

A Triple Dissociation of Neural Systems Supporting ID, EGO, and SUPEREGO

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The concepts of the ID, EGO, and SUPEREGO have occupied philosophers and scientists throughout recorded history because the ability to fully characterize all aspects of the self is central to our understanding of the human mind. Theoretical studies have examined the conceptual degree of overlap or separability of these selves and provided valuable insights that suggest that they may be at least partially dissociable (1–3). However, little is known about the neurobiological underpinnings of these representations of the self and how these neural mechanisms might rely on a single neural system or multiple systems.

In the present study, twenty-four healthy participants (all 19-year-old white, male undergraduates who sat near each other in an Introductory Psychology course and were raised in upper middle class suburban New England neighborhoods) were scanned but 17 were excluded for not following instructions or falling asleep in the scanner. While in the fMRI scanner, participants were asked to completely relax and focus on a fixation cross, but remain alert. After viewing the fixation cross, a prompt would appear on the screen ("MOTHER") for twenty seconds asking participants to think about their mother. A total of ten six-minute runs of the task were

completed. A jittered intertrial fixation interval was used between prompts. These fixations ranged from 2 to 34 seconds and were drawn from an Erlang distribution (4).

All participants were videorecorded while in the scanner. Two independent coders viewed the videotapes and made precognitive judgments of the onset of ID-related, EGO-related, and SUPEREGO-related control of current thoughts. These coders were selected as the two individuals with the highest scores of precognitive ability from among all participants in a recent publication (5). Reliability between raters was high (6). These onset times were convolved with a canonical hemodynamic response function and used to predict neural activity across the whole brain. The three regressors (ID, EGO, SUPEREGO) seemed reasonably orthogonal although we didn't actually check to make sure.

A striking triple dissociation emerged (Fig. 1). A large cluster of ID-related neural activity was located in the brainstem. No other regions of the brain showed ID-related activity. This result is not surprising given well known links between the brainstem and consciousness (7). The brainstem is an obvious home for the unconscious ID. A large cluster of EGO-related neural activity was centered

on the anterior cingulate cortex. No other regions of the brain showed significant EGO-related activity. The localization of the EGO to the frontal midline is consistent with notion that the EGO is the true self (8), that aspect of personality that is displayed to the world (9). This region is also ideally situated to translate the ID's drives into behavioral action (10). Finally, SUPEREGO-related neural activity was localized to lateral prefrontal and parietal cortex. These effects are consistent with the top-down control aspects of the SUPEREGO.

Although mostly abandoned over the years, we hope the present study breathes new life into psychoanalysis. If you're like us, you've probably been thinking that Social Neuroscience, Neuroeconomics, and Developmental Social Cognitive Affective Clinical Neuroscience are just not cutting edge enough anymore. Do not despair. This study represents the first of what is likely to be a productive and active new field of Psychoanalytic Neuroscience.

References and Notes

1. S. Freud, *The Standard Edition of the Complete Psychological Works of Sigmund Freud, Volume XIX: The Ego and the Id and Other Works*, 147 (1924).
2. A. Freud, *Psychoanal. St. Child*, **7**, 42 (1952).
3. H. Hartmann, *Psychoanal. St. Child*, **7**, 9 (1952).
4. The Erlang distribution was selected because it is our favorite distribution plushie sold on Etsy.com by far: <http://www.etsy.com/listing/71739287/collection-of-10-distribution-plushies>
5. D. J. Bem, *J. Pers. Soc. Psychol.*, **100**, 40, (2011).
6. Materials and methods are available as supporting material on Psyence Online.
7. J. Parvizi, A. Damasio, *Cognition*, **79**, 135 (2001).
8. D. A. Gusnard, E. Akbudak, G. L. Shulman, M. E. Raichle, *PNAS*, **98**, 4259, (2001).
9. We made this up after reading the Wikipedia entry for ID, EGO, and SUPEREGO just now.
10. Here's a quote we stole from Wikipedia that might be relevant: "Thus the ego, driven by the id, confined by the super-ego, repulsed by reality, struggles...[in] bringing about harmony among the forces and influences working in and upon it, and readily 'breaks out in anxiety'".

Supporting Online Material

www.psycemag.org/cgi/content/full/335/DC1

Materials and Methods

SOM Text

References

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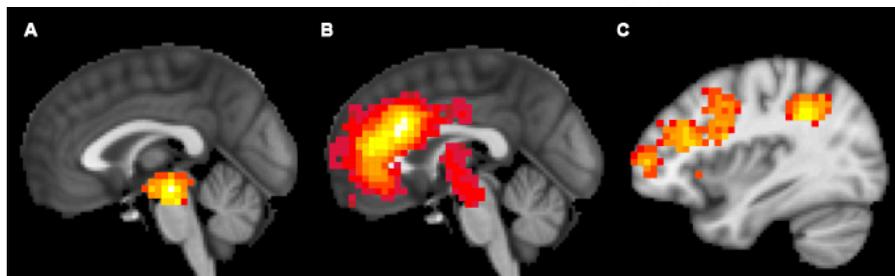


Fig. 1. fMRI results reveal a triple dissociation consistent with Freudian theory. **(A)** Regions of the brainstem were correlated with the ID. **(B)** The anterior cingulate showed robust EGO-related activation. **(C)** Lateral prefrontal and parietal regions showed the strongest SUPEREGO-related activity. We would show you the scatterplots, but now we are paranoid about accusations of double-dipping. Just trust us. There were no outliers and the data are totally normally distributed.

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