Arbitrary and Explicit Predictions Bias Perceptual Categorization

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Background

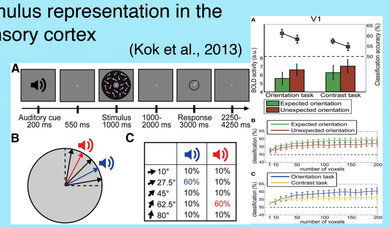
Prior expectations and sensory stimulus shape perception (Clark, 2013)

This has been largely studied via statistical learning paradigms


(ChatGPT)

With prior expectations resulting in a behavioral bias and enhanced stimulus representation in the sensory cortex

(Kok et al., 2013)

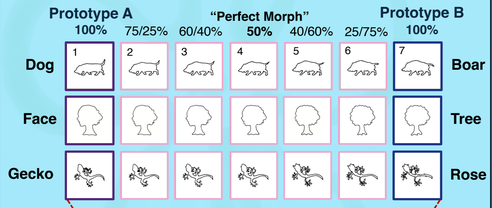


However, previously we found that ***arbitrary predictions*** also impact cognitive processes, such as LTM (Bulatova & Fukuda, 2025)

Do *Arbitrary* Predictions Also Bias Perceptual Categorization?

Methods

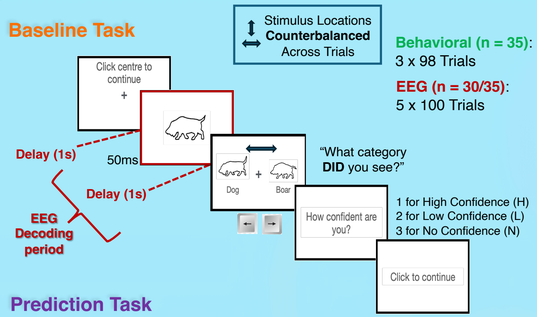
Range of ambiguity (Stöttinger et al, 2015)



Can We Decode This Bias in the Brain?

Using **a support vector machine** (SVM) classifier with a **2-fold hold-one-out, 5-way** procedure (x100 iterations)

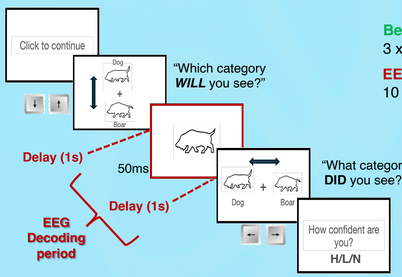
Baseline Task



Behavioral (n = 35): 3 x 98 Trials

EEG (n = 30/35): 5 x 100 Trials

Prediction Task



Behavioral: 3 x 98 Trials

EEG: 10 x 95 Trials

Does the *Likelihood of Prediction Confirmation* Modulate the Bias?

One category pair per condition…

Stimuli Types:
- Predicted Prototype
- Morphs
- Non-Predicted Prototype

Neutral Condition

If **DOG is predicted…**

Participants see **predicted** (Dog) and **non-predicted** (Boar) **prototypes** equally

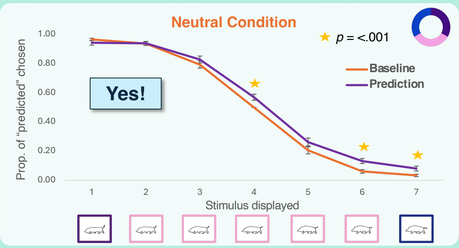
Confirmation Condition

If **GECKO is predicted…**

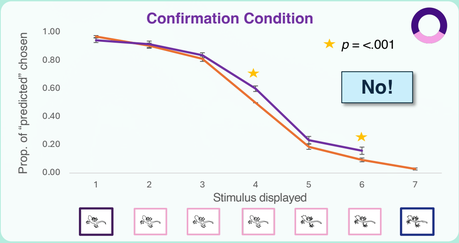
Participants DO NOT see the **non-predicted** (Rose) **prototype**

Behavioral Results

DO PREDICTIONS BIAS PERCEPTUAL CATEGORIZATION?



Does The Likelihood Of Confirmation Modulate This Bias?

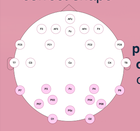


Can We Decode the Bias in the Brain: EEG Results

Can we decode each shape from EEG data?

Decoder trained on categorization (baseline) data from -200ms to 1000ms after stimulus onset

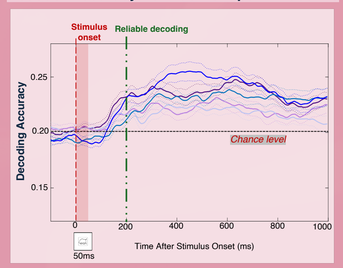
Decoding Accuracy =
Probability of the decoder choosing the correct shape



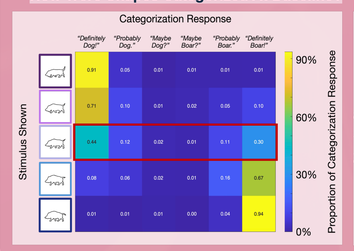
Using **posterior-occipital** channels

Stimulus on Screen
- 100% Dog
- 60% Dog
- 50% Morph
- 40% Dog
- 0% Dog

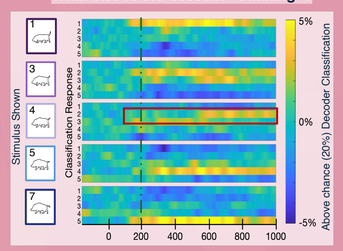
Decoder Accuracy For Each Shape At Baseline



How Were Shapes Categorized At Baseline?



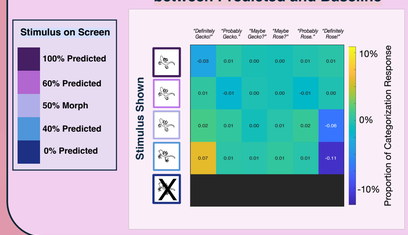
What else is the decoder "thinking"?



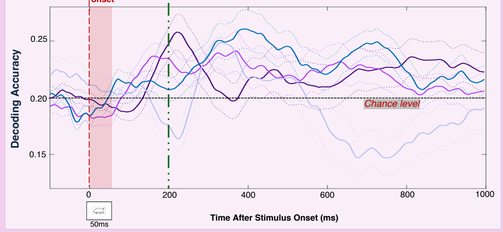
Confirmation Condition

*trained on baseline data

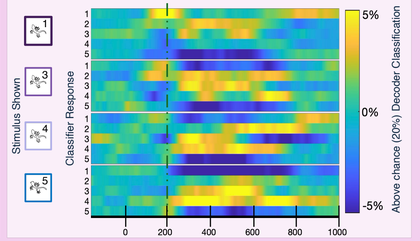
Differences in Categorization between Predicted and Baseline



Stimulus Decoding After Prediction



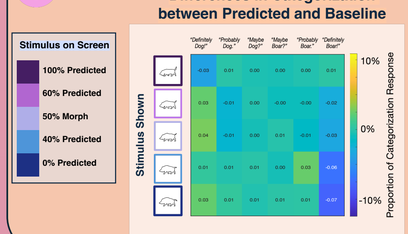
What Else Is The Decoder Thinking?



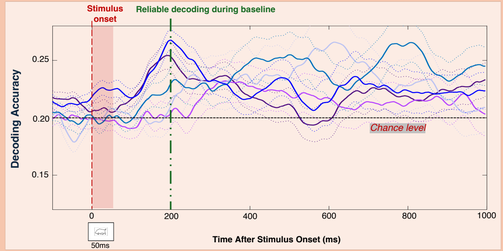
Neutral Condition

*trained on baseline data

Differences in Categorization between Predicted and Baseline



Stimulus Decoding After Prediction



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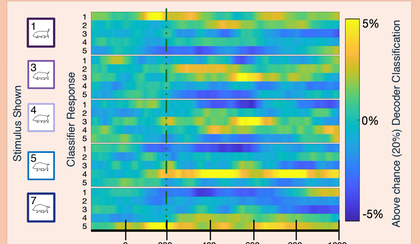

Discussion

- **Explicit, *arbitrary* predictions bias perceptual categorization**
  - We could successfully decode each shape at baseline
  - Predictions biased the decoding of each shape, however, the full picture remains unclear
- Likelihood of prediction confirmation seems to have a modulatory effect
- One possibility that needs to be controlled for would be priming
- Individual differences?

Get in Contact!

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