli were perceived as bodies, as evident from behavioural (decreased performance for inverted targets) and ERP data (N190)
- Worst performance in the Underweight Incongruent condition suggests an additive effect of the perceptual conflict generated by incongruent conditions and the emotional conflict created by social salience of overweight bodies. Performance is correlated with body dissatisfaction
- P2 amplitude is enhanced for overweight targets. This seems to suggest an early attentional bias for a non desirable body shape, unconsciously perceived as negative by women
- Conditions elicited conflict related processing (N2) in a hierarchical manner (Underweight Congruent, Overweight Congruent, Overweight Incongruent, Underweight Conguent) suggesting a combination of perceptual and emotional conflicts. N2 amplitude is correlated with body dissatisfaction.
- The negative bias implicitly sent to women may act at the implicit level and shape body perception, since the first stages of visual processing

## References

[1]Fitzsimmons-Craft, E.E. et al. *Body image*, 9, 2012; [2]Posavac, S.S. et al. *Eating disorders*, 10, (2002); [3]Dondzilo, L. et al. *Journal of behavior therapy and experimental psychiatry, 61*, (2018); [4]Gao, X. et al. *Body Image*, 10, 2013; [5]Minnebusch, D.A. *Behavioural brain research*, 198, (2009); [6]Gao, X. et al. *International Journal of Psychophysiology*, 82, (2011); [7]Mai, S. et al. *Biological Psychology*, 108, (2015); [8]Heil, M. et al. *Journal of Psychophysiology*, 14, (2000); [9]Cavanagh, J.F. et al. *Journal of Neuroscience*, 29, (2009); [10]Eriksen, B.A. & Eriksen, C.W. *Perception & Psychophysics*, 16, (1974).

## Contact

sofia.ciccarone@uniroma1.it