Uncovering the cascade of computations involved in ambiguity resolution: Decoding from MEG and neural network activity

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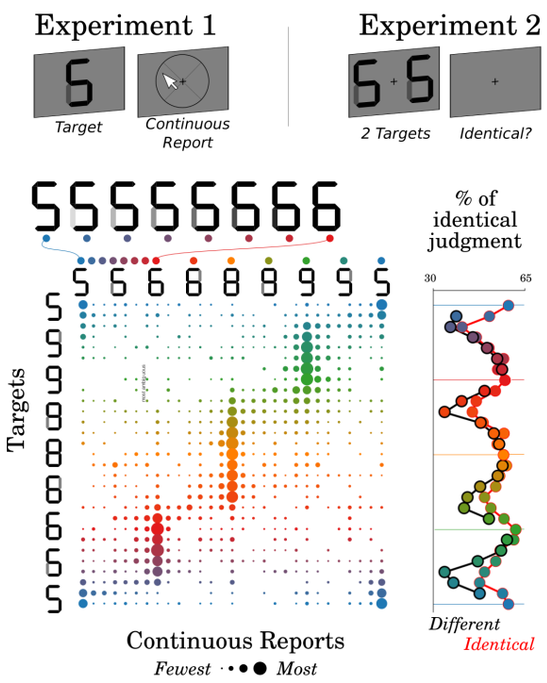
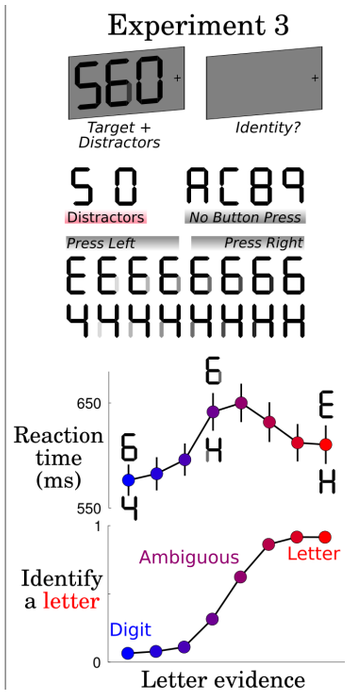
1 Introduction

- Ambiguity is ubiquitous in the world around us, yet humans are able to derive meaning with little error
- Performance-optimised deep neural networks (DNNs) are also highly specialised in solving perceptual ambiguity in the visual domain

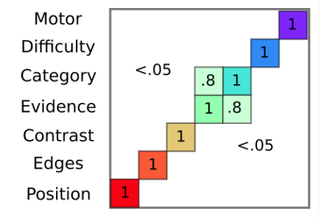
How does the human brain resolve ambiguity in visual input, and is this similar to artificial neural networks?

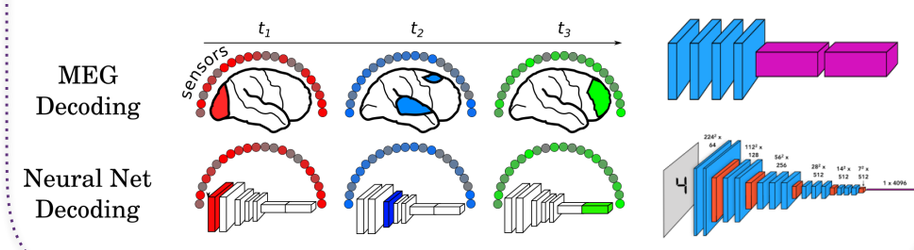




2 Method & Analysis

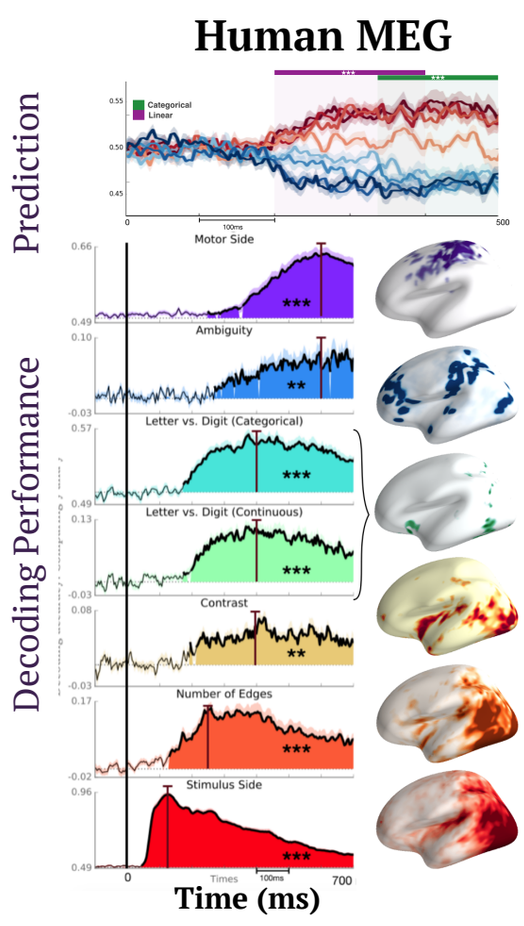
- 17 participants made letter/digit judgements while MEG was recorded
- Stimuli were designed to be orthogonal on 7 stimulus features
- Decoded each feature from the MEG data and three neural networks

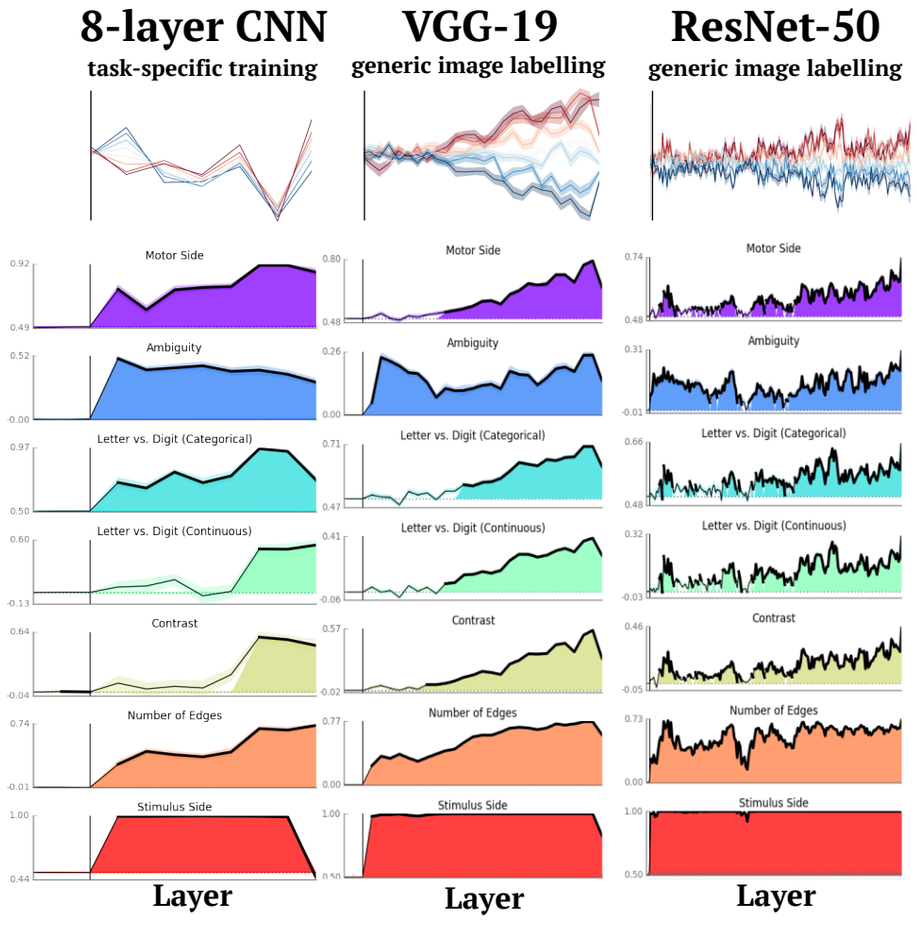




3 Cascade architecture is present in the human brain, and some of the neural networks

Motor
Difficulty
Category
Evidence
Contrast
Edges
Position





4 Conclusions

- The brain solves ambiguity with a cascade architecture
- Information is transformed from a linear (objective) to categorical (subjective) representation
- Similar computations and representations found in the generic but not task-specific DNNs

Ambiguity is resolved with a hierarchical sequence of feedforward computations which is emulated in some artificial systems

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