How much of the brain do we really need? Relevance of primary visual cortex representations in perceptual decision making

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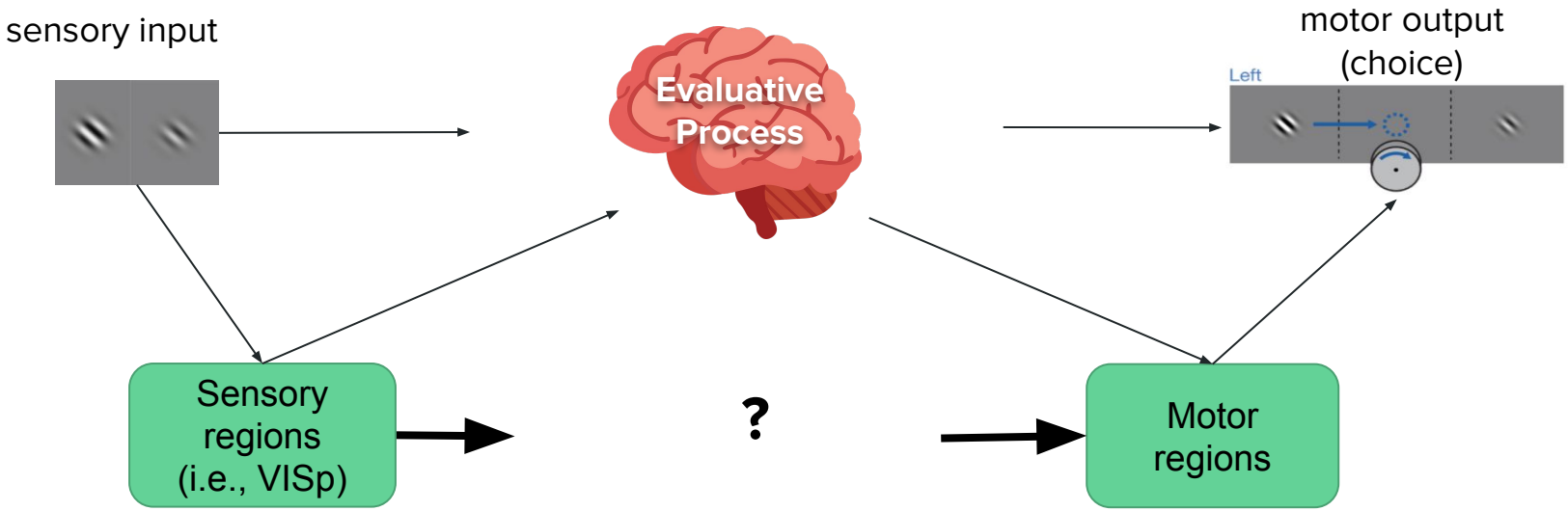
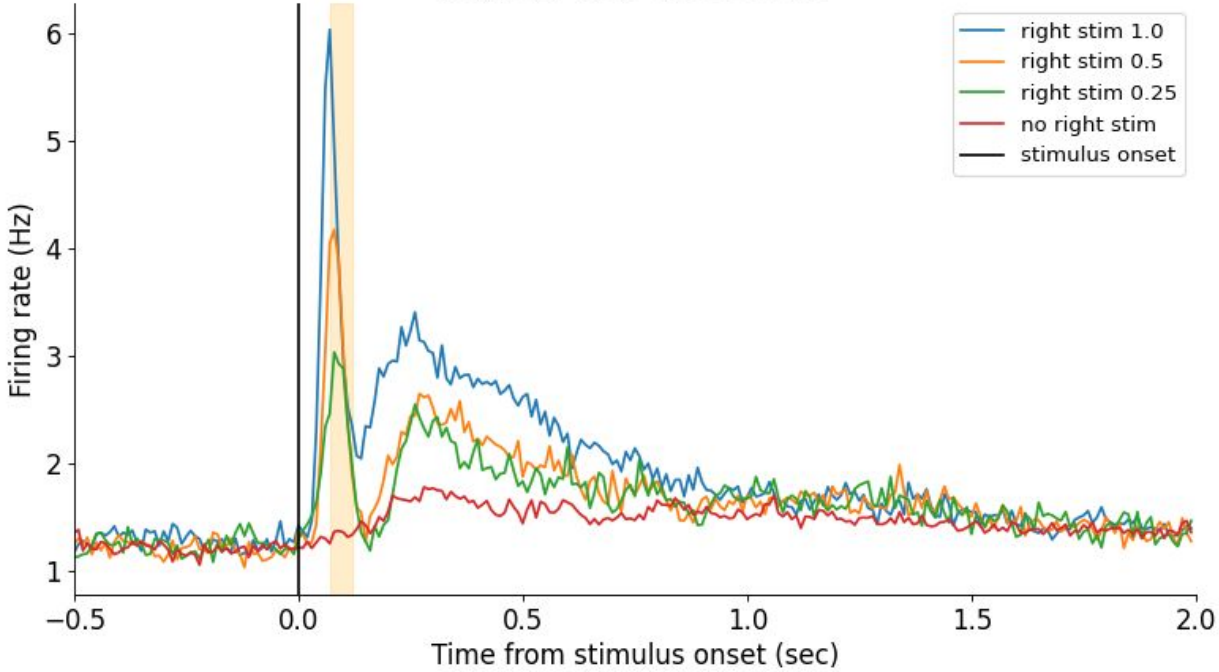
neuromatch

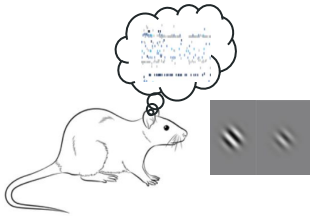
illustrious-pterodactyls

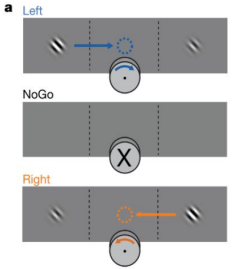
Background


sensory input
Evaluative Process
motor output (choice)
Left
Sensory regions (i.e., VISp)
?
Motor regions

Research Question







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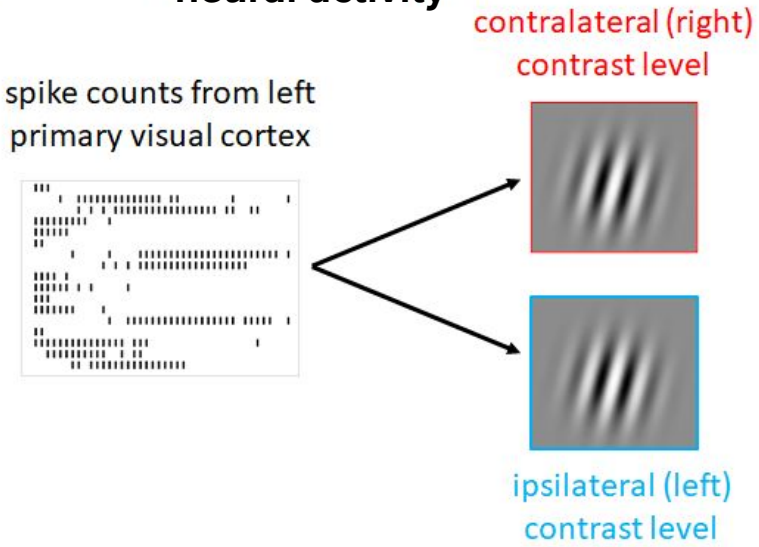
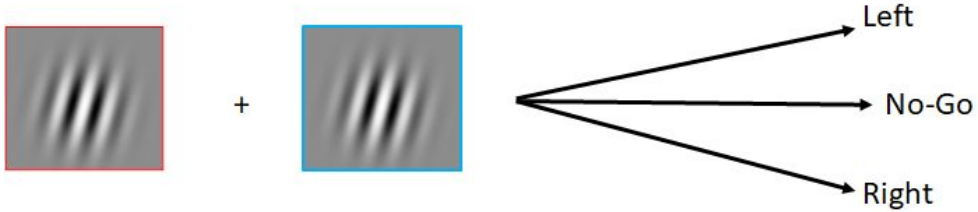
Modeling Approach

Step 1: **Decode stimulus contrast levels from population level neural activity**



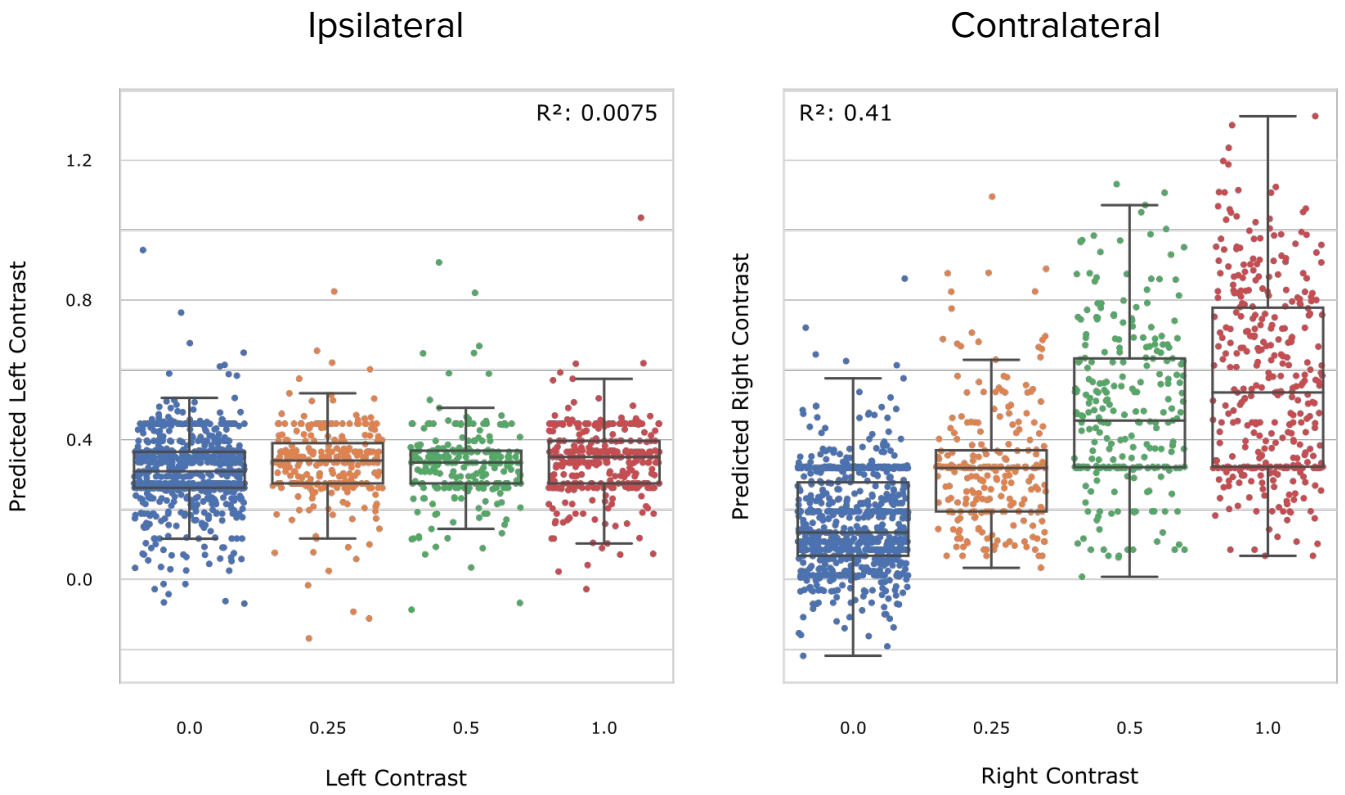
L1-Regularized (LASSO) Regression

Step 2: **Classify animals' decision using the decoded contrast levels**



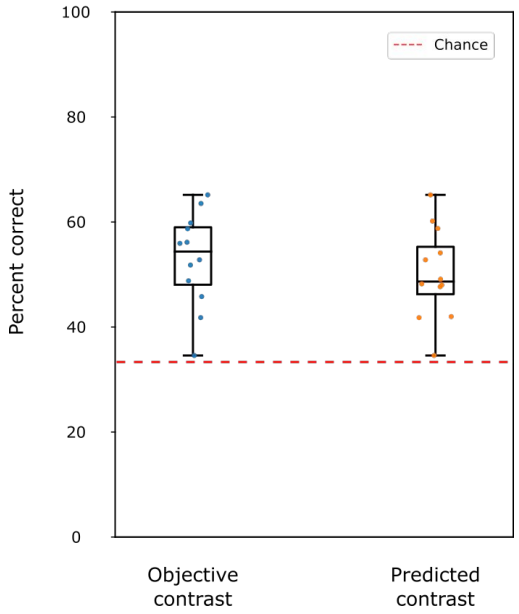
Multinomial Logistic Regression

The decoder performed better for the Contralateral stimulus

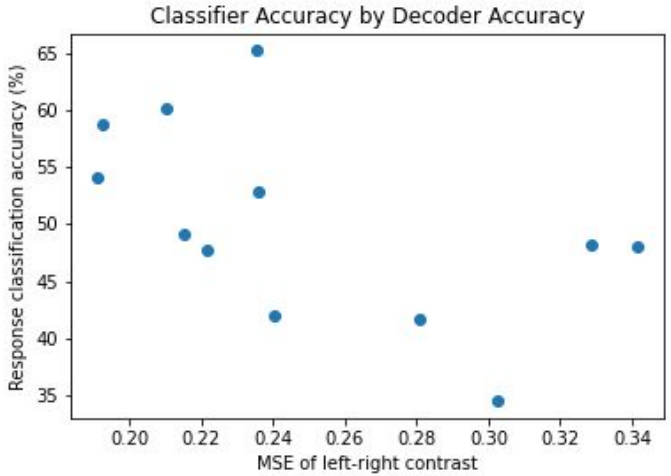


Response Classification Accuracy

The response classifier using the decoded contrasts performs nearly as well as one using the objective contrasts



Relative response classification accuracy depends on the fidelity of the decoded contrasts



Conclusion

An animal’s choice can be predicted based on the sensory representations decoded from the primary visual cortex

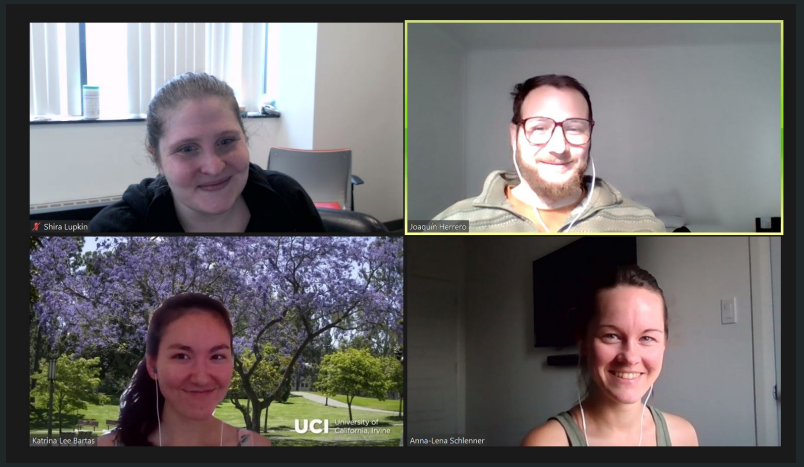
Conclusion

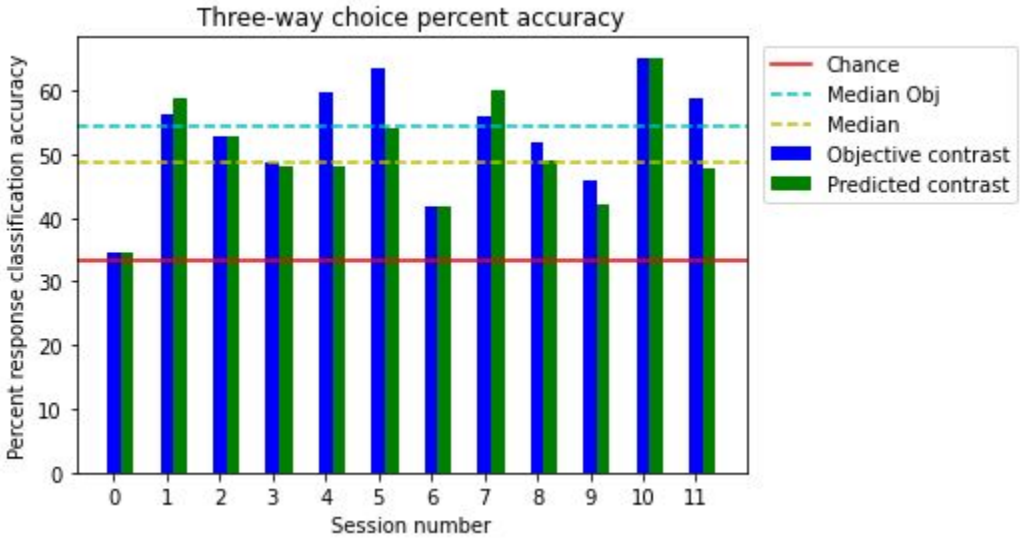
An animal's choice can be predicted based on the sensory representations decoded from the primary visual cortex

Open Questions

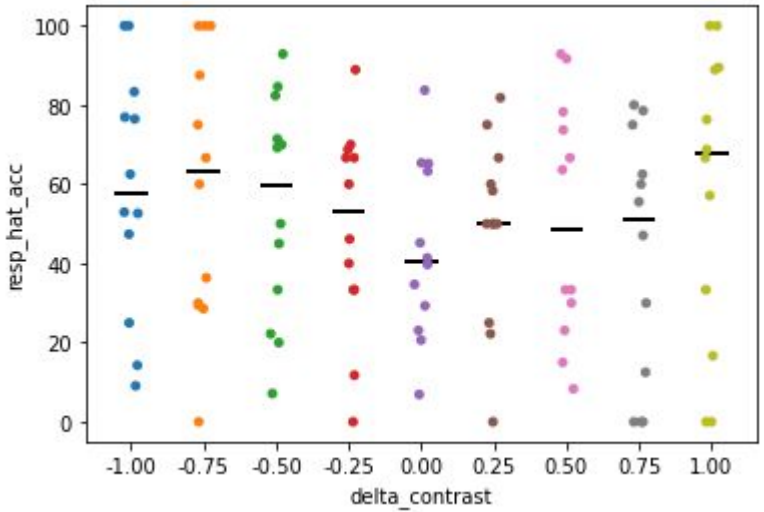
- Are the representations at this early stage *necessary* to make optimal decisions?
- Do we need information from both hemispheres?
- Do these results scale up to higher-order mammals (i.e., primates)?

Thanks for listening!

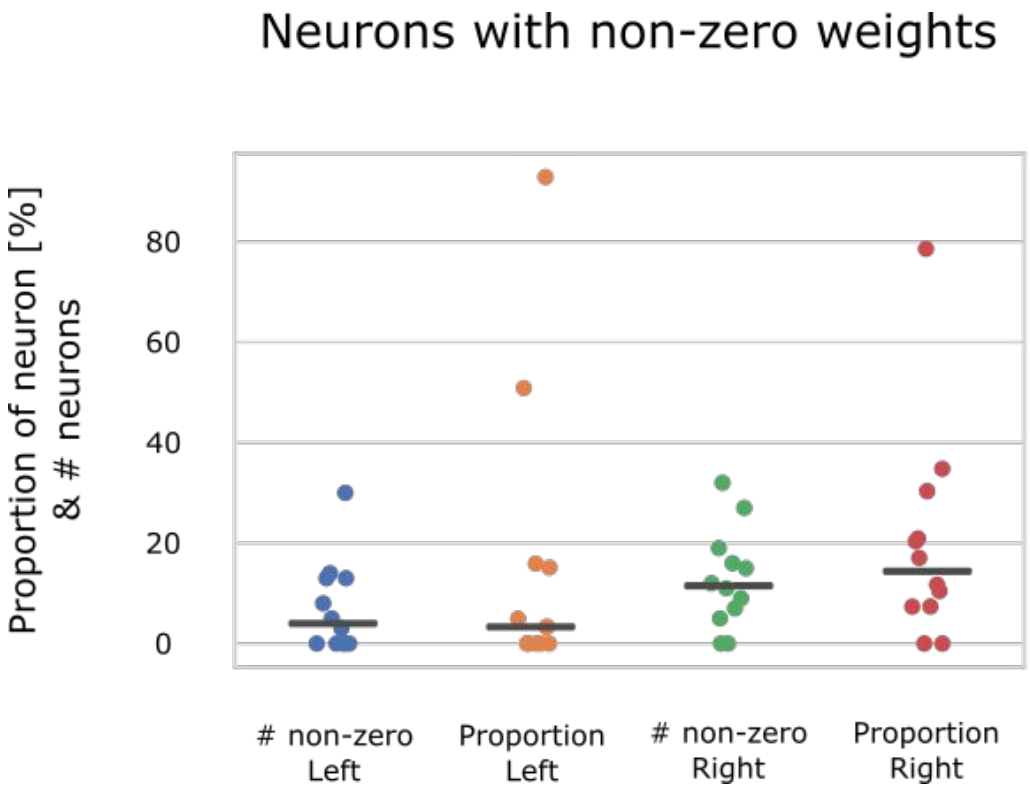



Three-way choice percent accuracy
Percent response classification accuracy
Session number
0
10
20
30
40
50
60
0
1
2
3
4
5
6
7
8
9
10
11
Chance
Median Obj
Median
Objective contrast
Predicted contrast

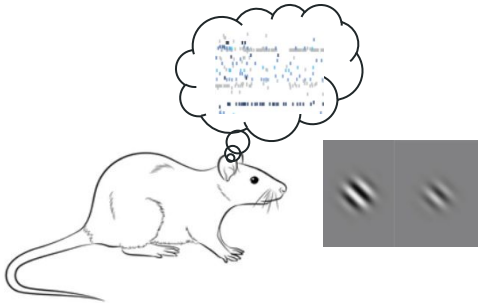
Accuracy split a few ways



Comparison between ipsi/contralateral stimuli



Research Question



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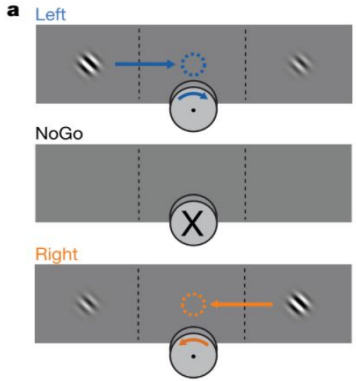

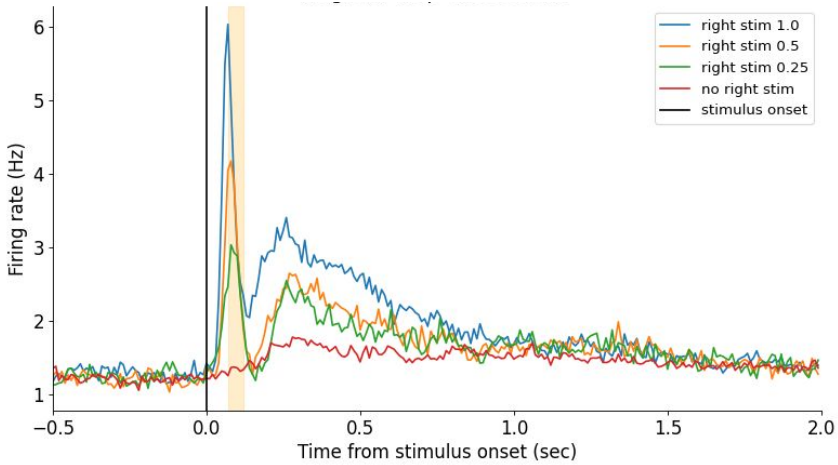

1. Can we predict choice solely based on contrast values decoded from VISp?
    a. How do these predictions compare to those made from the objective contrast values?