



Rehabilitating the Mind: Using AI to Track and Treat Mental Illness

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The “Cost” of Mental Illness

Impact


1st
Depression is the leading cause of disability worldwide, and is a major contributor to the global burden of disease.¹



-\$193b
Serious mental illness costs America \$193.2 billion in lost earning every year.³



90%
90% of those who die by suicide have an underlying mental illness. Suicide is the 10th leading cause of death in the U.S.³



National Alliance on Mental Illness (NAMI)

- Mental Disorders most costly (\$200B pa) health issue in the US¹
 - 2nd is cardiovascular disease (\$145B)
- 2013

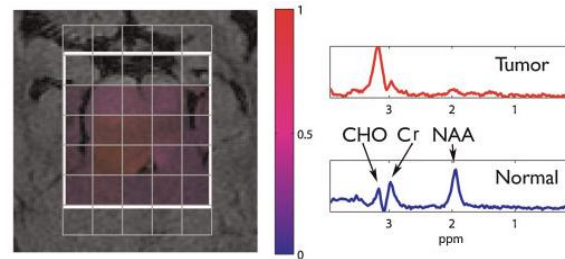


*“Despite the many advances in neuroscience in recent years, the underlying causes of most of neurological and **psychiatric conditions** remain largely unknown, due to the vast complexity of the human brain.”*

1: Health Aff May 2016 10.1377/hlthaff.2015.1659

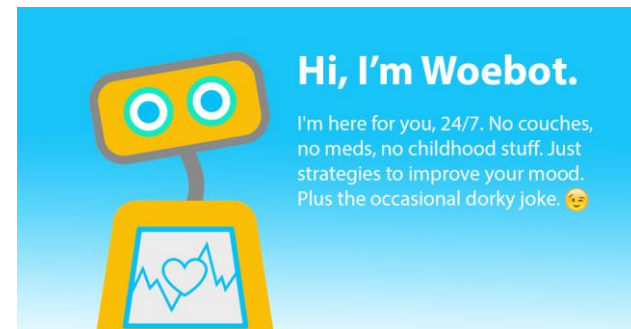
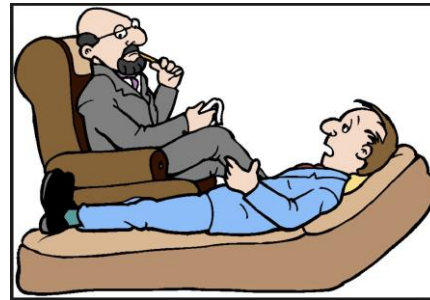
Neurology vs. Psychiatry

- **Neurology:** branch of medicine dealing with disorders of the nervous system.



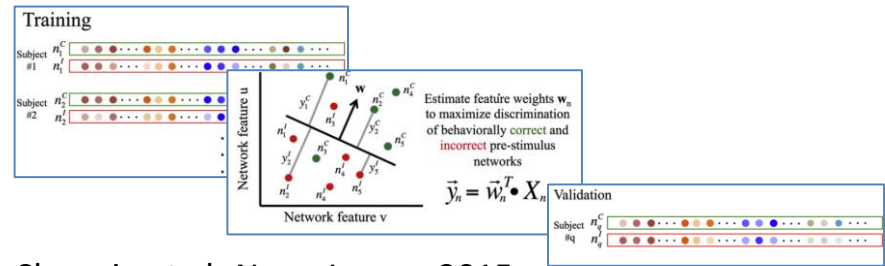
Su et al. *NMR in biomedicine*, 2008.

- **Psychiatry:** branch of medicine devoted to the diagnosis, prevention, study, and treatment of mental disorders



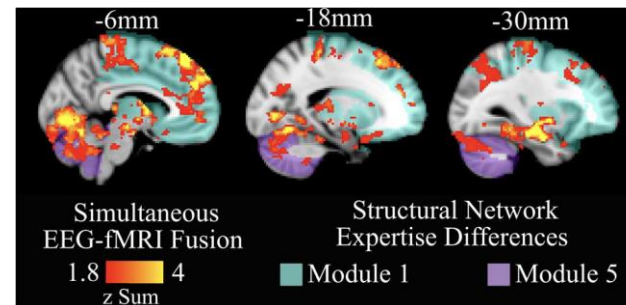
Technology “Enablers”

- Machine Learning



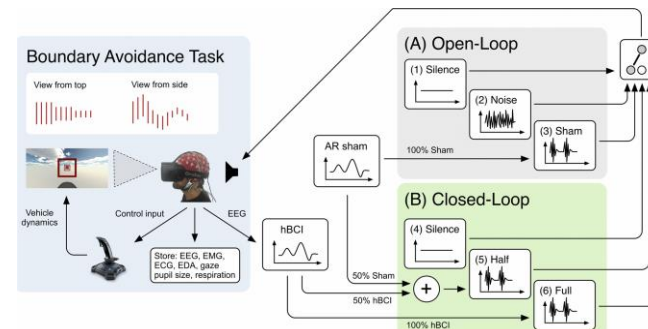
Sherwin et al. *NeuroImage*, 2015

- Multimodal Imaging



Muraskin et al. *Proc. of IEEE*, 2017

- Closed-Loop Control



Faller et al. *Conf. Proc. of IEEE SMC*, 2016



Examples: Machine Learning for ...

- identifying and tracking neural correlates of deceased related thinking for patients with **complicated grief disorder (CGD)**
- identifying brain networks in severe **obsessive compulsive disorder (OCD)**
- closed-loop personalized neuromodulatory treatment of **major depressive disorder (MDD)**



Complicated Grief Disorder

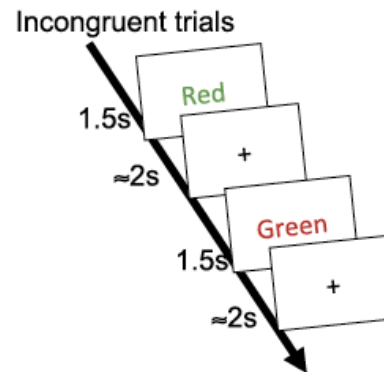
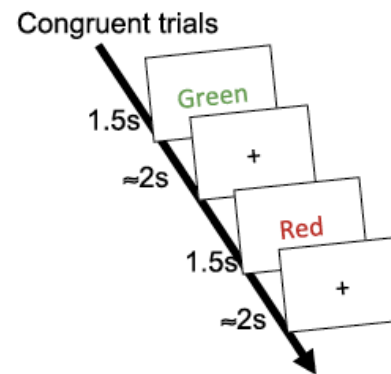
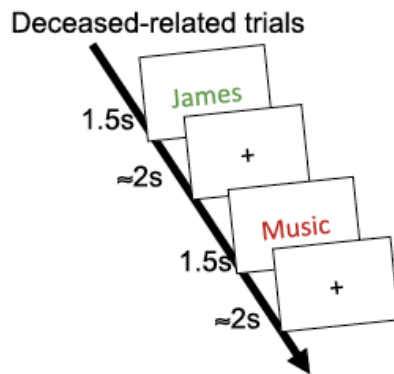
Complicated grief disorder (CGD): a disorder for those who are significantly and functionally impaired by prolonged grief symptoms for at least one month after six months of bereavement

Treatment: Psychotherapy

- **Goal:** To update the relationship, expectations and associations surrounding the deceased with the new reality of death.
- **Process:** An oscillating process of mental engagement and avoidance with the death.

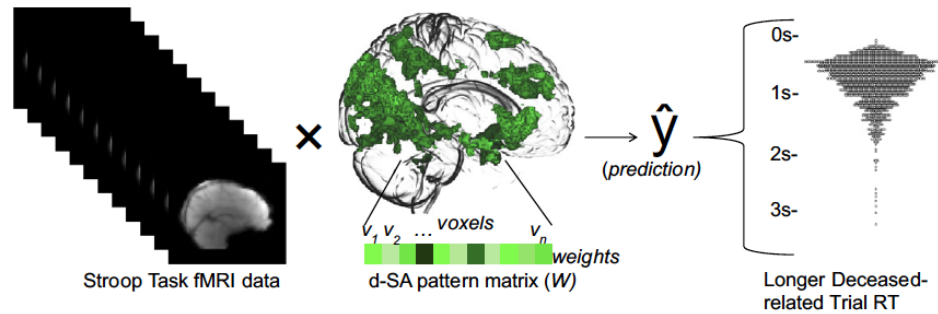
Tracking Neural Correlates of Deceased Related Thinking

Emotional and Cognitive Stoop

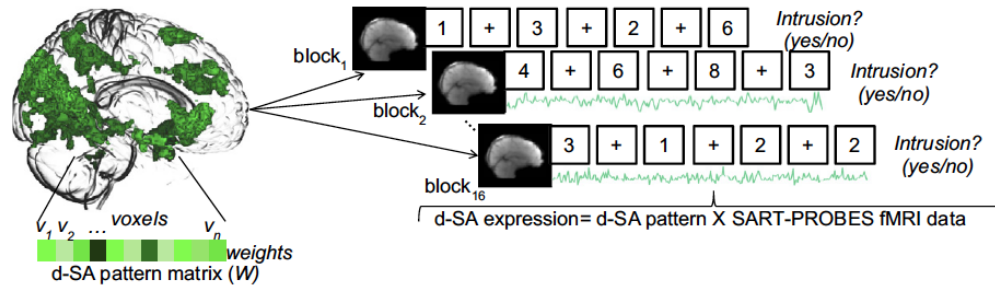


Machine Learning: MVPA using FaSTGLZ

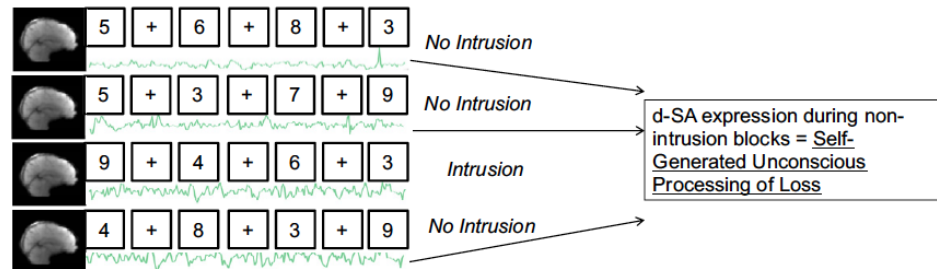
A Pattern Learning Task: Modified Stroop



B Pattern Expression Task: SART-PROBES

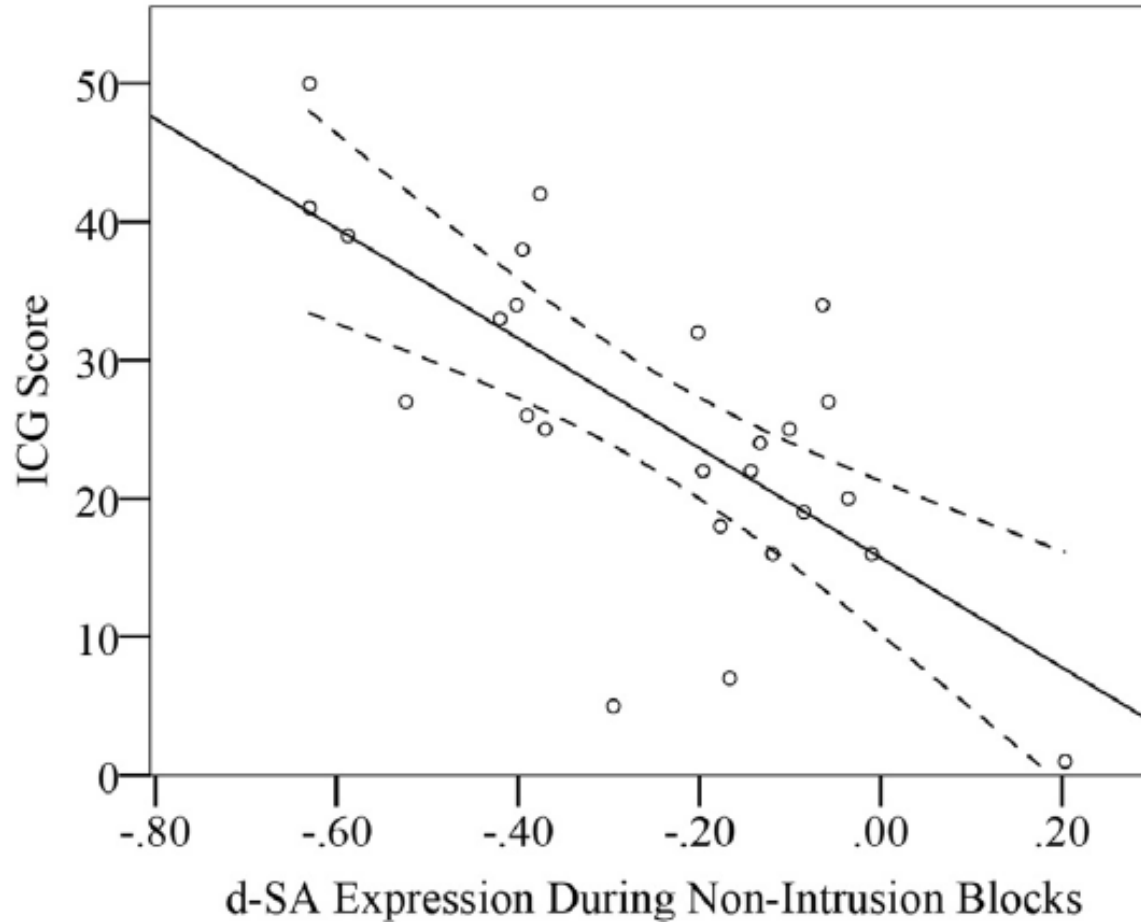


C Self-Generated Unconscious Processing of Loss





Self-generated Unconscious Processing of Loss and Grief Severity





Identifying and Tracking Neural Correlates of Deceased Related Thinking for Patients with CGD

Neural markers of thought processes may be better predictors of clinical variables than patient self-reports

Self-generated unconscious processing of loss linked to less severe grieving

Potential for new modes of therapeutic treatment which promote conscious and unconscious remodeling of thought patterns

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