A Multi-Attribute Neurocomputational Model Explains Divergent Choices for Self and Others

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Background

- **We often must take into account the preferences of others**
  - Preparing a meal for a child or buying a gift for a friend
- **How do we construct representations of others' preferences?**
  - *Anchoring-and-adjustment*
    - Serial correction from self to similar, but not dissimilar, other
  - *Attribute re-weighting*
    - Single neural mechanism for self, similar, and dissimilar others

Question

- **Neurocomputational model of choice for self and others**
  - Event-related potentials (ERP) + drift diffusion model (DDM)
- **Predictions**
  - Relative weighting of stimulus attributes depends on recipient
  - Neural correlates during stimulus value computation
    - ~450-650 ms after stimulus onset (Harris et al., 2011, 2013)
    - Localized to **ventromedial prefrontal cortex** (vmPFC)

Methods

- **Food decisions for self and two partners**
  - **Different**: Self-identified healthy eater

...I don't eat anything with added sugars...I generally don't eat things that come in plastic...I try to eat a lot of fruits and vegetables, and I eat a lot of peanut butter and almond butter.

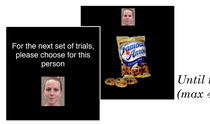
  - **Similar**: No dietary restrictions

...I would say for me, taste is my number one consideration when I'm eating...If it tastes good but it's not healthy, I'll just eat less of it, but for me eating food is all about it tasting good.

I. Set-Up	II. EEG Recording	III. Outcome

• *Photo taken*
• *Partner videos*
• *Taste/Health ratings*
	• *Decision task (6 runs) for:*
	  • *Self*
	  • *Similar partner*
	  • *Different partner*
		• *Implementation of randomly selected trial for each recipient*

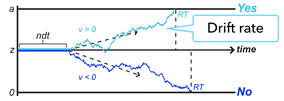
- **Experiment procedure**
  - 128-channel EEG
  - 600 trials (200 per recipient) in 10-trial blocks
    - Block order randomized by subject
    - Current recipient displayed during block
    - Strong No/No/Yes/Strong Yes
- **N = 38**
  - No dietary restrictions
  - Fasted for 3 hours before experiment
  - EEG analysis: N = 36
    - 2 subjects excluded due to sensor noise



Until response (max 4 s)

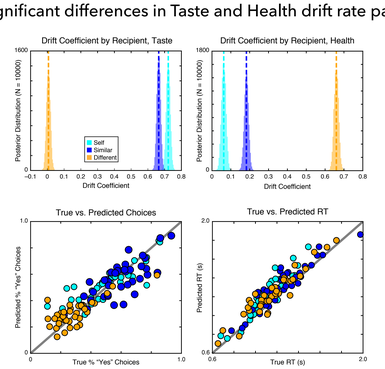
Drift Diffusion Model

- **Computational model of response time (RT) data**
  - Reveals cognitive mechanisms underlying choice
- **Drift rate:** Information processing strength

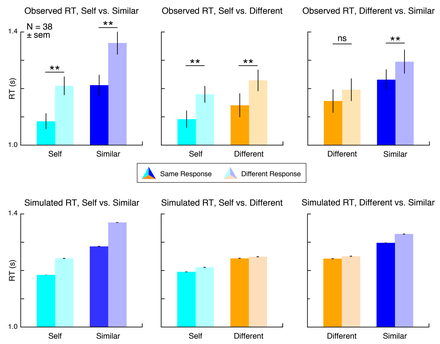


DDM Results

- **Relative weighting of taste and health depends on recipient**
  - *Self*: Greater weighting on taste
  - *Different*: Greater weighting on health
  - Significant differences in Taste and Health drift rate parameters

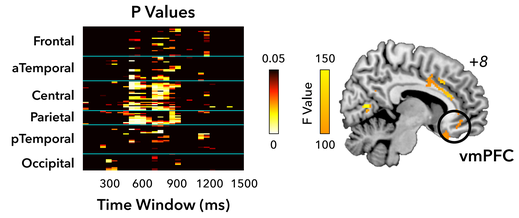


- **Longer RTs when choices for self and others differ**
  - Consistent with data from anchoring-and-adjustment
  - Model simulations produce same effect *without dual processes*



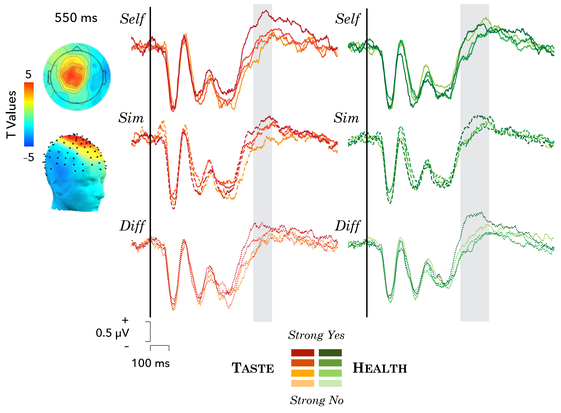
ERP Results

- **Neural correlates of stimulus value**
  - From 500-650 ms after stimulus onset
  - Localized to vmPFC

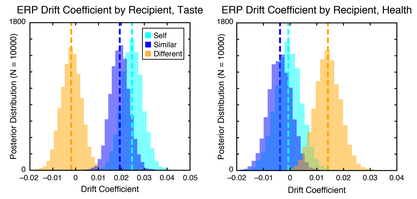


- **Differential neural weighting on taste and health**
  - *Self*: Greater weighting on taste
  - *Different*: Greater weighting on health
- During stimulus value computation window (Harris et al., 2013)

Taste & Health by Self/Other, 500 to 650 ms post-stimulus

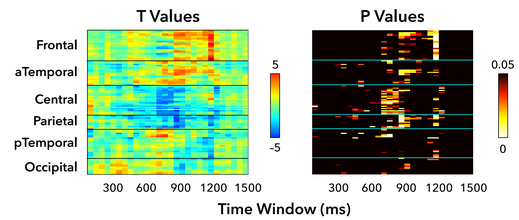


- **ERP signals and drift rate variability**
  - Separable contribution to attribute drift rate parameters
  - Neurocomputational support for attribute re-weighting

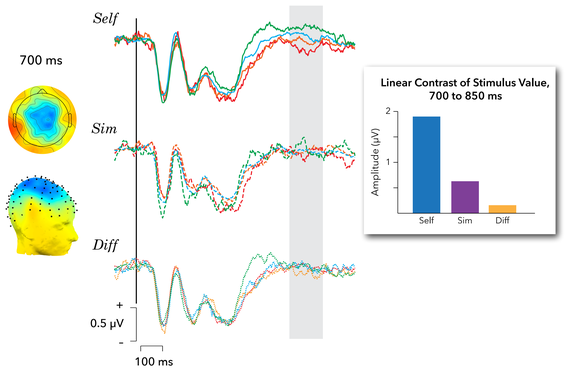


Self/Other x Stimulus Value

- **No evidence that stimulus value is first computed for Self**
  - Significant interaction *after* stimulus value window: 700-850 ms
  - Strongest activity for Self, not correction to Similar other
  - Inconsistent with anchoring-and-adjustment



Stimulus Value by Self/Other 700 to 850 ms post-stimulus



Conclusions

- **Relative weighting of taste and health depends on recipient**
  - Reflected in drift rate parameter of DDM
  - Longer RTs when choices for self and others differ
- **Neural value signals incorporate preference of recipient**
  - From ~500 ms after stimulus onset, localized to vmPFC
  - Differential weighting of taste and health attributes
- **Interaction of stimulus value and social cognition**
  - Late value signal (700-850 ms) largest for Self
  - No evidence of earlier value computation for Self vs. Similar

➡ ***Attribute re-weighting mechanism can account for behavioral and neural data without dual processes***