Arousal both decreases conservativeness and increases attentiveness in a random dot motion decision making task

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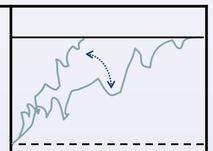
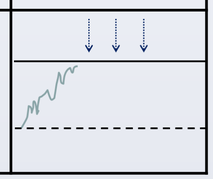
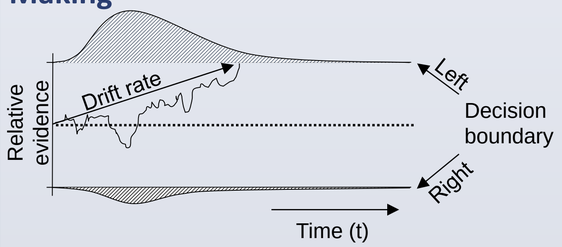
Arousal is a biological state that should drive faster responses

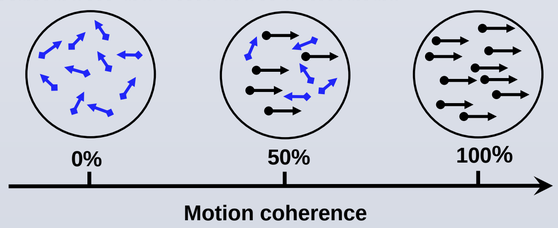
How are decisions affected by arousal?

Hypothesis 1: Arousal modulates attentiveness to environment (drift rate)	
Hypothesis 2: Arousal modulates conservativeness in decision (threshold)	

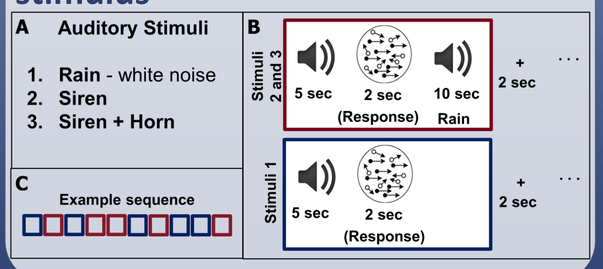
Drift Diffusion Model (DDM) of Decision Making[1]



Random dot motion stimulus[2]



Arousal manipulation before stimulus



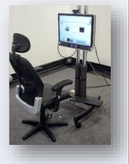
Arousal as a brain body state

Biometric measures

- Eye tracking/pupilometry, heart rate, galvanic skin response (GSR) IMOTIONS
- Automatic detection of emotional facial expressions

Electroencephalography (EEG)

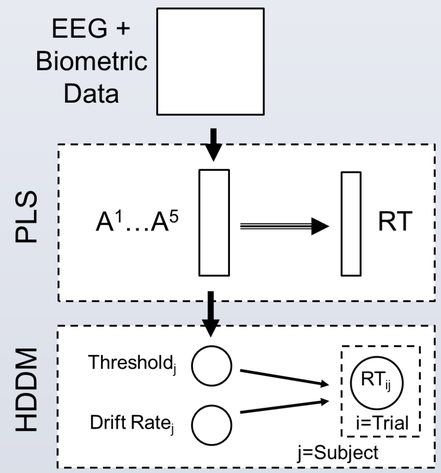
- 64 channel



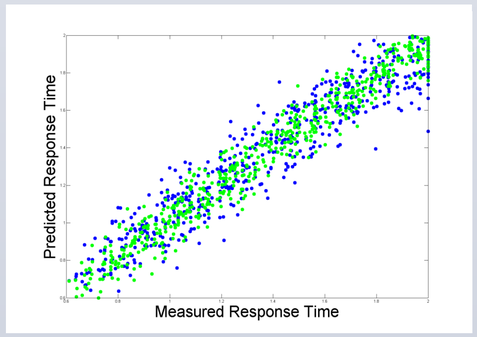
Behavioral data

- Decision response time (RT) & accuracy

Find "arousal" brain body measures and dissociate their influence on decisions



PLS components accurately predict RT



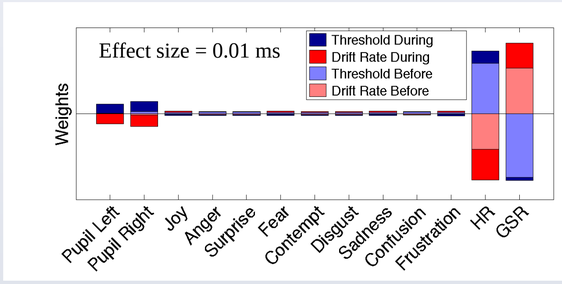
Example HDDM[3] regression equation

Threshold ~ Before[A1+..+A5] + During[A1+...+A5],
Drift Rate ~ Before[A1+..+A5] + During[A1+...+A5]

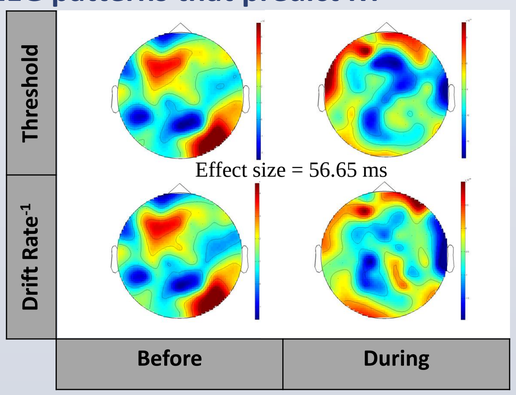
Biometric/EEG measures are better predictors of RT than stimulus

Model Comparison DIC Values	Threshold	Drift Rate	Threshold & Drift Rate
Stimulus only	789	640	657
EEG/Biometric only	480	619	443*
EEG/Biometric + Stimulus	492	624	457

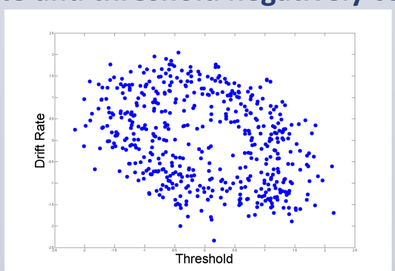
Biometric measures that predict RT



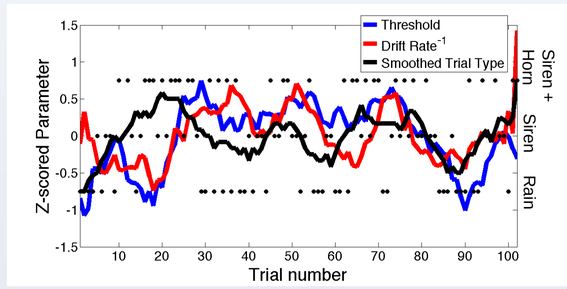
EEG patterns that predict RT



Drift rate and threshold negatively correlate



Threshold and Drift rate lag smoothed stimulus by ~ 5 trials



Arousal is having a coordinated impact on decisions

- As individuals attentiveness to the environment increases (drift rate), their conservativeness in their decision execution decreases (threshold), and vice versa

Arousal is a latent state being affected by environment through a slow process of integration

- Process occurs with a time lag of ~5 trials, and is likely integrating a window of 10-20 trials prior
- Arousal state fluctuates in the background influencing decision behavior
- Arousal can be manipulated by external events, but these external experiences are being integrated based on a summation of recent experiences
- We are weighted environmental integrators

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