

# CAMERA: Context-Aware Multimodal Ecological Research and Assessment Multimodal “Big Data” to Predict Memory and Anxiety

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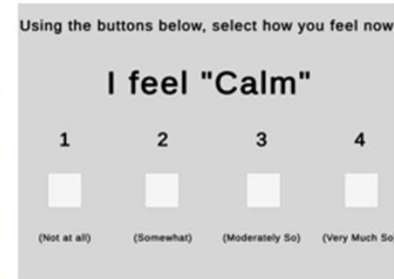
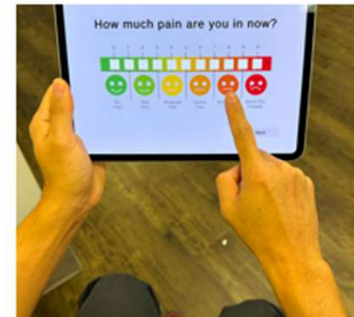
1. Identify neural and non-neural biomarkers of memory and anxiety
2. Record all of them together
3. Record over long periods
4. Use machine learning to predict memory and anxiety states based on biomarkers
5. Modify memory and anxiety with neuromodulation



EMAs combine self reported subjective mental status with visuospatial memory performance in a virtual environment



Acoustic startle response (95 db)

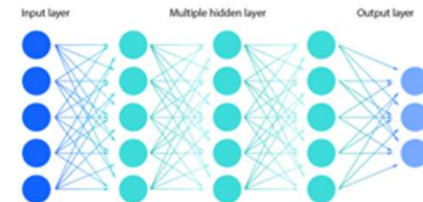


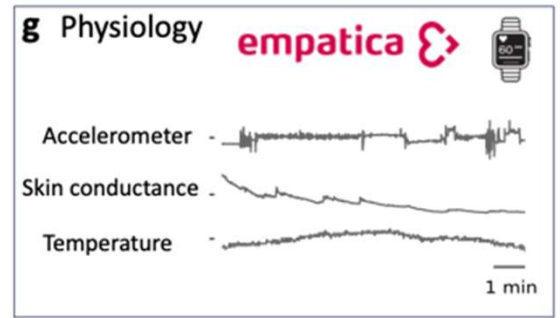
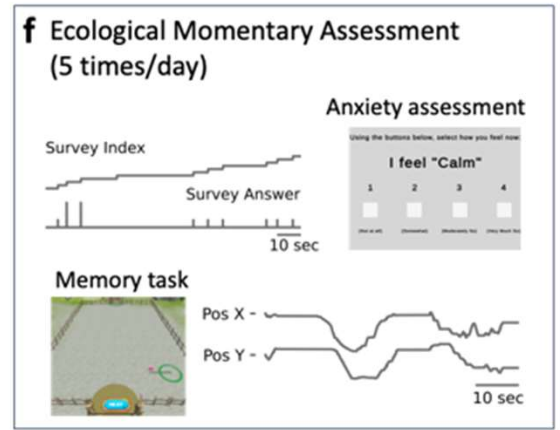
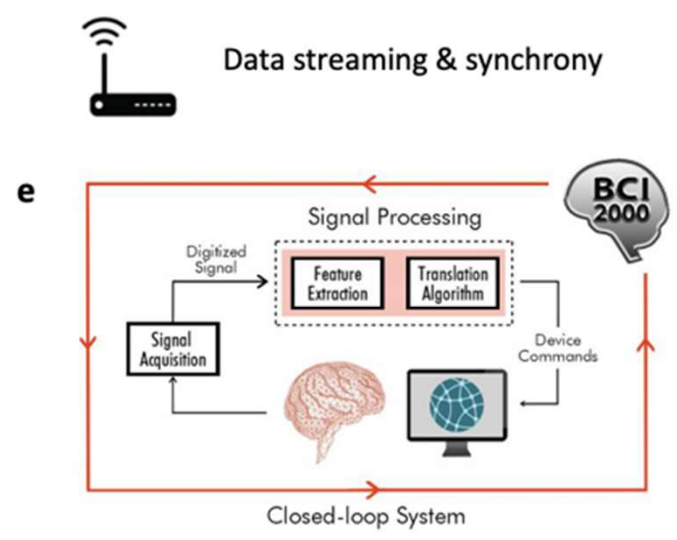
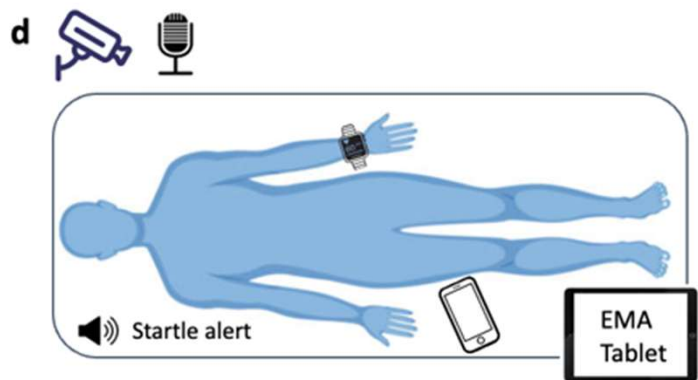
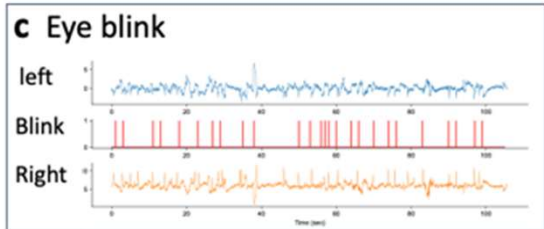
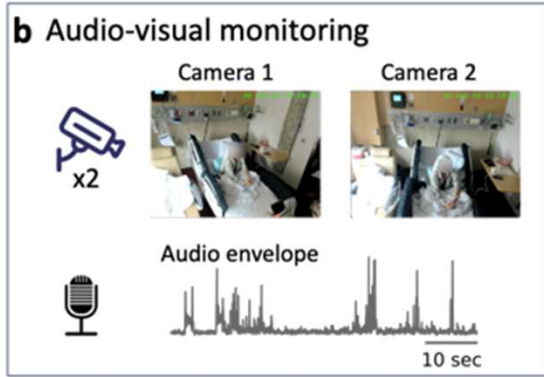
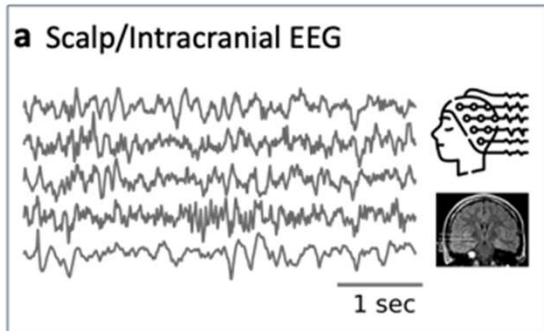
### Self-reported Anxiety State

- 2-item anxiety visual-analog scale (VAS)
- 6-item Spielberger State-Trait Anxiety inventory (STAI-6)



→ Synchronized through BCI2000





**h Smartphone usage (KSANA)**

KSANA  
HEALTH

## EMANet

Predict anxiety-memory state based on recent passive multimodal sensor data

## UncertaintyNet

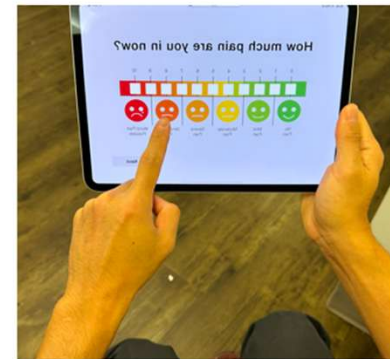
Report the level of uncertainty in EMANet's prediction

Timing of EMA delivery for optimal model learning

## ResponseNet

Predict and optimize the likelihood the subject will respond to EMA

e.g., no EMAs during lunch or medical check-ups



→ **Less disruptive, more informative EMAs**